HISTORY OF SATELLITE LASER RANGING IN AUSTRALIA

Notes:

1. *Originally prepared in March 2004 by John Pugh of Geoscience Australia*
2. *The magenta coloured notes relate to world wide events.*
3. *The light blue notes relate to world wide improvements in technology and the effects on accuracy.*

1962: Initial proposal to use satellite laser ranging for geodesy.

1964: First use of satellite laser ranging by the USA's national aeronautics and space administration (NASA) in USA to measure the orbit height of the Beacon explorer b satellite fitted with retro reflectors, to within 3 metres. The position of the station was measured to within 30 metres.

1965: Smithsonian Astrophysical Observatory (SAO) station set up by the USA's Smithsonian Institute for space tracking in Orroral valley.

1968, 16 oct: Australia signed treaty with United States of America for scientific and technical co-operation, designated the "hornig" treaty.

1969: Satellite laser ranging improved to provide position of its stations to 20 metres.

1969: Australian National University used a laser through their 26 inch telescope on Mount Stromlo to be viewed by Neil Armstrong to set up reflectors on the moon for lunar laser ranging.

1973, march: Agreement signed between Australia's national mapping (natmap) and NASA under the USA-Australia hornig treaty for co-operation on the construction of a lunar laser ranging facility at Orroral in ACT, further up the valley from the SAO facility.

1973: Start of approval and planning process for the construction of Orroral geodetic observatory for lunar laser ranging.

1974: With new technology satellite laser ranging is able to range satellites to 1 decimetre, lunar ranging to 1 metre, and provides position of the stations to 5 metres.

1974: Telescope and ruby laser transferred from Mt Lemmon in Arizona to Orroral by NASA.

1975, march: Orroral building commissioned after co-operation in construction and equipping between Natmap, NASA and SAO. Construction contracted out with operation of facility by Natmap personnel.

1976: SAO tracking facility in Orroral valley commenced satellite laser ranging.

1979: Satellite laser ranging improved to range satellite positions to less than 1 decimetre.

1979: Satellite laser ranging used to define orbits to calibrate altimeter satellite positions to measure land and sea levels.

1979: Moblas-5 established at Yarragadee in Western Australia by NASA, operated under contract by Fairey Australia ltd through Australian space office acting as the Australian contracting agency.

1981: Contract signed between Natmap and NASA to convert Orroral to lunar and artificial satellite laser ranging.

1983: SAO facility in Orroral valley ceased satellite laser ranging.

1983: Amalgamated Wireless Australasia ltd took over contract as facilities manager and operator at moblas-5.

1983: New telescope mount, ND:YAG laser and upgraded computerised operation system installed at Orroral.

1984: Conversion of Orroral from lunar laser ranging to lunar and artificial satellite laser ranging completed.

1984: Satellite laser ranging used to range satellites to within a few centimetres.

1984: Satellite laser ranging provides data with ability to measure plate tectonics.

1985: SAO tracking station in Orroral valley closed with some equipment transferred to Tidbinbilla deep space tracking facility.

1987: Natmap amalgamated with the Australian survey office to form Australian surveying and land information group (Auslig).

1987: Ground targets installed and surveyed at Orroral to calibrate the system accurately.

1989: Satellite laser ranging improved to range orbits of satellites to less than a centimetre and provide positions of the stations to 1-2 centimetres.

1990: BAE systems Australia took over as contractor for facilities manager and operator at Moblas-5.

1991, march: Completion of upgrade of Orroral for low earth orbiting (LEO) satellites.

1994: Satellite laser ranging measures contemporary tectonic plate motion to mm/yr resolution.

1994: Satellite laser ranging in conjunction with altimeter satellites gives centimetre ocean topography and wave height, and shows 3mm/yr rates in global mean sea level rise.

1995: Auslig becomes a regional analysis centre for the processing of satellite laser ranging data to contribute to many international organisations and for local monitoring of sea level.

1995, 19 dec: 10 year agreement signed for further joint co-operation in geodesy between NASA and Auslig. This agreement covers very long baseline interferometry (VLBI) and satellite laser ranging.

1996: CSIRO division of telecommunications and industrial physics (TIP) became Australian contracting agency for Moblas-5.

1997, 3 nov: Contract for construction and operation of new satellite laser ranging system on Mount Stromlo signed between Auslig and Electro Optic Systems (EOS).

1998: Satellite laser ranging measures tidally induced motion of the geocentre of the earth.

1998, 1 march: Auslig took over as Australian contracting agency from TIP for moblas-5, and assumed a 50/50 responsibility for operational funding with NASA for one year. NASA continue engineering and spare parts support at their own cost.

1998, 19 june: EOS passes systems acceptance tests at Mount Stromlo satellite laser ranging facility.

1998, 22 sept: International laser ranging service (ILRS) formed by the international association of geodesy (IAG) with approval of the international earth rotation service (IERS). At the time, the service supported and prioritised satellite laser ranging to 22 satellites. SLR accepted as a fundamental data source in the international terrestrial reference frame.

1998, 28 oct: EOS passed services acceptance tests at Mount Stromlo. Regular data flow started next day.

1998, 31 oct: Satellite laser ranging ceased at Orroral.

1998, 30 nov: Orroral site vacated.

1999, 1 march: Auslig took over full responsibility for Moblas-5 operational funding. NASA remained responsible for upgrades and logistic support of the facility with intention to replace the system with a new SLR2000 when available.

1999, 11 may: Orroral telescope dispatched to white sands, New Mexico, USA, for use by NASA.

1999, 29 nov: Orroral facility demolished leaving observatory building and dome intact. Site restored to nearly original condition.

2000: The analysis centre at Auslig submitted the first ever 10 year global satellite laser ranging solutions for Lageos 1 and 2 for the international terrestrial reference frame 2000 (ITRF2000).

2001, 21 sept: Auslig amalgamated with AGSO Geoscience Australia to form Geoscience Australia (GA)

2003, 18 jan: The satellite laser ranging facility on Mount Stromlo totally destroyed by bushfires.

2003, 4 july: Contract signed between GA and EOS Space Systems Py Limited (EOS) for the rebuilding of the satellite laser ranging facility on Mount Stromlo.

2003, 10 sept: Contract signed between GA and EOS for the facilities management and operation of the satellite laser ranging facility on Mount Stromlo. Contract to commence after successful services acceptance tests

2003, 30 dec The satellite laser ranging facility on Mount Stromlo completed by EOS ready for trialing the system.

2004, april: The SLR facility and Space Research Centre on Mount Stromlo officially opened.

2004, july Moblas 5 operations and maintenance contract from GA to EOS came into effect. NASA continues to provide logistics support.

2004, 1 dec The satellite laser ranging facility approved for operation after successful services acceptance tests.

2013 Moblas 5 operations and maintenance managed directly by GA.