

Embargo Tuesday 29 October 2002
Spy vs Spy: the science of surveillance and security
Session 1: 9.10am Watching the watchers



Presentation: Shutters or blinkers
Satellite imaging
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The Science Forums

- *key words/terms: resolution, revisit period, sensors, shutter control*
- *applications: many commercial, government and military*

Resolution: what can you see from space

From space you cannot:

- read car number plates
- recognise peoples faces or
- read a newspaper.

But from space you can determine the type of:

- vehicle - car, truck, tank
- airplane – commercial, military aircraft or
- ship – tanker, cruise ship, yacht.

What you can see from space depends on the resolution of the satellite sensor. This can be less than a metre for a commercially available, high-resolution satellite while military satellites can have sensors with greater resolution.

What you can't (aren't allowed to) see from space

Nearly all satellites are subject to shutter control. Shutter control restrict the parts of the world that can be seen by the satellite and are imposed as a result of military or security requirements.

Satellites are programmed from a ground station. These instructions are updated each orbit. Controls can be imposed prior to the acquisition of these updated instructions by an external agent. Highest resolution imagery can be embargoed for 24 hours prior to release.

Optical and radar sensors

Satellites normally record information in the visible and in the near-infrared spectra.

Currently there is only one high resolution radar satellite in operation, and that's in Canada. Radar satellites use radar to penetrate cloud cover but do not have as high a resolution as optical satellites. As views are obstructed in times of emergencies that involve, for example fire or heavy rain, this ability is essential. Radar satellites can also work at night.

US congress has limited the resolution of radar satellites as trials of nuclear submarines are said to be detectable. Congress has also imposed a limit of 0.65 metres on optical satellites.

Revisit period: how often can satellites see the same place

- Geostationary satellites used for eg weather, always see the same part of the earth but have very low resolution, hundreds to thousands of metres.
- Mid-resolution satellites that orbit the earth every 90 minutes and pass over the same spot on the earth every 16 days have a resolution of tens of metres.
- High-resolution satellites -- order 1 metre -- orbit the earth every 90 minutes and have steerable antennae so that they can see the same spot on the earth every 4 days.

Some military satellites are capable of staying in the same spot over the earth. This involves very high fuel consumption.

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Satellites versus aircraft

Satellites are expensive to launch and are risky business. At least half of the high resolution satellites have failed during or soon after launch. Satellites also have limitations on resolution and revisit period.

Aircraft are cheaper to build and launch than satellites. They can fly much lower and can see, monitor and identify smaller objects. But the area of their coverage is comparatively restricted and aircraft can be vulnerable to missile attack.

Who controls satellites

- Governments control low- and mid-resolution satellites that are used for research applications.
- Commercially operated mid- to high-resolution satellites are used for mining, agriculture, environment, and urban planning.
- Military organisations own the high-resolution satellites that are used for surveillance purposes as well as purchase data collected by commercial satellites.

Future developments in satellite technology

- Satellite technology is probably approaching the limit of its resolution; it could get down to 10 to 20cms.
- Many more satellites will be launched in the next 2 to 3 years; this will enable revisit periods of the order of hours, instead of days.
- Increased spectral resolution allowing discrimination for drugs, vegetation disease, fire monitoring, marine pollution (oil spills), and mineral exploration.

Sources of satellite images

- ACRES – the Australian Centre for Remote Sensing – www.auslig.gov.au/acres
- Spot Imaging Services - www.spotimage.com.au, www.spotimage.com
- Space Imaging - www.spaceimaging.com
- Digital Globe - www.digitalglobe.com, www.skm.com.au
- ImageSat International - www.imagesatintl.com

Profile

Dr Dave Johnson is a director of Australasian ImageNet Pty Ltd (AiNet), a Canberra-based company dedicated to the supply and support of satellite image catalogue and distribution services.

In the last 10 years he has also operated as an IT consultant, specialising in online delivery of complex information products. This business now operates as The Beaten Track Group Pty Ltd, of which he is a director.

After spending 18 years in academia -- mainly at Macquarie University – and publishing more than 40 scientific papers on subjects ranging from plate tectonics through to analysing magnetic field satellite data, Dr Johnson was Senior Principal Research Scientist to the then Bureau of Mineral Resources, now Geoscience Australia. As head of database research, he helped establish the National Resource Information Centre, a major federal initiative aimed at improving access to and the use of information for managing Australia's natural resources.

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