



ISIS – Innovative Solutions In Space

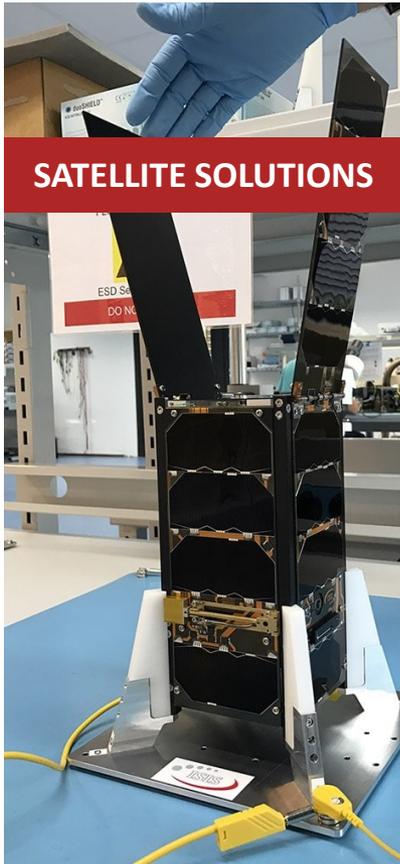
ISIS-BrightSkies: Taking a Breath from Air Pollution

Marc Bernabeu Peña

United Nations / Brazil. Symposium on Basic Space Technology “Creating Novel Opportunities with Small Satellite Space Mission”

ISIS-Our services

Vertically integrated small satellite company



ISIS – Innovative Solutions In Space

Facts & Figures



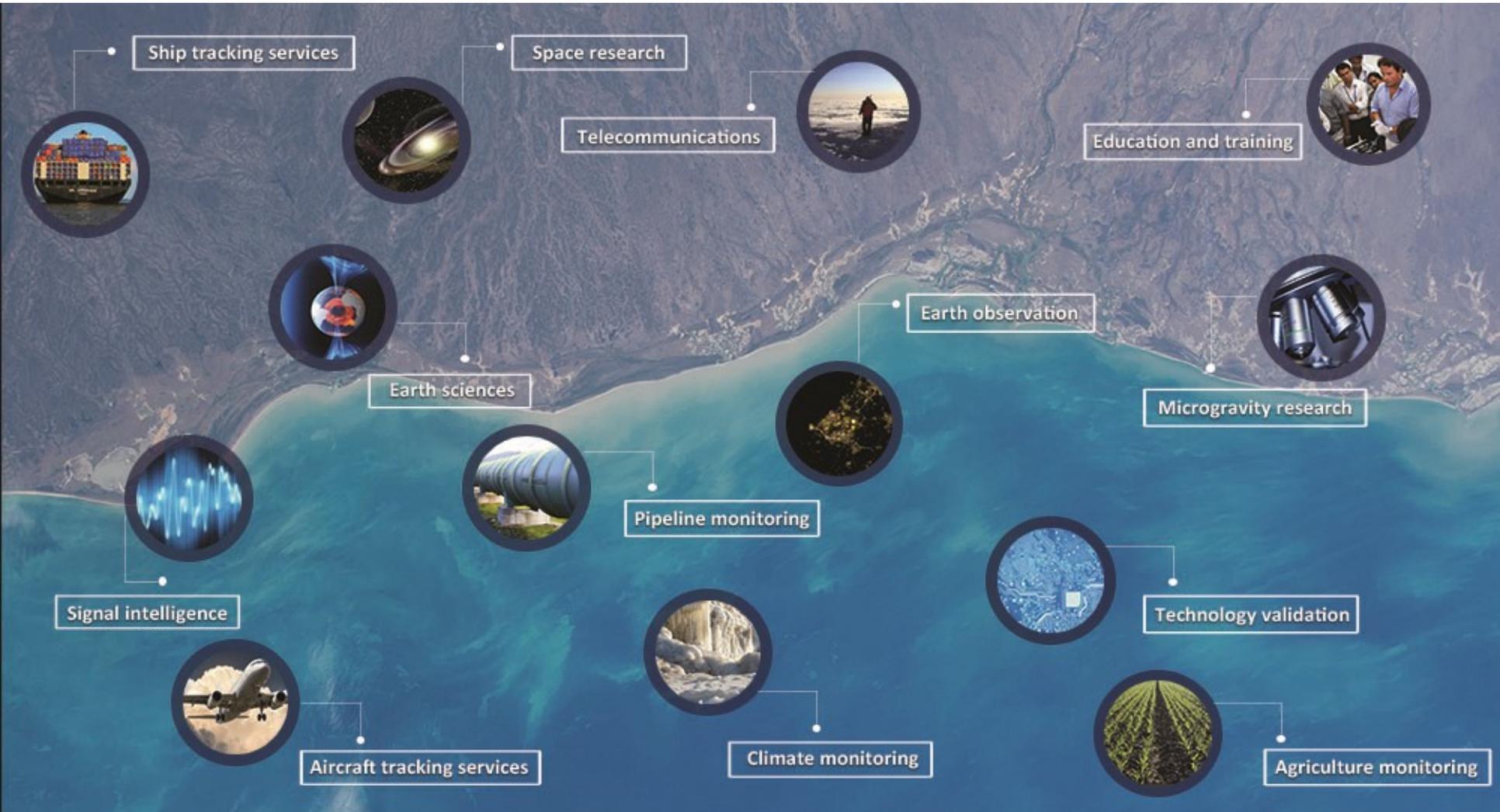
15 February 2017

World record of integrating 101 satellites on a single rocket



Applications and services

Nanosats enable multiple applications

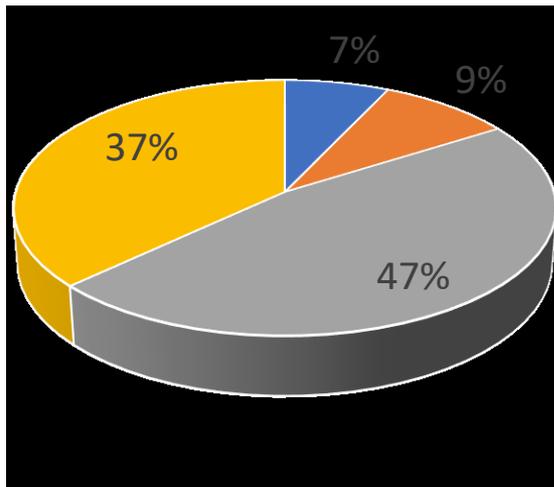


Applications and services

Nanosats enable multiple applications

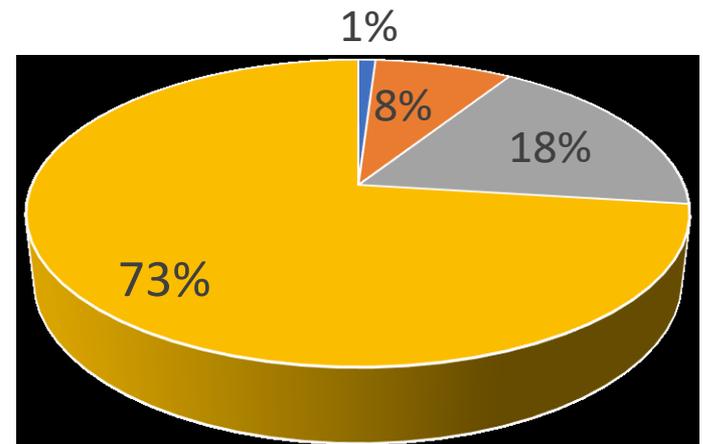
2009-2015

Small Satellites Application Share



2016-2018

Small Satellites Application Share



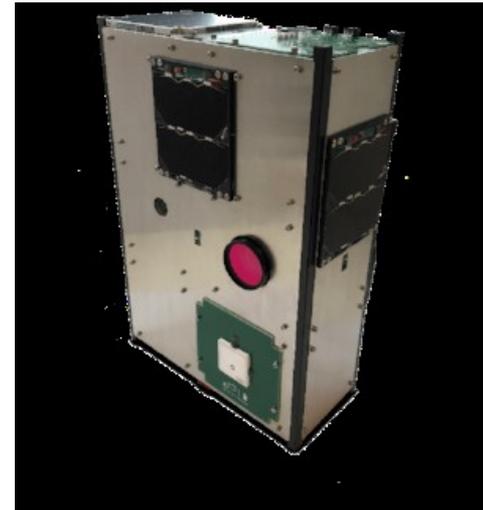
- Communications
- Scientific
- Technology
- Earth Observation / Remote Sensing

Source: adapted from Spaceworks

Small satellite products

Capacity building for Space Missions

- **3U and 6U platforms for capacity building**
 - Platforms based on actual flight hardware
 - Users from defence, research institutes to GEO-Data companies
- **Major milestone with 6U Training Engineering Model for Earth Observation (EO) for the Royal Thai Air-Force:**
 - Space Mission Design and Systems Engineering (from EO applications to the space mission)
 - Mechanical, electrical and software integration

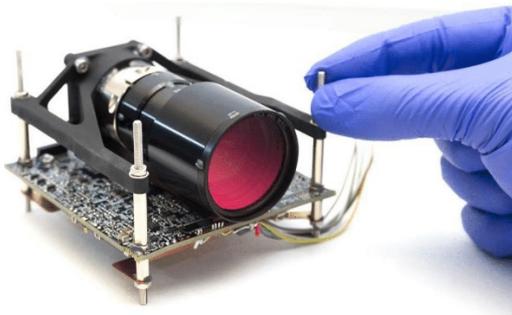


Small satellite products

Satellite Solutions- Earth Observation



Credits to SCS Aerospace Group



Credits to SCS Aerospace Group



- **3U Earth Observation Satellite**
 - RGB imager from SCS Aerospace Group
 - 39 m resolution @500 km
 - 80 km swath
 - Delivery in 6 months
 - Launch availability
 - Options for 5m GSD available

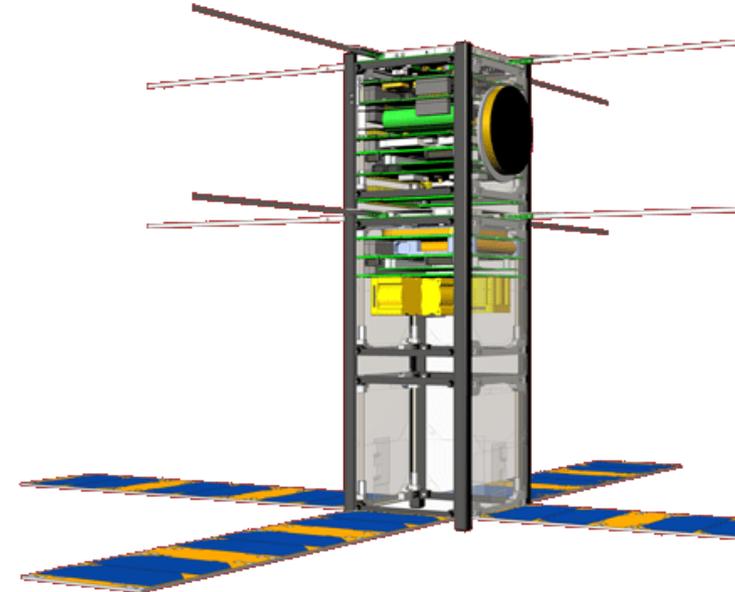
Small satellite products

Satellite Solutions

- **3U Satellite platform**

PAYLOAD AVAILABLE RESOURCES

	Basic bus	Advanced bus
MECHANICAL		
Volume available:	2U	1.5U
Mass available:	Up to 2kg/U	Up to 2kg/U
ADCS		
Pointing accuracy:	10° (in sunlight)	Down to 1° (whole orbit)
CDHS		
Data bus:	I ² C / SPI / UART	I ² C / SPI / UART / CAN
Storage:	Up to 64GB	Up to 64GB
POWER		
Average payload power:	Up to 2W	> 3.5W
Power bus:	3V3 / 5V / 8V (2A max per line)	3V3 / 5V / 8V / 12V
COMMUNICATION		
TT&C uplink	1.2 kbps (VHF)	9.6 kbps (VHF)
TT&C downlink	9.6 kbps (UHF)	9.6 kbps (UHF)
Payload data downlink	9.6 kbps (UHF)	3.4 Mbps (S-band)



Small satellite products

Satellite Solutions for IoT

- **6U Satellite for IoT :**
 - Delivery of 2 6U FM satellites
 - Launch coming soon...
 - IoT for precision agriculture, ship tracking, connectivity, etc



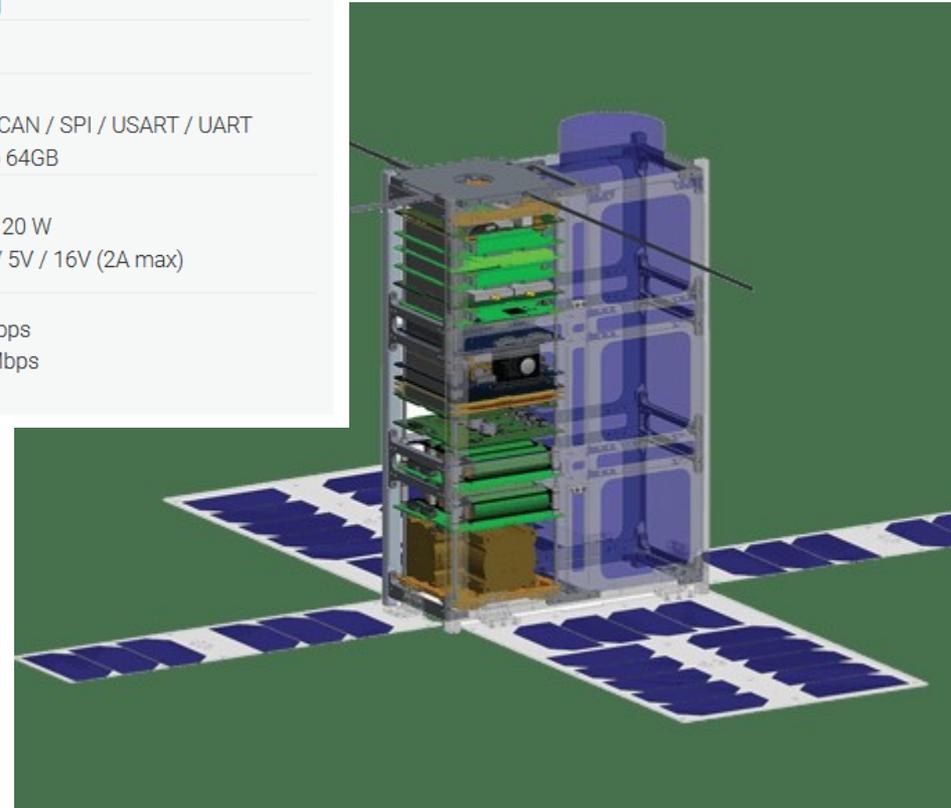
Small satellite products

Satellite Solutions

- **6U Satellite platform**

PAYLOAD AVAILABLE RESOURCES

	Basic bus	Advanced bus
MECHANICAL		
Volume available:	3U	2.5U
Mass available:	6kg	5.5kg
ADCS		
Pointing accuracy:	3°	0.1°
CDHS		
Data bus:	I ² C / SPI / USART / UART	I ² C / CAN / SPI / USART / UART
Storage:	Up to 64GB	Up to 64GB
POWER		
Average payload power:	10 W	from 20 W
Power bus:	3V3 / 5V / 16V (2A max)	3V3 / 5V / 16V (2A max)
COMMUNICATION		
TT&C (VHF/UHF)	9.6 kbps	9.6 kbps
Payload data downlink (S-band)	-	3.4 Mbps



Air Pollution, a problem to our health:

- A leading risk factor (**the 4th**) for death after metabolic, dietary and smoking risk factors
- The WHO estimates a total of **4.2 M premature deaths** to outdoor air pollution
- In Brazil **25000 premature deaths** due to exposure to air pollution

ISIS- BrightSkies

Air Pollution Information Services



Air Pollution, a problem to our economy:

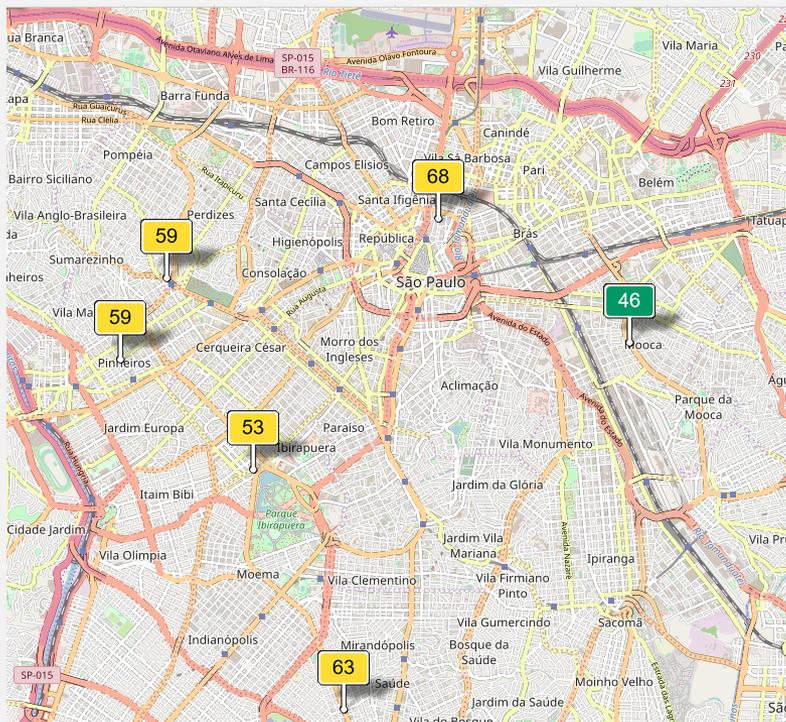
- Worldwide economic loss of **3 trillion** and expected to **attain 18 trillion**
- **>€600** welfare loss per person / year
- Growing pressure towards **curbing emissions** and meeting **air quality standards**

Current Air Pollution monitoring challenges:

- Current technology does not provide enough spatial / temporal resolution
- Non reliable and (mainly) voluntary emission inventories
- Despite the limited data available, regions with legislation in place are constantly surpassing air pollution limits

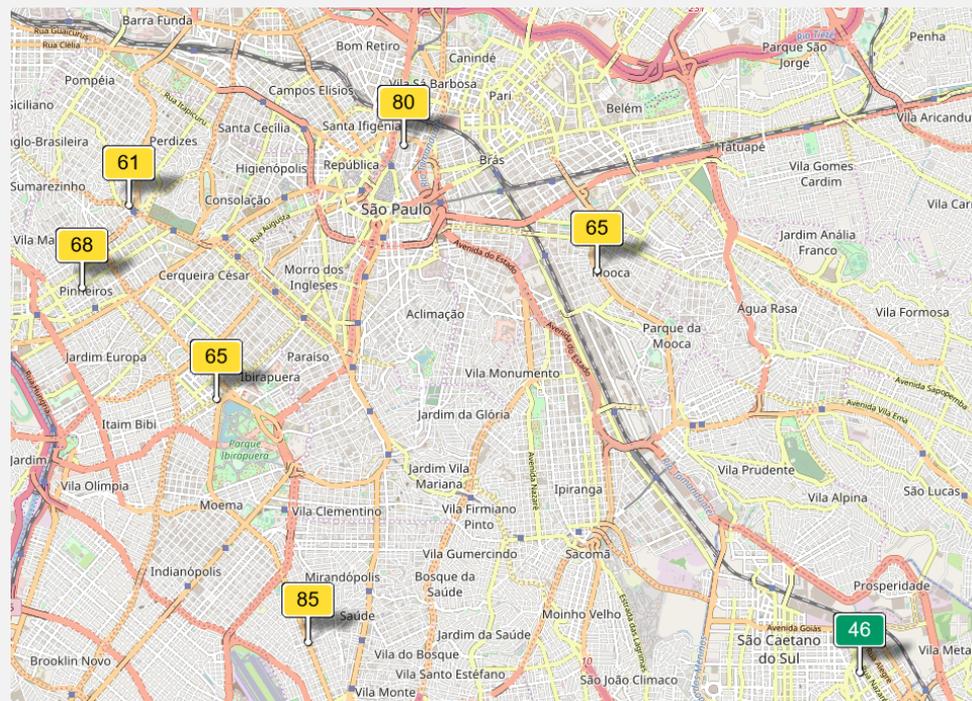
ISIS-BrightSkies

Air Pollution Information Services



12:00 h.

Source:
<https://aqicn.org/here/>



14:00h

Source:
<https://aqicn.org/here/>



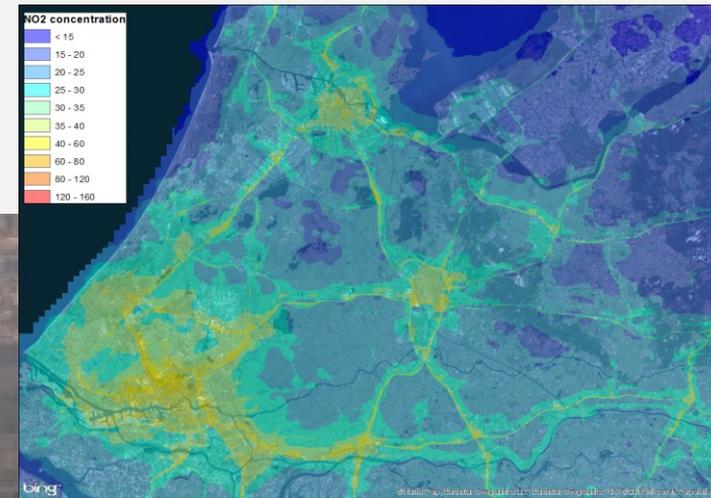
ISIS-BrightSkies

Air Pollution Information Services



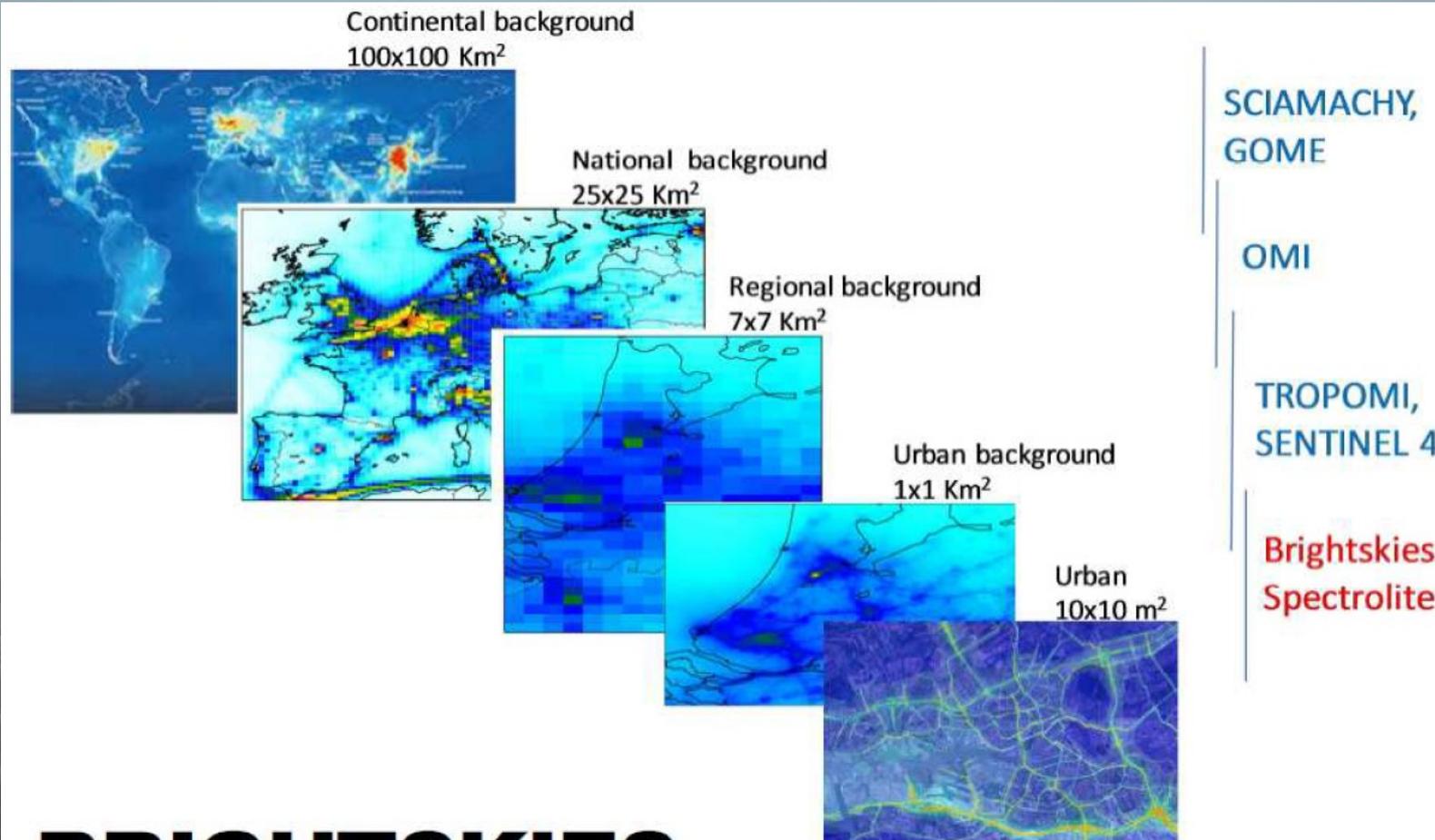
BrightSkies:

- Provide actionable data concerning air quality
- Provide high temporal and spatial resolution air quality measurements
 - 100X100 m spatial resolution concentration maps
 - Real-time monitoring of air quality and forecasting
 - Monitoring NO_2 , O_3 , SO_2 , PM and CO
- Provide source detection



ISIS-BrightSkies

Air Pollution Information Services



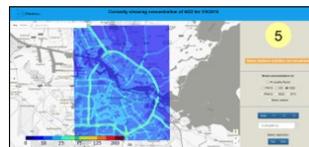
BRIGHTSKIES



ISIS-BrightSkies

Air Pollution Information Services

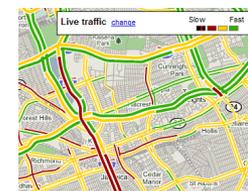
Proprietary air quality models for urban areas



Freely available sensor data from ground units and wearables



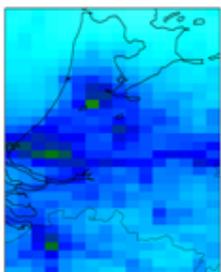
Infrastructure data, weather, traffic, meta information.



Bright Skies

Data Service
Higher resolution than 100m x 100m through machine learning

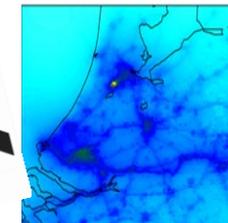
Regional data with Available assets such, as TROPOMI 7x7 km²



Urban data with new small satellites:

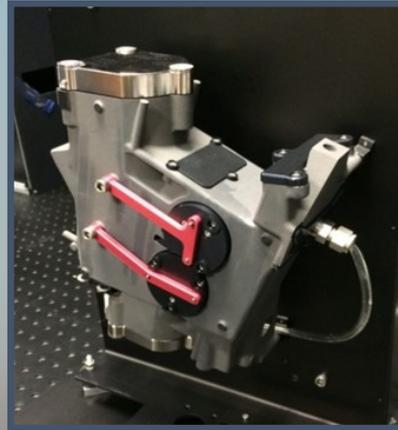
- 1x1 km² pixels
- 50x better GSD
- Improved tempc resolut

From 2020



ISIS-BrightSkies

Air Pollution Information Services



Credits to TNO

Spectrolite, monitoring air pollution from Space:

- 12U Nanosatellite based on ISIS and partners' technology
- Spectrometer , spectral range 0,3 um – 0,5 um
 - Spectral resolution < 0,5nm
 - Spatial resolution of 1 x1 km
 - Capable to monitor NO₂

ISIS-BrightSkies

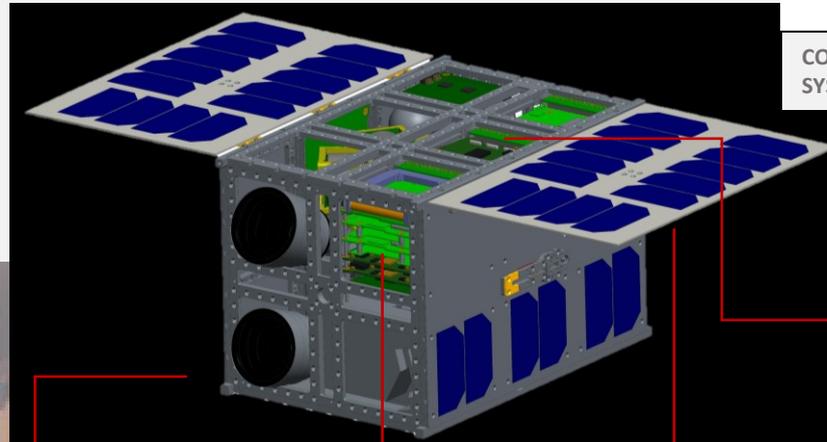
Air Pollution Information Services

Spectrolite, monitoring air pollution from Space:

- Added value of using small satellites?
 - Global coverage
 - Data robustness
 - Long records
 - Increased revisit times



ATTITUDE
KNOWLEDGE



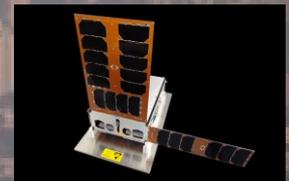
ON BOARD COMPUTER



COMMUNICATIONS
SYSTEMS



COMMUNICATIONS
SYSTEMS



SOLAR PANELS

ISIS-BrightSkies

Bright Skies

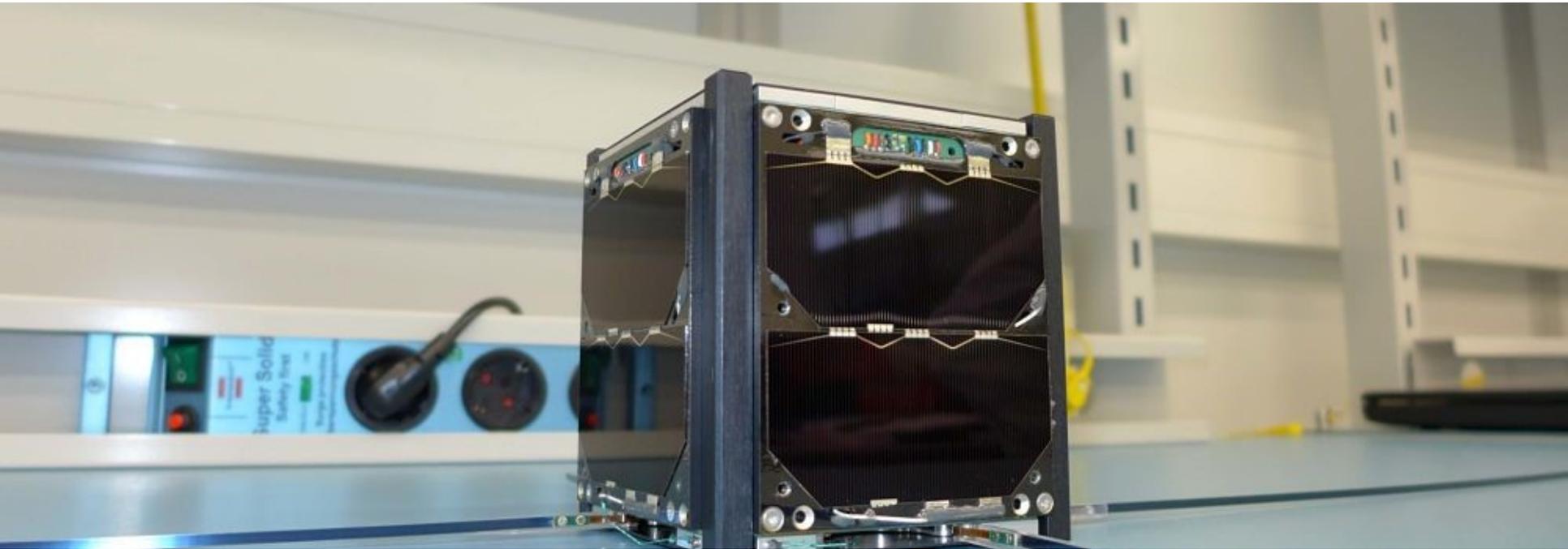


Spectrolite, monitoring air pollution from Space:

- Air Pollution is a “silent-killer”
- Current legislation is not protecting the citizens
- Small satellites are a key tool for monitoring a highly dynamic phenomena as it is air pollution



Thank you for your attention!



info@isispace.nl | Brightskies@isispace.nl
www.isispace.nl | www.isilaunch.com | www.cubesatshop.com