UNIVERSITY OF PORTSMOUTH

Atmospheric Microplastics

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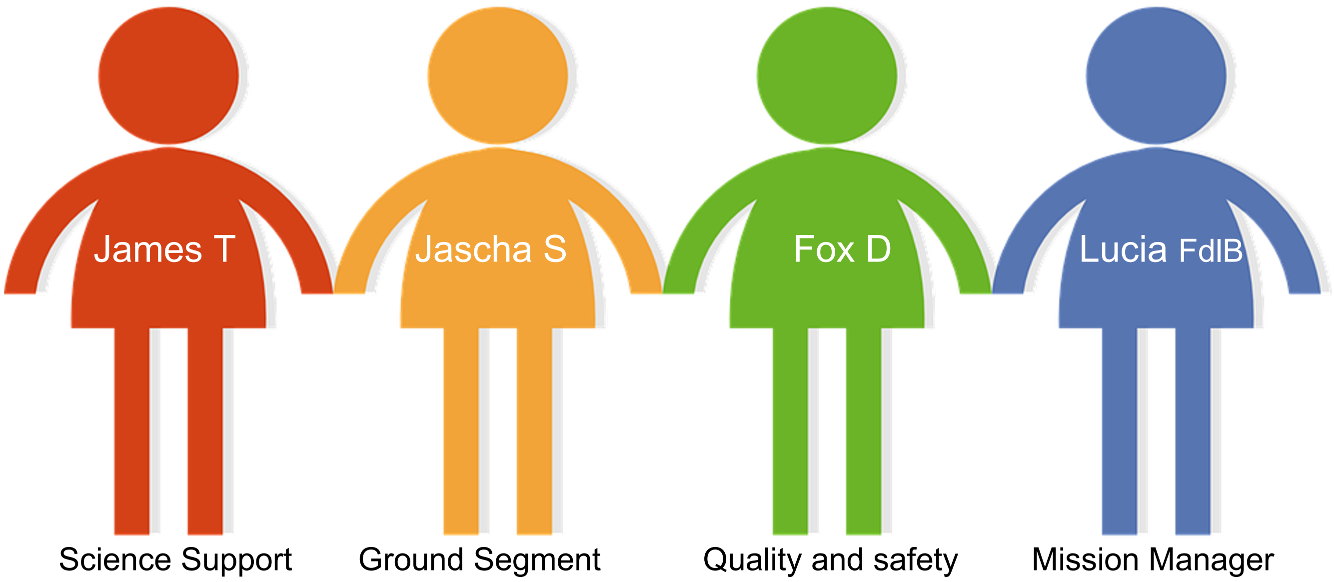
The People

LaunchUK Nanosat Design Competition



The challenge

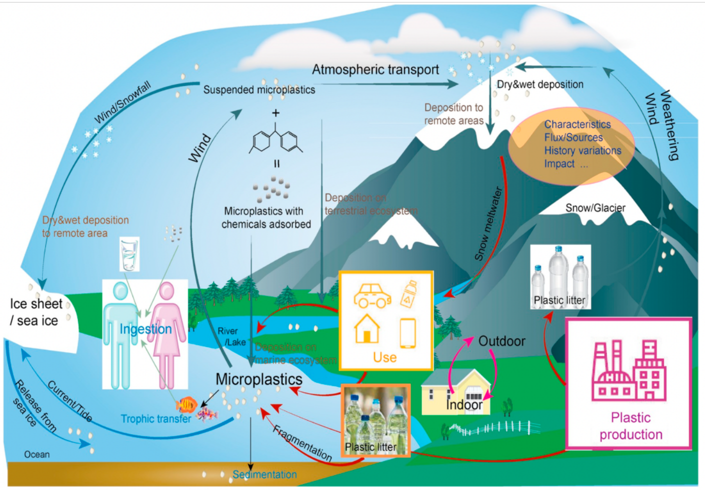


Fig. 3. Conceptual model of atmospheric microplastics in the environment.

Microplastics have been detected in remote regions far from their original source. How do they get to these pristine places?
Crucial to identify the global distribution of airborne microplastics and potential exposure to human health.

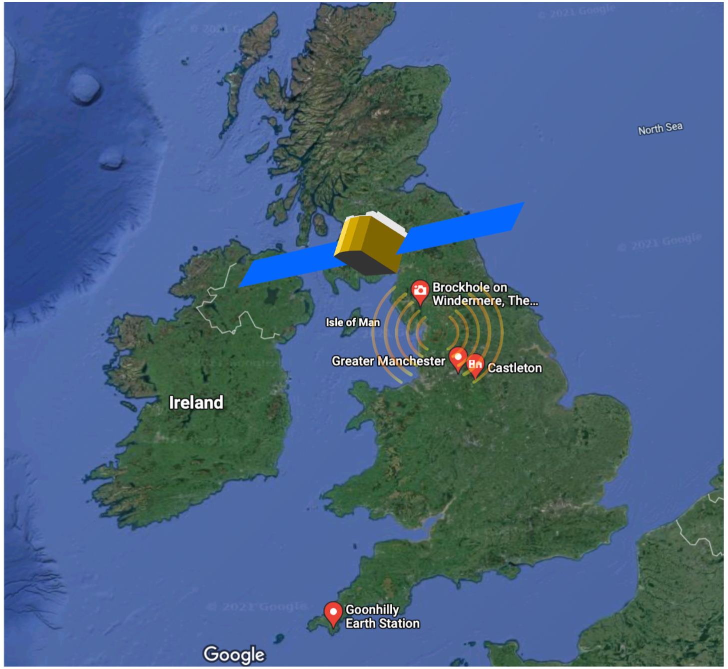
Current techniques inform about microplastic composition and concentration at the time and location of collection but not their origin and transport.

Space offers a revolutionary opportunity:
we can measure the microplastic abundances for months tracking them over a large region.

Mission objectives

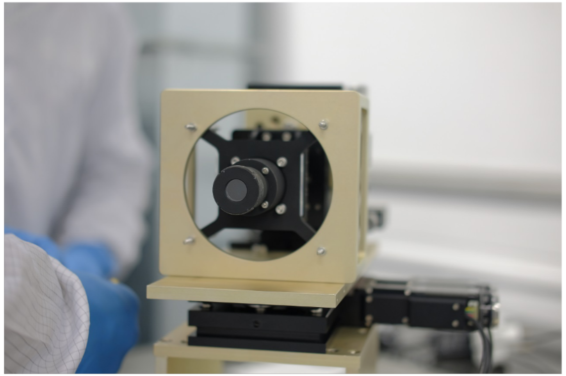
1. To analyse the **microplastic abundance** over the industrial area of Greater Manchester, The Lake District and The Peak District to determine the **atmospheric transport** for microplastics in North-West England over an extended period of time.
2. We will also take measurements of microplastics over the **poles and sea** - the most pristine locations in the world - and monitor the levels and transport there.
3. To **raise awareness of the health and environmental issues** due to microplastics produced by human activities and their impact in natural spaces

The £1M mission



- Greater Manchester, The Lake and The Peak District.
- Measure the concentration of 38 μm-5 mm fibres of acrylic, polyamide, polyester, polupropolene.
- Design a 1U CubeSat of less than 10 kg with a FTIR spectroscopic camera and launch from Spaceport Cornwall.
- Use a SSO, altitude 600 km.
- Communications with Ground Segment via Goonhilly Centre Ground Station.
- The camera is to send to the Ground Station spectral images from the designated locations with every orbit.
- We can get 1 picture every 5 days for 21 months 630 days/5 = 126 pictures spanning basically 2 years worth or weather pattern.
- End of life: deploy an aerodynamic end-of-life Deorbit System.

The Payload

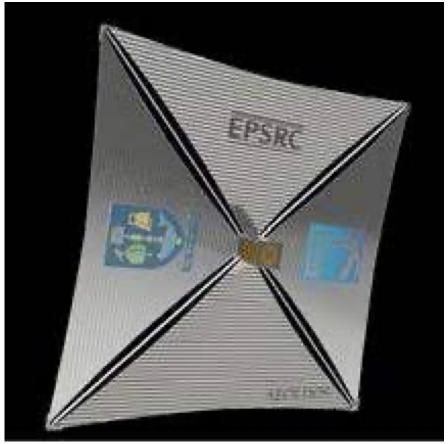


IR camera MultiScape50 CIS product is known for its compactness while addresses the need for wide-angle imaging with a Cubesat.

This payload is ideal for capturing vast areas in multispectral mode and it fits in a 1U volume.

	MultiScape50 CIS
Configuration	Push Broom
Focal Length	93.9 mm
Front Aperture	11.75 mm
GSD @ 500 km	29.3 m
Swath @ 500 km	120 km
Digital TDI Enabled	Up to 32 stages dTDI
Pixel Depth	12 bit
Spectral Bands	7 Bands VNIR
Spectral Range	450 – 900 nm
Storage Capacity	128 Gigabyte
Power Consumption	7 Watt (During Imaging)
Mass	0.37 kg
Volume	95.9 x 90.2 x 112 mm
Operating Temperature	-10°C to +50°C

The platform



AEOLDOS
Aerodynamic End Of Life Deorbit System

Component	Weight (g)	Power (W)	Dimensions (mm)	Number
Sun Sensor	6	0.175	30x30x10	4
Magnetic Torquer	40	1.4	11x90	1
Gyroscope	16	0.35	23x23x23	1
Rotation Wheel	200	0.7	50x50x30	4
GPS	2.1	0.158	24x20x2.7	1
Pulse plasma thruster	280	2	31.75x31.75x15.875	1
S-band antenna	120	13	95x46x15	1
UHF VHF transceiver	94		95x46x15	1
Solar Cells	80	40	480x240	4
Battery	250	40	36x20x10	2
Power Distribution Module	900	50.4	90.17x90.81x9.21	1
Onboard Computer	900	1.5	60x60x5	2
Deorbit System	372		0.4U vertical	1

Summary

- **Space** offers a revolutionary opportunity to track the transport of airborne microplastics and understand their impact on human health and environment.
- **Proposal:** Design a 1U CubeSat of less than 10 kg with a FTIR spectroscopic camera and launch from Spaceport Cornwall.
- **Essential:** This is essential for the implementation of standardized analytical protocols to assist policy making in line with the current Ten Point Plan for a Green Industrial Revolution (UK).

From GEM meeting

https://www.nature.com/articles/s41586-021-03864-x