Land Remote Sensing Satellites – Capabilities and Trends

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Introduction

Civil land remote sensing began in 1972 with the launch of the satellite now known as Landsat-1. Currently there are over 80 operating land remote sensing satellites currently in orbit, a number that will more than double in 2014.

This rapid growth is due to:

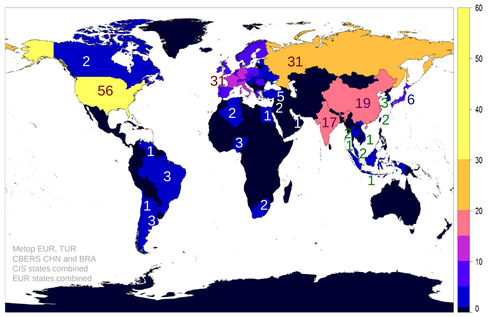
- New technologies for have reduced entry costs for launching and operating satellites, opening the field to many countries and commercial firms.
- New technologies on the ground, including computing power and sophisticated software, have increased the utility and demand for remotely sensed data.
- New technologies are helping create a wider variety of remotely sensed data, better able to serve more complicated and nuanced communities of users.

Earth Resources Technology Satellite (ERTS, later known as Landsat-1), sits atop Delta 900 rocket ready for launch July 23rd, 1972.

More Countries

Since the United States launched Landsat-1 in 1972, at least thirty-four countries have launched satellites of their own, including:

Algeria	China	Indonesia	Malaysia	Spain	UK
Argentina	Egypt	Iran	Nigeria	Taiwan	Ukraine
Belarus	ESA	Israel	Russia	Thailand	UAE
Brazil	France	Italy	Singapore	Turkey	USA
Canada	Germany	Japan	South Africa	Venezuela	
Chile	India	Korea		Vietnam	



Geographical regions that have launched near-polar orbiting, land imaging civilian satellites (or had such missions launched on their behalf by a third party) between 23rd July 1972 and 30th June 2013

Source Belward and Skøien, IJP In Print

Operating land remote sensing satellites is no longer limited to governments. Commercial firms have been viewing the earth from space with private satellites in since 1999 and are currently the fastest-growing sector with respect to the number of satellites launched. Universities and other civil entities are now operating satellites as well

Remote Sensing Satellite Capabilities

The chart below illustrates the relative technical capabilities of some of the better-known land-imaging remote sensing systems, including the satellite and sensor names, the nominal swath width of data collected, the radiometric resolution given in bits per band per pixel, and the nominal ground sample distance (GSD) at nadir. To the right of these specifications, a schematic illustration is given of the spectral coverage of each sensor, allowing quick comparisons with other sensors.

Sources:
- Earth Observation Handbook, Committee on Earth Observation Satellites (CEOS, 2014); http://www.eohandbook.com/
- CEOS Database: Missions, Instruments, Measurements. CEOS; http://database.eohandbook.com/
- OSCAR - Observing Systems Capability Analysis and Review Tool. World Meteorological Organization (WMO); http://www.wmo-sat.info/oscar/
- UCS Satellite Database. Union of Concerned Scientists; http://www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/technical_issues/ucs-satellite-database.html

Plus numerous government and commercial websites for individual satellites

More Commercial

In addition to government-sponsored satellite systems, there is rapid growth in the number of private firms putting earth-observing satellites into orbit. The list below is incomplete, with new businesses and plans being announced frequently.

- Airbus
- Digital Globe
- Skybox Imaging
- Planet Labs
- Dauria Aerospace
- Nanosatisfi
- Foresight 500
- UrtheCast

More Capabilities, More Questions

The technical capabilities of land remote sensing continues to improve, with increasing numbers of spectral bands, improved geographic coverage, improving resolution (GSD), radiometric resolution, and revisit potential.

With the benefit of more choices, come questions. Users need to understand how well the data are calibrated and how accurate they are. Detailed specifications are needed to be able to compare data from multiple sources, such as "What is the spectral response of this sensor" or even simple questions such as "Where can I get these data?" and "What restrictions come with it?"

As governments plan for future missions they need to know which needs can be met by available means and which require new missions to be planned for them.

Providing Resources to Science

With the growing number of sources and widely varying capabilities of remotely sensed data available to science today, it is important to understand the qualities and capabilities of these new sources of data. The USGS Remote Sensing Technologies (RST) Project works to track the new players in remote sensing and understand the capabilities and qualities of data that they bring to potential users.

It is also vital to understand the needs of science and other users of remotely sensed data in order to plan for future satellites and datasets that will best serve the broad remote sensing community. The USGS National Land Imaging Requirements (NLIR) Project has recently been formed to collect the requirements of users and the capabilities of remote sensing systems in order to support decision-makers as they determine the long-range plans for the USGS and its partner agencies to best serve the community.

For further information on the RST or NLIR Projects and their activities, please contact the manager for both projects, Greg Stensaas, at (605)592-594-2569 or stensaas@usgs.gov