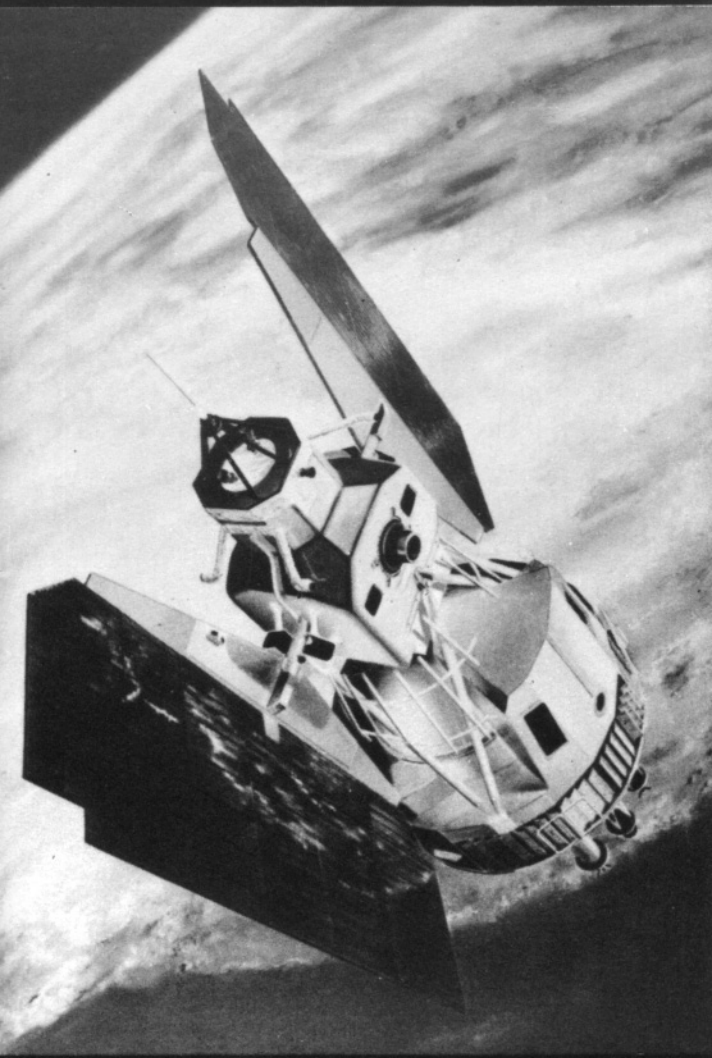
ORRORAL VALLEY

Tracking Station



Department of Science - Space Projects Branch

December 1976

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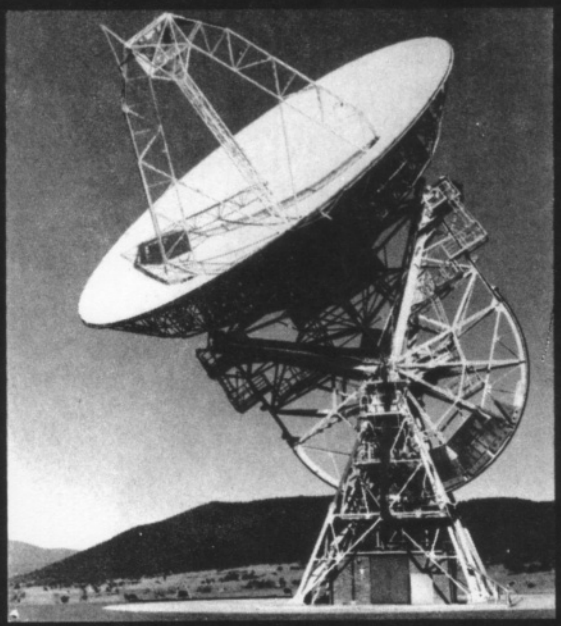


Orroral Valley Tracking Station's 26 metre antenna, which tracks and receives data from earth-orbiting satellites.

Introduction

The Orroral Valley Tracking Station is one of three spacecraft tracking stations in the A.C.T. which are operated by the Department of Science's Space Projects Branch for the United States National Aeronautics and Space Administration (NASA).

Whereas the other two stations support planetary and interplanetary spaceflights, Orroral Valley tracks, communicates with, and controls, earth and lunar-orbiting satellites. It is part of NASA's worldwide Spacecraft Tracking and Data Network which has its headquarters at the Goddard Space Flight Center in Maryland, U.S.A.

The equipment, construction and operation of the station is financed by NASA, but the design and construction of station buildings and support facilities, as well as management and operation of the station, is the responsibility of the Department of Science.

Australia has co-operated with NASA in the operation of tracking stations since the late 1950s when satellites were first put into orbit. A number of stations have been operated for limited periods in various parts of Australia over the years, but technical advances and experience have consolidated the tracking and data collection requirements so that Orroral Valley and the other two stations at Tidbinbilla and Honeysuckle Creek now meet all of NASA's needs in this part of the world.

Construction at Orroral Valley began in 1964 and the first phase was completed in 1965. Modifications and extensions since then have made the station one of the most comprehensive in NASA's spacecraft tracking network.

In common with Tidbinbilla and Honeysuckle Creek, Orroral Valley is used from time to time for Australian scientific purposes when not required for NASA work.

Location

The station is located on a 16 hectare site in the Orroral Valley, 60 kilometres by road south-west of Canberra. It is shielded from man-made radio frequency interference by the surrounding ridges, and is free from interfering light at night – important considerations in the siting of a tracking station using both radio and optical systems for spacecraft support.

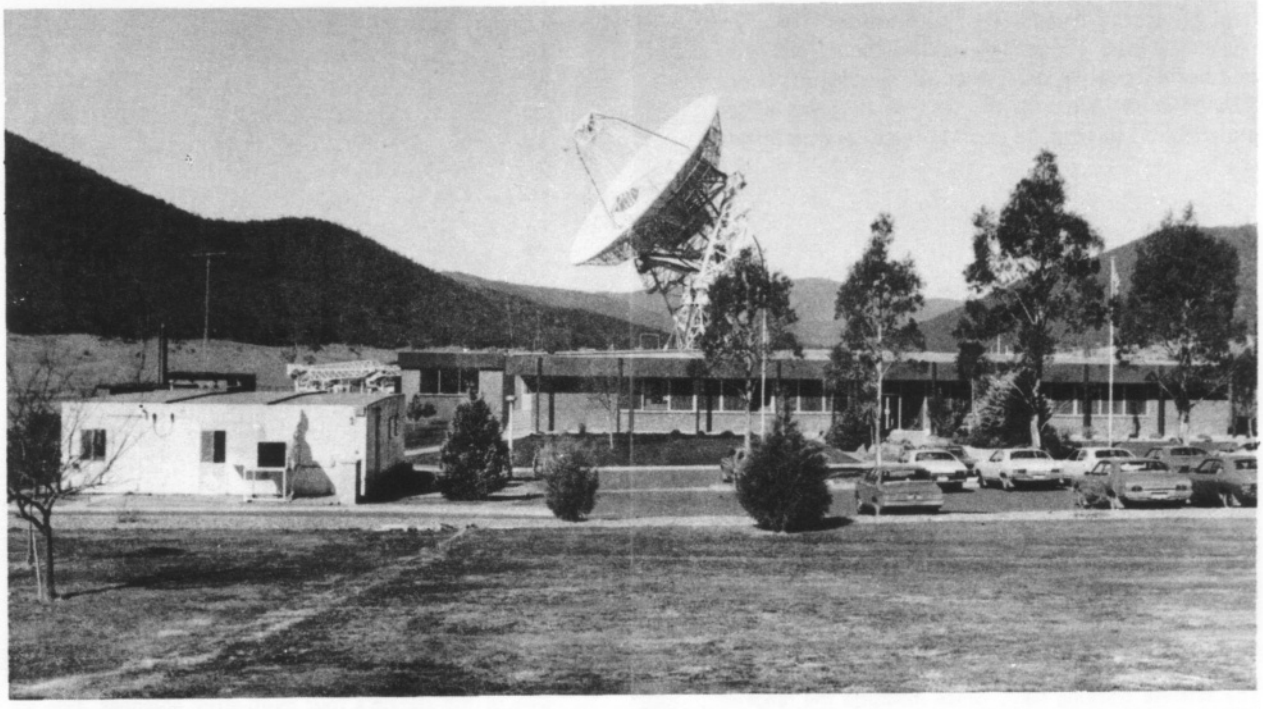
Station layout

The largest building on the site is the Operations Building, one wing of which is occupied by the operations control room, the station nerve centre where most of the electronic equipment is located. Other sections of the Operations Building house offices, maintenance laboratories, a communications centre and the station logistics area. Several smaller buildings house specialised spacecraft support equipment.

Another large building accommodates diesel-driven generators with a capacity of 2500 kilowatts to provide power for electronic equipment, air-conditioning, lighting and other needs.

Remaining buildings include mechanical workshops, a documentation/training centre and a canteen.

Engineering services for the station buildings and facilities are provided or arranged by the Depart-



The Operations Building where commands transmitted to satellites and data received from satellites are processed and recorded. The 26 metre antenna is in the background.

ment of Science's Network Support Facility at Fyshwick. This unit works closely with its counterpart in the NASA organisation and with appropriate Government departments.

Tracking spacecraft

The station maintains a 24 hour-per-day, 365 day-per-year spacecraft support role. During a typical day it makes contact with more than a dozen different satellites, some more than once and often with up to three simultaneously. Contact varies from about ten minutes to about ten hours.

Most earth satellites, the more complex of which are often called scientific observatories, are unmanned spacecraft which orbit the Earth at altitudes ranging from hundreds to thousands of kilometres. They carry scientific measuring and observing instruments which may be divided into the following categories:

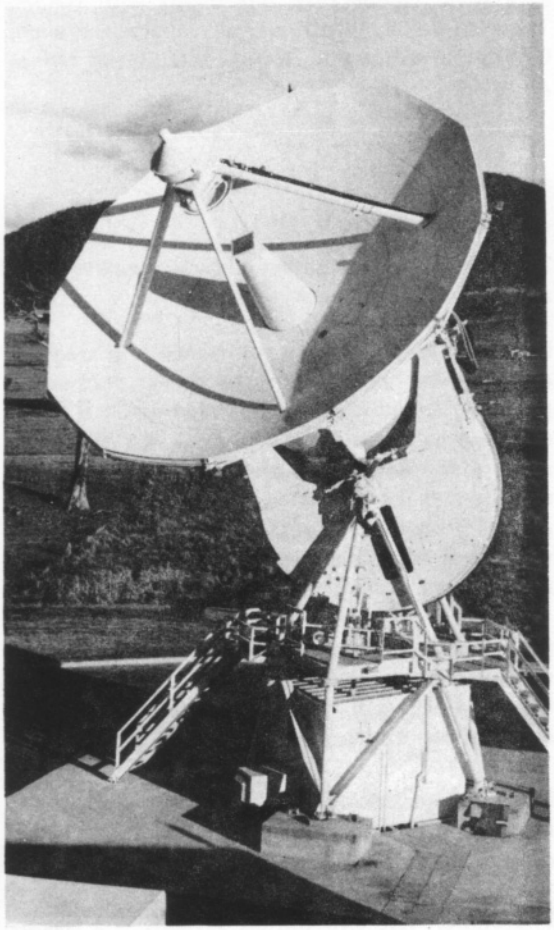
- earth-directed instruments which measure the characteristics, shape and resources of the Earth and its atmosphere;
- others which monitor the physical characteristics of the near-earth space environment as they pass through it; and
- outward-directed instruments which detect and measure radiations emanating from outer space.

Some satellites carry 'test bed' systems to support the development of advance technologies for use in future generations of spacecraft.

Tracking projects

Spacecraft tracked by Orroral Valley include the following:

- **Nimbus** – A series of past, present and future satellites used to develop spacecraft meteorological instruments and techniques and to make important earth-environment observations.
- **Orbiting Solar Observatory (OSO)** – A series of past, present and future satellites carrying highly directional instruments for observing the Sun in considerable detail over a period of at least an 11-year solar cycle.
- **LANDSAT** – A series of past, present and future satellites carrying earth-directed sensors making measurements related to the development of a wide variety of earth resources in fields such as agriculture, water conservation, mineral development, demography and mapping.



Orroral Valley's 9 metre antenna, which transmits commands to satellites as well as receiving data from them.

- **International Sun and Earth Explorers (ISEE)** – A series of three future spacecraft for exploring solar-terrestrial relationships at the outermost boundaries of the magnetosphere and to examine the shockwave which forms the interface between the solar wind and the Earth in its orbit around the Sun.

Orroral Valley supported the joint U.S.-U.S.S.R. manned Apollo-Soyuz mission of mid-1975 and is scheduled to support NASA's manned 'Space Shuttle' program in the 1980s.

By special agreement, Orroral Valley also supports a wide variety of satellites of countries which have established co-operative agreements with NASA. These have included British, Dutch, French, German, Japanese and Spanish satellites as well as Australian.

Station equipment

The function of the station is to receive data from, and to control and track, satellites.

Data are received from satellites via four tracking and receiving antennas – one having a 26 metre parabolic reflector or dish, another with a 9 metre dish, and two multi-array receiving units. When the appropriate antenna is directed at an orbiting satellite and the station receivers are tuned to the correct frequency, data flow from the satellite's transmitters to the station for processing by computer and recording.

Satellites are controlled by sending commands at the appropriate frequency from the 9 metre antenna, which is a dual receive-transmit unit, or either of two multi-array transmitting antennas.

Satellites are tracked by both radio and optical methods, which produce data on direction, range or velocity.

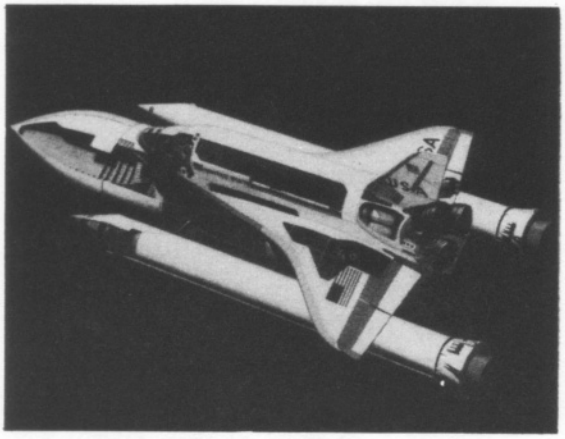
The station has two optical systems – a Baker-Nunn satellite tracking camera and a satellite laser pulse ranging system. Both are part of the world-wide satellite tracking network operated by the Smithsonian Astrophysical Observatory of Massachusetts, U.S.A. Data are provided for NASA's Earth and Oceanographic Physics Applications Program and for other geodetic research programs.

The station is equipped with a wide range of recording, computing, data processing and communications equipment to meet the needs of different satellites, and its operations are synchronised with other tracking stations around the world by atomic clocks which are accurate to within 50 millionths of a second.

Data received from the satellites may be analysed, recorded on magnetic tape (which is later sent to the U.S. for more detailed analysis) or transmitted instantaneously to mission control centres in the U.S. A scientist in the U.S. can monitor experiments performed by a satellite as it passes over Orroral Valley and also control the experiments at the same time.

Communications

Communications between the tracking station and NASA are made via the NASA Communications



NASA's Space Shuttle, a spaceship which will be supported by Orroral Valley when it becomes operational in the 1980s. The Space Shuttle will be attached to a rocket for launching, but will be able to land like a normal aircraft.

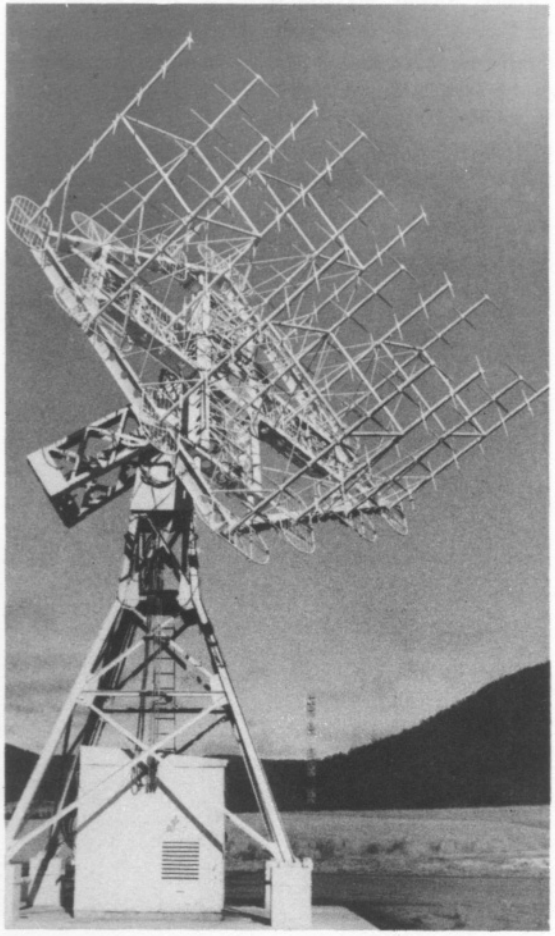
Network, which includes geosynchronous satellites and undersea cable links provided by the Australian Overseas Telecommunications Commission and links in the Australian Telecommunication Commission's domestic network. Circuits are provided to relay data to NASA mission control centres and to return commands to the station for transmission to satellites. Efficient use of communications channels in Australia is controlled by the Department of Science's Canberra Switching Centre at Deakin where circuits are selected and monitored for correct performance.

Staff

The Station Director, who is a senior officer of the Department of Science, is responsible for the station's operation.

Maintenance and operations services are provided by private industry, the current contract being held by Fairey Australasia Pty. Limited. The company employs about 190 professional, technical and administrative personnel at the station, about 120 of whom work in the four shift teams which are required to provide round-the-clock operation.

The satellite tracking laser, which measures the range of satellites by determining the time it takes for pulses of light to reach them and to be reflected back to Earth.



One of the station's four multi-array antennas. Two are transmitting antennas and the other two are receiving units.

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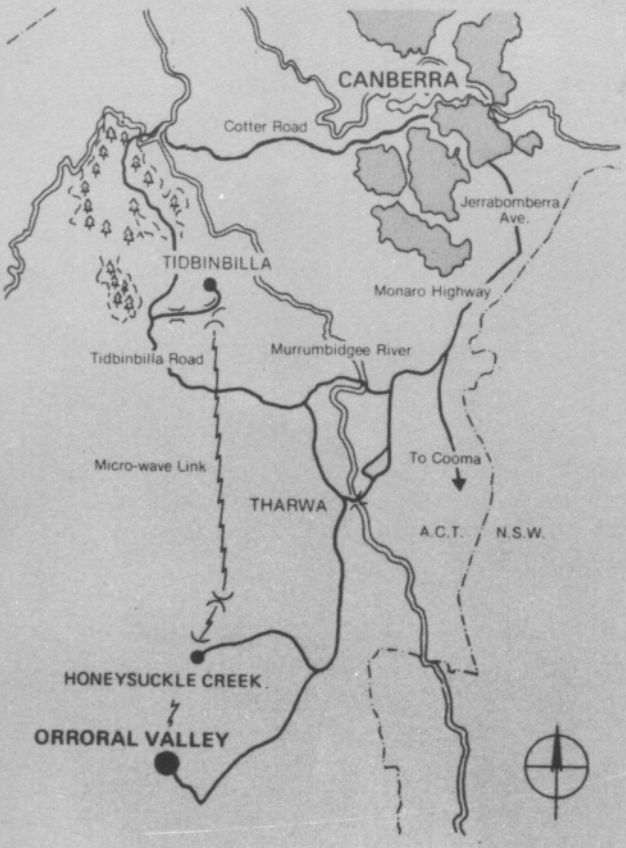

Location of Orroral Valley Tracking Station in relation to Canberra and the other two tracking stations at Tidbinbilla and Honeysuckle Creek.

Front Cover

One of the LANDSAT series of earth resources satellites which are supported by the tracking station.