

AT MEMORANDA SERIES. ANALYSIS. LO Systems & Data Links

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OPTICAL FIBRE USAGE IN THE A.T.

REPORT ON THE SEVENTH AUSTRALIAN WORKSHOP

ON OPTICAL COMMUNICATION

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This Workshop was held at the University of NSW on December 7, 8 and 9, 1982. Because of strong interest in using optical fibres for the AT we felt some Radiophysics representation was desirable. The Workshop program, list of participants, abstracts and some papers presented have been placed in the Radiophysics Library.

There were 68 participants, representing most of the institutions, organizations and companies in Australia committed to optical communications. Some overseas experts gave invited lectures. The local presentations were a mixture of theoretical and practical.

After hearing details of the practical application of fibres, particularly by Telecom, there is no doubt the AT should use optical fibres for both local oscillator and data transmission. Undoubtedly our application will break new ground but most of the expertise is here in Australia. It will need a small AT design team plus contracts to Universities, Telecom and industry to cover the necessary development work. The following are some specific points which came to our notice.

1. Telecom is heavily committed over the next two decades to introduce a large amount of optical fibre (1500 km sheathed cable by 1988). It already has several pilot projects working in Queensland and Victoria. Economic factors show a rivalry with digital radio links but this is probably in low traffic areas with small bandwidth requirements and where the security of link is not vital. For the AT bandwidths fibres will be the cheapest solution for 20 km baselines. It may even be feasible to use it on longer baselines.

The Telecom 76 km Melton-Ballarat link is their first using single mode fibre. It is a testing ground for a Melbourne-Sydney link by 1988. It will use 140 Mb/s and 1.3 μm wavelength (with possible expansion to 565 Mb/s and 1.55 μm). Repeater spacing will be 30 km. Cable will be buried to 1½ m depth. Pictures of ploughing-in machinery trials were shown. Strain minimization is important primarily for cable life. This is measured during laying.

The cost of single mode fibre now differs little from multimode and as a consequence Telecom is looking at standardising on single-mode fibre. They are also expecting to standardize on 140 Mb/s initially, jumping over the Queensland 34 Mb/s system.

A lot of work has gone into joint loss testing. 120 joints gave 0.23 dB average loss on multimode fibre. This is still higher than the usual 0.05 to 0.07 dB for careful joining of single mode fibre. The difference looks to be due to spurious modes which can be suppressed.

Field trials are underway on pulling cables through existing ducts and on ploughing them directly into the ground. Effort has had to go into industrial relations on new technology problems such as fibre fusion welding.

2. Optical cable developments were interesting. Examples from Japan were shown. Austral Standard Cables gave a paper on the local production sheathing of imported fibres in various combinations of up to 18 fibres and metallic pairs with a central strain member. Attenuation and optical TDR measurements are made during production. Attenuations of 0.6 dB/km at 1.3 μ m were quoted.
3. A paper by Harvey of AWA reviewed the availability of many of the components that would be needed for an AT system. Some costs were disturbing and need to be considered in evaluating different possible systems, e.g. connectors at \$240 a pair could push the design away from many separate fibres towards multiplexing up to higher data rates. Laser diodes at 0.5 to 1.5K\$ can just about achieve 1 year MTBF.
4. Tucker at University of Queensland has been doing some top quality work applying microwave modelling approaches to laser diodes with the objective of optimising them for higher speed operation. Present work has taken commercial units up around 5 GHz. The work is also applicable to detectors which at present work to higher frequencies.
5. Cole of University of Sydney is starting work on time and phase stabilizing fibre links. This has direct application to AT requirements. Previous efforts at JPL and Chalmers (5 GHz) do not yet satisfy requirements. Cole believes this can be achieved by applying various microwave stabilizing approaches used in radioastronomy. Continuation of this work at a rate useful to the AT would probably require direct AT funding.
6. Two papers presented by Howard, Jeffery and Hullett from University of Western Australia described techniques for joint loss measurement and cable loss characterisation in single mode fibres at 1.3 μ m. This work could have AT applications, particularly for fault location during installation and subsequently, to evaluate cable and joint performance in the long term.