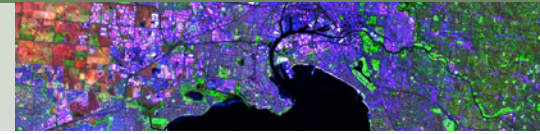


The 40th Anniversary of Landsat

Australia's 33 year archive of Landsat data

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July 2012 marked the 40th anniversary of the Landsat, a series of satellites, which has provided Australia with unique, wonderful and incredibly valuable images for over three decades.

On the 23 July 1972, the Earth Resources Technology Satellite, which came to be known as Landsat 1, was launched by NASA. The Landsat missions were the brain-child of the Director of the U.S. Geological Survey (USGS), William Pecora. Pecora first proposed the idea of a remote sensing satellite program to gather facts about the natural resources of our planet in 1965. Seven Landsat satellites have been launched since 1972. The latest in the series, Landsat 8, is ready for launch in January 2013 (See Table 1).

As stated in the NASA Landsat overview, the Landsat series of satellites has produced “the longest unbroken data stream of Earth’s surface as seen from space”. Images from Landsat have provided the world with unprecedented information on land cover changes and their residual effects since 1972.

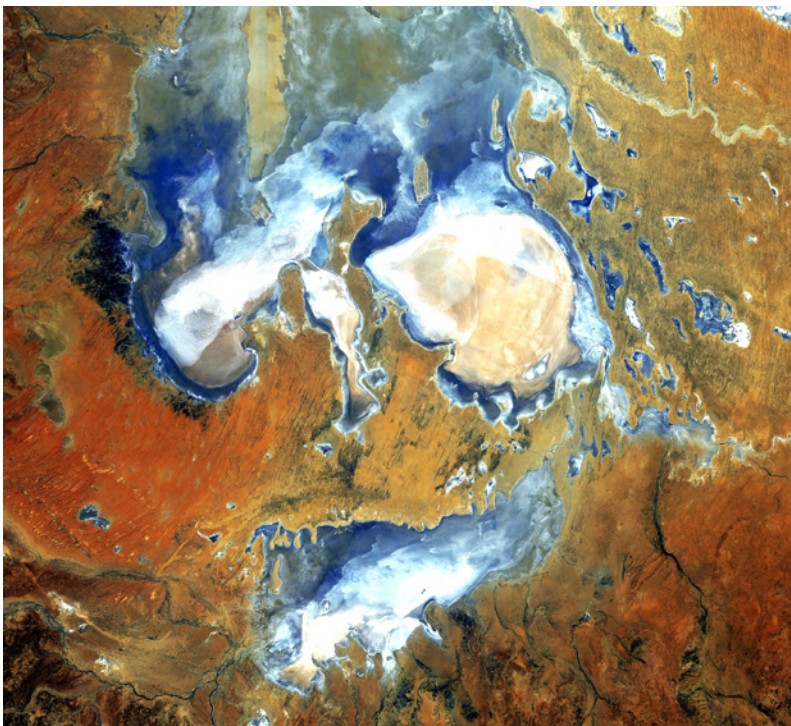


Figure 1. The scary face of Lake Eyre. Captured on 6th May 2006, in this Landsat image Lake Eyre appears as a scary face. The image won fifth place in the Earth as Art competition held by USGS in July 2012.

Landsat instruments have a moderate spatial-resolution. Individual houses cannot be seen on a Landsat image, but large man-made objects such as highways are visible, so human-scale processes like urban development, agriculture and deforestation can be detected and mapped, as can geological features and vegetation.

Australia’s role in Landsat began in October 1979 when the Australian Landsat Station was opened by then Minister for Industry and Commerce, The Hon Phillip Lynch. The Australian Landsat Station could receive data from the Landsat satellites as they passed over Australia, so Landsat images of Australia, including some offshore regions and parts of Indonesia and Western Papua New Guinea, could be captured for the first time. Since then, Geoscience Australia has collected over 666 000 Landsat scenes. Over 50 per cent of the Landsat images distributed by Geoscience Australia are over two years old.

Landsat images of Australia are still collected every day. The satellite transmits information to Geoscience Australia’s nine metre satellite dish at Alice Springs, which tracks Landsat 7

Table 1.

Satellite	Launch Date	Period of Operation
Landsat 1	23 July 1972	Decommissioned 6 January 1978
Landsat 2	22 January 1975	Decommissioned 25 February 1982
Landsat 3	5 March 1978	Decommissioned 31 March 1983
Landsat 4	16 July 1982	Decommissioned June 2001
Landsat 5	1 March 1984	Thematic Mapper stopped acquiring data 18 November 2011
Landsat 6	October 1993	Failed on Launch
Landsat 7	15 April 1999	Operating in SLC-Off Mode after May 2003
Landsat 8	February 2013	Due to be launched February 2013

each time it passes over the continent – generally three ‘passes’ each day, but over different parts of the continent. Today, however, Alice Springs receives data from a number of satellites, and Geoscience Australia also operates a satellite antenna at Hobart which can receive data from Landsat 7 whilst it is over New Zealand and even parts of Antarctica. The Alice Springs ground station also helps the USGS and NASA to operate their satellites, by providing communications from the satellites as they pass over Australia when they are not directly visible to mission controllers in the USA.

Landsat imagery now underpins many government and private activities. The Australian archive of Landsat images, now 33 years in duration, has become an invaluable resource for mapping the continent and monitoring changes in land use and the environment. Perhaps surprisingly, the archive of data becomes more, rather than less, useful through time. The archive is continuously being re-used as advances in science and technology make it possible to tackle more difficult questions about the past and present state of the continent.

Getting the data to the users has been a challenge throughout the 40 years of Landsat. In 1980, processing a single 263 megabyte Landsat image required 4 hours of computer processing time. Few organisations had the computers to handle such data, and standard practice was to print the image and for users to work with a hard-copy.

Computers have increased in power since 1980, but at the same time the volumes of data have increased because the satellite instruments are more sophisticated, and user requirements have changed. In 2012 the user community is expecting not one image of a site, but hundreds of images captured over time, each fully calibrated

for sensor variations and the effects of terrain and atmosphere, to detect and measure changes in the landscape. Getting the data to the users therefore remains a problem to this day.

In 2011 the Australian Government (Australian Space Research Program) funded a project called Unlocking the Landsat Archive (or ULA). The ULA project aims to improve access to Landsat data for Australia by processing and calibrating at least the last decade of Landsat data (about 250 000 images) and making these available on-line. The project will also prototype an analysis system that will use advanced supercomputing facilities to produce information from the images for reporting and decision making.

The ULA project will load the calibrated Landsat datasets into a National Data Grid in the National Computational Infrastructure (NCI) at the Australian National University. The National Data Grid (NDG) is a consistent approach to continental observations from satellites (and other sources), including different spatial-resolutions of satellite imagery.

The ULA project partners are Geoscience Australia, Lockheed Martin Australia (LMA), the Australian National University (ANU) – National Computational Infrastructure (NCI), the Victorian Partnership for Advanced Computing (VPAC) and the Cooperative Research Centre for Spatial Information (CRC-SI).

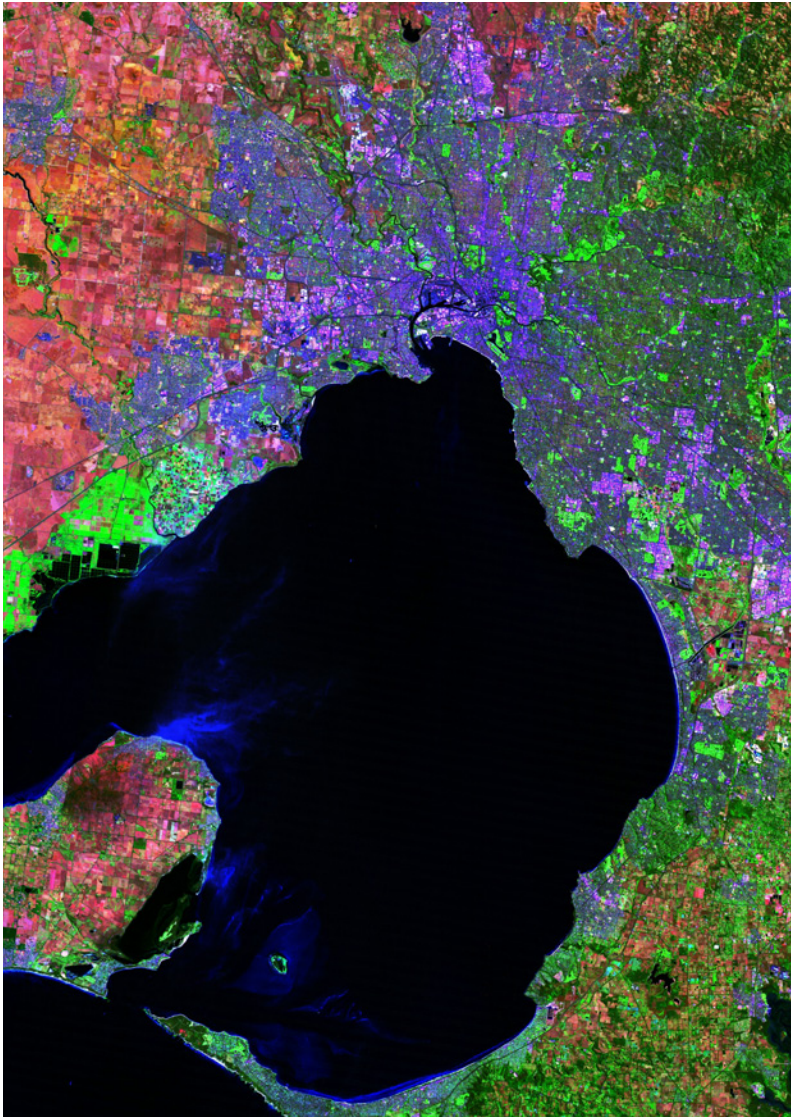


Figure 2. Melbourne in 'false colour'. Satellites generally observe in slightly different wavelengths of light to those that we see. Satellite images are therefore false-colour, but can enhance features like urbanization (mauve-purple in this image), irrigated areas and wet forests (green here), and dry grasslands (red-brown here).

Related articles/websites

USGS Earth as Art

<http://eros.usgs.gov/imagegallery/>

For more information

email ausgeomail@ga.gov.au

Geoscience Australia is now preparing for Landsat 8, which is ready for launch in February 2013. If successfully launched and commissioned, Landsat 8 will continue the Landsat record of Australia.

Some Landsat images are both science and art. The USGS tracks the more 'artistic' Landsat images through the 'Earth as Art' initiative. From the millions of Landsat scenes that now exist, 126 aesthetic front runners were selected, in July 2012, for the ultimate 'Earth as Art' competition. In the finals, Australia made 5th place with the 'scary face' of Lake Eyre (Figure 1).

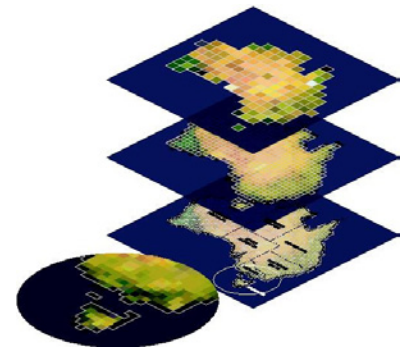


Figure 3. The Unlocking the Landsat Archive project will calibrate ten years of Australian Landsat data and load it into a standardized data-grid for analysis.



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