

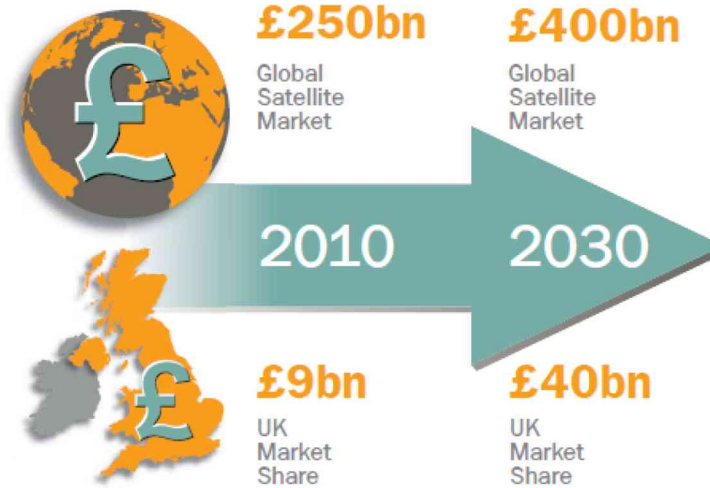


University of  
Hertfordshire **UH**

*Dr Sandra Rothwell*

*Professor Mark Thompson*

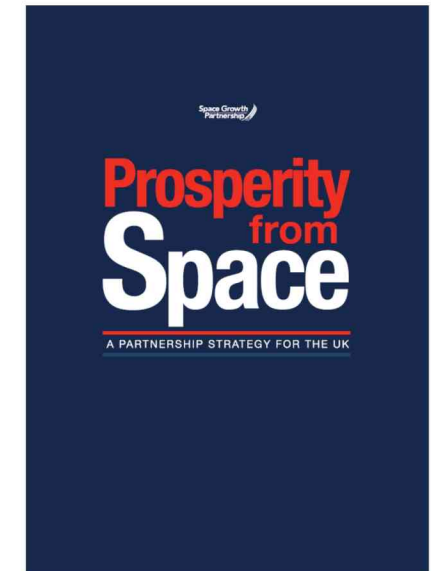
Innovation Hub  
@ Goonhilly



Significant opportunities for growth...



Space Growth Partnership







# HUMAN CENTRED SPACE

## Ambitious targets over the next 6 years.

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### ***2018-25***

- 1,000 new upstream jobs (doubled by 2030)
- A further 8,000 new positions in wider supply chain

### ***NEXT 11 YEARS (to 2030)***

- £200m contribution to economy from launch and spaceport activities
- Increase space related activity by 10% (£1bn economic contribution)

# *2018 Cornwall Space Sector analysis*



## **Sector Growth**

The Spacetechnology sector in Cornwall has seen growth of 164% since 2010, with the sector currently estimated to have a turnover of around £3.8 million.

## **Sector Business Count**

Within the Spacetechnology sector in Cornwall there were around 55 active businesses in 2017. The number of businesses has risen by 243% since 2010.

## **Employees in the Sector**

In 2017 the Spacetechnology sector in Cornwall employed an estimated 120 people. Employment has risen by 234% since 2010.





## Space Innovation

The University of Exeter is globally recognised for education and research excellence. We are experts in developing impact, connecting partners, nurturing collaborations and generating value.

We engage with regional, national and international partners to drive growth across the UK space sector.

We help innovative organisations develop and commercialise space-related technologies and applications, through our pioneering scientific research.

Our world-class research creates economic, environmental and societal impact.

### Key Offerings

As a member of the Russell Group, the University of Exeter is committed to outstanding teaching and research, in order to solve complex challenges.

Collaborative R&D	Innovation	Skills
Smart solutions to business and technical challenges	We help businesses think bigger	We help to grow, recruit and retain talent
<ul style="list-style-type: none"> <li>• Flexible and cost-effective</li> <li>• Interdisciplinary</li> <li>• World-class facilities</li> <li>• Regional R&amp;D hubs</li> <li>• Pragmatic contracting</li> </ul>	<ul style="list-style-type: none"> <li>• Innovation hubs</li> <li>• New technologies</li> <li>• Business acceleration</li> <li>• Raising venture funds</li> <li>• Commercialisation</li> <li>• SETSquared</li> </ul>	<ul style="list-style-type: none"> <li>• Develop your workforce</li> <li>• Training and development</li> <li>• Degree Apprenticeships</li> <li>• Highly motivated students</li> </ul>

## Space Capabilities

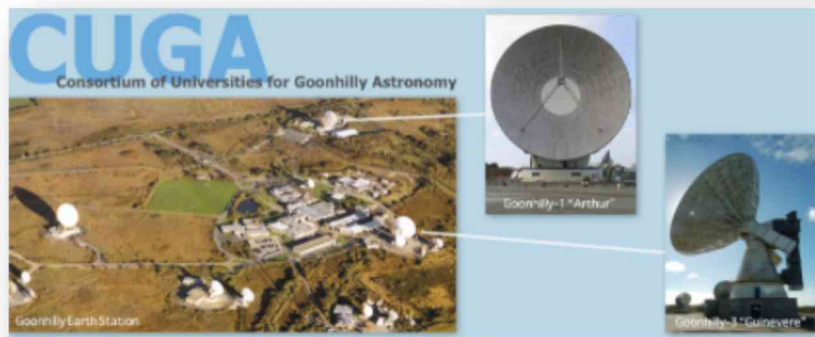
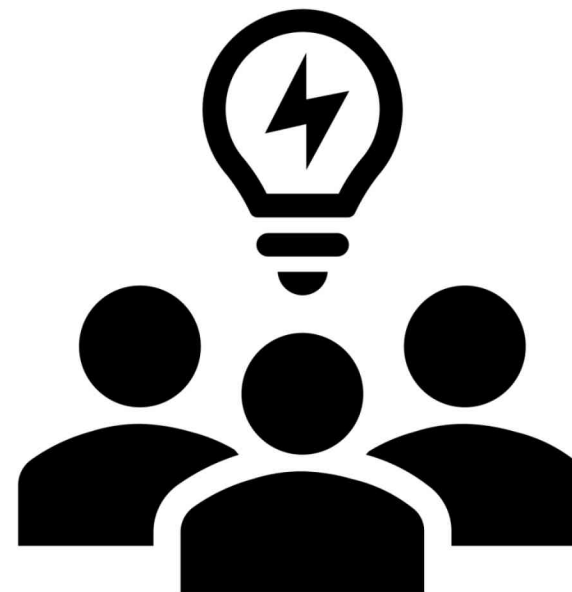
Partnering with the University of Exeter can give you access to a wide range of pioneering expertise and resources. Our Space-related capabilities include:

- Additive Layer Manufacturing
- Autonomous Systems and AI
- Communications
- Control Systems
- Cyber Security
- Data Science
- Drone Services
- Earth Observation
- Electronics
- Energy Harvesting
- High Performance Computing
- Metamaterials
- Nanomaterials (incl. Graphene)
- Photonics
- Quantum
- Renewables
- Satellite Applications
- Simulation
- Space Law
- Space Weather

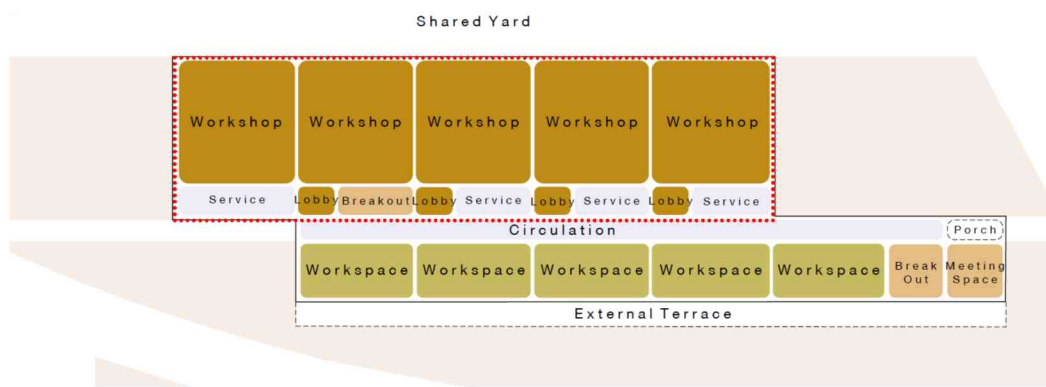
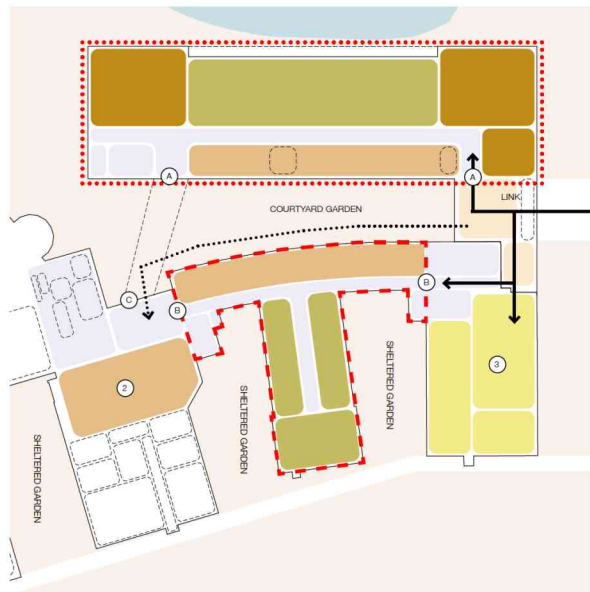
The University of Exeter is also the leading partner of the South West Centre of Excellence in Satellite Applications (SWCoESA), and we have strong business networks, including links with Goonhilly Earth Station, Spaceport Cornwall and Exeter Science Park.

### Contact:

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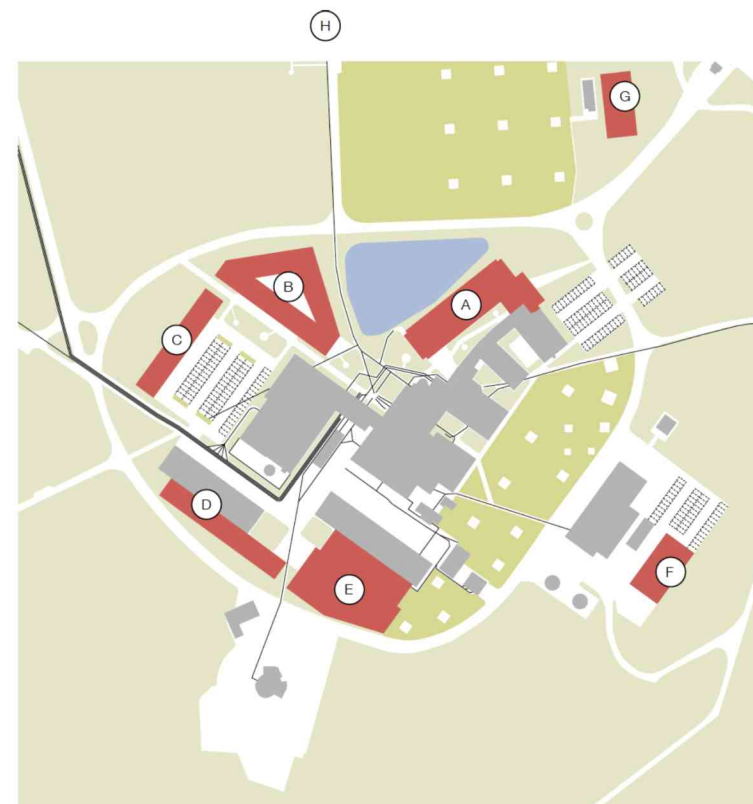
#### KEY

- (A) WORKSPACE PHASE 1  
1585m<sup>2</sup>
- (B) WORKSPACE PHASE 2  
1780m<sup>2</sup>
- (C) WORKSPACE PHASE 3  
780m<sup>2</sup>
- (D) ADVANCED MANUFACTURING PHASE 1  
857m<sup>2</sup>
- (E) ADVANCED MANUFACTURING PHASE 2  
2120m<sup>2</sup>
- (F) SITE MAINTENANCE BUILDINGS  
700m<sup>2</sup>
- (G) THE PAVILION  
580m<sup>2</sup>
- (H) PAD 2  
1600m<sup>2</sup>

POTENTIAL NEW BUILD = approx 9720m<sup>2</sup>

#### NOTE

AREAS STATED ABOVE ASSUME SINGLE STOREY BUILDINGS ONLY











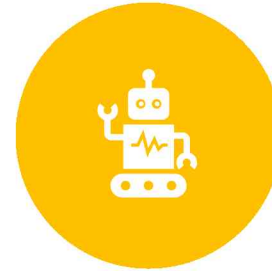
# Innovation Hub @ Goonhilly



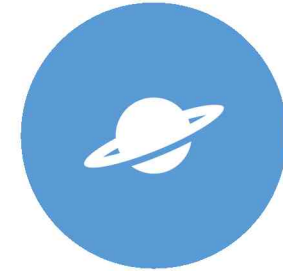
SPIN-OFF (RESEARCH) AND  
INCUBATION FACILITIES.



START-UPS/GROWTH SME RELATED  
TO RECEIVER FACTORY (E.G.  
CUBESAT CONSTRUCTION &  
COMMUNICATIONS AND PHASED  
ARRAY FEEDS FOR SATCOMS).



START-UP/GROWTH SME RELATED  
TO SPACE DATA SCIENCE AND  
OTHER RELATED TECHNOLOGIES  
(DATA ANALYTICS, DRONES,  
SENSORS, PRECISION  
AGRICULTURE).



APPLICATIONS OF ASTRONOMY  
TECHNIQUES TO SPACE WEATHER,  
SATCOMMS AND ORBITAL DEBRIS  
TRACKING.

Two examples:

- Galaxies to the Ground – astronomy techniques applied to agritech
- The Receiver Factory – commercial scale radio research instrumentation

# Galaxies To The Ground (G2G): applying AI and astrophysics analysis to Earth Observation data for uninterrupted agricultural monitoring

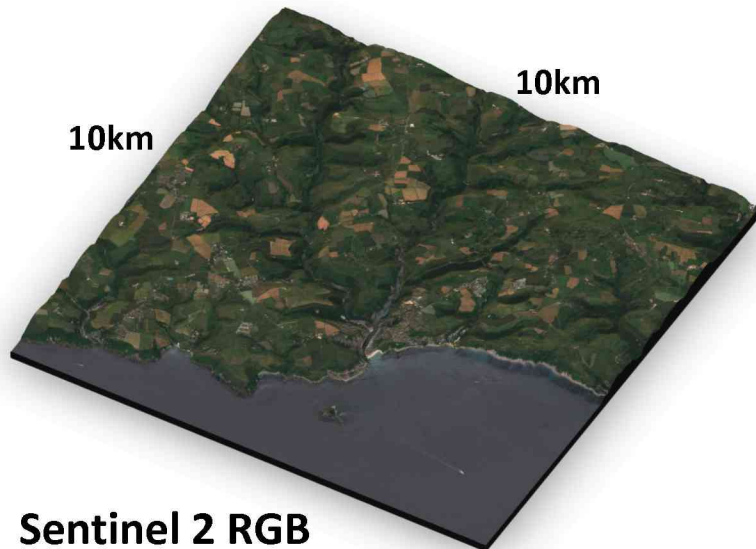
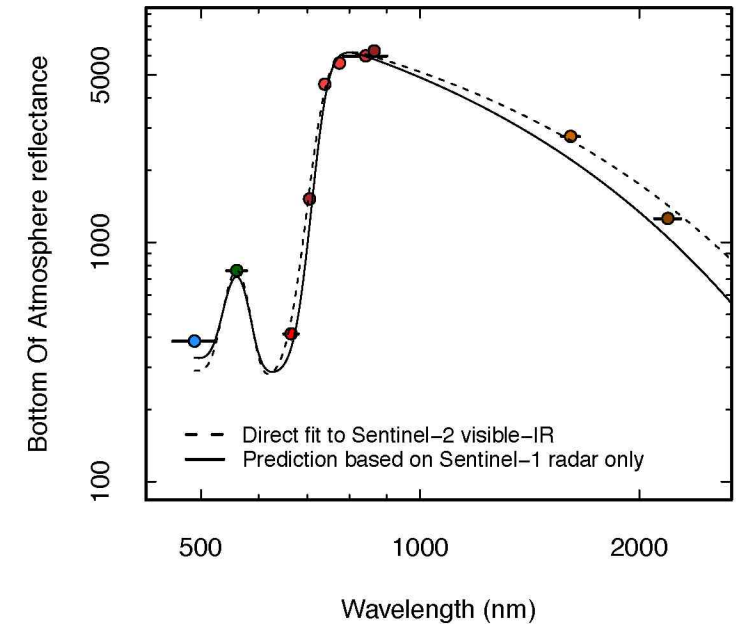
Astrophysics is the ultimate remote sensing challenge:

- Generally scant, noisy, incomplete imaging/spectral data
- Modelling of hyperspectral information to infer unresolved physical properties of an observed system

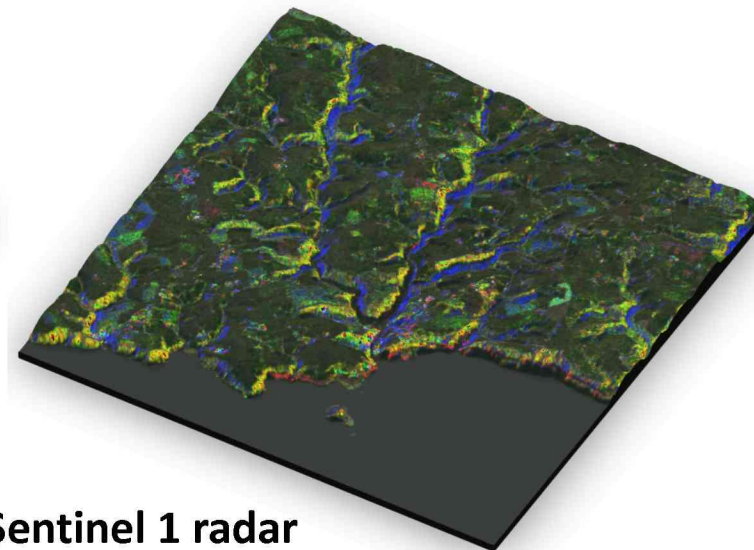
We are combining astrophysics techniques with AI and machine learning to interpret EO data for precision agriculture

G2G is making reliable predictions of ground conditions **even in the presence of cloud**, using radar reflectance. STFC-funded Opportunities project led by Dr Geach

Radar-only prediction of observed 400-2500nm response



Sentinel 2 RGB



Sentinel 1 radar

1. Deep learning identifies field boundaries across UK from Sentinel 2 data
2. Our algorithm models the spectral response of every 10x10m pixel, including cloud-covered patches; revisits every 3-5 days
3. Translate spectral features to valuable information for land-users (biomass, signatures of crop stress, growth rates, etc.)



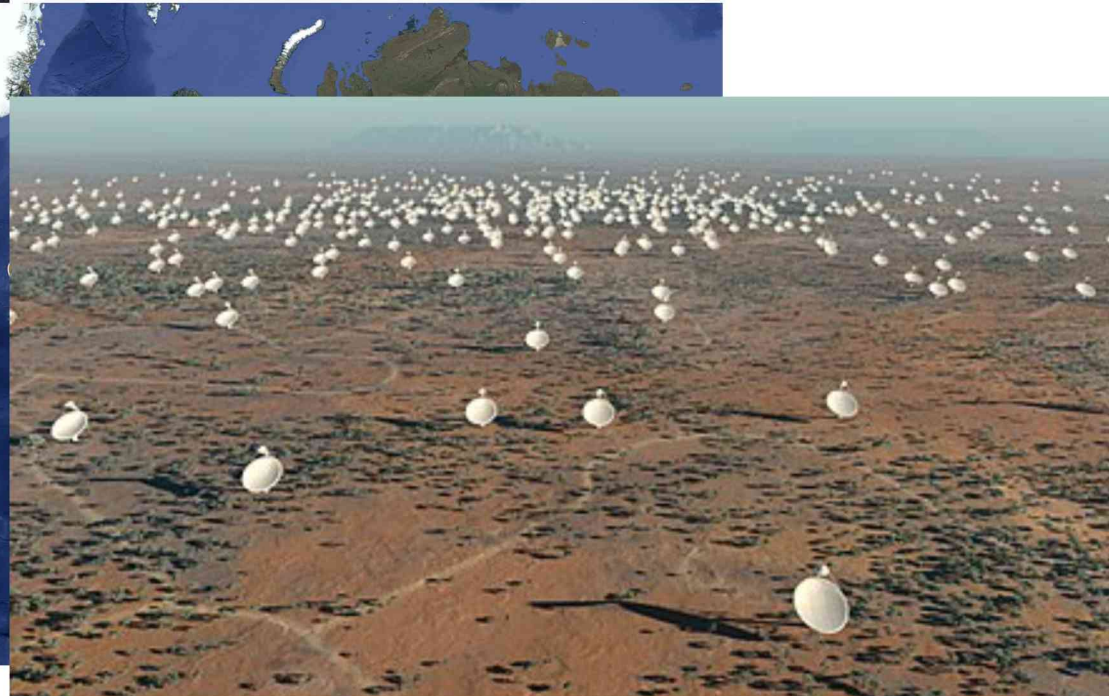
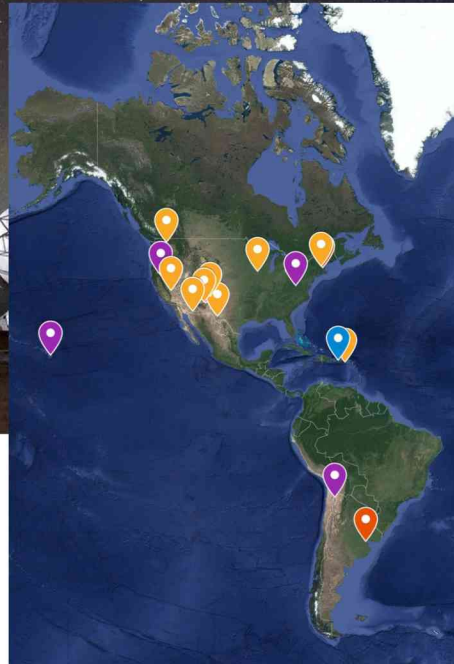
# The “Receiver Factory” concept



Developments in interferometry  
driving up antenna numbers

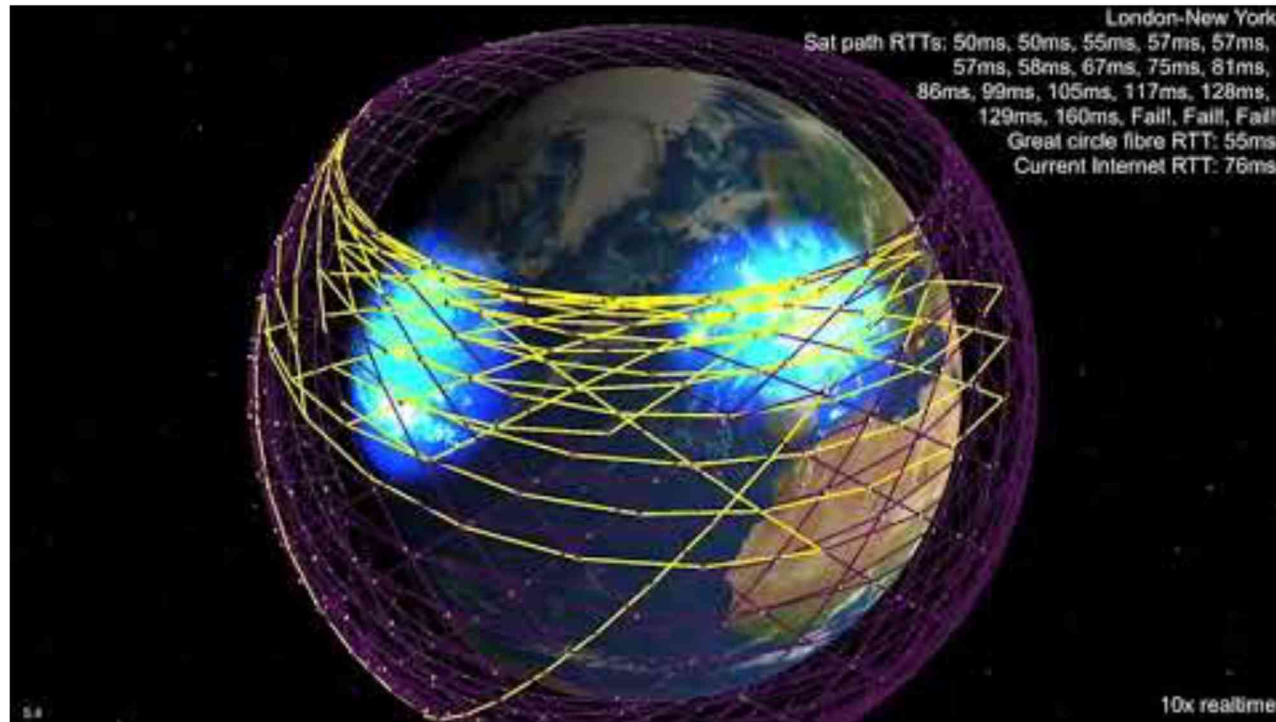


10s to 100s to 1000s...



# Growth in constellations = growth in ground stations

Larger numbers of LEO constellations mean larger number of agile dishes to serve satellites with data



## **Growing instruments to industrial scale**

For all these facilities, need to build ~ hundreds of standardized sensitive receivers

University laboratories great for R&D – not so great for manufacturing

Large overhead costs plus relatively expensive staff

Need to go from artisanal production to production line

Hence, the “Receiver Factory” – dedicated commercial production facility.

## **Getting to the Receiver Factory**

Selected as High Priority STFC community project

Proposal to build ~80 SKA Band 5 receivers for MeerKAT, e-Merlin and AVN

No funding yet but exploring options



**Thank you for listening – any questions?**