SURREY SATELLITE TECHNOLOGY LTD

SSTL Contribution to NDU Spacepower Symposium

Dr. Stuart Eves
s.eves@sstl.co.uk
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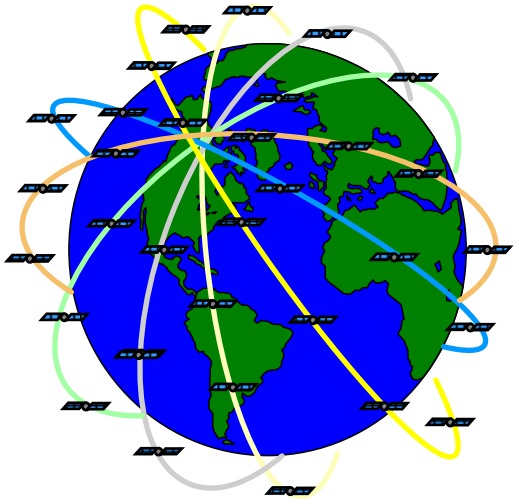
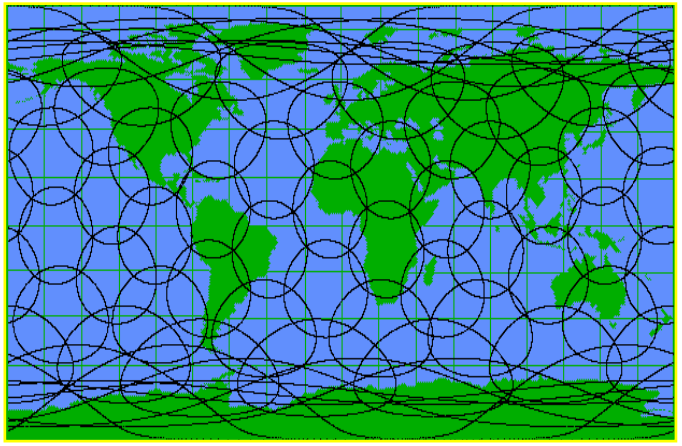
To what degree can opportunities and developments in space serve to capture the imagination and attention of citizens and policymakers in a way that will significantly expand current levels of effort in research, development, or operations?

Inter-Satellite Link Network

- The power and value of PC computers was massively enhanced when they were networked in the World Wide Web
- Similarly, the true value of small satellites, (the PC's of space), will be realised when they are fully "networked" via inter-satellite links into a "space internet"
- To date, inter-satellite links have been used on a limited number of systems
- In the future, it will be conventional to provide intersatellite links for all satellites
- The space enterprise will become much more responsive as a result, meeting the deadlines demanded by the news media, for example

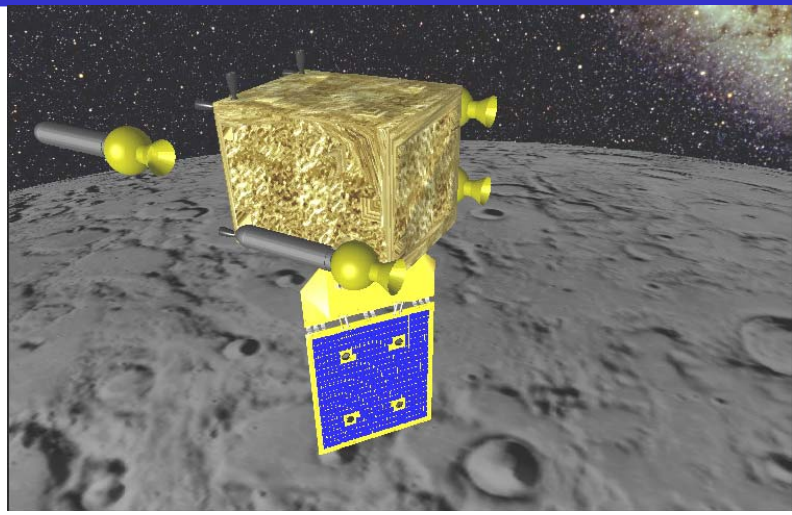




UK Lunar Mission Concepts

MoonLITE

- A **polar orbiter** for communication, navigation and orbital remote sensing
- **Multiple micro-penetrators** (3-10 kg each) for far-side, near-side, and South pole deployment providing in-situ geophysics & geochemistry
- **Launch in 2010-11**



Moonraker

- **Small lander** for near-side geophysics & geochemistry
- **Micro-rover** for surface mobility (<1 km range) and multiple-site sampling
- **Launch in 2013-14**

Potential Science Missions

Lunar Missions

Mars Mission

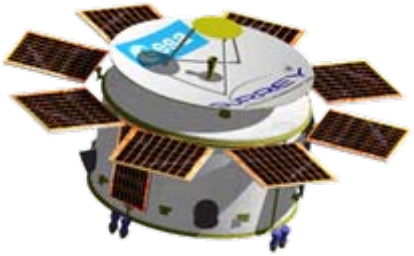
Venus Mission

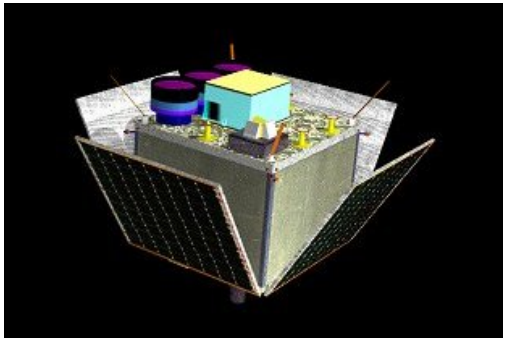
NEO Mission

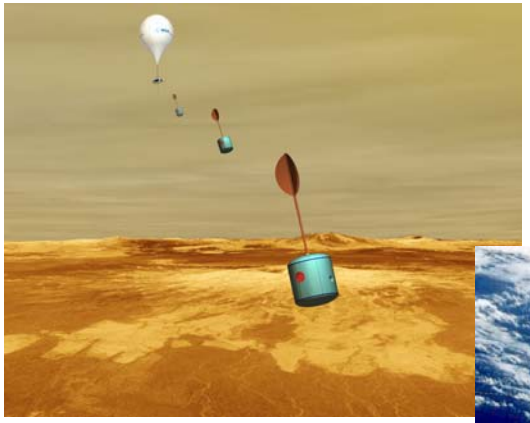
Formation flying science experiments

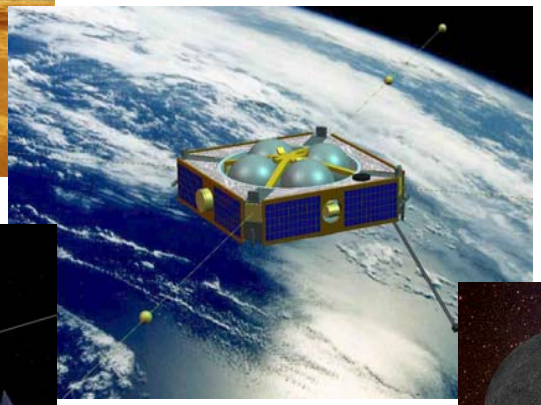
High Delta-v nanosatellites

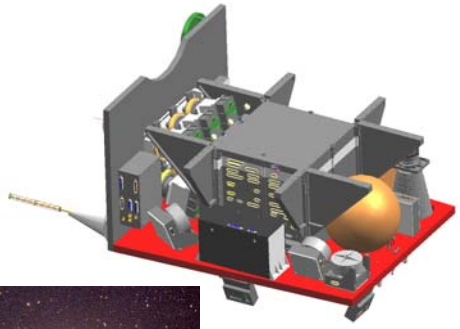
Small space-based telescopes

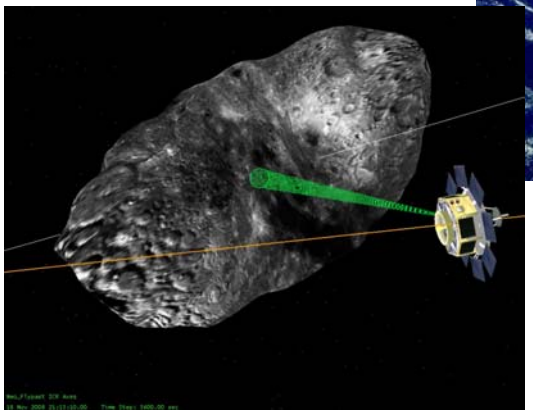












Commercial Space

- Massive investment in space tourism
  - Sub-orbital
  - Orbital
- Governments will shortly lose the technological lead in space, (as in the telecommunications sector), if indeed they have it today
- Lower entry costs means that there is increasing potential for non-governmental players to develop satellite systems

Which is more likely, that space development and operations will serve to bring nations together or act as a point of hostile confrontation and conflict? Why?

International Space

- Lower entry costs means that more nations will invest in space and so have a vested interest in maintaining access
- Increasing realisation that much of modern society relies in some way on space capabilities
- PAROS-type treaties could help to preserve the space environment
- Frequency coordination process already well established
- Emerging international standards on debris mitigation also a positive sign
- It is in the space industry's own interest to support such initiatives

Disaster Monitoring Constellation

Novel International Collaboration

- ★Individual ownership
- ★Collaborative operation
- ★Data sharing and exchange
- ★Mutual data exploitation

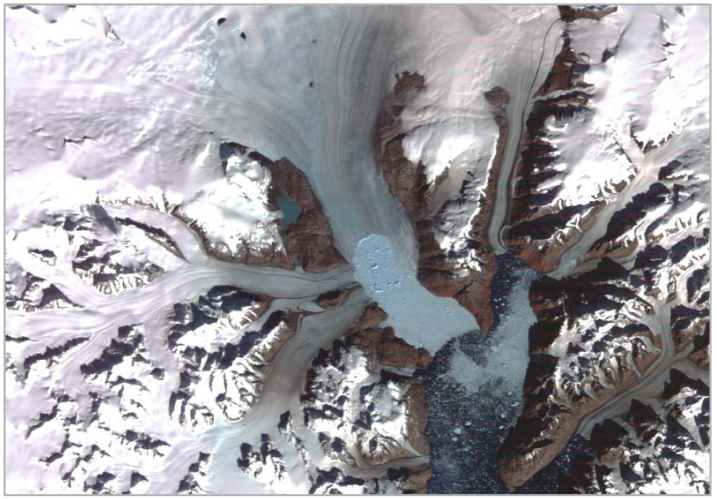
Affordable opportunity for real co-operation in space achieving mutual benefit – global daily imaging capability

Three launches into the same orbit:

November ’02: Algeria
September ’03: Nigeria, Turkey, UK
October ‘05: China, (with TopSat)

Mission results

Land Cover & Vegetation



Global Science

Floods

Fire

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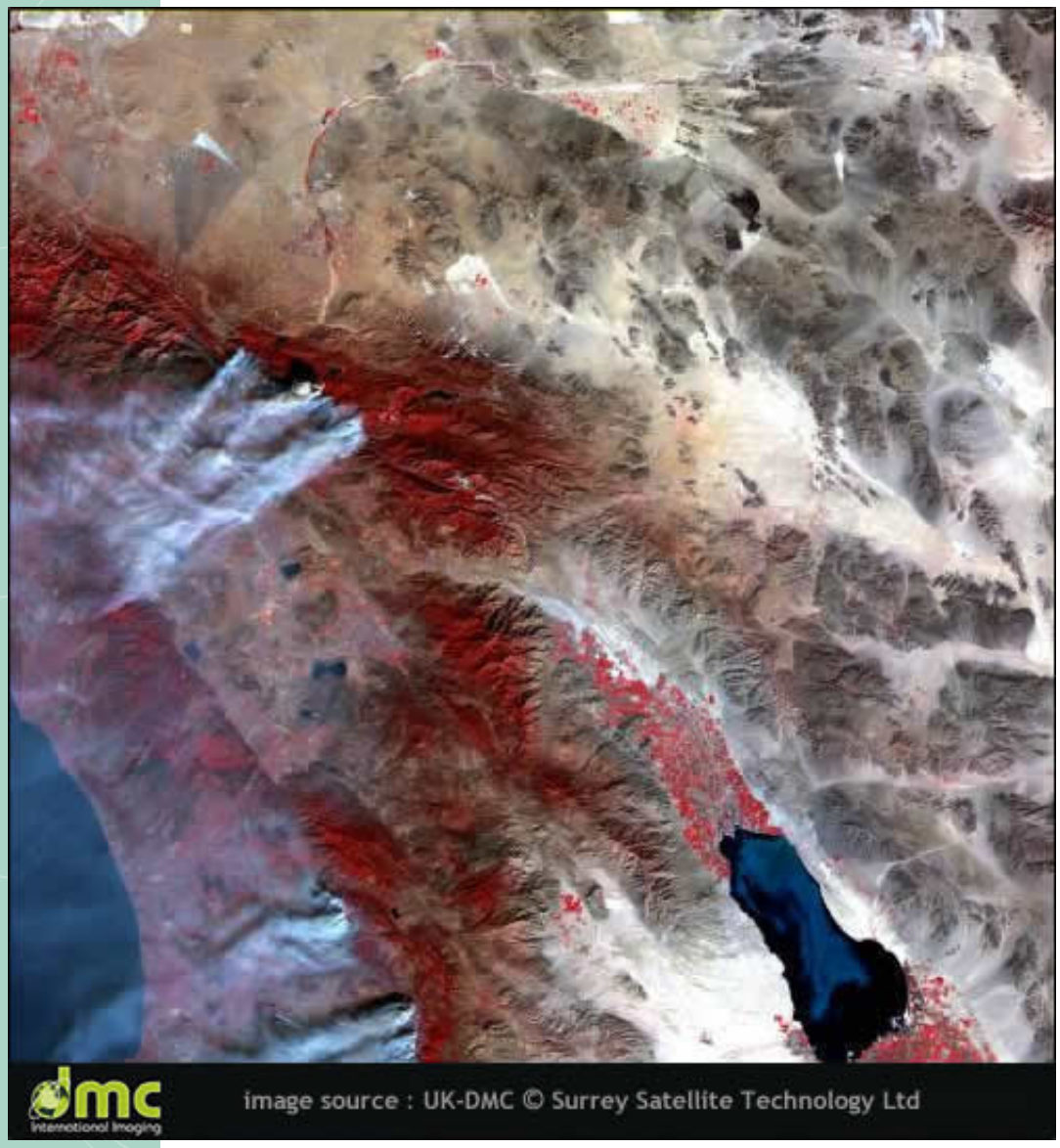
Hurricane Katrina

www.dmcii.com

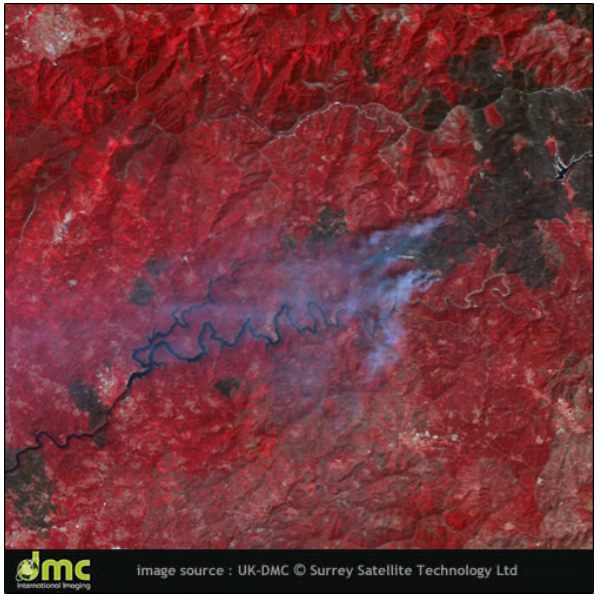
NigeriaSat-1 DMC image 2 September 2005

DMC – Forest Fires in the US



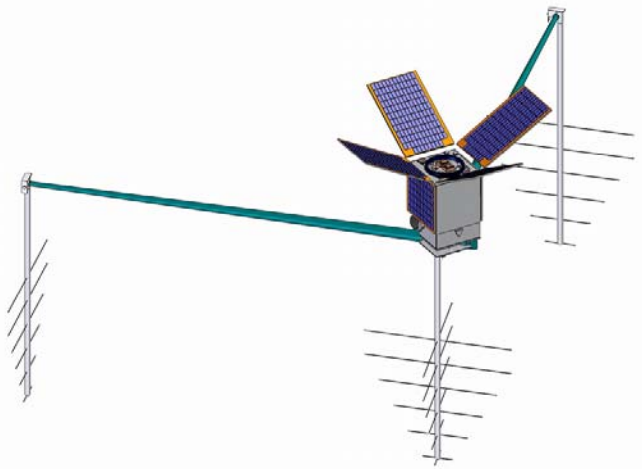
The DMC is being used for burn scar mapping and monitoring active fires

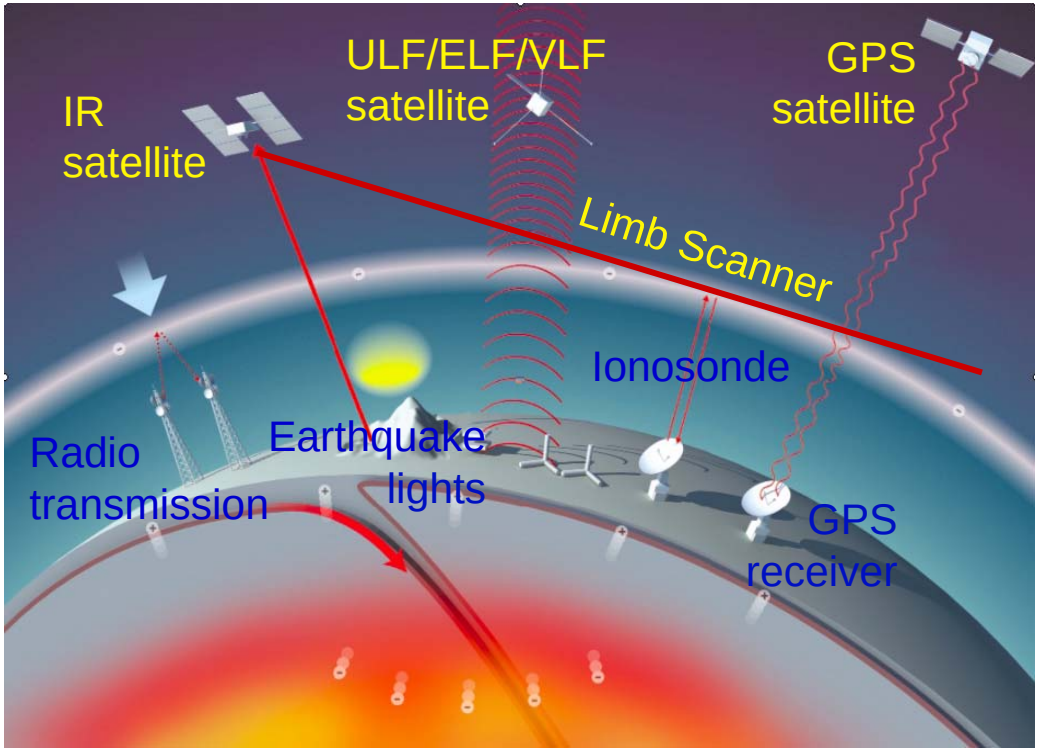
It also has the potential to monitor changes over particular land use elements such as forests for fire risk assessment, given the high frequency of image acquisition



Earthquake Prediction

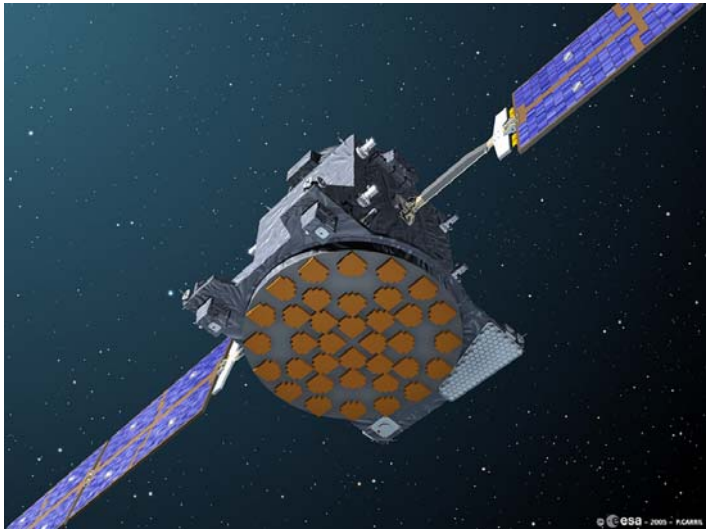
- There is an increasing theoretical understanding of the way that rocks behave under extreme stress
- Theory indicates that low-frequency RF and wide-area IR sensors may allow earthquake prediction





Precision Navigation and Timing

- Central to the operation of a vast array of services including:
  - Coordination of mobile phone networks and pagers
  - Timing of transactions on the financial markets
  - Operations of power grids
  - Precision agriculture
  - Etc.
- Schriever wargame conclusion that US should support the Galileo navigation programme as a back-up to GPS

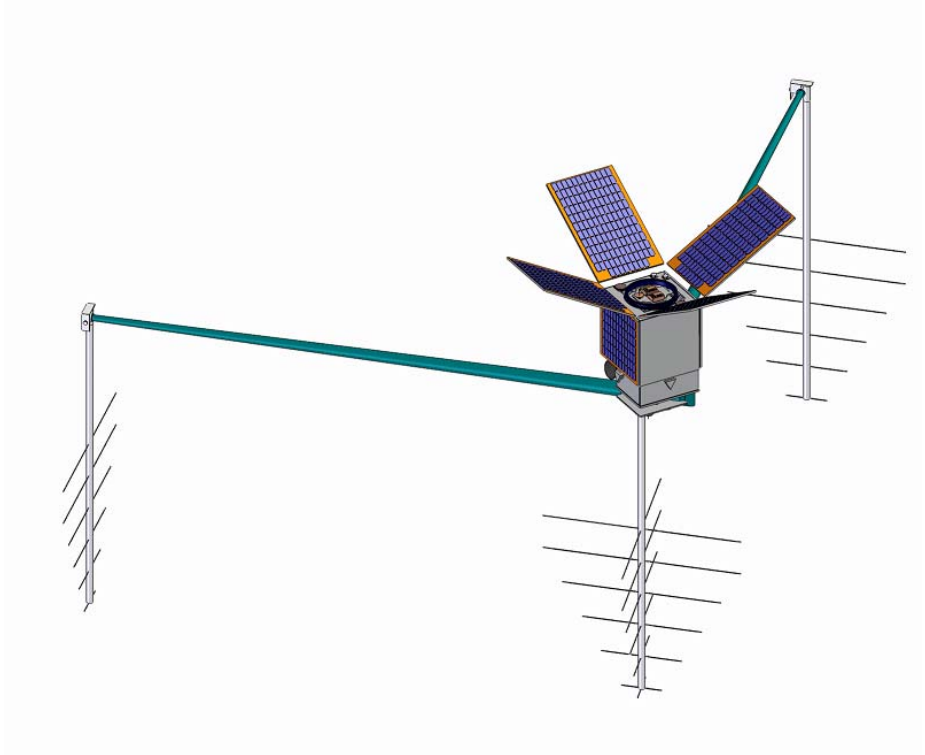


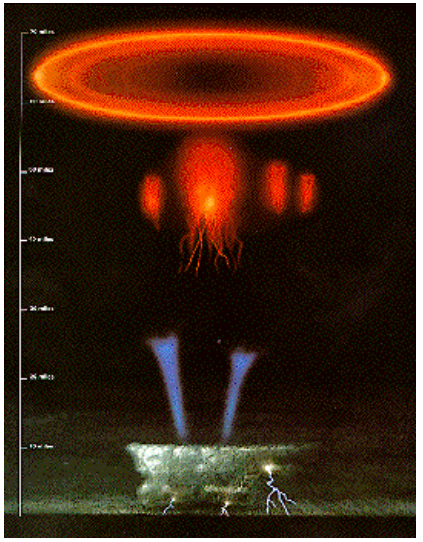
How would a nationally agreed upon spacepower theory influence the trajectory of space development?

How would an internationally agreed upon spacepower theory influence the trajectory of space development?

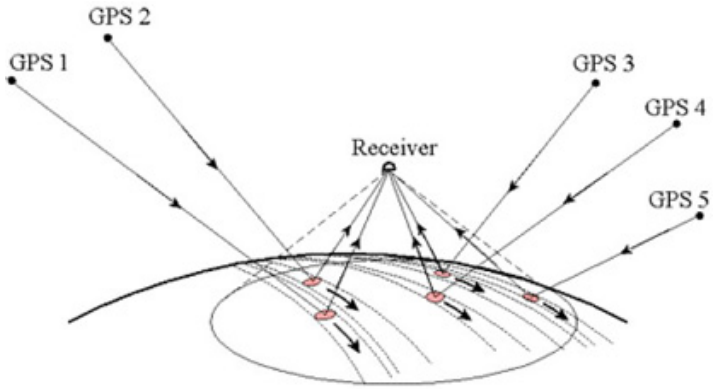
Understanding our planet

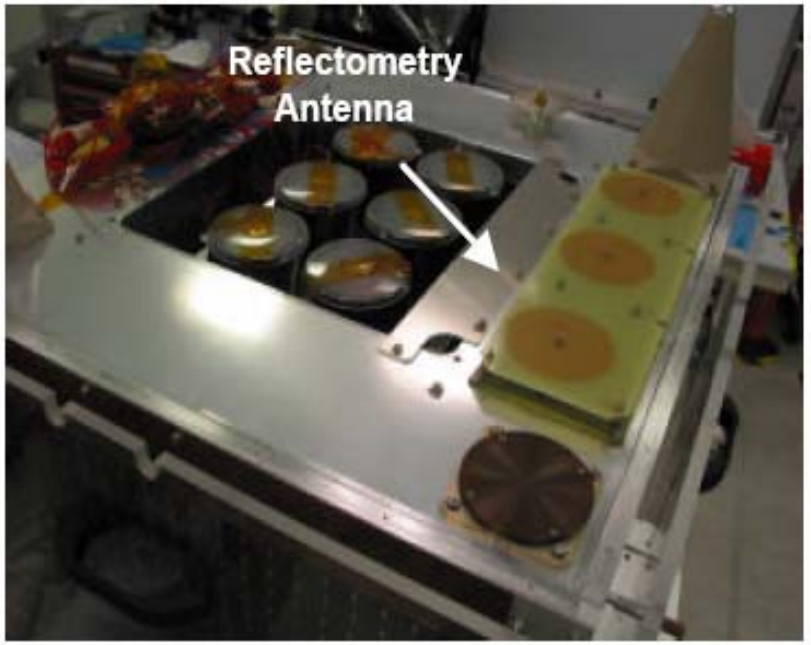
- Flight experiment of LANL's new FPGA-based software radio for VHF/UHF spectrum monitoring
- Mission will detect broad-band emission from different types of lightning

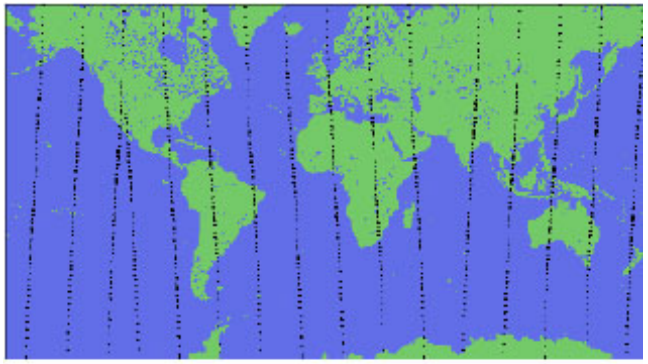


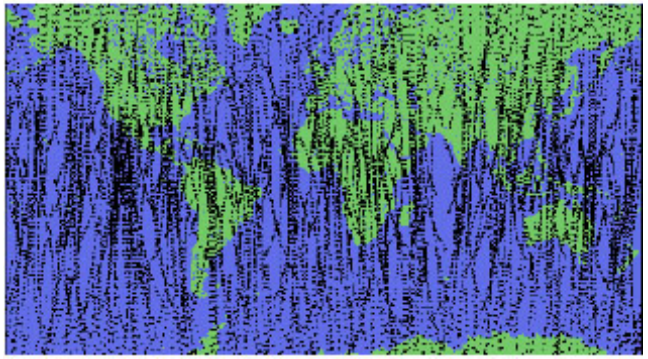


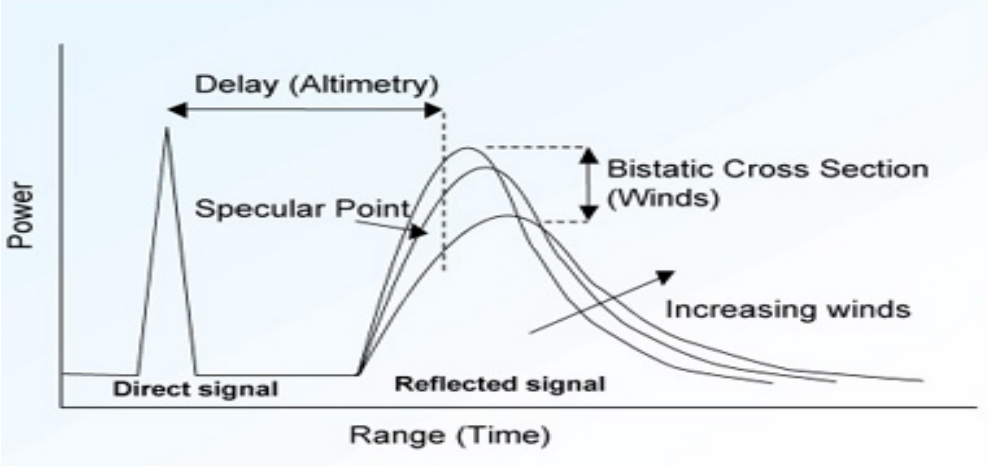
GPS Reflectometry







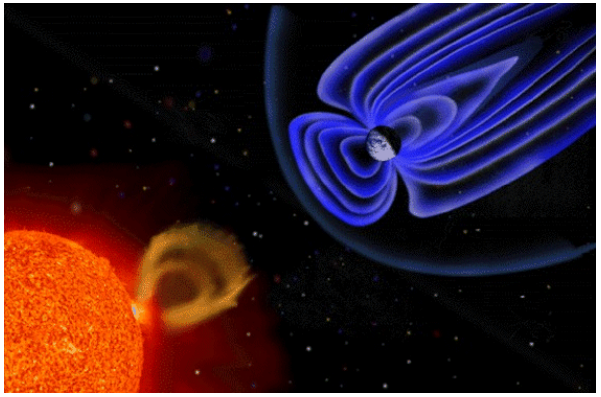


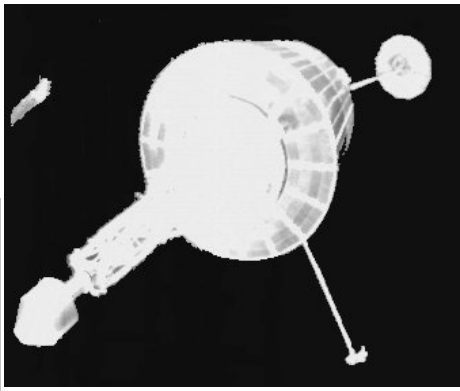


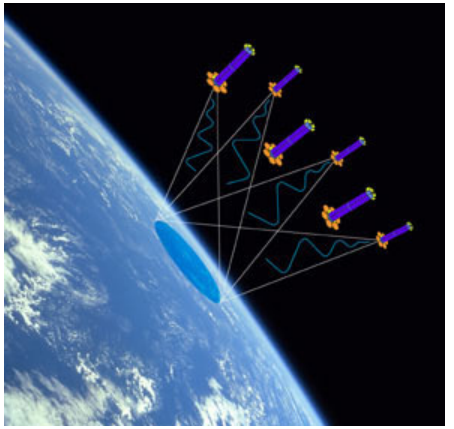
What technologies are available or required to spur global economic development in space?

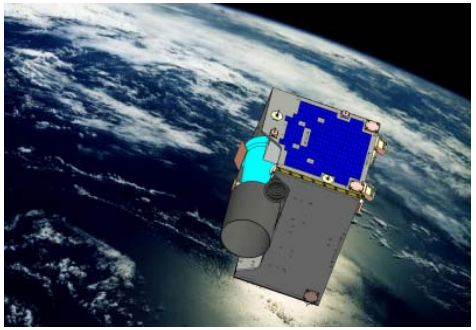
Technologies

- Cheap Launch
- Nuclear Rockets
  - Sea launch sites
- Solar Monitoring
- Plasma Shields
- Debris Mitigation
- Constellations and Formation Flying
- Space Surveillance
- Stealth

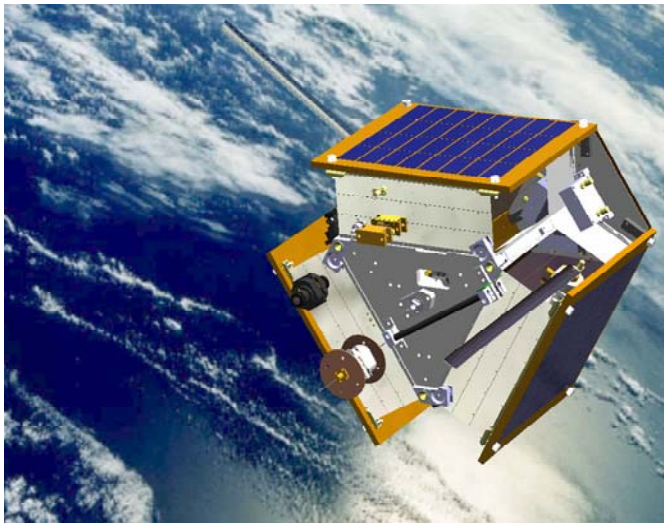




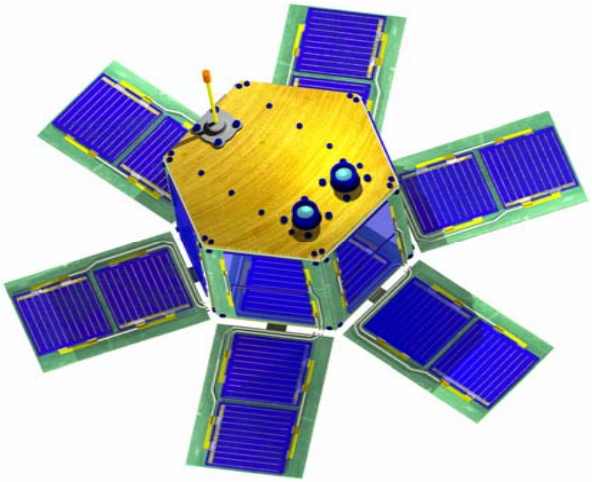




COTS-based Nanosatellites



Snap-1

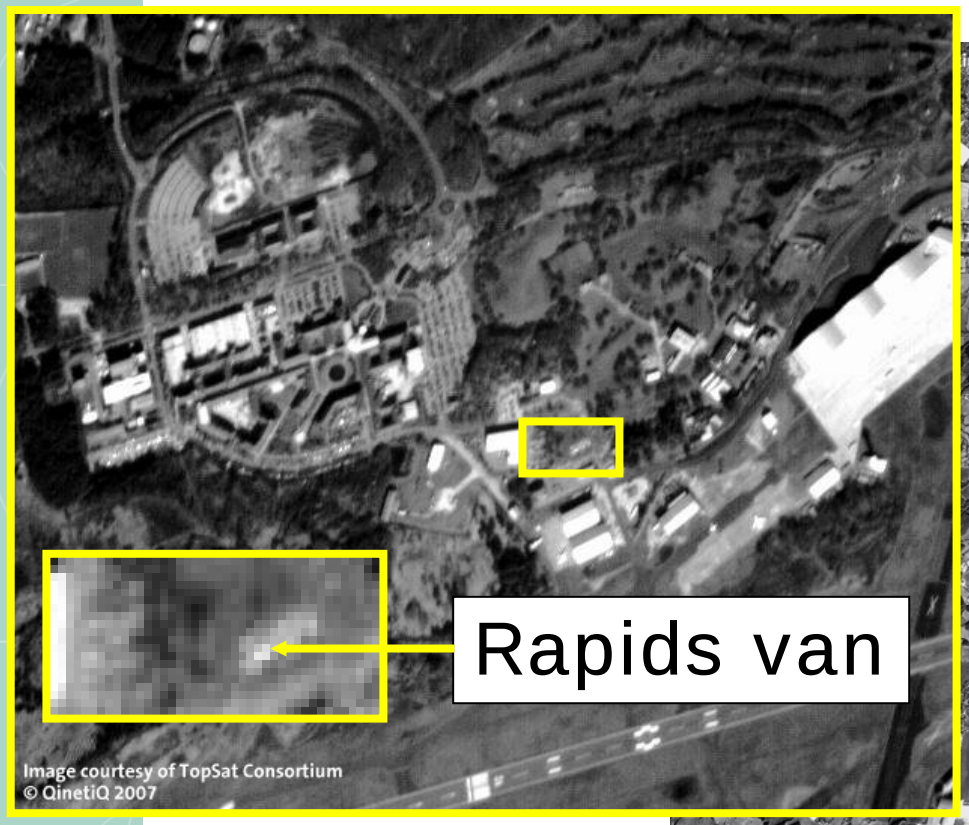


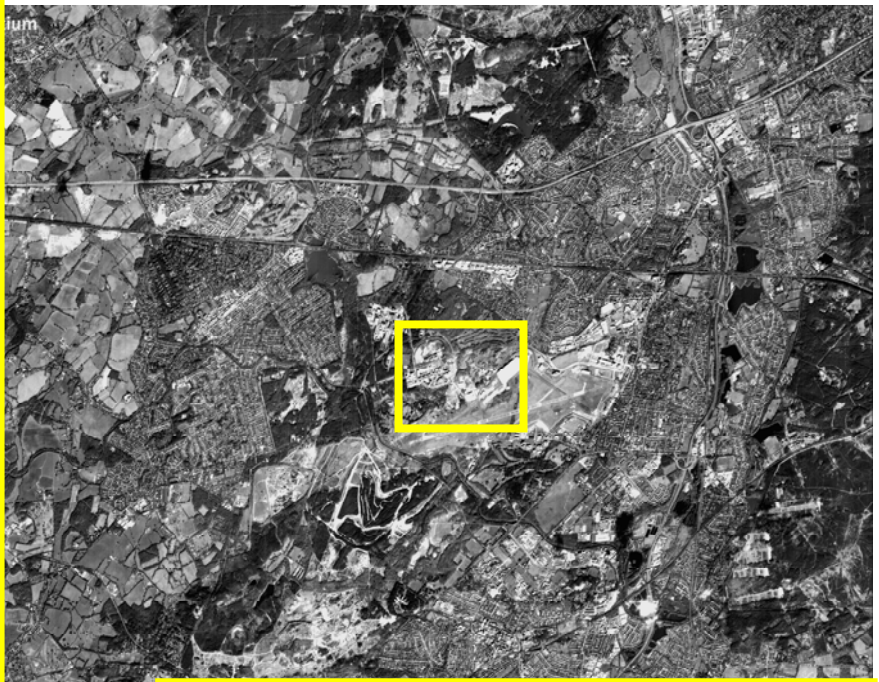
Overall satellite dimensions: approx. 12 cm diameter by approx. 10 cm height.

Palmsat

- **Applications:-**
  - **Constellations**
  - **Formation flying**
  - **Sparse apertures**

Ground station infrastructure

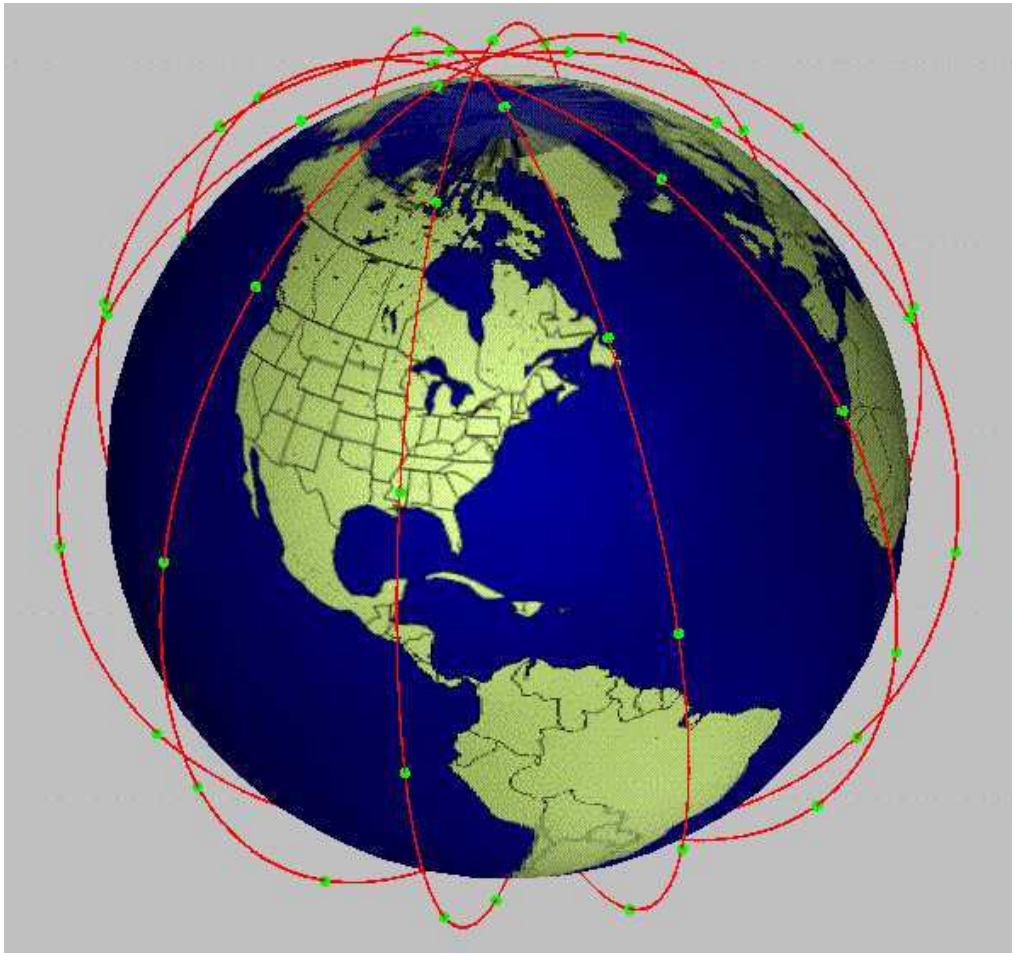




End to end timeliness (Target selection to image availability) = 36 minutes

Affordable hand-held terminals

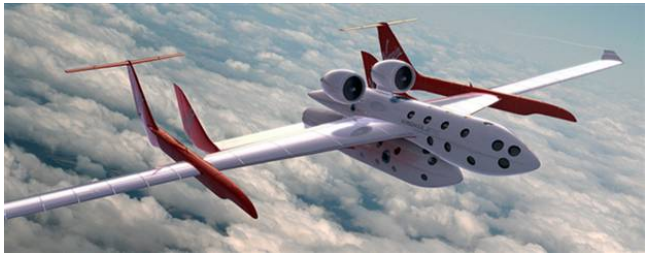
- Interacting through satellites could become routine if the costs of handsets falls



How would future conflict alter the commercial and economic promise of space?

Conflict in Space

- The results of conflict in space would be that we would “Lose our Virginity”
- Massive commercial investment potential would be lost as investors move away from the space sector
- Huge infrastructure investment potentially lost
- Enormous difficulty in reconstruction of that infrastructure due to global financial crash
- Potential long term barriers to space exploitation and exploration (debris, radiation)



Thank you

For further information contact :

Business Development Department
Surrey Satellite Technology Limited
Tycho House, Surrey Research Park,
Guildford, Surrey, GU2 7YE; UK
Tel: +44 1483 803803, Fax: +44 1483 803804
Email: info@sstl.co.uk Web: www.sstl.co.uk