DEPARTMENT OF SUPPLY

Muchea Tracking Station
for
PROJECT MERCURY

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF SUPPLY

AUSTRALIAN DEFENCE SCIENTIFIC SERVICE

WEAPONS RESEARCH ESTABLISHMENT

MUCHEA TRACKING STATION

FOR

PROJECT MERCURY

POSTAL ADDRESS: The Controller, Weapons Research Establishment,
Box 1424H, G. P. O., Adelaide, South Australia.

BACKGROUND OF SPACE TRACKING IN AUSTRALIA

The tracking of man made satellites from stations based in Australia commenced in 1957 when Australia established tracking facilities as part of a contribution to the International Geophysical Year. Apart from Moonwatch which is a voluntary organisation, the remaining tracking activities named below are managed and operated by the Department of Supply, Australia on behalf of U.S. authorities. The United States National Aeronautics and Space Administration (NASA) is the agency concerned with all the activities with the exception of the Baker-Nunn Camera station for which the Smithsonian Institution is responsible. All the specialised technical equipment has been supplied by the U.S. sponsors.

MINITRACK

A world wide network of radio interferometers known as Minitrack Stations were set up during the IGY for determining the orbits of satellites and for receiving and recording telemetered data transmitted from them. One such Minitrack Station was established at Woomera in 1957.

BAKER-NUNN CAMERA

In addition to tracking satellites by means of their radio transmissions, a world wide optical tracking network was organised using cameras specially developed for the purpose. One of these Baker-Nunn cameras was installed at Woomera and commenced operations early in 1958.

MOONWATCH

A number of volunteer teams of observers were established throughout the world to search the skies for satellites as they became visible at dusk and dawn. A number of such groups which are known as Moonwatch Teams were established in Australia, including one at Perth.

THE DEEP SPACE INSTRUMENTATION FACILITY

In addition to their programme of unmanned and manned earth satellites, the United States of America also has a programme of unmanned spacecraft for exploring interplanetry space. In order to track these spacecraft, three Deep Space Instrumentation Facility stations have been set up, one in California, USA, one near Johannesburg, South Africa and one at Woomera, South Australia. These three stations are so placed that between them they can provide continuous tracking and telemetry communication with the spacecraft as the earth rotates. All Deep Space Instrumentation Facility Stations are equipped with an 85 feet diameter dish type antenna which can automatically track the radio transmission from the space probe.

PROJECT MERCURY

Project Mercury is the name given to the first United States 'Man in Space' programme. The aims of this project are to ensure the safe orbital flight and recovery of a man in the spacecraft and also to study man's capabilities in a space environment.

SPACECRAFT

The spacecraft in which the Astronaut rides is bell shaped in configuration and measures a little over nine feet in height and six feet across the base; its orbital state weight is approximately 3,000 pounds. Some of the major items installed in the spacecraft are as follows:-

The instrument panel which is directly in front of the pilot contains the navigational instruments, electrical switches and warning indicators, environmental controls and automatic pilot indicators and controls. Altogether there are over 100 lights, fuses, switches and miscellaneous controls and displays.

A pilot observer camera is mounted in the instrument panel and is used to photograph the astronaut.

A periscope is located in front of the pilot enabling him to view the earth.

The pilot support couch is made of a crushable honeycomb material bonded to a fibreglass shell and lined with rubber padding. Each astronaut has a couch moulded to his specific body shape in order to give him maximum comfort and protection from the accelerations at launch and re-entry.

The environmental control system which provides the spacecraft and pilot with a 100% oxygen environment for breathing, ventilation and pressurisation during flight, is fully automatic, but, in the event of failure, emergency controls can be used.

Throughout the flight the pilot's respiration rate and depth, electrocardiogram and body temperature are provided to flight surgeons on the ground via the telemetry system. The telemetry senders also provide information on the spacecraft systems performance to ground observers.

The pilot converses with the ground observers via a high frequency or ultra-high frequency radio link; emergency communications are provided should the main links fail.

LAUNCH VEHICLE

An Atlas booster is used to launch the spacecraft on orbital missions enabling it to attain a speed of approximately 17,500 miles per hour. At launch the spacecraft and launch vehicle stand 93 feet tall including a 16 foot escape tower above the spacecraft. The escape tower contains a solid propellant rocket, and if trouble develops on the launch pad or in the early stages of the mission the rocket will be fired to lift the spacecraft away from the launch vehicle.

MERCURY NETWORK

The Project Mercury Tracking Network consists of 18 stations around the world, including two ships, one in the Indian Ocean, the other in the Pacific. All the stations are in radio or cable communication with the Mercury Control Centre at Cape Canaveral via the NASA Goddard Space Flight Centre near Washington. During a mission, information on the spacecraft position is passed from the tracking radars of the network to digital computors at Goddard via the teletype link. From this information, the orbit parameters are established, and the computors prepare acquisition messages for other stations advising them of the time and position for contact with the spacecraft on the next pass.

MUCHEA TRACKING STATION

Project Mercury Tracking Station Number 8, located at Muchea W.A. is one of the two Australian stations in the Mercury network. The second station, number 9, is located at Woomera S.A. These stations are managed and operated by the Weapons Research Establishment of the Department of Supply for the NASA. The Muchea station is a typical installation with radar and acquisition aid tracking systems, telemetry reception and air-to-ground voice communication facilities. Because of its geographical position, being situated almost 180^{o} in longitude from the launch area, it was selected to have a command facility as well as normal tracking, telemetry and voice capabilities.

The Verlort (Very Long Range Tracking) radar tracks the spacecraft when it appears over the horizon, the output information of range, bearing and elevation being automatically sent to the Goddard computors via the teletype system.

The telemetry receivers, main operators' consoles and ground communications equipment are located in the main Telemetry and Control building. Telemetry transmissions from the spacecraft are received and decoded to obtain the various items of information which are then channelled to various recorders and indicating lamps or meters at the flight controllers' console. There is a timing system which provides accurate timing information from hours to 1/1000 of a second to drive clocks and indicators

and also provide timing references on the various tape and paper records made during a mission.

The station is controlled and all activities are co-ordinated from a main control room which contains the flight controllers' console, air-to-ground console, acquisition aid and acquisition data consoles and the plot board associated with the radar.

The flight controllers' console is occupied by the team of Americans who are present during a mission and by the flight surgeon, one of the two Australian doctors associated with the project. The console is split into three main sections viz. medical, main spacecraft functions and systems. At the medical panel information relating to the pilot's health is displayed. Some of this data is also recorded on adjacent equipment for future reference. The position at the centre panel which contains information on certain spacecraft events, is occupied by the Capsule Communicator, who, up till the last mission has been one of the seven Astronauts. It is from this position that voice communications with the spacecraft originate. The remaining position is occupied by the systems monitor, from here spacecraft systems are monitored for performance, and reports are sent back to the Mercury Control Centre at Cape Canaveral.

The air-to-ground or Communications Technicians' console contains the voice communications controls; various ground transmitters and receivers may be selected at this position.

The acquisition aid and acquisition data consoles control the positioning of all aerials associated with the station. The acquisition aid system receives the telemetry transmission from the spacecraft and automatically keeps its aerial pointing to the spacecraft after it has been acquired. The acquisition data console controls the positioning of all the aerials, receiving pointing information from the acquisition aid and the radar. On initial contact with the spacecraft the acquisition aid normally feeds the acquisition data to all the other aerials, but as soon as the radar has locked on, all aerials are driven from this more accurate information. All aerials can also be manually pointed from this position.

The radar plot board presents radar information in the form of a ground position plan. The slant range, bearing and elevation outputs are electronically coupled to produce a ground plot which when read with a height plot which is also produced, gives the spacecraft position in relation to the station.

The teletype equipment consists of receiving machines, sending machines and the tape machines on which messages can be punched on paper tape for later transmission or print out.

The air-to-ground and command transmitters are located with their separate aerial system. The transmitters are housed in a mobile van which, in case of an aerial failure, can be moved to the Telemetry and Control building for connection to one of the other aerial systems.

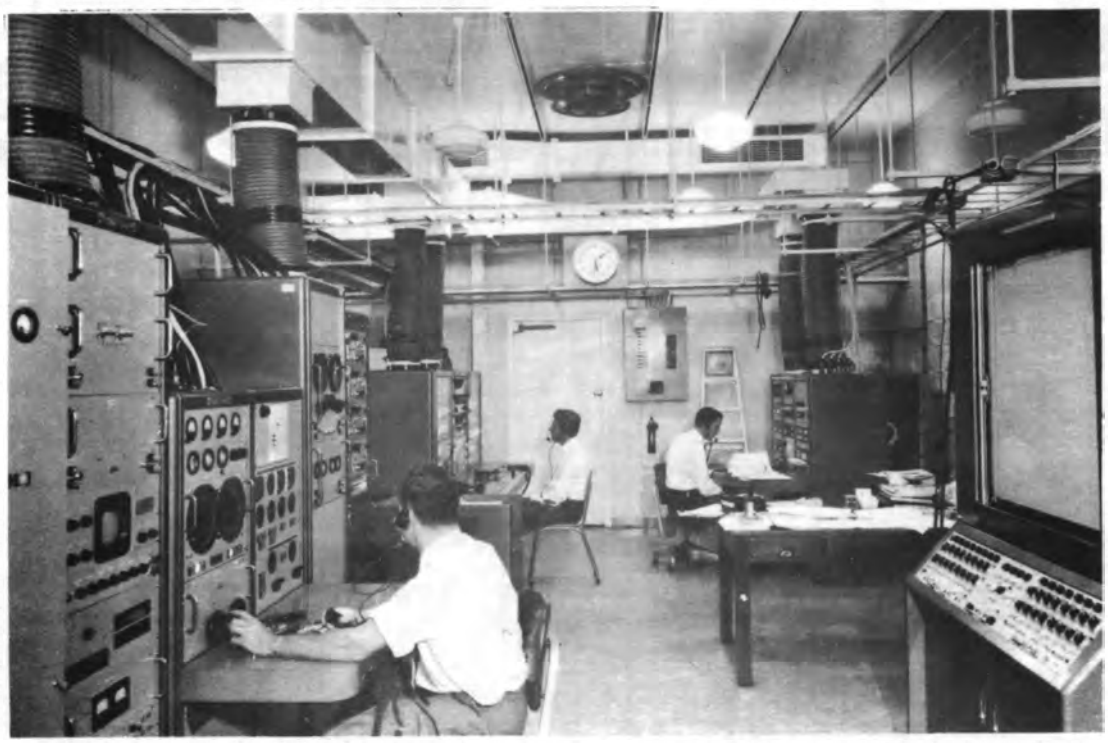
Muchea station has been actively engaged in all Mercury orbital missions since it became operational in March 1961. Between missions a specially instrumented RAAF Dakota is used to make performance checks of all the equipment.

The following missions have been supported by the Muchea Station.

Sept. 1961	MA4, the first orbital Mercury mission in which an unmanned spacecraft was flown. Astronaut Scott Carpenter was the senior flight controller.
Nov. 1961	MA5, a two orbit flight containing ENOS the chimpanzee. Astronaut Walter Schirra was senior flight controller.
Feb. 1962	MA6, the first manned orbital flight in which Astronaut John Glenn successfully completed three orbits. Astronaut Gordon Cooper was senior flight controller.
May 1962	MA7, in which Astronaut Scott Carpenter completed three orbits. Astronaut 'Deke' Slayton was senior flight controller.
Oct. 1962	MA8, in which Astronaut Walter Schirra completed six orbits. Mr. Eugene Duret of NASA was senior flight controller.

Project Mercury, Muchea - Verlort Radar & Van

Neg. No. N61/187



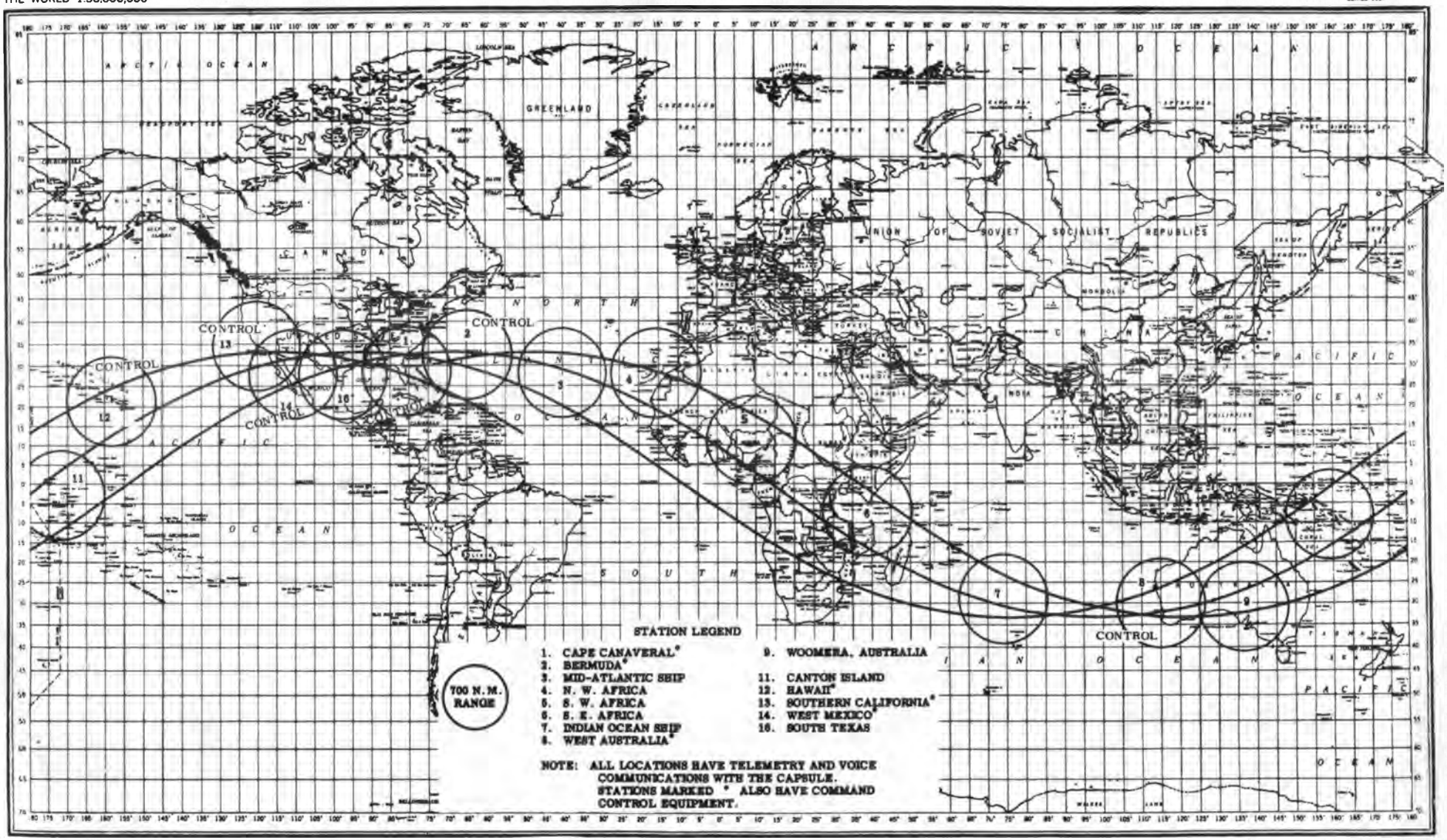
Project Mercury, Muchea - Flight Controller's Console Control Room, Telemetry & Control Building

Neg. No. N61/192

THE WORLD 1:36,000,000

THE WORLD

REFER TO THIS MAP AS
THE WORLD 1:36,000,000
SERIES 1107



Telemetry and vehicle communications