SURREY SATELLITE TECHNOLOGY LTD

Changing the economics of space

Micro Satellites Fostering Space Technology Development with the focus on the Support for Human Space Exploration

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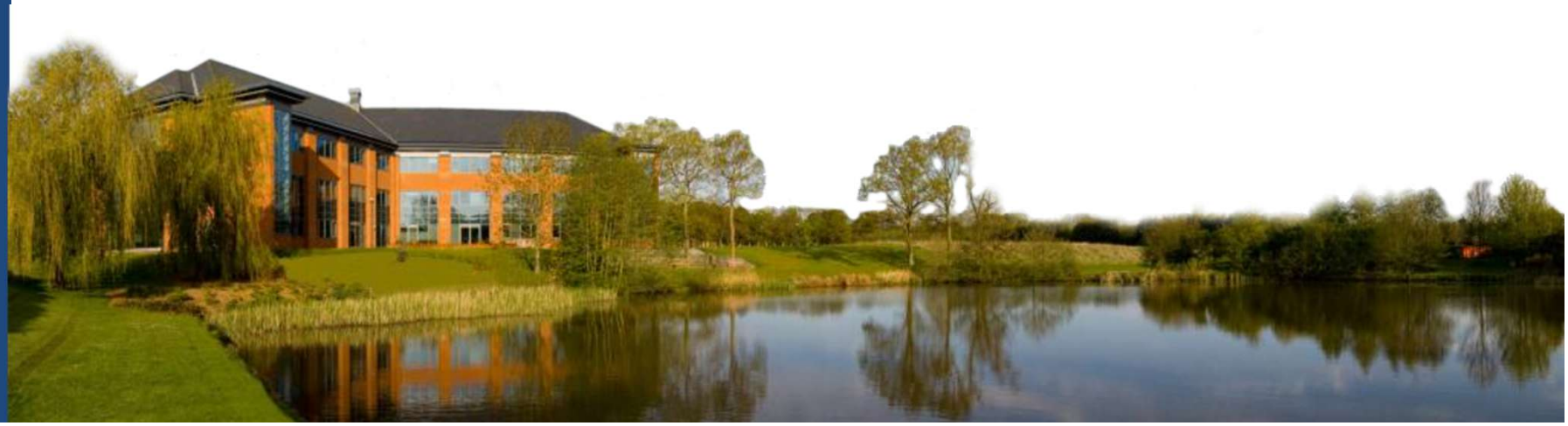
SSTL- who we are

- Small satellite manufacturer form UK, 30 years on the commercial market
- Based in Guildford, UK with around 500 staff
- Spin-off from the University of Surrey with strong academic links
- 47 missions launched, including many EO, science, navigation, meteorology
- 18 know-how transfer and training programmes

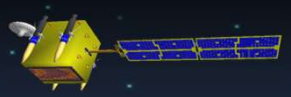


UoSAT1 - 1979

35 years later….

Sir Martin Sweeting

2040 roadmap …



MoonRaker

Asterix

MoonLITE

Mars relay

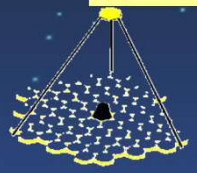
Mars service

Lunar NavCom

Lunar service

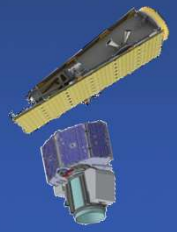
GEO Quantum

GEO HiRes optical EO



AAReST

Debris removal & IOS



X-band SAR constellation

S-band SAR constellation

0.5m GSD optical EO

Commercial services for the future

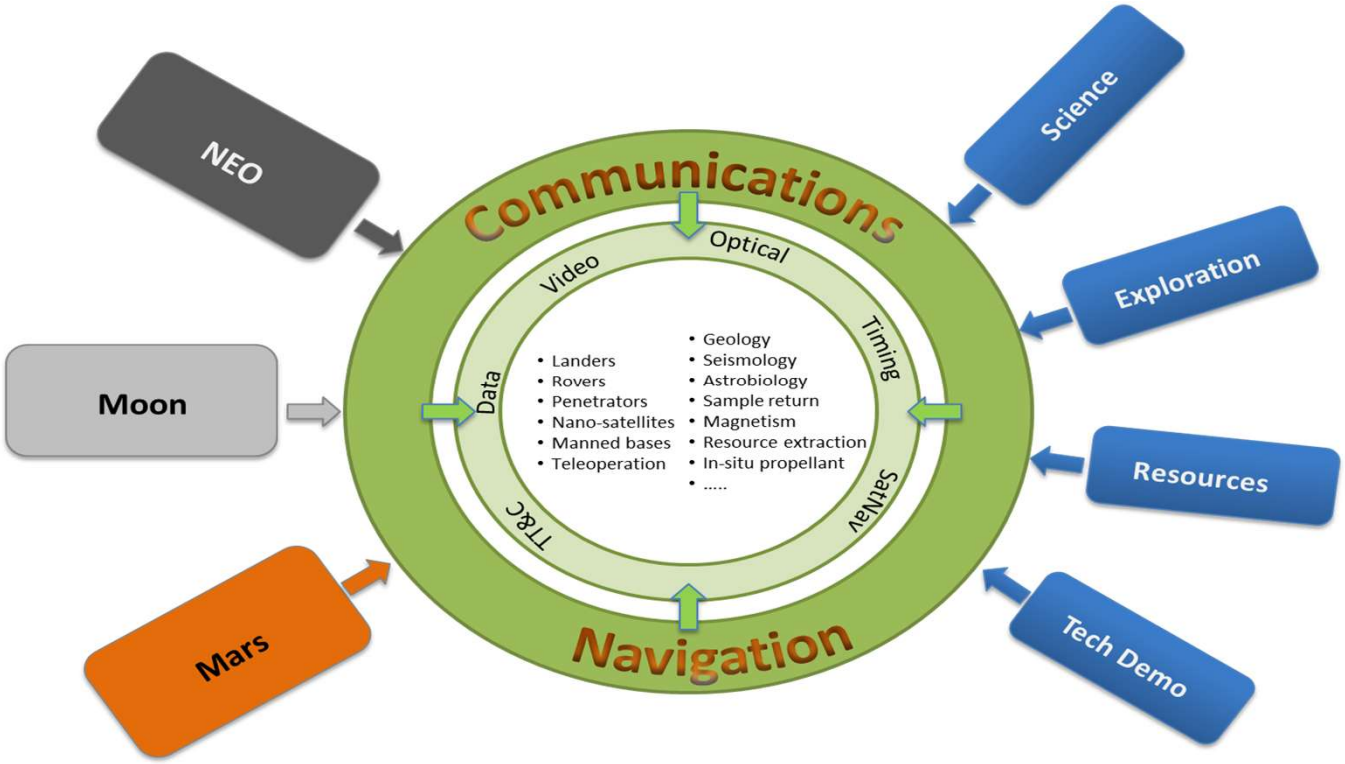
2016 → 2020 → 2025 → 2030 → 2040

Long Term Vision

- Provision of *support infrastructure for exploration*
  - Moon & Mars
    - Communications and navigation services
  - NEO's
    - Object characterisation, and impact threat assessments
- To service and enhance:
  - Commercial missions
    - E.g. Moon (GLXP, Shackleton), NEA (Planetary Resources)
  - Agency & national missions
- Offering frequent opportunities to enable space science & exploration with smaller budgets
  - Hosted payload opportunities
  - Serving the needs of emerging space nations (inc. know-how transfer) and help create the potential for UK bilateral opportunities
- We believe there is a significant market potential in being part of the supporting logistics of space exploration

Long Term Vision

- Communications and related services (e.g. navigation) will be the ‘glue’ that holds together all future exploration activities



Lunar Orbiter- Pathfinder Concept

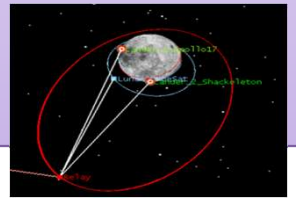
Space Segment

Transfer to Cis-Lunar space from GTO (auxiliary launch)

- Lowest cost launch approach
- Provides numerous launch opportunities per year

Highly Elliptical Lunar Orbit

- Long duration visibility of the Lunar Southern Hemisphere (~10hrs)
- Short revisit time (2-3hrs)
- Long duration visibility of ground station
- Stable orbit



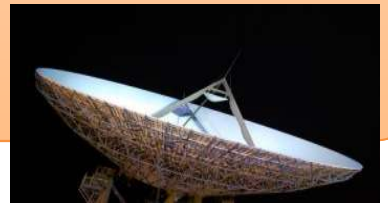
Ground Segment

Goonhilly Earth Station

- Goonhilly-6 32m antenna dish
- Being upgraded for use with the Orion Capsule for Cis-Lunar missions
- Will be visible ~8 hour per day

Internet based distribution

- Users will be able to command and receive data from their spacecraft via a web based interface
- Removes the need for users to acquire and maintain their own ground station



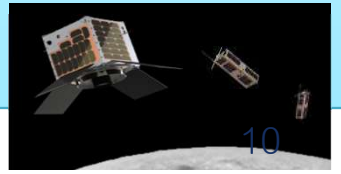
User Segment

Passenger Payloads

- Initially fleet of NanoSat users will be taken with the Lunar Comms spacecraft
- Can be placed into LLO
- Demonstration phase

Other users

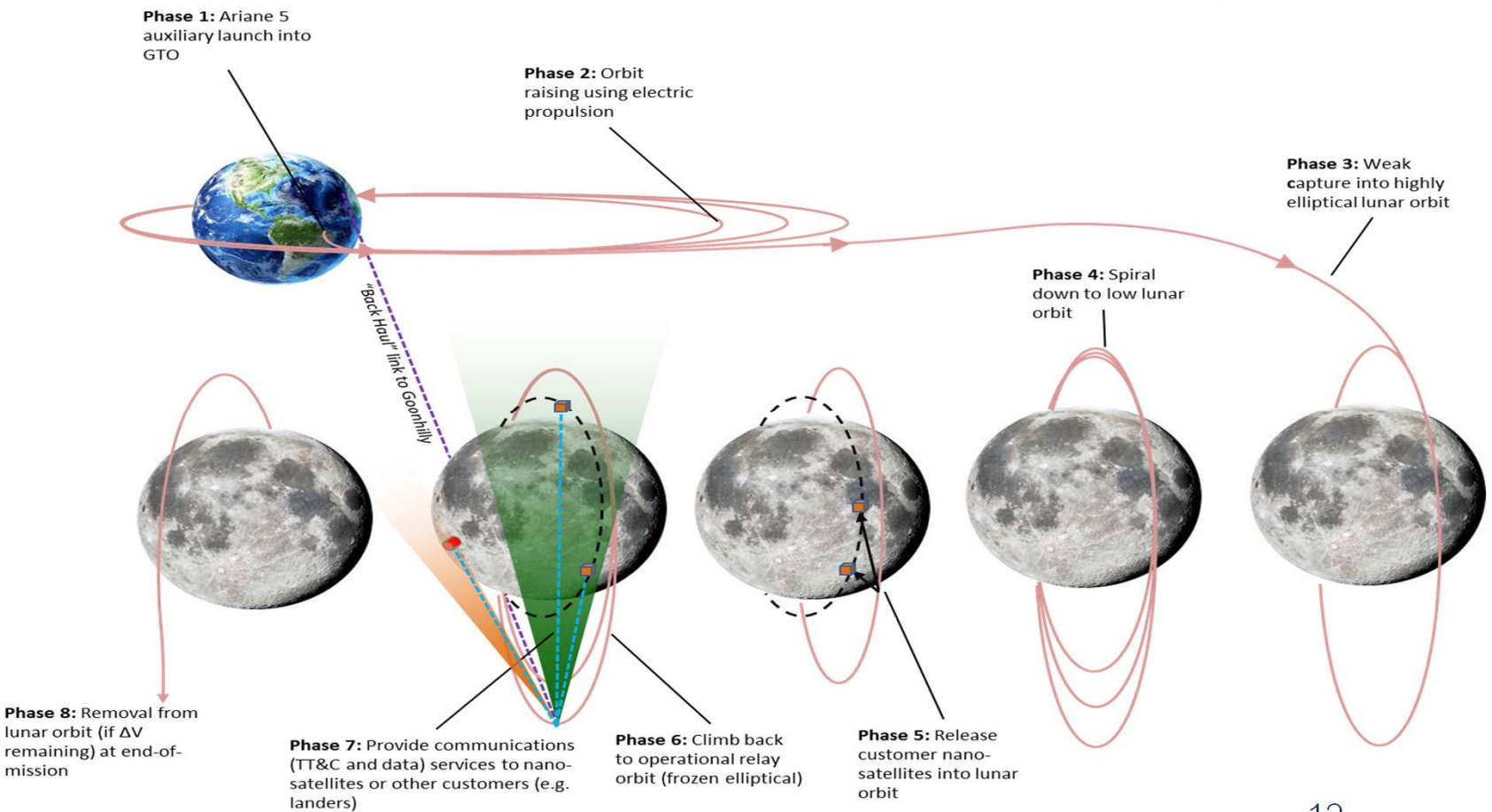
- Once demonstrated the service can be user by other Institutional and Commercial missions
- Services will be as transparent to the user as possible



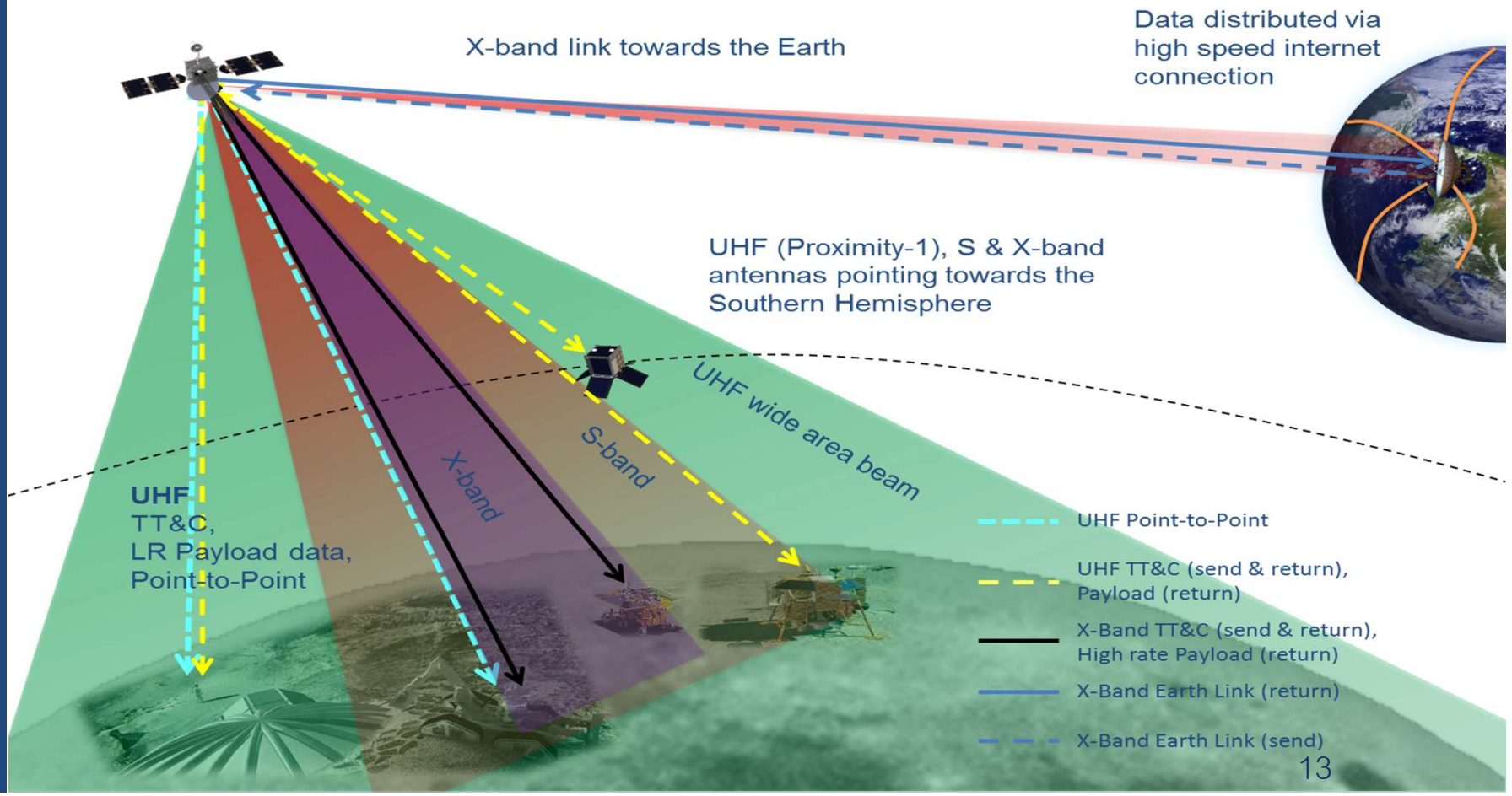
Lunar Orbiter- Pathfinder Concept

- Our concept is novel and combines several aspects with exploitation potential:
- *1. Use of an "adapter-sat" communications spacecraft*
  - Exploit un-used launch mass and volume on Ariane 5
  - Very low cost launch
  - Regular launches into GTO per year (good high-energy starting orbit for exploration)
  - Currently being studied under UK Government NSTP by SSTL
- *2. Use the spacecraft to transport customer payloads to the Moon*
  - Currently no market at the Moon for communications
  - Transport – paying - customers (e.g. nano-satellites, hosted payloads, micro-landers) to the Moon via the main spacecraft
  - Act as a communications relay for these assets once at the Moon
- *3. Use existing deep-space compatible ground segment*
  - Goonhilly is a significant UK asset and is currently being upgraded for forthcoming Orion flights
  - Cost of renting NASA or ESA DSN time is prohibitive and a barrier to low-cost exploration
  - Goonhilly is the first element of a future private commercial DSN which could support solar system exploration
- Put together, these elements will help to create a new market with all of the associated benefits in terms of growth, wealth, jobs etc.
  - Fulfilling as important aspect of the UK Innovation and Growth Strategy (IGS) and the general UK space sector strategy

Lunar Orbiter- Pathfinder Concept

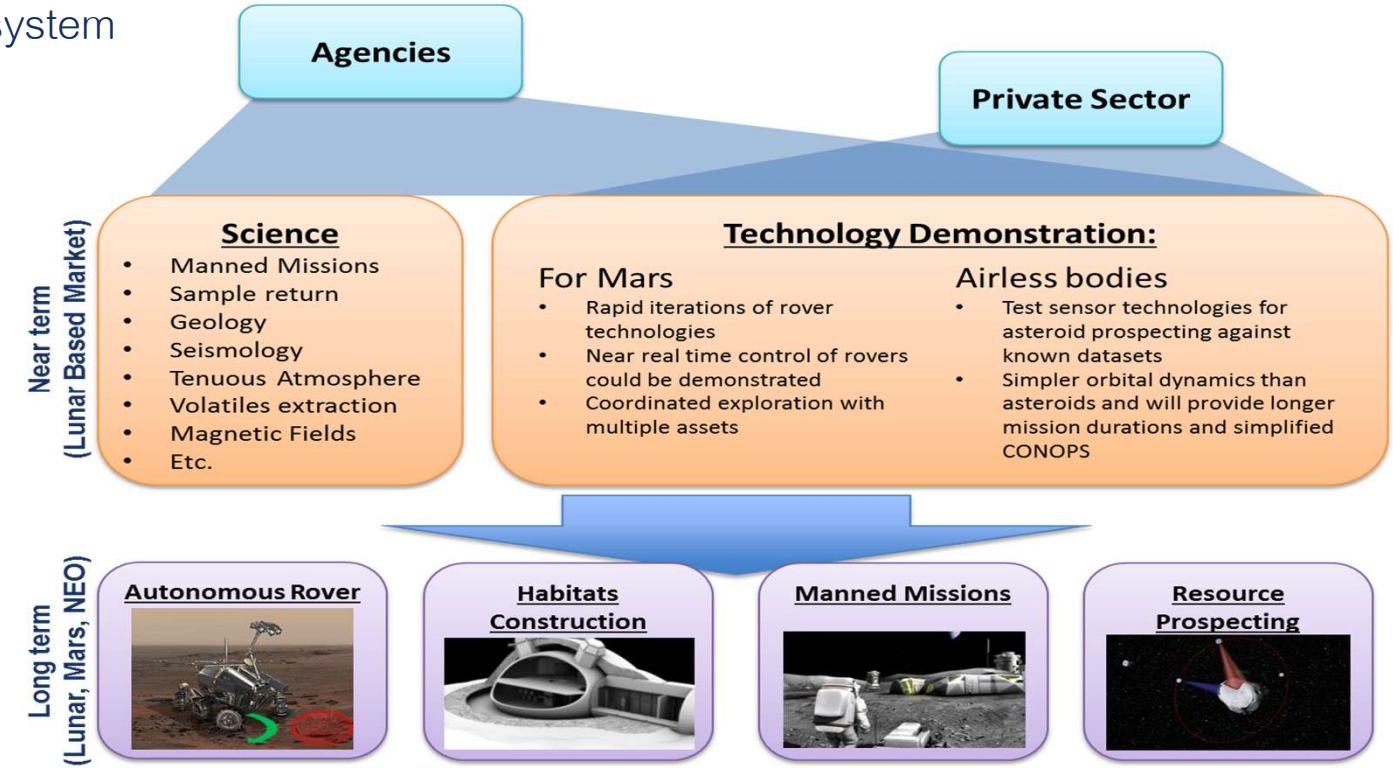


Pathfinder Concept



Long Term Model

- By providing a low-cost support infrastructure, we believe this will help to grow a new market at the Moon for both agencies and the private sector, not only for lunar-based activities but also for testing systems for elsewhere in the solar system

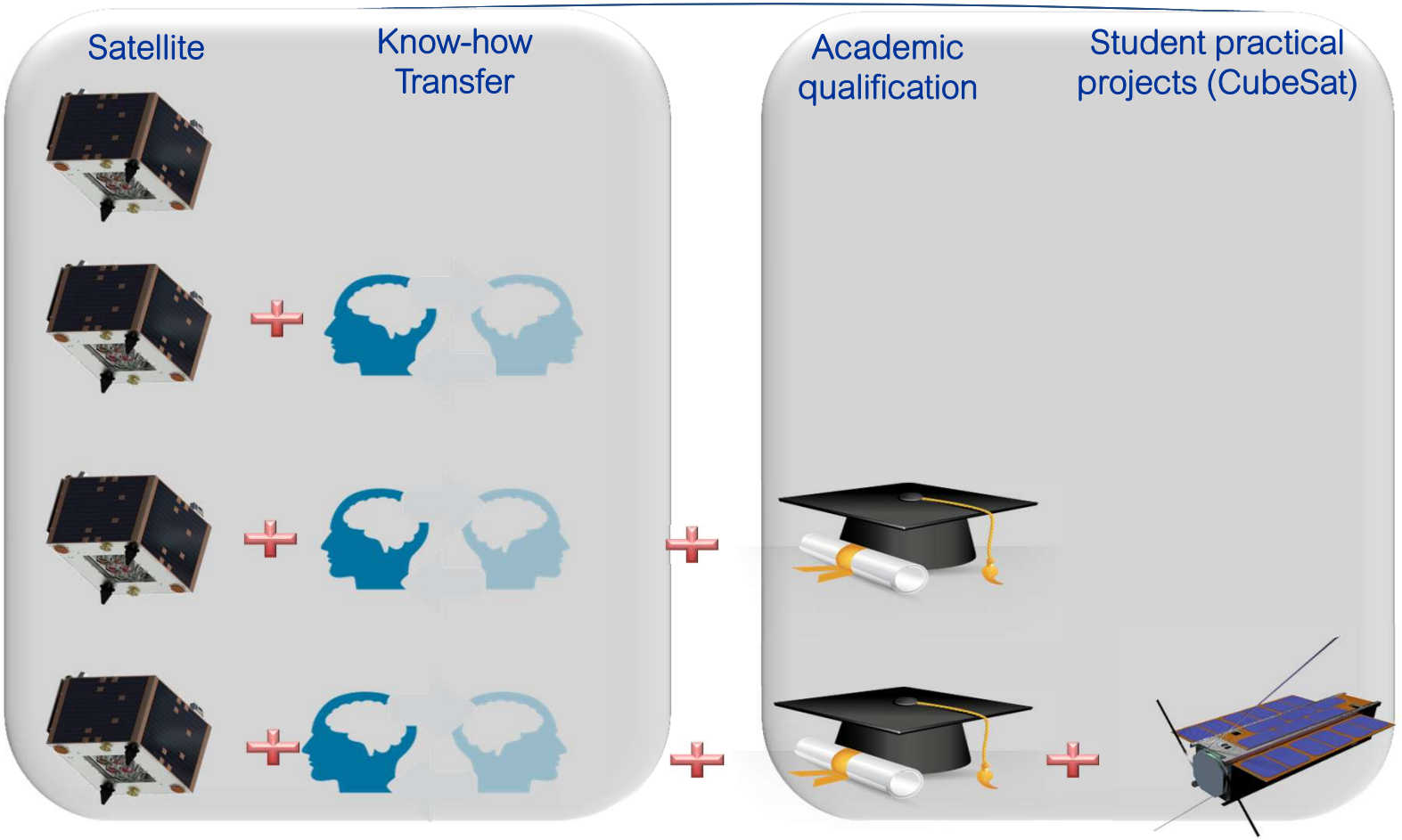


SSTL's unique approach to know-how sharing

OBJECTIVE of SSTL's Know-how Transfer:

"Ability for the customer to reproduce the SSTL spacecraft product, and fly it with new or updated payloads".

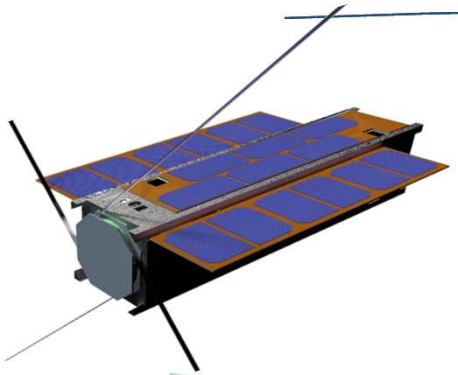
SSTL Technology Training options

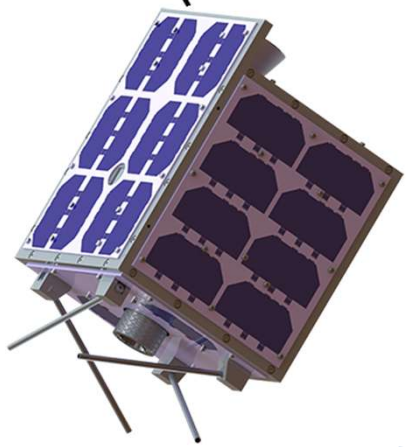


Training programmes

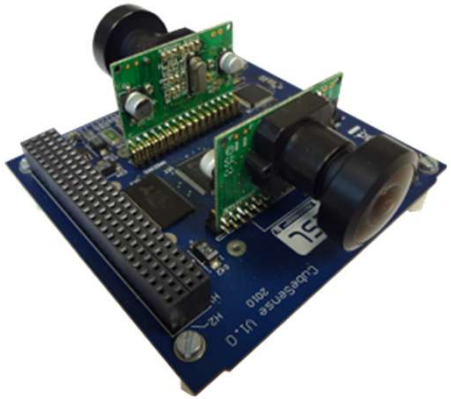
Nation	Period	Team	Mission
Kazakhstan, Ghalam	2014-2016	14	KazSTSAT
Algeria, ASAL	2014-2016	14	AlSAT-1B
Kazakhstan, KGS	2012-2013	24	KazEOSat-2
USA, NASA/MSU	2007-2008	3	Magnolia
Nigeria, NASRDA	2006-2009	26	NigeriaSat-2/NigeriaSat-X
Turkey, Bilten	2001-2003	12	Bilsat-1
Nigeria, NASRDA	2001-2003	12	NigeriaSat-1
Algeria, CNTS	2000-2002	12	AlSAT-1
China, Tsinghua University	1998-1999	12	Tsinghua-1
Malaysia, ATSB	1996-1998	9	TiungSat-1
Singapore.MTU	1995-1997	2	UoSAT-12 (payload)
Thailand, MU	1995-1997	12	Thai-Paht
Chile. FACH	1994-1998	8	FASAT-A&B
Japan, Fujitsu	1992-1994	3	(FjSAT)
Portugal	1992-1994	6	PoSAT-1
South Korea, KAIST	1989-1993	12	KITSAT
South Africa	1989-1992	2	UoSAT 3/4/5
Pakistan	1984-1988	10	BADR-1

Looking for partners





Lunar nanosats



Payloads

Landers


Thank you
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