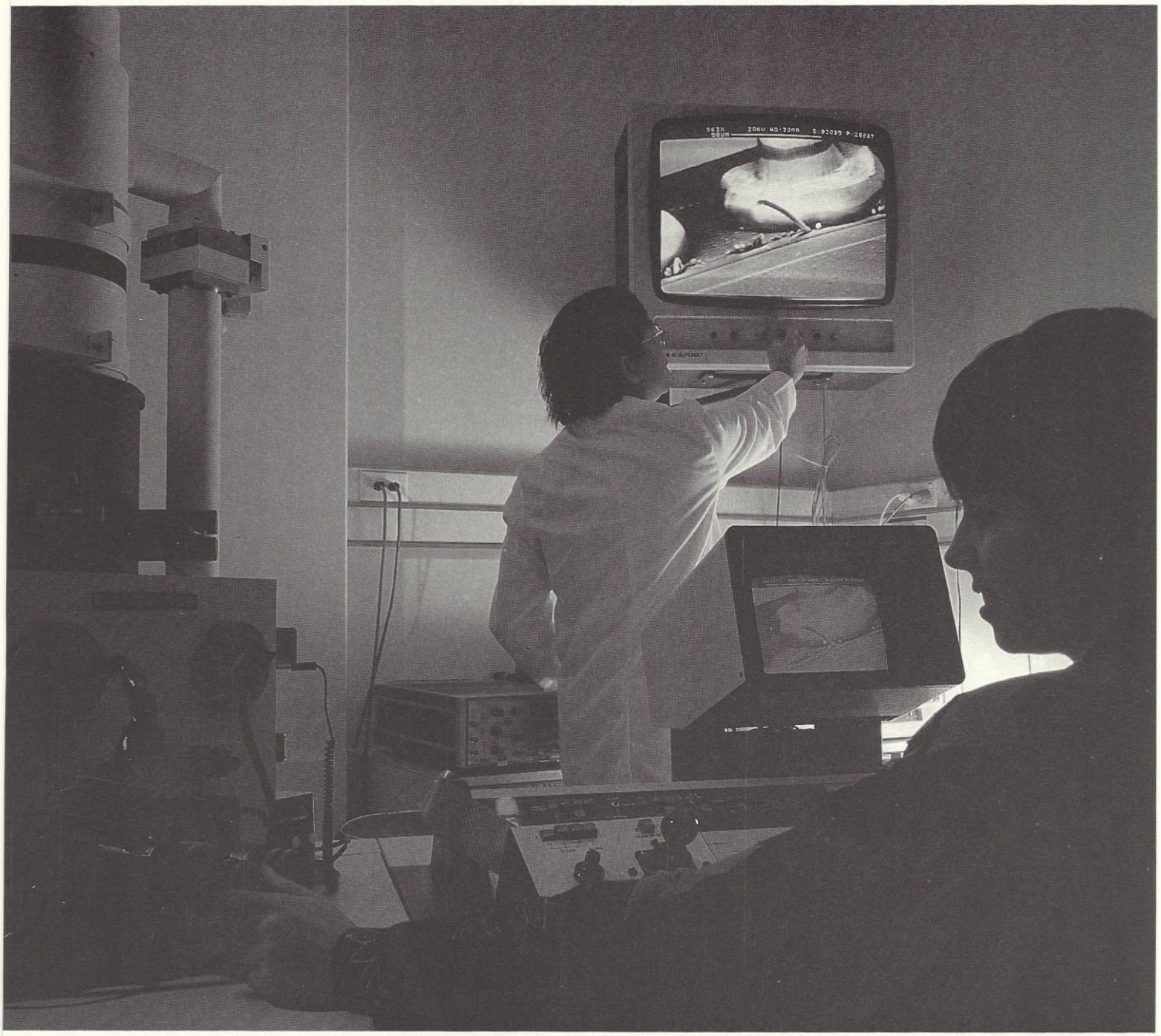
IN CONFIDENCE

RESEARCH

QUARTERLY 77



A RESEARCH UPDATE FOR TELSTRA STAFF ONLY

October, November, December 1994

FOREWORD

This quarterly publication provides brief insights into recent project activities and achievements of the Telecom Research Laboratories (TRL) that might be of wider interest or assistance to Telecom staff in the performance of their work. Information is provided under a number of headings including:

- The Telecom Research Laboratories – A Brief Overview
- Customer Services and Systems
- Switched Networks
- Transmission Networks and Standards
- Telecommunication Science and Technology
- Research Laboratories Information Transfer – includes reports, papers, talks and Standards Contributions.
- Visitors to TRL
- Staff contacts

The names and telephone numbers of appropriate TRL personnel are included throughout this booklet. If you would like to get further information on a particular topic, please call the contact person nominated.

A.K. Mitchell
for Director of Research

Our cover:

Researchers Kim Scott and Simon Li using the IC analysis system to check the operation of an integrated circuit.

The Research Quarterly has been printed on 100% Australian made Recycled paper.

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THE TELECOM RESEARCH LABORATORIES – A BRIEF OVERVIEW

Mission Statement

To provide Telecom with technological and scientific leadership, knowledge and expertise so that it can be the best provider of telecommunications and information services.

The Mission

Telecom Research Laboratories' (TRLs') mission is to provide Telecom with technological and scientific leadership, knowledge and expertise so that it can be the best provider of telecommunications and information services.

The mission is being achieved through seven key areas:

- provision of strategic advice and expert consultancy;
- value adding to Telecom's products and services;
- cost reduction of Telecom's equipment, systems and networks;
- technical support of Telecom's existing plant and equipment;
- transfer of technology to other parts of Telecom;
- increased ownership of Telecom's products through system and component design;
- maintenance of a highly skilled, expert and motivated workforce.

A Resource for Telecom

TRL is responsible for performing Telecom's research needs. TRL conducts a Research Programme derived from a corporately endorsed and approved business plan. The services that TRL provides are available to all other organisational units of Telecom.

The annual formulation of the business plan requires the consideration of corporate priorities and performance needs of R&D projects and related activities. This is in terms of the required deliverables, and the resources needed to ensure their timely delivery. These processes require that specific projects are either funded by a particular client unit in Telecom or on a corporate basis.

Deliverables include:

- the conduct of the Research Programme in accordance with the approved business plan;
- the operation of corporate facilities (National Information Resource Centre, Intellectual Property Consultancy, and Time and Frequency Standards);
- the management of and participation in corporate external R&D Programmes on behalf of Telecom.

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CUSTOMER SERVICES AND SYSTEMS

Symmetric Encryption Algorithms For Secure Communications

Telecom's interest in providing secure communication services means that strong cryptographic techniques need to be investigated. In particular, this includes symmetric key block ciphers, such as the Data Encryption Standard (DES). By maintaining expertise in the design and analysis of block ciphers, Telecom can evaluate the design of any commercially available cipher. Additionally, Telecom can design its own cipher should commercial ciphers be unavailable or unsuitable for the company's needs. It is important that Telecom be able to match the strength of the cipher to the level of security appropriate for the application.

Design criteria for a cipher reflect the current knowledge of cryptanalysis, and do not necessarily protect against new methods of attack. Because of the difficulty of 'future proofing' a cryptographic algorithm, a block cipher needs regular assessment of its security. As an example, technological advances have meant that the 56-bit key of DES is no longer large enough for many applications. Current research estimates that $US 1 million would be sufficient to build special hardware to find the secret key used to encrypt a known plaintext with DES. On average, an exhaustive search with such a machine would take about 3.5 hours. For many DES applications it would now be prudent to use DES in triple encryption mode.

The design of a new symmetric key block cipher is a difficult task, and developing a secure replacement for DES is proceeding in the international research community. Past research often concentrated on the design of individually strong cipher components, but we now know that this may not lead to an algorithm that is necessarily strong overall. Current research focuses on how to jointly choose individual cipher components and design a cipher so that the security of the resulting algorithm is optimised.

The TRL investigation of block ciphers was carried out in order to analyse the symmetric key cipher algorithms used in the GSM mobile telephone system. A confidential assessment of the security of the GSM block ciphers will be presented in a subsequent report.

(Contact: A. Mich, Customer Services and Systems Branch, (03) 253 6530)

Telstra Participation in DAVIC

The Digital Audiovisual Council (DAVIC) is a non-profit industry association, established along similar lines to the "ATM Forum", to look at end-to-end standards for delivery of interactive and broadcast digital audiovisual (broadband) services. TRL was approached and involved during the formative stages of the group, as a result of our extensive participation in the "MPEG" audiovisual compression standard and the high profile achieved from it.

DAVIC aims to cover all of the digital broadband services that Telstra is likely to provide in the future, so the DAVIC architectures and specifications will be critical to our future business. Recognising that standards for only some components of a complete end-to-end system for digital audiovisual/multimedia service provision exist, DAVIC aims to define a reference model for a complete system, and specify the interfaces and protocols necessary to allow the "boxes" from different manufacturers to interwork. The work therefore involves defining the interfaces and communications into and out of servers, set-top-units, value added service providers and other elements in a complete system. Where possible, existing standards will be selected and other, formal standardisation bodies will be encouraged to fill identified gaps.

At TRL's initiative, Telstra joined DAVIC to monitor its progress. It was not, at first, obvious that the initiative would be successful and, in particular, if there would be sufficient industry support. However, it is now clear that DAVIC will be the key body in the establishment of architectures and specifications for digital broadband service provision. Over 130 companies and organisations all around the world have become members. They include all major players in the area; all major telcos, switch manufacturers, set-top-unit manufacturers, software and computer hardware companies. DAVIC will drive the architectures and specifications for digital broadband delivery, profoundly influencing the systems that Telstra wishes to put in place. Decisions made in DAVIC on "Trusted Third Parties" for security control, on network termination points and customer premises networks, on separation between storage facilities and equipment that supplies bitstreams to the network, on interfaces between content providers and service providers, will influence the services that Telstra could provide, and could influence the regulatory view of our industry. Both Standards Australia and Austel have discussed joining DAVIC.

Broad participation in DAVIC (involving experts from the different areas under consideration) is essential because it could be either an opportunity or a threat. Standardised interfaces offer the opportunities and advantages of purchase

from multiple vendors and international connectivity – the usual benefits we expect from standards. However, if Telstra's interests are not represented and supported, there is a real threat that DAVIC could specify architectures, interfaces and protocols that may constrain Telstra service offerings, may differ (unrecoverably) from the Telstra-News JV solution or which may compromise our ability to offer services we wish in our regulatory environment (because those of North America, Europe or Japan dominated decisions in DAVIC). Current participation, at the rate of one person per DAVIC meeting, is inadequate and this is an issue that has been raised with senior management. However, Telstra will be hosting the June 1995 meeting (a pivotal meeting at which the first specification will be "frozen") in Melbourne and this should permit broader representation, at least for this meeting.

Integrated Communication Services Section at TRL is co-ordinating Telstra's DAVIC interests and providing current participation. But it is also encouraging the additional participation necessary to cover the technical areas sufficiently. We are liaising with the newly established Multimedia Standards Advisory Group in Telstra to provide guidance on Telstra's priorities.

With the first draft of a "Video-on-Demand" specification already completed, and an objective of finalising that specification by December 1995, the DAVIC timetable is ambitious. To follow and influence their directions is not easy. However, Telstra must be aware that DAVIC's specifications will underpin our move into broadband services and we must be aware of the directions taken by DAVIC, the potential implications for our business, and any divergence between these directions and our own network plans or the directions taken by the Telstra-News JV.

(Contact: L. Conte, Customer Services and Systems Branch, (03) 253 6282
M. Biggar, Customer Services and Systems Branch, (03) 253 6756)

Hospitals Without Walls

This phrase has been used around the world for a number of years, but the vision is now rapidly becoming a reality with consequent implications for the provision and development of new information and communication technologies.

A case study of a large Area Health Service in NSW has just been completed for Telecom, with a view to better understanding the implications of what is happening in this industry. The health sector is currently engaged in serious attempts to disperse and then to network the provision of services which have previously been undertaken in high-cost hospital environments. It is a social experiment with profound ramifications for everyone, but in particular for communications providers who have the opportunity to work with health sector leaders to develop new ways of delivering health services for this country, which may then be exportable elsewhere.

The study reviews the broad political framework, then examines in detail the day-to-day activity of a range of health care providers and looks at the ways in which the relationships within and between groups operate to shape their use of communications technologies and handling of information. The groups studied include the primary care givers, as well as the administrative and other support staff who worked in a large public hospital and its associated district hospitals and community health centres. Also considered in the study are the connections between public, private and non-government providers and the effects of government policy on their activities. Most importantly, the study focuses on the impact of new communications technologies on work practices, to clarify what may be the blocks and difficulties in taking up new ways of working.

Telecom has been slow to recognise the commercial and political significance of these changes within a complex and important industry group. It is believed that this year will probably see our last opportunity to position the company strategically in the development of new multi-media products and as a supplier of networked services for the health sector.

(Contact: L. Kennedy, Customer Services and Systems Branch, (03) 253 6716)

TRANSMISSION NETWORKS AND STANDARDS

Measurement of Passive Intermodulation Products in Antennas, Cables and Connectors

TRL has set up a measurement system to characterise the intermodulation performance of RF and microwave mobile communications equipment. Intermod products (IMP) are produced in multiple carrier environments and present a problem when the IMP frequencies fall into the receive band of the same service or other services. For example mobile communications base station transmissions and TV broadcast services can generate IMP which interfere with telecommunications services on the same tower.

The causes of passive IMP are material non-linearities or contact non-linearities. Material non-linearities can be avoided through the use of appropriate materials. An instance would be the use of connectors which are silver plated rather than nickel plated: nickel is ferromagnetic and hence non-linear. Contact non-linearities occur in connectors, cables and antennas and are more difficult to eliminate. A number of good practices need to be used to reduce IMP due to contact non-linearities. For example, in connectors, centre pin alignment, cleanliness and adequate mating torque are important.

TRL's intermod measurement system or test rig operates in the 900 MHz band. Two 50 Watt carriers are used as inputs. Forward and backward propagating intermod levels from a device-under-test (DUT) can be measured. That is, the intermod generated in a DUT travels both away from and back toward the transmitters, with the relative levels being determined by the impedance in each direction. In a matched system the forward and backward propagating IMP are assumed to be equal. Importantly as well, the test rig can be used to determine the back propagating IMP generated by antennas.

The art in setting up an intermod test rig is to ensure that it can be used to measure the IMP down to very low levels so as to be able to characterise the performance of individual components. The effort that has to be put in to reducing the residual measurement system intermod levels can best be illustrated by the requirement to measure IMP levels to at least −160 dBc (dB below the input carrier level into the DUT).

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Dispersion Management Using Mid-Span Spectral Inversion (MSSI)

In Australia and in many other countries worldwide, the infrastructure underpinning the long distance inter-exchange network incorporates a large installed base (presently 1.6 million fibre km in Telecom) of standard single mode optical fibre, optimised for use at 1300 nm. At this wavelength the loss is moderate (~0.4 dB/km) and the dispersion low ($|D|<3$ ps/km/nm). This allows loss limited transmission of SDH signals at rates up to STM-16 (2.5 Gbit/s) over regenerator spacings up to 50 to 60 km.

For a given transmission technology and bit rate, the allowable regenerator spacing is either loss limited or dispersion limited. However, the advent of Erbium Doped Fibre Amplifiers (EDFA's) has essentially removed the loss limit for transmission systems operating in the 1550 nm wavelength region. At 1550 nm the attenuation is low (~0.25 dB/km) but the dispersion is high (~17 ps/nm/km). Therefore, by operating at 1550 nmand using EDFA's the only fundamental limitation that still remains is fibre dispersion. If the dispersion limit can also be removed, the vision of an ideal (i.e. lossless and dispersion free) light pipe comes closer to reality.

Appropriate dispersion management is the key to overcoming this last hurdle. At the Telecom Research Laboratories (TRL) a number of different schemes are presently being evaluated (see also the article by T.D. Stephens in this issue).

One of the most promising techniques is mid-span spectral inversion (MSSI). In this technique the signal (which may be a wavelength division multiplexed (WDM) array of signals) is allowed to travel down the first half of the link where it degrades (due to dispersion) well beyond the limit of normal detectability. After spectral inversion by means of a nonlinear element at the mid point, the dispersion of the remaining half of the link reverses the degradation caused by the first half. The technique requires only a single device placed close to the mid-span of a long, multi-amplifier transmission system, and it is the only compensation technique known to date which can operate at the presence of fibre nonlinearities. However, dispersion cancellation is not perfect, in that the fibre dispersion is not a strictly linear function of wavelength and second-order dispersion terms are not cancelled using MSSI. The limits in terms of the length of fibre that can be compensated, and the bandwidth over which it can be achieved are still being explored, but a system transmitting two WDM, 10 Gbit/s signals over 560 km of standard fibre at 1550 nm has been demonstrated recently by AT&T, and compensation of many times that length is projected by computer simulations.

At TRL a directly modulated 2.5 Gbit/s data signal at 1555 nm has been successfully transmitted through 400 km of standard fibre using MSSI. Using a high performance optical amplifier as a booster, the signal was sent into 200 km of standard fibre before being inverted. Spectral inversion was achieved using Four-Wave Mixing (FWM) in 25 km of dispersion shifted fibre. The output at 1549 nm was amplified, filtered and then sent through a further 200 km of standard fibre. After the total transmission distance of 400 km a dispersion power penalty of ~1 dB at an error probability of 10^{-10} was observed, whereas without MSSI, the signal was undetectable after 200 km.

Like most methods for dispersion management mid-span spectral inversion is still in the research stage. Much work is conducted in order to improve the efficiency of the inversion process and to increase its bandwidth. In this respect the use of a semi-conductor laser amplifier as nonlinear element is a promising alternative to dispersion shifted fibre and is also under investigation.

(Contact: Dr. Dieter Schadt, Transmission Networks & Standards Branch (03) 253 6737)

CAN Radio Propagation Characterisation at 30 GHz and Performance of Broadband MM Wave CAN Radio Technologies

The introduction of Pay TV and interactive multimedia services in the future Customer Access Network (CAN) will require a transmission network capable of cost effectively supporting these services and which can be rapidly installed in the face of competition. To achieve these objectives several manufacturers and potential operators are looking at developing delivery systems based on, for example, millimetre (mm) wave broadband radio, particularly for "last mile" applications. Telecom Research Laboratories have recently been investigating the feasibility of using millimetre wave radio technology in the CAN for such services. The investigation consisted of propagation characterisation at 30GHz in suburban streets. Excess path loss characteristics were measured on concentric circles at radii of 0.5 km intervals extending out to 2 km. Measurements were made at 90 suburban "customer" sites in Melbourne using Springvale exchange and Rusden College, Mulgrave as base sites with the following objectives:

- Assess the availability of line of sight with practical customer premises antenna heights and base station heights
- Estimate the excess signal loss (i.e. the signal loss due to obstructions) at various distances and deduce path loss statistics
- Evaluate the reduction in excess path loss as a result of using reflected signals when line of sight (LOS) paths were blocked, increased customer premises antenna heights, change in placement of customer premises antenna and accessibility to more than one transmitter site
- Deduce the technical performance and network cost structure of the mm wave broad band CAN

The results of the study quantify the correlation between excess path loss and customer premises antenna height, base station height and customer premises antenna location across the front of suburban house blocks. The availability of LOS or near LOS appears to be critical for operation of mm wave CAN radio. Foliage attenuation from suburban trees is the dominant factor in reducing LOS availability.

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Dispersion Compensation Using Chirped Fibre Gratings

Currently Telecom is installing 2.5 Gbit/s (STM-16) intensity-modulated/direct-detection (IM/DD) SDH transmission systems on the intercapital single mode optical fibre network. The fibre network uses standard optical fibre optimised for zero dispersion near 1310 nm. This fibre has a typical loss of 0.4 dB/km and −3 to +3 ps/km/nm dispersion around 1300 nm while at 1550 nm the loss is lower ~0.25 dB/km and the dispersion higher ~17 ps/km/nm.

The current systems being installed all operate in the 1300 nm wavelength window with regenerator spacings of 50-60 km. At 1550 nm where the fibre loss is low and using a low chirp distributed feedback laser to reduce the effects of fibre dispersion it is possible to operate 2.5 Gbit/s SDH systems with 100-110 km regenerator spacings. By double hopping, Telecom will in future on selected routes significantly reduce the capital costs of these high capacity transmission systems.

Looking further ahead, one of the many options is to increase the bit rate of the current SDH system to 10 Gbit/s (STM-64). To maintain the existing regenerator spacings around 100-110 km at these very high bit rates, these systems will use an optical amplifier at the transmitter to boost the optical signal power perhaps also an optical amplifier at the receiver. The most common form of optical amplification is the erbium doped fibre amplifier (EDFA) that amplifies optical signals in the 1550 nm wavelength window, therefore these future 10 Gbit/s systems will have to operate in the 1550 nm window where the fibre dispersion of the installed fibre plant is high.

TRANSMISSION NETWORKS AND STANDARDS

The effect of fibre dispersion is to delay long wavelength components of the signal spectrum relative to the short wavelength components of the signal spectrum. Even with a zero chirp modulator, the modulation sidebands in a 10 Gbit/s digital signal in conjunction with fibre dispersion are enough to limit the allowable transmission distance between regenerators to around 50 km. Dispersion is therefore a critical problem that must be addressed before these next generation transmission systems can become a viable option.

At TRL, as part of our ongoing investigations into technology choices for the next generation of SDH transmission systems beyond 2.5 Gbit/s, we are currently studying dispersion management techniques (see also the article by D. Schadt in this issue).

One very promising technique is the use of chirped fibre gratings. A chirped fibre grating is simply a short piece of single mode fibre typically 12 cm in length that has a grating permanently written into the core. A chirped grating reflects light at different wavelengths from different points along the grating. Therefore, using a chirped grating it is possible to delay short wavelengths relative to long wavelengths. Thus a chirped grating can be used to compensate for fibre dispersion.

As part of Telstra's support for the Australian Photonics Cooperative Research Centre (CRC), the Optical Fibre Technology Centre (OFTC) at Sydney University has been developing the technology to manufacture chirped fibre gratings. Using the world's longest fibre grating from OFTC, we have at TRL in collaboration with OFTC recently completed a series of systems measurements to investigate the dispersion compensation properties of these gratings. In the first system test a standard 2.5 Gbit/s IM/DD system was successfully operated over 210 km with a −1 dB power penalty, that is better performance with the grating than that achieved back to back with no dispersion. This is the current world record in terms of fibre dispersion compensated for by a single fibre grating.

While this system test clearly shows it is possible to compensate the dispersion of 210 km of standard fibre at 2.5 Gbit/s, it is more efficient to reduce the transmitter chirp using an external modulator. To really demonstrate the power of chirped fibre gratings a second system experiment at 10 Gbit/s was performed. On January 19th 1995 the first demonstration ever of 10 Gbit/s data transmission over 210 km of standard fibre using a single 12 cm chirped fibre grating with a 0.5 dB dispersion power penalty was successfully achieved. With an additional 31 km of fibre operation at 10 Gbit/s over 241 km was achieved with a 1.9 dB dispersion power penalty. This system experiment has smashed the current world record which was up until now 150 km at 10 Gbit/s.

Further work is continuing on optimising the grating chirp and investigating other new and novel applications of fibre gratings. One potential application of particular interest to Telecom, is the possibility of using a single chirped fibre grating to compensate for fibre dispersion in multi-channel wavelength division multiplexed (WDM) systems.

(Contact: T.D. Stephens, (03) 253 6731)

Replacement Strategy for Solar Modules

TRL has had a long and close involvement in the evaluation and selection of solar technologies for use in the network. A recent aspect of this work has been to follow up and see how particular products, materials and designs, chosen more than a decade ago, have performed in the field. An evaluation of solar modules presently powering remote parts of the network was undertaken by TRL late in 1994. The data collected will be used to form a strategy for future module replacement, and will also help refine the correlation between laboratory testing and in-service performance.

It was known prior to the field visit that numerous examples of one type of module, the Philips BPX 47CF, had degraded, reducing output power. Many of these modules have been in use for over 13 years. Measurements were taken on over 170 of these modules and a similar, earlier type, the Philips BPX 47C. Both module types are used in the Port Hediand to Kununurra microwave route and in selected other places across Australia. There was a significant difference in performance between the Philips BPX47C and BPX47CF modules although these modules have been seen within Telecom as being equivalent. The BPX47CF modules have deteriorated at a much faster rate with cracked glass, delamination of the plastic encapsulating the solar cells, disintegration of the plastic terminal box, and corrosion of connections being the common faults.

A number of Solarex modules of types LX81BGT and LX81BGT(S) have been observed to develop splits in the backing material. Of particular concern is the possibility that moisture ingress may occur via splits in the backing material. Resulting corrosion of the solar cell interconnects would then reduce module power output and perhaps eventually result in complete failure. Over the past ten years many thousands of the Solarex modules have been installed by Telecom in most regions throughout Australia. Electrical measurements were made on a mix of 117 of the above types and visual observations made on another 120. Accelerated ageing tests have also been performed at TRL on a number of modules with splits to estimate the rate of corrosion and hence the expected remaining lifetime in the field. Splitting in the rear surface layer of Solarex modules is widespread and seems to affect modules made over a wide timespan. However, these modules still seem relatively impervious to moisture, and TRL's measurements indicate that the current from such modules has not reduced significantly and so no immediate action is required.

Also investigated were 76 BP Solar modules, type BP1236T. This type of module has been in the network for up to nine years. Bubbles have developed within the rear backing layer of some of the earlier modules and in severe cases, individual solar cells have been broken. The problem appears to be caused by the materials used in manufacture to form the rear water barrier. TRL has arranged that these modules be periodically examined by Telecom field staff to determine the rate and extent of bubble formation.

Overall, solar modules have been found to have performed quite well in the field. TRL's original recommendations have thus stood the test of time. Some signs of deterioration are to be expected after many years of exposure in the harsh Australian outback. In the majority of cases the problems observed have not caused complete failure but have only reduced the power output or life expectancy. The results of this field measurement programme together with TRL's extensive knowledge and experience with photovoltaic materials and solar module technology will result in a solar module replacement strategy being released early in 1995.

(Contact: Barry Hawkins 03 253 6545 or Ian Muirhead 03 253 6542, Telecommunication Science & Technology Branch)

OH&S Comparison of Jointers' Tent Fabrics

A polyvinyl chloride (PVC) alternative to the standard cotton canvas jointers' tent has been informally introduced in Western Australia. The PVC variant offers a worthwhile price advantage, is substantially lighter, and with zips and velcro strap fastenings, is more convenient to use than the standard canvas tents. However, discussions at the External Plant Consultative Forum raised questions from the CEPU about the effect of the PVC on the working environment in the tent, including heat and moisture dissipation and the build-up of fumes during jointing operations.

Polymer & Chemistry Section have shown by means of laboratory and outside experiments, that both tents are potentially dangerous to workers when used fully closed during jointing operations using LPG. However, when both flaps on one side of the tents were held open during testing, no significant differences were noticed between cotton canvas or PVC tents. Under these conditions, although some oxygen depletion and carbon dioxide increase were noted during use of a large LPG burner, with the application of sound work practices, it was concluded that the PVC tents are a suitable alternative to canvas.

The test data have been forwarded for formal presentation at the next External Plant Consultative Forum by National Health Safety and Environment staff.

(Contact: C. Sandford, Telecommunication Science & Technology Branch, (03) 253 6570)

TRL INFORMATION TRANSFER

During the last quarter, the TRL staff have published or presented details of the progress and noteworthy achievements of various projects and activities. These publications comprise both official Telecom publications (in the form of Research Laboratories Reports and Branch Papers) and papers submitted for external publications in learned journals or presented to outside organisations (including professional institutions and societies).

Some of the listed Research Laboratories Reports and Branch Papers are confidential and restricted to appropriate areas within Telecom. These are indicated by the '*' included in the publication number. Only the titles of such publications are included.

Reports and Branch Papers 'for general use' are available on request and are also listed with abstracts or summaries of the contents of such publications given after the lists.

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RESEARCH LABORATORIES REPORTS

8303* – A Design for an Experimental Distributed and Automated Management System
Hogg, S.

8310* – CORBA and TINA: The Architectural Relationship
Kitson, B.

8321* – Composite Second Order Distortion Due to Self-Phase Modulation in Externally Modulated Optical AM-SCM Systems Operating at 1550 nm
Desem, C.

8322* – Intensity Noise Due to Multiple Reflections and Rayleigh Back Scattering in Lightwave AM-SCM Video Transmission
Desem, C.

8323* – Method for Gathering Configuration Information in a SDH Network
Ginger, J.L., & Sawyers, G.

8325 – Overview of DCE 1.0 Security
Warner, M.

8326 – Authentication and Key Distribution in Distributed Systems
Warner, M.

8327* – Study of Interactive Multimedia and the Related Customer Profiling
Rowles, C, & Denger, L.

8328* – Results of a Simulation Study on the Performance of Slow Frequency Hopping in GSM
Campbell, J., Gitlis, M., & Wedding, L.

*Reports marked * are classified as 'IN CONFIDENCE – For Telecom Australia Use Only'.*

Research Laboratories Reports Note: In some cases Research Laboratories Reports classified as 'In Confidence – For Telecom Australia Use Only' will only be released to staff when accompanied by their Section Manager's authorisation.

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TELECOMMUNICATION SCIENCE AND TECHNOLOGY

Component Analysis Report

CAR94/018* – Investigation of Modular Telephone Connectors (RJ45)
Hand, R.G.

CAR94/019* – Failure Analysis of Fujitsu 8051 Micro-controllers Used in Siemens Loop-Multiplex Equipment
Petkovic, N

CAR94/020* – Corrosion on Digital Radio Concentrator System (DRCS) Droput Unit 2 (DOU-2) Printed Board Assemblies
Frost, C., Gwynn, P., Kibel, M.H.

Technology Trends Report

*TTR94/03** – DRAM Technology – Future Trends and Challenges
Thornton, R.P.

TTR94/04* – A Comparison of External and Direct Laser Modulation Techniques for Analogue and Digital TV-Transmission
Thornton, R.P.

Consultancy Report

*CR94/08** – Failure Analysis of Telefunken Optocouplers Type 4N33
Petkovic, N

Energy & Device Technology Report

ED94/01 – Payphones Cabinet
Godfrey, J.R

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RESEARCH LABORATORIES PAPERS PRESENTED/ PUBLISHED

TRANSMISSION NETWORKS AND STANDARDS

Composite second order distortion due to self-phase modulation in externally modulated optical AM-SCM systems operating at 1550nm – Electronic Letters, Vol.30 No.24, 24th November 1994.

Composite second order distortion due to self-phase modulation in optical AM-SCAM systems operating at 1550nm. ACOFT '94, 4-7 December 1994, Melbourne.
Desem, C.

TELECOMMUNICATION SCIENCE AND TECHNOLOGY

Structural Aspects of MOCVD Grown $Cd_xHg_{1-x}Te$ By X-Ray Diffraction Techniques; COMAD '94, Macquarie University, NSW, 12-14 December 1994.
Berrigan, R.A., Stevenson, A.W., Leech, P.W., Faith, M.E.**

The Growth of AlN Films for the Production of Metal-Insulator-Semiconductor Devices on HgCdTe; COMAD '94, Macquarie University, NSW, 12-14 December 1994.
*Butcher, K.S.A.; Li, X; and Tansley, T.L.; Wielunski, L.S.; Leech, P.W.**

Plasma Processing of Silica on Silicon for Fabrication of Planar Waveguide Devices; COMAD '94, Macquarie University, NSW, 12-14 December 1994.
Faith, M.E.; Leech, P.W.; Kemeny, P.C.

Waveguide Formation by Germanium Ion Implantation in Fused Silica; ACOFT '94, 4-7 December 1994, Melbourne.
Leech, P.W.; Faith, M.E.; Kemeny, P.C.

Photo-induced Planar Germanosilicate Waveguides; ACOFT '94, 4-7 December 1994, Melbourne.
Moss, D.; Ibsen, M.; Duellette, F.; Leech, P.W.; Faith, M.E.;* Kemeny, P.C.;* Leistiko, D. and Poulsen, C.V.*

Pd/Zn/Pd/Au Ohmic Contacts to p-type $In_{0.47}Ga_{0.53}As$/InP; Journal of Applied Physics, 76(8), 15 October 1994.
Leech, P.W.; Reeves, G.K.; Kibel, M.H.*

CUSTOMER SERVICES AND SYSTEMS

An Interactive Multimedia Service, Australian Telecommunications Networks & Applications Conference (ATNAC '94), December 1994, Melbourne.
Flower, M.; Trinkle, H.**

An Efficient Inference Engine for Interactive Fault Diagnosis in a Helpdesk Application, 8th International Conference on Industrial & Engineering Applications of Artificial Intelligence and Expert Systems, August 1995 – Melbourne.
Zhao, M.; Leckie, C.;* de Beler, M.**

Capacity and VC-Dimension of Multilayer Network with Higher Order Input Transformation, 2nd Australia and New Zealand Conference on Intelligent Information Systems, November 1994, Brisbane.
Kowalczyk, A.; Szymanski, J.*

Generalisation in Feedforward Networks, Neural Information Processing Systems, Natural and Synthetic, Denver, Colorado, U.S.A., December 1994.
Kowalczyk, A.; Terra, H.**

Interactive Multimedia Services Prototyping Environment, Australian Telecommunications Networks & Applications Conference (ATNAC '94), December 1994, Melbourne.
Conte, L.; Oetterli, T.;* Spicer, S.**

Reordering of Video Bitstream Elements for Improved Error Resilience, Australian Telecommunications Networks & Applications Conference (ATNAC '94), December 1994, Melbourne.
*Leditschke, M.**

**Denotes TRL Professionals.*

BIBLIOGRAPHIES

In the recent quarter the National Information Resource Centre has conducted literature searches to compile bibliographies on the following topics:

Clayton NIRC

94/375 Data integrity in billing systems

Melbourne NIRC

1357/94 Interactive multimedia in Australia
1361/94 Telecottages
1383/94 Number portability
1503/94 Customer loyalty programs
1504/94 Frequency buyer programs
1513/94 Geographic information systems

Sydney NIRC

336/94 Cities of the future
304/94 Measuring and monitoring morale
316/94 Telesales/Telemerchandising
310/94 Asynchronous Transfer Mode and broadband
323/94 Product development/product management
329/94 Pricing discount schemes and US long distance market
306/94 Convergance and telecommunications
344/94 Preparing business plans
349/94 PABX market in Australia
357/94 Managed router services
275/94 Electronic commerce

To obtain a copy of a bibliography please contact the NIRC office which produced the bibliography. Full contact details are given below.

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Fax: (08) 231 3837

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A wide variety of people from within Telecom and from external organisations visit the Laboratories, either as individuals or in groups. The visitors include executives, clients, researchers and officials of government and private organisations, and the purposes of such visits are to facilitate information transfer relating to the management and outcomes of R&D activities of mutual interest. Some notable visitors during the last quarter were:

October

Optical Waveguides Australia (Production Team)
A. Tziavaris, P. White, P. Skinner, B. Anderson, S. Lee, N. Krunic, M. Herbert, K. Timson, Z. Baginski, J. Kenneth, R. Shottle, K. Ianna, P. de Koning, P. Fielding.

Education Brief on Telecom Futures
Helen Smith, Office of the Secretary
Neil Elliot, (DSE)
Fran Thorn, (OTFE)
John Hird, (Western Metro, TAFE)
Prof. Robert Pargetter, Monash University
Prof. Cliff Bellamy, Monash University
Prof. John Anderson, Monash University
Prof. John Harris, Monash University

Telecom Personnel:
Adrian McKenzie, Manager, Integrated Communication Services, TRL;
Ross Kelso, Manager Technology Regulatory;
Carol Scott, Manager Technology Strategy;
Brendan Gibbs, Regional Account Manager;
Judy Slatyer, Education Applications Manager;
George Diamantopoulos, Account Executive, Education

Australian Bureau of Statistics
Jonathon Palmer; Warren Richter; Henri Kriegel; Stuart Jackson accompanied by **Nick Reavell,** Account Executive

DDB Needham
Barbara McCann, Richard White-Smith, Peter Sandor, Ian White, accompanied by **Allison Caruk,** Graduate Officer, Telecom

Victoria University of Technology
Terry Leedham, Manager, Academic Computing & Network Services
Malcom Barker, Communications Specialist
Dr Richard Jacewicz, Systems Programmer
Richard Everett, Audio Visual Librarian
David Lavender, Network Manager
Jack Payne, Acting Work Services & Maintenance Officer
Kay Darbyshire, Computer Systems Officer

Optical Waveguides Australia
T. Turner, E. Toto, J. Reutt, S. Ross, A. Gibb, B. Benson, R. Woodlock, L. Dawson, G. Miller, R. Wood, M. Mex, M. Norwood, T. Wyngard, R. Youngman, R. Slinger, B. Cook, P. Blake and P. Fielding

Optical Waveguides Australia
R. Lloyd, B. Shilliday, J. McColl, J. Bastin, M. McGivern, B. Farrelly, A. McIntosh, L. Carroll, A. Afentakis, R. Holcroft, H. Hassett, A. Beilby, R. Ianna, S. Lockley, D. Doyle

Patents Office
Stephen Clark, Mark Haynes, Edgar Perris, Mano Ramachandran, accompanied by **Peter Gretton of TRL**

TSEPP (Telecommunications Small Enterprises Projects)
Hugh Littlewood, Larry King, Jordan Reizes, Graham Farrar, Ewan Brown and **Robert Mursillo** accompanied by **Tony Bundrock,** National Manager, **Mike Robey,** Manager, Quality Programs & Benchmarking and **Garry Maher,** Billing all of Mobile Communication Services

Centre for the Development of Information & Telecommunications Policy (South Africa)
Andile Ng Caba, Project Co-ordinator

Korean Ministry of Communications Group
Yim, Eul-Mo, Director
Jeon, Tae-Seol, Director
Kang, Dong-Kyung, Assistant Director

November

Caucas Committee for Transport, Communications and the Arts
Hon. Leo McLeay MP, Committee Chair
Hon Dick Adams MP, Committee Secretary
Mr Maretyn Evans, MP
Hon Neil O'Keefe MP, Parliamentary Secretary to the Minister for Transport
Lynette Foulkes, Advisor to the Minister for Trade
Joe Fonte, Departmental Liaison Officer to the Hon. Neil O'Keefe MP Parliamentary Secretary Transport
Carey Badcoe, Departmental Advisor (Arts)
Senator Michael Forshaw accompanied by **Gillian Welshe** and **David Shires**

Indonesian Science & Technology
Petrus "Chris" Mboeik and Ida Aya Lindawati

Beijing Glass
Mr Wen Ou, Director
Mr Yang Kewu, Senior Engineer
Mr Li Qin, Senior Engineer
Mr Yu Baoting, Senior Engineer

DB Telekom
Mr Jurgen Haag, Mr Claus Strange, Mr Klaus-Dieter Grohs, Mr Michael Becker-Wehner, Mrs Elke Franze

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Dr Y. Y.Kuen, Hong Kong

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John Duthie, Communications Consultant

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Peter Warne, Executive Vice President, Treasury
Linda Gough, Manager Client Services
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David Rothwell, Project Manager, Future Strategy
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TRL is managed to a rolling 5-year Business Plan, which is corporately reviewed and approved annually. The Business Plan encompasses agreed 'deliverables' and the resources needed to achieve them. The deliverables include:

- the conduct of the TRL's R&D Programme, comprising a range of investigatory projects performed for and nationally funded by a variety of Telecom Client Divisions, with their endorsement;
- the operation of Corporate Facilities for the whole of Telecom, including the provision of specialised services relating to:
  - library information and translation services,
  - intellectual property consultancy services,
  - academic programme.

The preceding table gives details of TRL activities and appropriate staff contacts.

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