AT NEWSLETTER
The Australia Telescope
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The Australian Bicentenary 1788-1988
National Project
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BICENTENNIAL ENDORSEMENT

The Australia Telescope project was officially endorsed as an Australian Bicentennial Activity on 14 March 1984.

The endorsement ensures the integration of the AT Project into the total Bicentennial Program and provides for the use of the Bicentennial Authority's symbol.

Mr John Reid AO, Chairman of the Authority, noted that completion of the AT would be a major scientific event of which all Australians could be proud and a fitting tribute to the 200th anniversary of European settlement in Australia.

Dr Bob Frater, Chief of the CSIRO Division of Radiophysics (on left) receives the endorsement certificate from Dr David Armstrong, General Manager of the Australian Bicentennial Authority.

COMMUNICATION LINKS

Call for expression of interest

Advertisements in the national press calling for expressions of interest from companies interested in the AT communication links are to be placed in May. Budgetary estimates are being called for to enable the Division to determine the optimum type of links - microwave radio, optical fibre, AUSSAT (Ausralia's domestic satellite) or any combination thereof. The link is to be capable of carrying at least 140 MBit/sec between Culgoora and Siding Spring and at least 80 MBit/sec between Siding Spring and Parkes. Link utilization of aproximately 50% with 99% reliability is required.

This reassessment of the type of link for the AT follows the release of AUSSAT's rates and the suggestion by several companies (in reaction to the first issue of A.T. Countdown) that optical fibre technology will soon be cost competitive with microwave radio links.

AT ADVISORY COMMITTEE

The Committee met on 21 March 1984. Extensive discussions took place on the progress reports presented by section leaders, ATSOC and the AT Configuration Study Group.

Recommendations made included:

the adoption of the station locations for the Compac Array (see report below)
that future consideration be given to adding a third station near the 6 km point
dual-frequency linear polarization splitters be used and IF hybrids be provided to allow circularly-polarized outputs
the project manager to investigate priorities in construction particularly in regard to the possibilities of bringing forward the date of the first working interferometer currently scheduled for March 1988.

STAFFING DETAILS

New Arrivals

Bruce Egan - employed in the machine shop on a 3 year appointment, Bruce was previously employed by William Adams Pty. Ltd.

Stephen Skinner - a recent Royal Melbourne Institute of Technology graduate, Stephen is attached to the Antenna Group as an Experimental Officer on a 3 year appointment.

Cessations

Andy Henderson - left at end of April. Andy is a member of the Australian expedition which will attempt to climb Mount Everest this year.

David LeComte - leaving 11 May to take up an appointment with Time Office Computers.

OVERSEAS VISITS

Graeme James - feed system designer, will go to the the USA and London for 3 weeks in June this year.

Dick Manchester - chairman of ATSOC, will visit a number of institutions in the USA and Europe from the end of May to January 1985. Gordon Robertson from the Anglo Australian Observatory will be acting chairman of ATSOC during Dick's absence.

John Brooks, Dennis Cooper, Bob Frater, Dick Manchester will all be in attendance at the XXIst General Assembly of URSI in Florence, Italy from. 28 August to 6 September.

PROGRESS TALKS FOR STAFF

In the first of a series of talks by the section heads, Warwick Wilson will bring us up to date on VLSI developments for the correlator design with a talk in the lecture theatre on Tuesday 22 May 1984 at 10.30 am.

The purpose of these talks is to ensure that all members of the AT project team are conversant with developments in all sections of the project and to help develop more of a team spirit for this large project.

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CORRELATOR CHIP DESIGN

On February 29 (one day late !!) the VLSI chips submitted last December arrived at RP. Of the 3 designs, 2 were found to work quite satisfactorily whilst the third, a very experimental structure did not. However, the data obtained gave us the confidence to design a complete 2*2, 2-bit XCELL, which was submitted to the April 84 AUSMPC run. The design contains 2047 transistors, which at 4 micron minimum line widths, occupy a slab of silicon 3.3 * 1.8 m.m. These are due back in June.

CONFIGURATION FOR COMPACT ARRAY FINALIZED

At the end of February an *ad hoc* study group from the Division of Radiophysics presented its report [AT/10.1/036] on the configuration of the Compact Array. As approved by the Parliamentary Public Works Committee, the array consists of a linear east-west rail-track, 3km in length and containing five antennas, and a short length of rail track 3km further west containing one antenna giving an overall extent of 6km. The antennas are located on stations - 35 on the 3km track and 2 on the short track at the "6km point". The stations are all located at multiples of a basic grating increment of 15.306m.

An optimization procedure was used to determine the station locations so as to provide minimally redundant configurations for maximum baselines of 1.5, 3 and 6km. The configurations were all optimized for uniform baseline coverage at multiples of 4 observing "days"; the 1.5 and 3km arrays can be completely filled in 12 and 25 days respectively. Simulations suggest that 4- or 8-day observations will be adequate for many purposes.

In addition to the minimally redundant arrays, arrays providing just sufficient redundancy to solve for the antenna phase errors (apart from an array-wide phase slope) have been provided. For multiple-day observations, a further repeated baseline enables the phase slope on different days to be related. This feature is expected to improve the reliability of image restoration using self-calibration techniques.

The report was endorsed by ATSOC at its 7th meeting on 6 March, and by the AT Advisory Committee on 21 March. It now forms the basis for the detailed station layout for the antennas of the Compact Array at Culgoora.

FEED SYSTEM DEVELOPMENTS

The feed system is defined to include both the horn antenna, which captures the energy at the focus of the reflector antenna system, and any interconnecting waveguide components used to direct the received signals to the appropriate low noise amplifiers (LNAs).

Since the AT must operate over a large frequency range from approximately 0.3 GHz to 116 GHz and must also provide on-axis operation of feed antennas with dual linear polarization capabilities, the problem facing the feed system designer is an acute one.

These difficulties will be compounded if simultaneous operation, that is, the reception of two widely spaced frequency bands at the one time, is required. This facility of course, would effectively increase the speed of the instrument as well as meeting some specific scientific requirements.

At the outset it was clearly necessary to reduce the number of feed antennas and to this end intensive effort has gone into the design of wideband feeds. One result is that conical corrugated horns have been developed by the Division's Antenna Group. These horns are capable of high-performance over at least octave bandwidths (i.e., bandwidth ratios in excess of 2:1). This type of feed will be used to cover the K/Q bands (21-50 GHz) on the 22-m-diameter dishes.

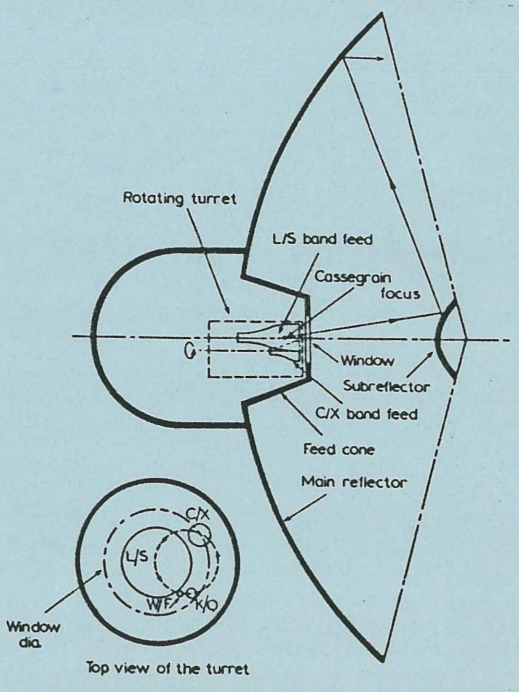
For lower frequencies these wideband conical horns can become unmanageably large, particularly for the L/S bands (1.25 - 2.5 GHz), and alternative solutions are required. Recently the Division has developed compact corrugated horns capable of operating over a 2.4:1 frequency range with a performance approaching that of the considerably larger conical wideband horn. Two such horns will be used on the AT 22-m- diameter dishes: one will cover the L/S bands and another the C/X bands (4.4 - 10.7 GHz). Currently this C/X horn is being manufactured in the Division's workshop while possible methods of manufacturing the L/S horn are still being investigated.

All of the three horns mentioned above will be located on a rotating turret (see diagram) which will allow them to be brought on-axis as required. Following the feed horns and attached to the turret will be various waveguide components for signal distribution. At the very least a waveguide switch at the end of each feed horn will be incorporated so as to direct the signal to the appropriate LNA. Of course this would preclude simultaneous polarization and frequency operation. However research is now being undertaken to develop low-loss waveguide polarization and band splitters which would provide four simultaneous outputs, being two frequency bands each with two polarization components.

For the W/F bands (86-116 GHz) an appropriate wideband quasi-optical feed system is yet to be developed but space is allocated for it on the turret. For frequencies below 1 GHz the most likely feed system will be a removable circular array situated on top of the feed cone. Preliminary results are promising but a detailed study is yet to be undertaken.

Another feature of the AT will be the provision of simultaneous S/X band operation for VLBI work. To implement this option, it is planned to use the existing L/S feed on-axis and to provide a separate X-band feed mounted permanently within the cone (but not on the turret). The energy will be directed to this feed by a detachable dichroic plate/offset reflector-type optical system. The design of this system is currently being investigated.

All of the above relates to the dual-reflector antennas being built for Culgoora and Siding Spring. The Parkes single dish radiotelescope is also part of the AT and its feed requirements present different design problems. These have yet to be fully worked out.



Outline of Reflector Optics and Feed Horns.