



Commercial Lunar Missions Support Services (CLMSS)

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Introduction

Surrey Satellite Technology Ltd (SSTL) and Goonhilly Earth Station Ltd (GES), in partnership with the European Space Agency (ESA) are developing the Commercial Lunar Missions Support Services (CLMSS)

- The programme will provide service infrastructure for lunar missions, covering:
 - Communication
 - Navigations
 - Operations
 - Transportation
- CLMSS will underpin lunar exploration and help to build the lunar value chain by:
 - Reducing the cost/enhance the utility of lunar missions
 - Reduce the complexity of operating a spacecraft around the Moon
 - Simplify the transportation of payloads to the Moon
 - Expand mission possibilities with Polar and Far-side coverage
- An inclusive service structure
 - Supports a range of governments, industry & academia mission objectives
 - Provides opportunities for emerging space nations to be active in lunar exploration
 - New International partnership & commercial alliance opportunities
 - International standards for communications to enable cross support
 - New opportunities for education & public engagement



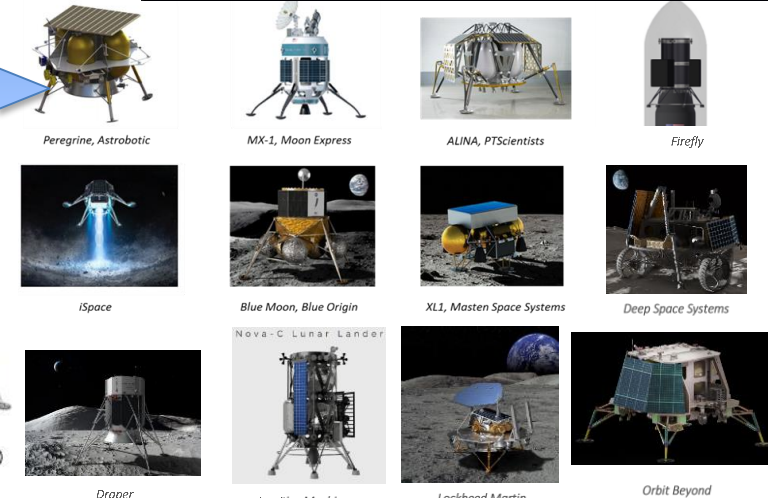
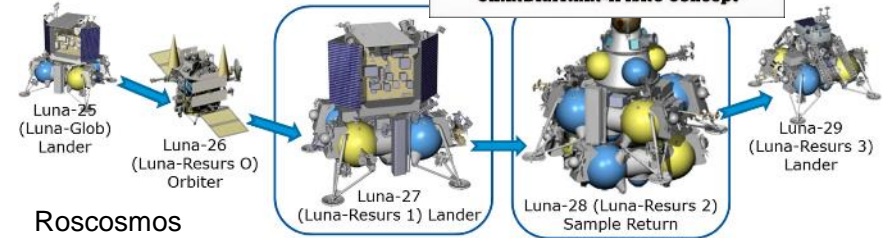
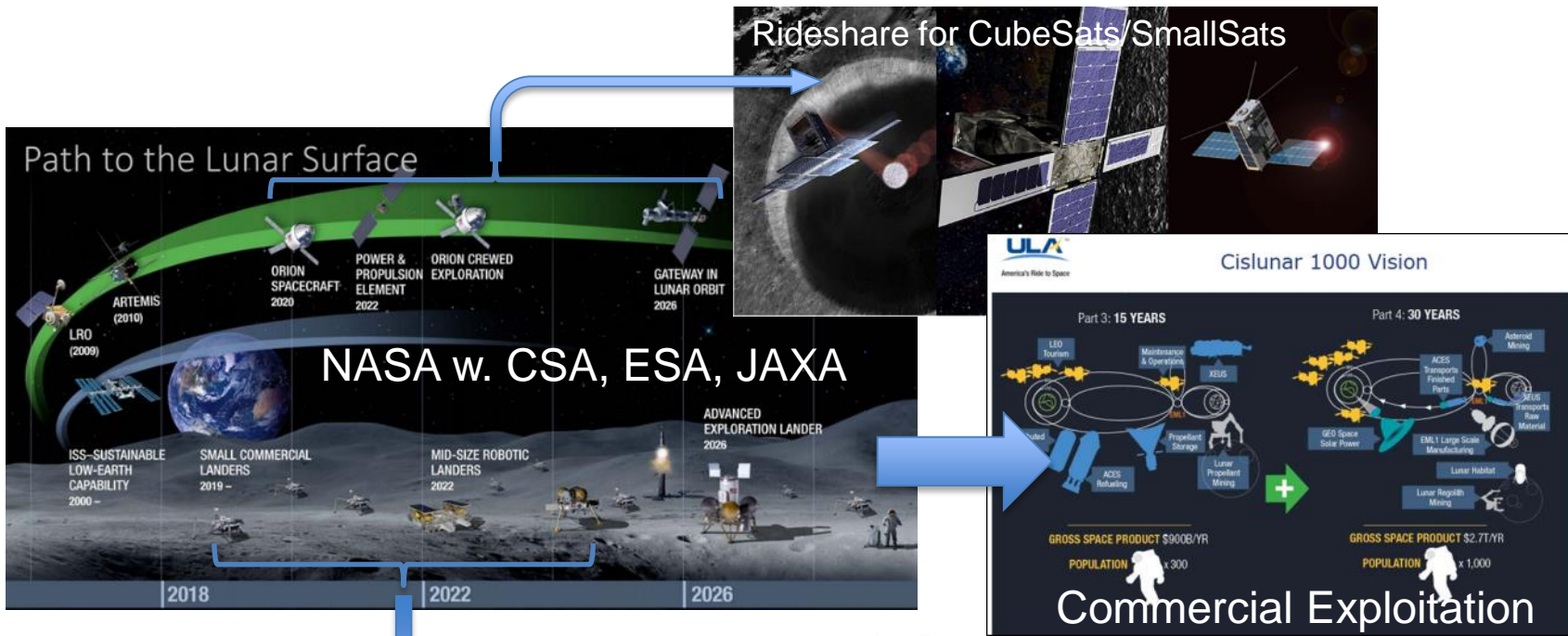
Market Overview

Renewed interest in lunar exploration has been invigorated by:

- Google Lunar X-Prize
- NASA CATALYST
- NASA CLPS
- Lunar Gateway
- China's Chang'e missions
- Other national programmes

Potential commercialisation through In-Situ Resource Utilisation (ISRU)

- Resources detected by missions such as:
 - NASA Lunar Reconnaissance Orbiter
 - ISRO Chandrayaan-1
- Numerous missions studied to extract:
 - Hydrogen and oxygen for rocket fuel and life support
 - Metals and semiconductors for manufacturing on the lunar surface



Commercial Partnership for Exploration

- Commercial approach leveraging expertise from all partners



Space Segment

Provision of Space Segment
Data relay and navigation orbiter



Ground Segment

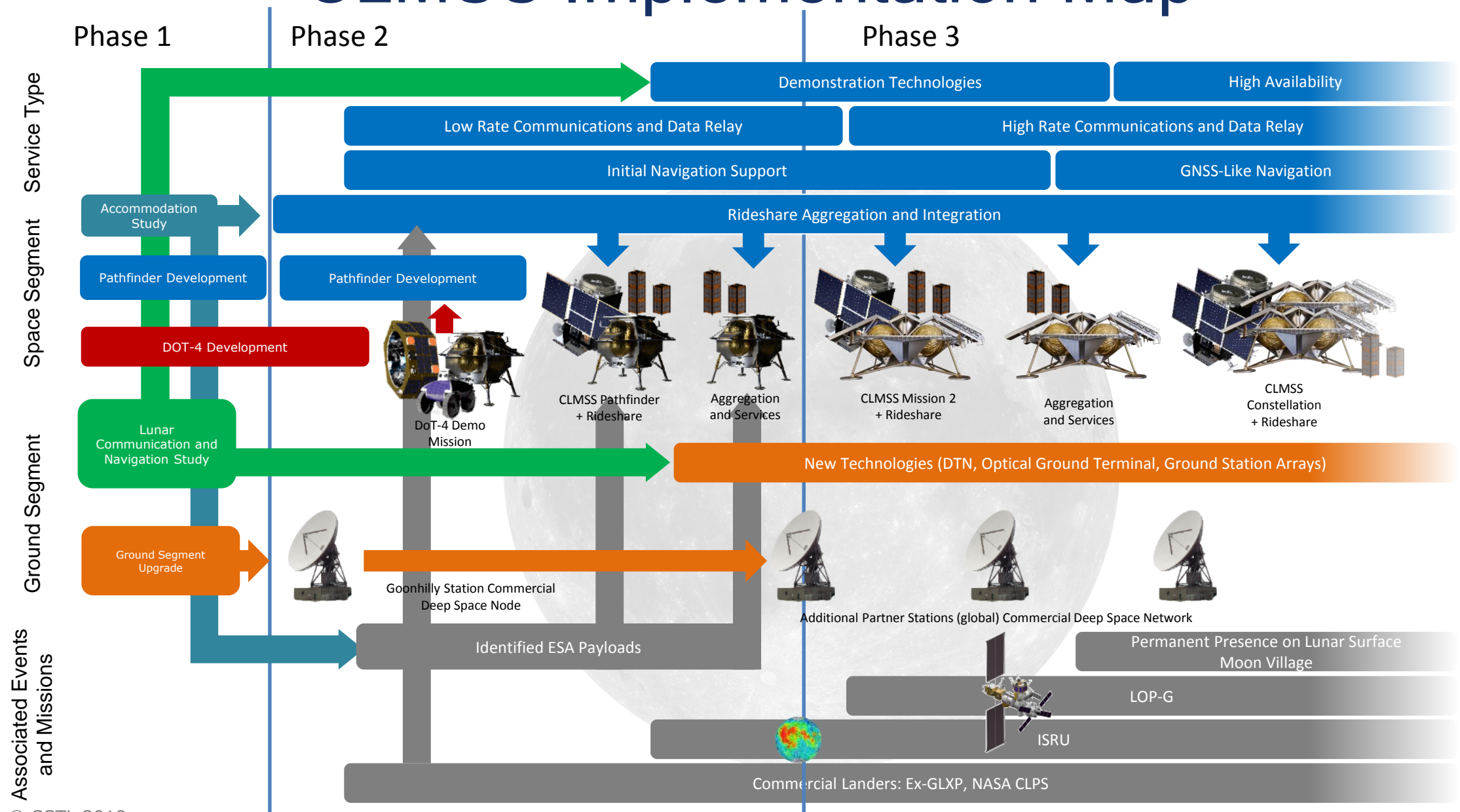
S & X-band Deep Space Antenna
Mission operations center



Enabling Partner

Extending ground segment capability
Enabling deep space service

CLMSS Implementation Map



Phase 1: Space & Ground Segment Development

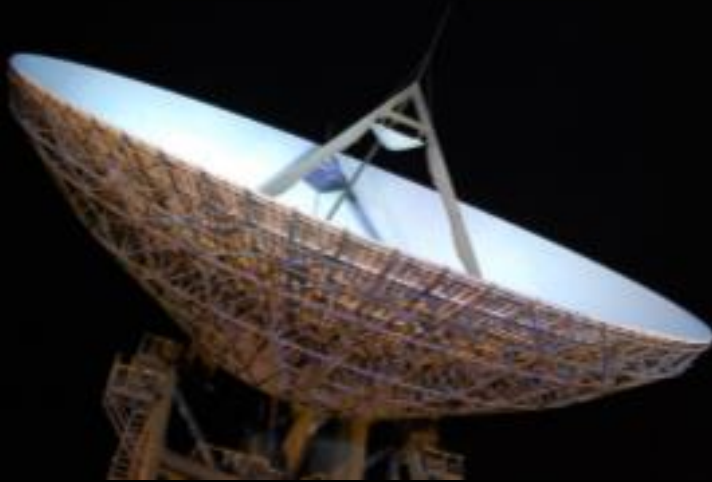


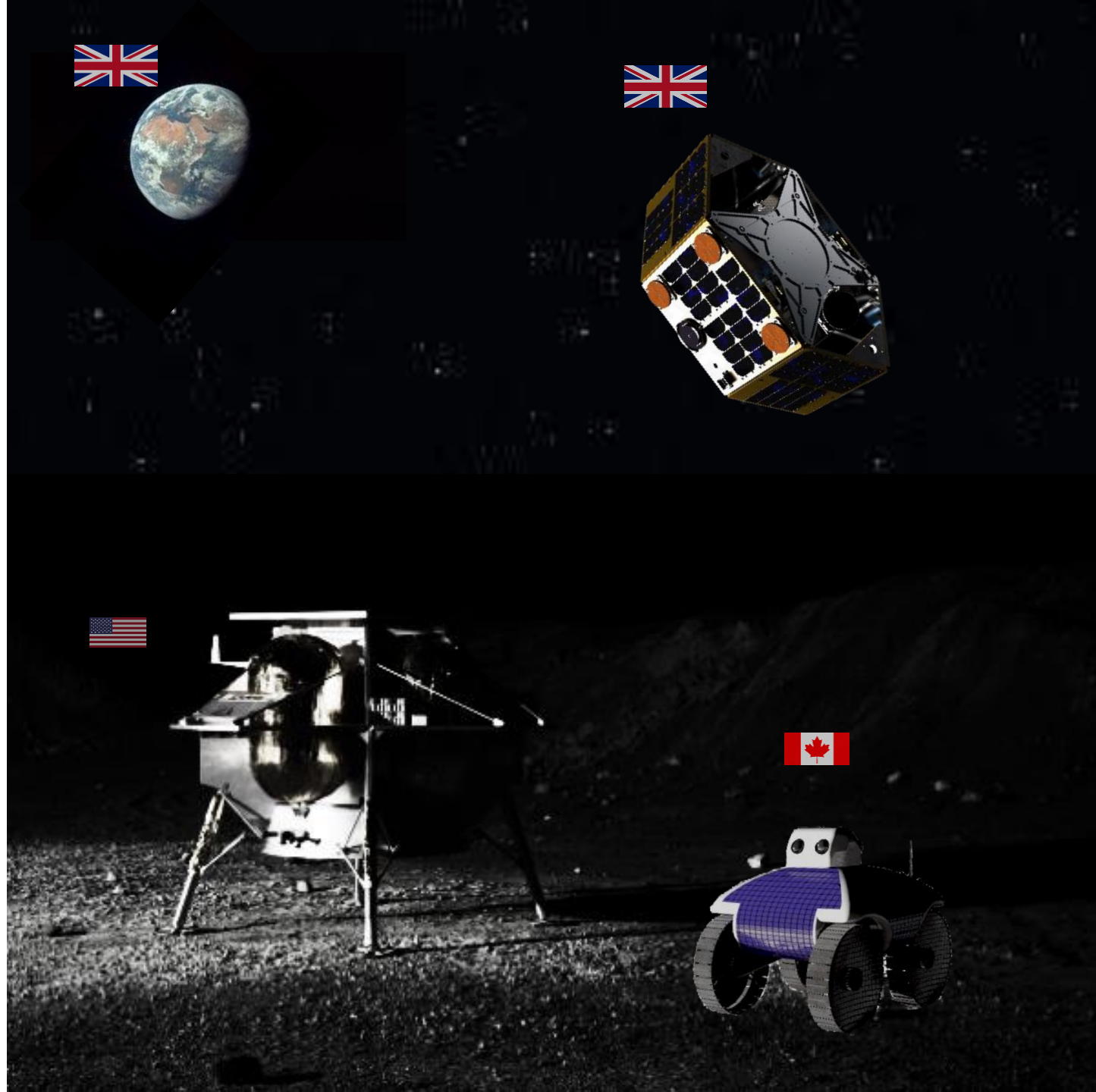
GES

- Received funding from UK Local Government, industry and private investment
- Ground segment upgrade implementation to provide S and X-band Near-Earth/Deep Space capacity for Europe
- Cross-link support for the ESA ESTRACK network

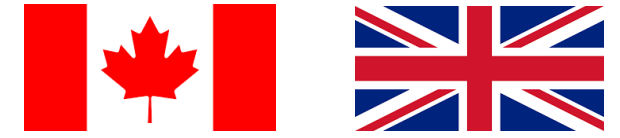
SSTL

- Maturing the Space segment for Phase 2 & jointly promote the services with GES
- Implementation of ESA studies for payload accommodation (Phase 2 opportunities for Europe) and ISRU communication support





DoT- 4 Mission



UK-Canadian industry-led mission

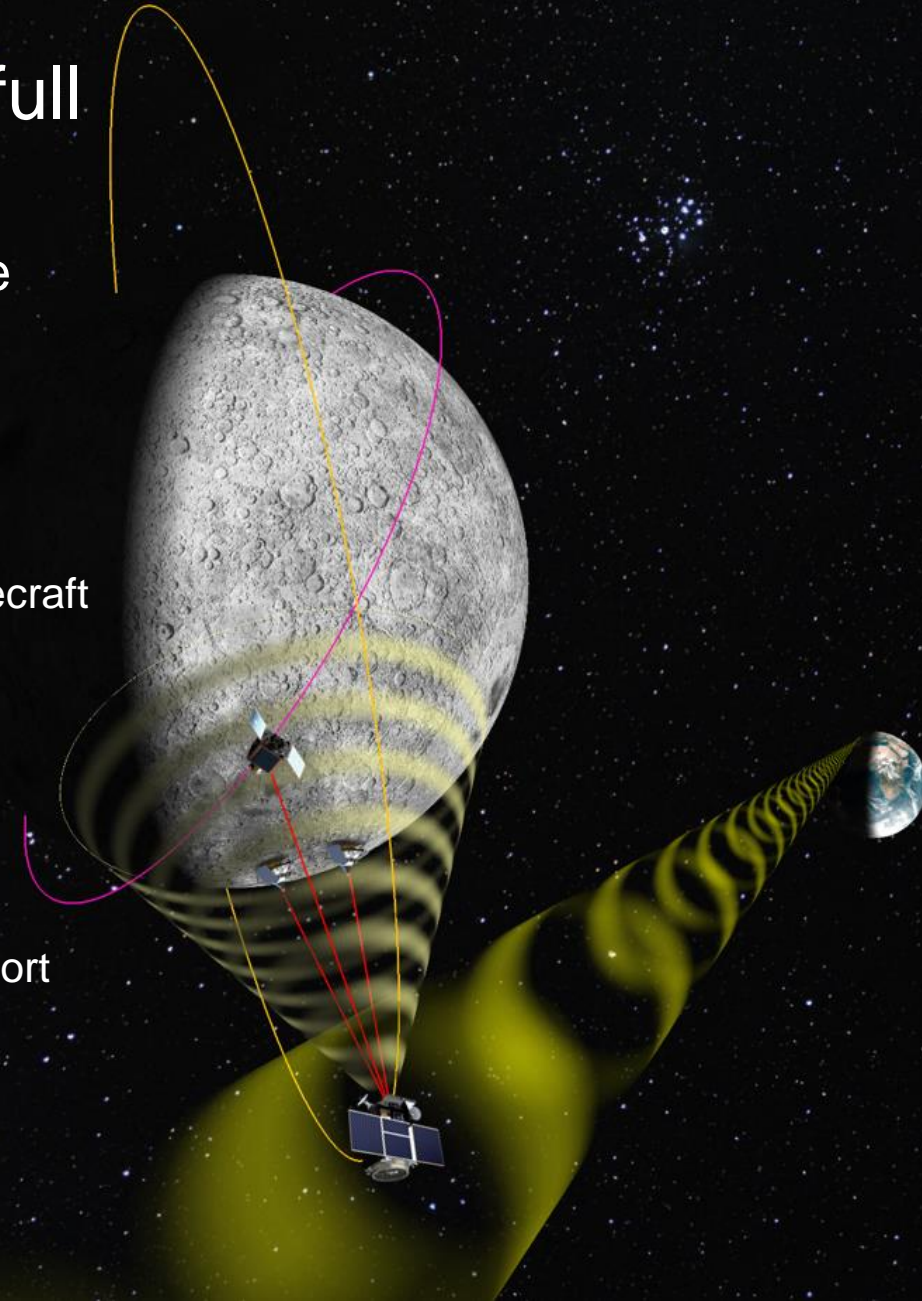
- Canadian Lunar Rover (Canadensys)
- UK Comms Relay (Surrey Satellites)
- Deep Space Network (Goonhilly)
- US 2021 Commercial Rideshare (Astrobotic)
- Unique Canada & UK STEM activity involving rover operations and outreach

Mission objectives DoT-4

- Demonstration of low cost technologies and commercial approach beyond LEO
- Demonstration of communications relay capability
- De-risk elements of the communications architecture and spacecraft operations
- STEM opportunity with orbiter and rover

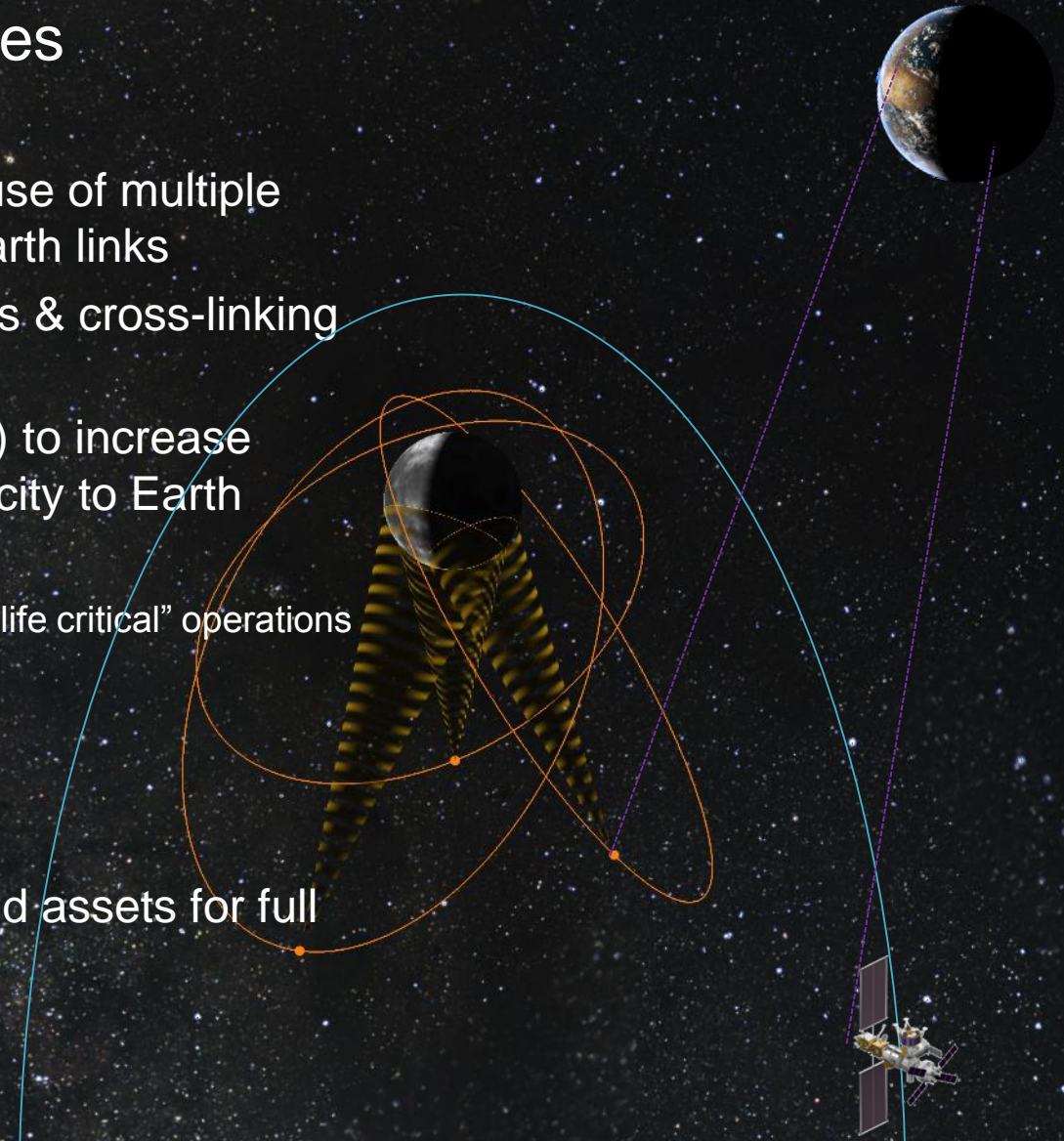
Phase 2: Lunar Services Pathfinder

- Pathfinder Mission to provide a full suite of services:
 - Transport of payload to lunar orbit/surface through commercial lander aggregation
 - Supporting procurement and integrations to the rideshare with commercial landers
 - Payload hosting opportunities
 - Experiments remaining on the Pathfinder spacecraft
 - Communications relay services
 - Store and forward service providing operational flexibility
 - Frequent accesses to lunar assets
 - UHF and S-Band services Moon links
 - Uses international standard to allow cross support
 - Initial Navigation support
 - Application Programming Interface (API)
 - Simplified user operations interface
 - Low missions control setup cost



Phase 3: Mission Support Services

- Constellation of spacecraft provides enhanced coverage and services
 - Greater mission assurance through the use of multiple assets reduces the need for Direct-To-Earth links
 - Enhanced coverage, point-to-point assets & cross-linking between spacecraft for added capacity
 - New Technologies (e.g. optical terminals) to increase data rates with users and backhaul capacity to Earth
 - Interaction with the LOP-G
 - Potential to provide extended services for non-“life critical” operations
 - Enhanced navigation services will aid:
 - Mission planning
 - Landing safety and accuracy
 - Increased autonomy
 - Additional commercial deep space ground assets for full 24/7 Earth link availability





Thank You!

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