



Infrastructure + Space

Down to Earth:
Practical applications of space for
infrastructure and asset managers



Rethink Space

You may think that space is all about astronauts and scientists colonising Mars. For infrastructure leaders, the real value of space is today, down on Earth. And it isn't some future proposition or sci-fi concept – it is here, it is real, and it is already creating significant opportunities across infrastructure sectors.

If you think space is someone else's opportunity, this guidebook is for you.

It's been just over 30 years since GPS became commercially available. Today, around 75 percent of the world's population uses it. But GPS isn't just a classic example of the rapid adoption of space-based technologies for the benefit of humankind. The real story of GPS is the efficiency it has unlocked.

And it is just one of many examples of space technologies that are already deeply embedded in our economies.

The reality is that space technologies and capabilities have been developing rapidly over the past few years. There is a wide variety of applications that infrastructure organisations could be using today. Yet the sectors' hesitancy to adopt new innovations is leading to missed opportunities.

In this paper, we identify the space-related technologies and ideas that are impacting the infrastructure sector **now**. We scan forward to showcase the impact space will have in the **near** future and explore the early-mover opportunities. And we look ahead to the **next** wave of innovation that stands some 5 to 10 years out. Our focus is on bringing you the practical applications that can help you solve real problems, not the moonshots.

Towards a UK space economy

The UK's space sector continues to grow and mature, with 300% growth in the last 10 years. Spaceport Cornwall is buzzing with scientists, startups and venture capital investors. Launch licenses have been awarded for SaxaVord in Shetland.¹ And our ecosystem is expanding with a number of industry disruptors and satellite OEMs putting down roots in the country. The CAA – having moved quickly to develop a launch checklist and licence process – has shown itself to be open to innovation.

Can the UK emerge as a leader in the space sector? Before direct launch capabilities are developed, our success will rest on our proven abilities to combine high-tech manufacturing with services and light-touch regulation.

With continued government encouragement through initiatives like the National Space Strategy, venture capital investment and a pipeline of strong talent, we believe it can.

What would that mean for infrastructure players in the UK? For one, it would likely lead to lower cost and easier access to space technology, data and insights. At the same time, it should create new opportunities for sector leaders to partner with a UK space ecosystem – a sector already worth more than £16 billion – to develop a range of new and valuable innovations.

UK infrastructure leaders will want to keep their eyes on the space sector. The benefits could be out of this world.

¹ <https://www.bbc.com/news/articles/c3r4n7qd5yzo>

Now: Developments to be aware of

Three technologies enabling the 'now'



Satellite imagery (EO) and data

Earth observation satellites can provide imagery of assets to a very high resolution. Many infrastructure operators and asset managers are already using satellite imagery to better manage and maintain their assets. Applications range from vegetation management through to disaster and recovery activities.



Climate risk and scenario modelling

Weather satellites, combined with satellite imagery and remote sensing technologies, provide key data to drive more accurate climate risk and scenario modelling. This can unlock important insights for the design, planning and operation of key infrastructure assets.



Satellite enhanced IoT integration

IoT devices are equipped with satellite communication modules to deliver secure connectivity where traditional cellular networks may be limited or unavailable. This allows asset owners to track, monitor and even operate devices and equipment in remote locations.

Now opportunities for infrastructure

Design

Satellite imagery and data:

Monitor traffic flows and land usage to support planning and development.

Climate risk and scenario modelling:

Develop reliable climate models to avoid or design for event-prone areas.

Build

Satellite imagery and data:

Assess land use patterns, subterranean structures and soil stability.

Satellite enhanced IoT integration:

Enable autonomous condition reporting, operational performance and usage data.

Operate

Remote sensing: Non-visible spectrum analysis by satellite can help provide insight into asset function, efficiency and health.

Weather monitoring: Inform operational decisions ahead of extreme weather events or natural disasters.

Maintain

Satellite imagery and data:

Earth observation data helps improve damage assessments and response triage and prioritisation.

Satellite enhanced IoT integration:

Track the usage and health of mobile or remote maintenance assets.

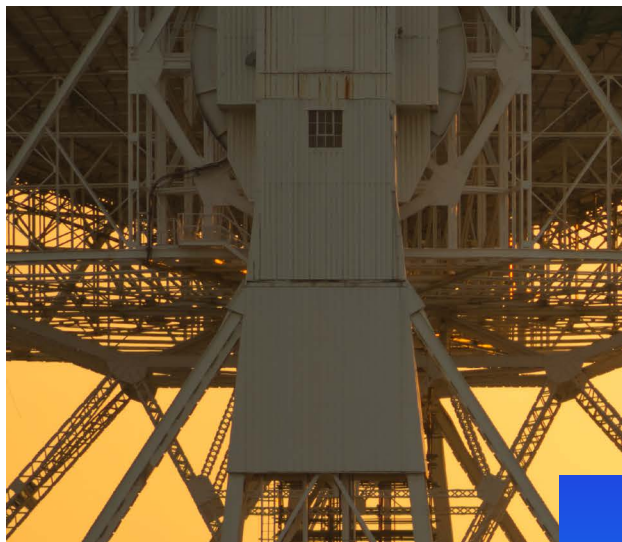
Decommission

Satellite imagery and data:

Earth observation imagery can help detect key indicator emissions such as heat.

Robotics: Robots initially designed to withstand space can work in contaminated or extreme environments on Earth.

Near: Early-mover opportunities



Three technologies enabling the 'near'



Off-world data and analytics

Orbital data and analytics use 24-hour solar energy and the coldness of space to dramatically reduce server and computational costs. Primarily used to process space-based data from satellites, for example, these assets will increasingly be used to process terrestrial data as well.



Quantum communication and sensing

Quantum mechanics will deliver computer processing speeds magnitudes faster than we enjoy today, allowing extraordinarily complex calculations to be conducted in a short amount of time. Quantum sensing uses that power to provide high-precision measurements.



Advanced materials and technology

Innovation within the space sector is unlocking a wide range of new fibres, alloys, materials and technologies that can be adapted for use in existing terrestrial assets. This will unlock not only greater efficiency, but also new opportunities and technologies.

Near opportunities for infrastructure

Design

Off-world data and analytics: Orbital data centres and AI can help inform and drive complex design requirements.

Build

Microgravity manufacturing: Microgravity manufacturing will enable advanced crystalline structures and alloys to support terrestrial construction.

Operate

Orbital energy generation and transfer: In orbit solar power generation coupled with microwave power transfer will reduce energy costs and improve access.

Satellite enhanced IoT integration: Increasing resolution and enhancements to AI asset tracking will improve asset management data frequency and insights.

Advanced global satellite communications: Realtime, persistent and reliable connectivity allows asset health and condition reporting at increasing levels of detail.

Off-world data and analytics: Enables the analysis of ever-increasing quantities of data from remotely monitored assets.

Maintain

Satellite imagery and data: Capacity to identify, diagnose and predict maintenance issues will rapidly increase.

Quantum communication and sensing: As quantum computing capabilities start to emerge, the ability to measure the effects of maintenance actions will grow.

Next: Transformative technologies



Three technologies enabling the 'next'



Off-world resource extraction and processing

From the mining and processing of Helium-3 as rocket fuel through to the discovery of new resources and minerals, efforts to commercialise resources in space are already attracting significant interest and investment, with many legacy terrestrial resource leaders now eyeing the opportunity.



Automation and robotics

The need to automate virtually every activity and process on a different planet will lead to rapid and significant advances in fully-automated capabilities. From processes to assets to systems to systems-of-systems, new efficiencies will be achieved through automation.



Applied sustainability technology

The desire to reduce the carbon emissions of space programmes and rocket launches will lead to rapid innovation in areas such as sustainable fuels and carbon capture technologies. Off-world launch stations will also play a key role in cleaning up the sector.

Next opportunities for infrastructure

Build

Off-world resource extraction and processing: Harvesting rare and undiscovered resources from space will reduce the cost and availability of rare minerals.

Operate

Automation: AI and Machine Learning will achieve the capacity and reliability to run complex and critical operations.

Maintain

Robotics: Advances made in miniaturisation and automation for space will lead to a new generation of commercial robotics designed to conduct complex maintenance.

Considerations for infrastructure leaders

Now

- 1 How could we use existing space-based technologies to drive efficiency, sustainability and innovation?
- 2 How are we monitoring evolutions in the space economy and identifying opportunities for our organisation?
- 3 What operational data are we currently lacking that could be fulfilled through space-based technologies?

Near

- 1 What partnerships could we consider to ensure we remain embedded in the evolution of space technologies?
- 2 Are we shaping our technology estate with a view towards incorporating space-based data and technology in the future?
- 3 What new business models might be emerging in the sector and how can we leverage them?

Next

- 1 What is our long-term vision for growth and how might the space economy drive our success?
- 2 Can we use our current capabilities to drive new and diverse revenue models from the expansion of the space sector?
- 3 Have we assessed the risk of long-term disruption to space-based technologies and do we have a strategy to mitigate these risks?

Going interplanetary: To Mars and the Moon



Humans are going interplanetary. NASA's Artemis programme is returning humans to the Moon for the first time since the 1970s, and the Chinese space programme is hot on their heels. SpaceX plans to be carrying out crewed landings on Mars by 2031. Interlune, a US-based space mining startup, expects to be actively mining Helium-3 on the Moon by 2029. Dozens of companies around the world are hoping to beat them there.

While these big ideas may seem experimental and niche, it is worth remembering the history of the humble standard shipping container. The first container ship (the SS Ideal X) launched in 1955 with space for just 58 containers. Today's largest ships can carry more than 24,000. Scale comes quickly once standardisation occurs.

The opportunities for established infrastructure players could be significant. From parts suppliers and technology providers through to operators and owners, some infrastructure leaders may find early investments into the burgeoning space economy today pays dividends in the not-too-distant future.



How KPMG can help

With a dedicated global network of Space professionals and a long heritage in public and private infrastructure, our team brings a deep understanding of the opportunities and risks facing organisations at the intersection of the space economy.

From supporting clients with market sizing analysis, strategy development, innovative funding and financing models and insightful commercial and procurement approaches through to helping traditional players and startups build, expand and drive value from new ecosystems, our people have the capabilities and experience to help your organisation make the most of the emerging space economy.

To learn more about how KPMG can help, we encourage you to contact us.



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