Space Communications and Navigation

ITU Interference to Satellite Systems Webinar: Space Science Considerations

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16 September 2020

Unique operations of some NASA satellite missions

Satellites with special operations or operating locations

- Deep space missions
- Passive remote sensing
- Lunar operations

Each has unique:

- Operating locations
- Mission requirements
- Sensitivities to RFI

Deep Space Spacecraft

Spacecraft operating in "deep space" bands don't operate only in deep space (>2 million km from Earth).

- **Launch and early orbit**
- **Cruise phase (Distance to the moon is only 384,400 km)**
- **Near-Earth flybys**
- **Missions returning to Earth**

Use of deep space allocations by missions intended for deep space are protected while still near the Earth under RR No. 4.24 (WRC-15)

Many near-Earth operations are mission critical: Course corrections, early mission checkouts.

Stardust landed in USA in 2006 after visiting comet Wild-2

Passive Remote Sensing

Every physical body (water, soil, clouds, trees, people…literally everything on earth) spontaneously and continuously emits electromagnetic radiation.

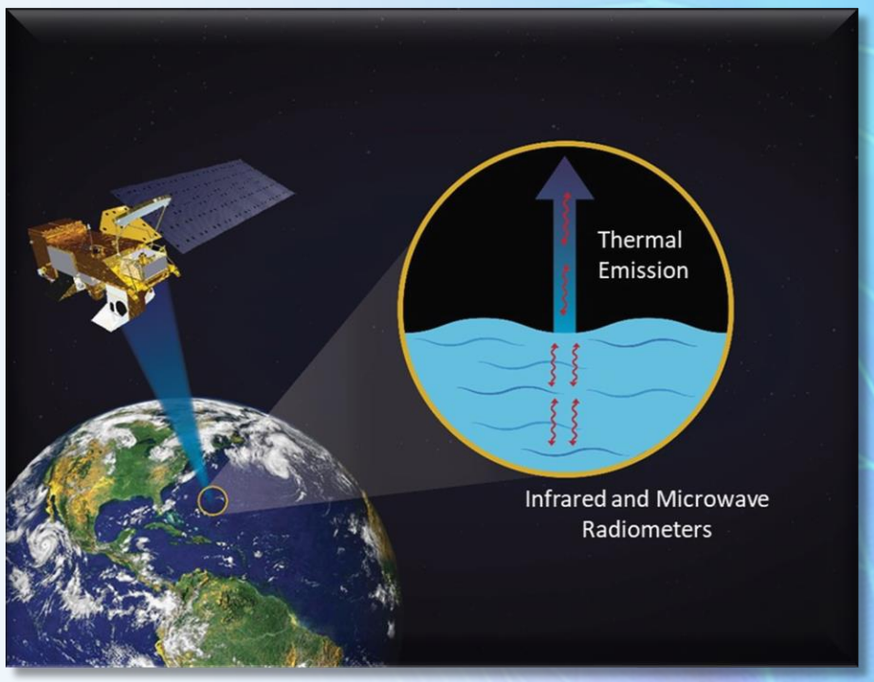
The energy (thermal emissions) are measured by microwave sounders (radiometers).

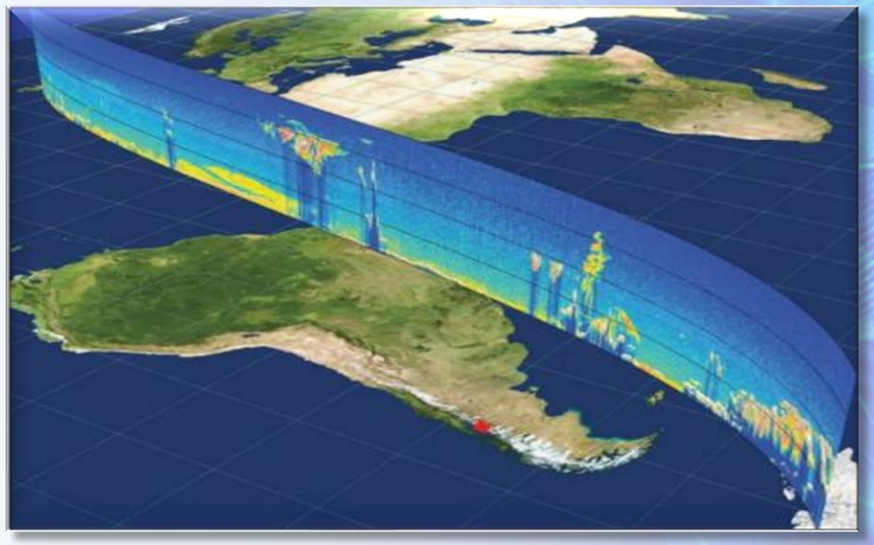
The amount of energy a body emits is proportional to its temperature and tends to be very weak.

Example:

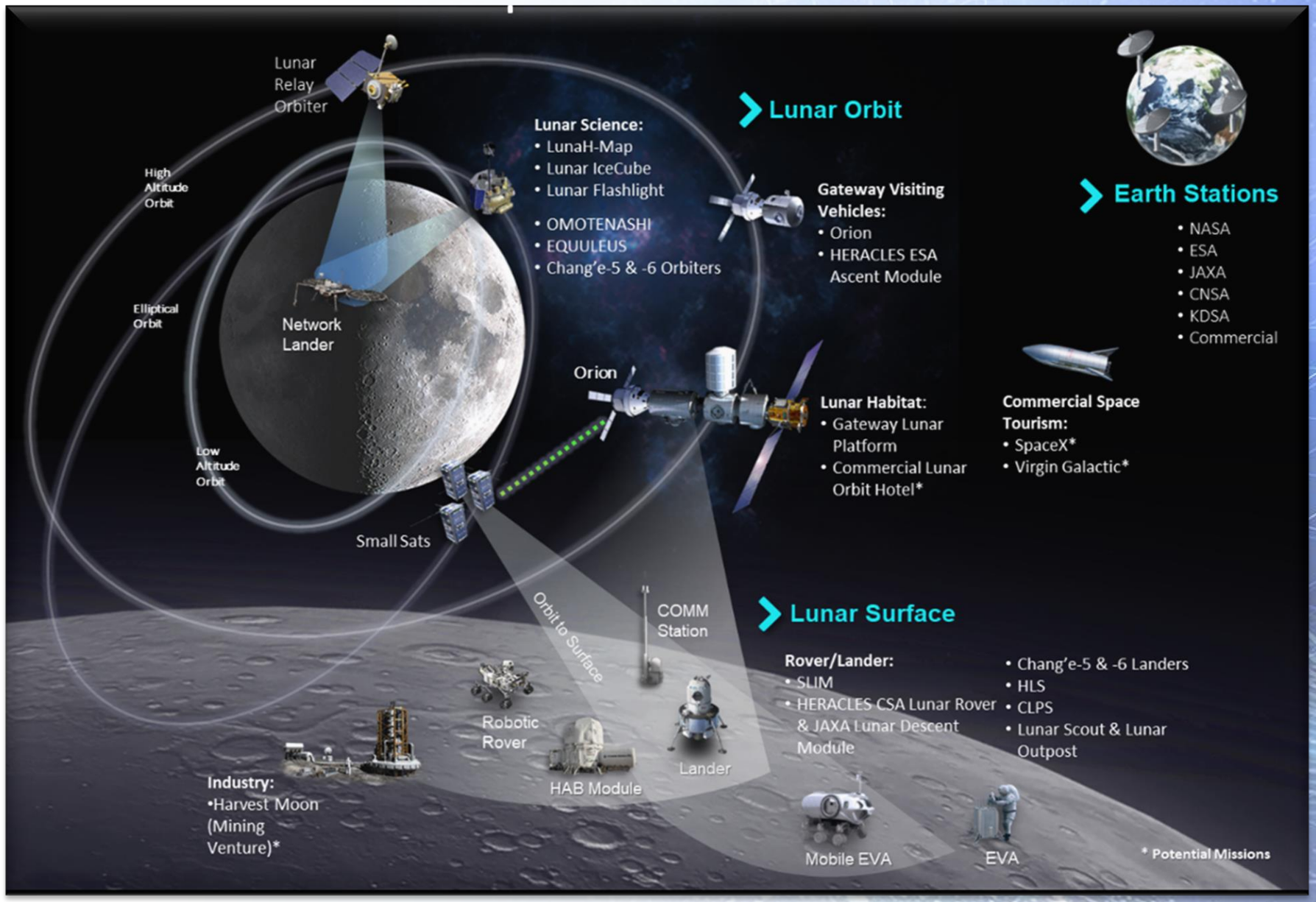
- **Object at 100 Kelvin emits 0.1 pico-Watts (= 10^{-13} W) within 100 MHz**
- **With a signal fluctuation on the order of 0.1 Kelvin or 0.1 femto-Watts (= 10^{-16} W)**

The extreme sensitivity required makes it essential to maintain protected allocations and to properly manage use of the spectrum near the protected allocations.





The Moon is about to get Busy!



Thank you!

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