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Space

Emerging Technologies in the New Space Age

Overview of space domain, key themes and technologies

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Importance of Space

Over the past few decades, space has become a key domain of interest for the UK.

- There is an overwhelming national reliance on space technology.
- There are huge investment opportunities due to the global demand of space services.
- Space is a dangerous and a hazardous environment with many threats.

In 2022, UK Prime Minister: “ UK to be a meaningful actor in space by 2030 ”; “Space is a national enterprise”; MoD is to protect and defend ” UK’s interests in space.

The UK is investing >£Billions over the next decade into civil and defence space services that promote and preserve national prosperity.



Space by the numbers

Space in the UK



~50,000 direct employees within the UK space sector



~£17.5bn total industry income from space services.



~1,600 organisations with space related activities.



~£788m spent on space related R&D.

Global Space



~\$117bn global investment in space programs.



~\$470bn global worth of space sector.



~\$1.4tn forecasted global revenue of space sector by 2030.



223 rocket launches in 2023, ~275% increase to a decade ago.



Space tourism expected to grow into ~\$3bn market by 2030.

Space Applications



~\$78bn market size value for SATCOM.



~\$4.2bn market size value for Earth Observation.



~\$61bn market size value for satellite navigation services.



Space Themes



Satellite Communications: Data relay services from space to ground and space-to-space (i.e. between satellites). They are commonly used to carry internet and broadcasting services.



Earth Observation: Satellites dedicated to the collection of imagery and videos of the Earth for reconnaissance, disaster relief, and climate monitoring.



Space Situational Awareness: Satellites and ground-based sensors (e.g. telescopes and antennas) to observe and help manage the space environment, including space debris and nefarious activities.



Position, Navigation and Timing (PNT): Satellites that provide information about one's location and orientation, current and desired position, and precise time (think GPS!).



Launch: Rocket services to propel satellites out of the Earth's atmosphere, and satellite propulsion systems for in-orbit manoeuvring.



Key Technologies for Space



Advanced manufacturing techniques and technologies are required to meet the increasing demand of satellites. This includes better modelling and materials for space services.



Rockets and satellites require propulsion for launch and manoeuvring. More efficient propulsion mechanisms, chemicals and methods are required to manage the increasing demand for satellite launches.



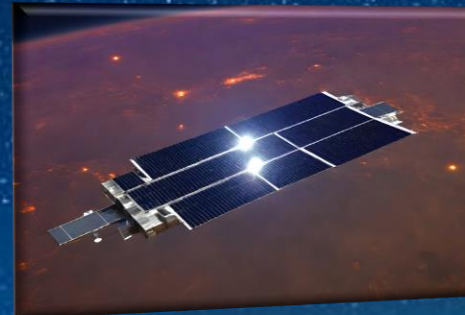
Efficient management of the ever the increasing number of satellites in space requires improved telecommunication techniques and algorithms, and the adoption of automation and autonomy.



Machine learning and artificial intelligence is critical to process the enormous amounts of space data and assist in decision-making processes for operations.



Space requires a litany of robotic services to manage launches, satellite, rovers and generally to aid humans conduct operations in the hostile space environment.



Relaying energy from space is becoming a feasible alternative to serving global needs. These require efficient materials, optics, and significant automation.

Use Case Example – Telecommunications



Summary of Key Points

- Space is a booming sector that is likely to grow on a global scale in the coming years and decades.
- Many civil and defence users rely on space-based technology for communication services, daily navigation, and observing the Earth for climate monitoring, disaster relief and surveillance.
- There are a multitude of key technologies required to meet the demand for space services and applications. These include technologies that are not unique to space such as:
 - Artificial intelligence, machine learning and autonomy.
 - Material science.
 - Optics and Telecommunication systems.
 - Power generation and storage technologies.
- There is a huge opportunity for many organisations that are not traditionally associated with space to take advantage of this demand.





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