IN CONFIDENCE

RESEARCH

QUARTERLY 74

A RESEARCH UPDATE FOR TELSTRA STAFF ONLY

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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;
- Broad Categories – by Activities;
- Research Laboratories' Information Transfer – includes Reports, Papers, Talks and Standards Contributions;
- Visitors to the Laboratories;
- Staff Contacts.

The names and telephone numbers of appropriate TRL personnel are included throughout the booklet. Interested persons are invited to make direct approaches for further information.

A.K. Mitchell
for DIRECTOR OF RESEARCH

Our Cover:

Alison Payne and Steve Leask examining a weather map from the Bureau of Meteorology, which could be one of hundreds of possible providers of information when broadband services are introduced.

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

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THE TELECOM RESEARCH LABORATORIES – A BRIEF OVERVIEW

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, and;
- 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), and;
- the management of and participation in Corporate External R&D Programmes on behalf of Telecom.

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.

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Computerised Tools for Management of Telecom Structures

Telecom has to maintain and upgrade thousands of structures for radio communications: poles, towers and guyed masts. It takes up to three weeks for a complete structural analysis of a site using a classical approach, thus the Telecom's Network Product Structures Group has came up with a concept of developing specialised computerised tools for time and cost savings. In addition, due to the current emphasis on safety, it is necessary to upgrade the documentation relating to Safe Work Practices for Transmitter Sites. The problems are exacerbated by the fact that there is no uniform data base system for all radio structures.

The Artificial Intelligence Section is developing a family of software tools (Expert Systems) for assistance in design and maintenance of poles, towers and guyed masts. The tools are capable of making preliminary assessments of structural loading, producing antenna radiation hazard surveys for use in site radiation folders and maintaining records of site configurations. The software uses highly interactive graphics to generate structures, mount antennas and produce antenna radiation hazard patterns. The system consists of two families of tools, one for structural design and one for generation of antenna radiation hazard patterns. Both families use similar interactive graphical interface and databases.

The tools for structural design have been developed in close co-operation with the Structures Group, Transport Technology, Network Products, consisting of separate products for poles (Pole Expert System), towers (Tower Expert System) and guyed masts (Guyed Mast Expert System). Each system consists of an interactive front end for generating, manipulating and displaying various graphical views of the structure and its mounted antennas. A software process (artificial neural network) in the background continuously monitors the structure parameters and the types and number of antennas mounted, and continuously supplies a confidence figure, an assessment that the structure has a safe loading.

Version 2.1 of the Pole Expert System, the latest release, supports the most common poles, headframes and antennas. Version 1.0 of the Tower Expert System (supporting only 64 type towers) and version 1.0 of the Guyed Mast Expert System (supporting the family of 45D guyed masts) are scheduled for release in July 1994.

The tools for producing Site Radiation Folders are being developed in co-operation with Electromagnetic Compatibility Section. Again it will be a family of separate products: Pole Radiation Hazard Expert System, Guyed Mast Radiation Hazard Expert System and Tower Radiation Hazard Expert System.

All three expert systems share some common features with the structural design products as they use similar graphical interfaces and the same (securely encrypted) databases. They contain a graphics editor which enables the user to generate/edit user defined radiation hazard patterns, a text editor to generate/edit textual information anywhere on the screen and a database of previously measured antenna radiation patterns that can be imported onto user defined locations on the structure. The high quality, standardised print outs for inclusion into the Site Radiation Folders are automatically generated.

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Smart Cards Standards Visit – March 1994

Smart cards are becoming important to a number of telecommunication applications including: the GSM mobile telephone system; Baseline Information Technology Security (BITS); advanced intelligent network services such as UPT; Pay-TV and associated services such as home shopping; and EDI. Some of these are regarded as being of strategic importance. Consequently it is important that cards and related applications develop in such a way that they meet Telecom's requirements. The success of smart cards standards would allow off-the-shelf solutions to many of Telecom's future needs. For these reasons, Telecom is actively participating in international standards activities for smart cards.

In March 1994, Edward Zuk attended the ISO/IEC JTC1/ SC17/WG4 standards meeting on smart card. The main topic of discussion during the meeting was the result of a technical ballot for ISO 7816-4. This is an important draft standard which attempts to define a core set of commands for smart cards. The ballot received negative votes from Germany, Canada and The Netherlands. The result of ensuing discussions was that the key elements of the Canadian's proposed changes were accepted, and it is expected that the Canadians will change their vote to a yes vote. This would leave only 2 negative votes which is the maximum allowable for the ballot to succeed. In this case a new draft of the proposed standard could be ready by the end of the next meeting and the final ballot to make the document an international standard could be completed by the end of the year. The next ballot is very important as it could be the last opportunity to make changes to the current draft.

The Australian comments accompanying the standard stressed that the draft still has too many optional components so that different cards complying with the standard may not be able support the same application.

Australia's yes vote was based on the fact that delays in setting the standard would result in more applications becoming incompatible with the standard which would diminish the chances of the standard becoming widely accepted. As a compromise Australia inserted an annex into the standard where a number of card profiles, with reasonable options, can be specified. Two of these card profiles define ETSI and GSM compatible cards. This should result in more application designers using cards that Telecom has in the field today.

Satisfactory progress was also made on the standard for inter-industry data elements. This standard is to make it possible to reuse data elements stored in a card among many applications. The draft standard now contains a number of data elements, many of which have been borrowed from banking standards. The major issues concern the coding, storage and retrieval of data elements in such a way that the methods chosen are efficient yet compatible with cards already in use. Since Telecom is not committed to any particular method, it is important that this standard is progressed as quickly as possible.

Two new work items have recently been approved which are of interest to Telecom: namely a security architecture for smart cards and an advanced command set for smart cards. As little work has been done on these topics, Telecom has the ability to be influential in the progress of these standards so that they are formulated quickly and meet Telecom's needs. Working on and hence being able to identify the stable portions of emerging standards also enables Telecom to design applications compatible with these standards well before they are published.

Discussions with the other delegates, some of whom are recognised as leading experts in smart cards, have revealed a number of security breaches relating to smart cards. In addition, the underlying causes of those breaches and the approaches taken to stop further breaches have been identified. Such information is invaluable to Telecom in its attempts to understand the technology.

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Major Enhancements to CED Software

TRL have recently completed some major enhancements to the CED (Corporate Electronic Directory) software. These enhancements fall into two major areas. The first is support for the Distributed Operations protocol of X.518. This will enable CED to interwork with other directory systems, making it possible for users to access information on other systems (as permitted by access controls). The second major area of enhancement is the provision of graphical user interfaces for on-line users. Currently users access the system via VT100 terminal emulation. The enhanced software will allow for native GUI access for MS Windows and Macintosh personal computers.

The CED system has been deployed within Telecom for several years now. It is a high performance electronic directory system expressly designed to hold corporate directory information. It is used within Telecom to: provide on-line access to corporate information to ordinary users; generate the data for the printed Telecom Corporate Directory; supply data to several other systems; and produce reports. The system is based on the OSI X.500 Standard. The CED was in fact probably the first X.500 based system to gain mainstream corporate acceptance anywhere in the world. Currently thesystem is in use within several major organisations, both public and private, as well as in Telecom.

The enhanced CED software will be released as Version 3.4. Deployment of this version within Telecom and other customer sites will take place during this year.

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Human Factors and Customer Issues in Interactive Voice Response Systems (IVRS)

Telecom is set to expand its use of Interactive Voice Response (IVR) technology. Researchers in the Human Communication Section have been working on various IVR systems both inside and outside the company. We can assist designers in a number of ways.

We can provide guidance on when it is appropriate for IVR technology to be introduced and when it is not. Such guidance is based on understanding the needs of customers and passing this knowledge on to designers.

A study of various IVR applications has been made drawing on Australian experience and international literature. Reports on IVR in general and on an evaluation of the Telephone Testing Service (TTS) have been prepared. The TTS is a new system which uses an IVR front end to the 1100 faults service. It is designed to handle two types of enquiries from customers, namely, those regarding numbers which are constantly busy and numbers which never answer. The main inputs have been twofold. Firstly, advice by Human Factors experts, on the voice script used and preliminary evaluation and comprehensive testing of the service, using real people who were observed interacting with the system while completing realistic tasks. The resulting interface proved very successful in a pilot held in Perth earlier this year. Secondly, Information Flow Studies researchers evaluated the pilot from the view point of the Service Consultants and the effects on their roles and work loads. This work was carried out for the Breakthrough for Customers, Service Assurance team.

Telecom is represented on the Standards Australia Committee, IT/22, by a member of the Human Communication Section. This committee is currently producing a standard for IVRS in Australia. This link with the standards body provides useful knowledge and experience which benefits IVR development in our company.

The recently published Human Factors Kit provides guidelines and styleguides for user interface design for Telecom systems and products. A new section entitled "Tips when setting up your IVRS" has been added to the booklet "Guidelines Part 5: Interactive Voice Systems". This can be obtained by contacting Liz Bednall on (03) 253 6306 and will soon be available on-line as part of the Kit.

In addition to advice and guidelines, the Section is able to provide assistance in evaluating and testing developing systems, paying particular attention to scripting and logic issues from the perspective of the customer. As noted earlier, such assistance was provided during development of the TTS.

Anyone interested in implementing an IVRS should be aware that the Customer Support Breakthrough Team has convened a working group, The Automated Access to Telstra Team, which represents all Telecom Business Units. This group has responsibility for putting together a corporate strategy for automated access, which includes the use of IVR. A representative from the Human Communication Section is in the group.

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Human Factors Studies for Voice Mail Services

The Voice Mail project team, Network Products, has been developing a range of network-based voice mail products, using Comverse's voice mail platform – the same platform which Mobile Communication Services use for their MessageBank service. The first of these products to be offered later this year for residential and business customers will be the Network Answering Service (NAS). Currently under commercial trial in Brisbane under the name of "Message Manager", this service provides customers with a mailbox to which callers are diverted if the phone is busy or not answered. The customer records a personal greeting which callers will hear and by using a PIN, is able to access the mailbox from any touchtone phone to retrieve messages.

The Human Factors Group in the Human Communication Section has worked closely with the development team over the last year, assisting in the design and evaluation of all aspects of the service that users will interact with: scripts (wording and logic), network features such as access mechanisms and the user documentation. In April, the group completed an extensive usability evaluation and testing of the NAS under trial. The task faced by the Voice Mail team was a complex one – many constraints are placed on any design effort of this size, where you are taking a system purchased from overseas, adapting it to your own customers' needs and incorporating it into your network in order to offer all customers the best possible solution. It was further complicated by the need to allow for different service levels (e.g. including full messaging) in the future.

In the usability test, people who might use the service were observed in intensive sessions as they completed a structured set of tasks while interacting with the NAS. Although the on-line user interface to the service was the main part of the evaluation, the test also investigated other components of the interaction such as the user documentation. Various problems were identified, including access arrangements, some technical bugs as well as aspects of the scripting and user documentation.

A detailed report was prepared for the voice mail team highlighting problem areas and recommending strategies for improving different aspects of the service prior to launch. On the 19 April, the outcomes of the study were presented to the project team and others interested in voice mail and related Interactive Voice Response systems. Human Factors is now working with the team, Alcatel (who is responsible for digitizing any new voice prompts) and representatives from MessageBank to finalise decisions about which changes will be made to the NAS interface in preparation for launch.

The next phase will be to develop full voice messaging in the company. This will ultimately involve an integration of MessageBank with the new Voice Mail service.

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Telecom's Health Sector Customers

Time was when Telecom's central task was to construct a telephone network and connect people to it. That time is well and truly past. We now need to identify our customer groups and to understand their needs in some detail. One customer group which the company has consistently overlooked, largely because it is so disparate and appears so unco-ordinated, is the Health Sector. Our lack of focus has already resulted in the loss of significant business opportunities for the company. The IFS team has however been following with some interest the telecommunications implications of changes in the sector over the last few years. What follows is a review of work done and under way at this time.

In 1988, just prior to national moves toward increased regionalization of health services generally, the group undertook a study of the ACT Health Authority and its various institutions, with a view to understanding the

implications of regionalization for information flow in the sector. We learned a great deal about how the sector works and have continued to build on that knowledge base.

In 1992 a national study of the information flow patterns of GPs and of their use of communications was funded by the Commonwealth Department of Health, the RACGP and the AMA. While this study was funded externally it nevertheless provided the company with valuable insights into a very private world. As well it produced a detailed overall picture of relationships across the sector with significant information about communication behaviour.

In 1993 the team undertook an evaluation of quite a prolonged trial of several telemedicine applications set up between The Royal Adelaide and Whyalla hospitals. This trial was assisted by the responsible Telecom Account Executive and the evaluation was funded by Business Video Services. It looked at the uses of group video-conferencing for medical consultations, for meetings and for medical education. The transfer of x-ray and pathology slides alongside the video-conferences was a secondary feature of the trial. A report on the successes and problems of the trial is available from the research team. It includes advice for Telecom on a range of relevant issues.

Two further studies are currently under way. One is taking place in Brisbane, funded by the Health Communications Network and Telecom Industry Marketing. The focus of particular interest for Telecom is the use of voice recognition technology in a health application. The other study is in Sydney and is fully funded by Telecom's C & G team for the State Government. The focus in this one is the use of Lasercast as a tool to link hospitals for a range of activities. In both cases the use of e-mail as a means of communication between medical groups at different sites is seen to be of major significance in that two very high profile projects will be offering models which, at this time, could well tip the balance in the medical world toward wholesale adoption of computerised communication systems. From the Telecom perspective this will mean that an 'invisible' network will become visible and offer business opportunities of considerable and expanding value to the company.

Of particular significance in this regard is the recent formation of the Health Communications Network. Managers of the network are looking to Telecom for strategic advice and partnership. We need to present a united front as an informed and supportive telecommunications company with whom they can work to develop new and appropriately designed products and services.

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Information Society 2000 (IS2000)

The recently completed Information Society 2000 Project, headed by John Burke from Corporate Strategy, provided an opportunity for participants to consider Telecom's role in the provision of future telecommunications and information services. A key strategic response to these considerations was the preparation of three documents by the Information Flow Studies Group. They are: *Building in Evaluation: Guidelines for Setting-up and Evaluating Field Trials; Understanding Communicative Strategies: a Basis for Application Development; and Assessing Customer Needs: A Strategy for Product Development and Market Growth.*

Building in Evaluation: Guidelines for Setting-up and Evaluating Field Trials provides a comprehensive guide to the evaluation and conduct of trials, from understanding the context of the trial, to managing the trial activities and the evaluation process, through to reporting and 'managing out'. The document is intended for use across the company for anyone who is involved in the trialling of new products and services.

When preparing this document, the IFS group drew on its past involvement in other trials and evaluations, including one study arising directly from the IS2000 Project, that is, the 'Evaluation of the IS2000 Bulletin Board'. This study is Part One of a two part evaluation, with the general aims of assessing the impact of the Bulletin Board on users' work practices; broadening Telecom's knowledge of Bulletin Boards; and identifying implications for other Telecom internal and/or external products. As a flow on to this study, IFS has been asked to undertake an evaluation of the Corporate Document Server developed by ITG's Desktop Solutions, during the early part of 1994/95.

Understanding Communicative Strategies: a Basis for Application Development is a first principles paper on the nature of human communication and interaction. It aims to extend mathematical models of communication which emphasise concepts such as 'information source', 'information transmitter', 'channel', 'signal' and 'receiver', to include the human and social dimensions of communication by building in an appreciation of context and content of the message(s).

Finally, *Assessing Customer Needs: A Strategy for Product Development and Market Growth* presents three reasons why Telecom should study customers' requirements. These are: to develop products and services that best meet customers needs; to provide advice on how to price and market such products; and, to design and engineer the Telecom network to meet the capability and quality requirements of our customers. The document then goes on to discuss the importance of an integrated and balanced research approach, comprised of fundamental technical and social research;

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development research and evaluation; and, market research.

The major point of the "Understanding Customer Needs" document was the importance of grounding product development in the day-to-day communication and information contingencies of our customers. The Information Flow Studies group in fact holds a great deal of such customer data as a result of previous research. Building on this expertise, the IFS team was asked by the IS2000 project group to contribute detailed application development advice, particularly in the health and education sectors. The work in education has involved Dr Dallas Isaacs' participation on the steering committee for the CIRCIT conference on "Learning Networks in the 21st Century" as well as conducting various forums with representatives from different education sectors.

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ASPG Simulator

The Digital Services Protection Network (DSPN) has been established in order to protect Telecom Australia's PDH inter-capital network from route failures such as fibre cuts. When a failure is detected network controllers within the DSPN initiate real-time restoration procedures using a computerised scheme called the Automatic Switch Plan Generator (ASPG).

TRL has developed an ASPG simulator (a Unix-based C-code tool) which allows extensive examination of a number of operational aspects of the DSPN. These operational aspects are significant because of their effect on the restorability which can be achieved by the DSPN. A poor choice of parameters which affect the behaviour of the restoration procedure can cause a significant drop in the number of bearers restored in any outage.

A major strength of the simulator is that it has been built with full knowledge of the code which implements the ASPG in the current DSPN. This has allowed the simulator to exactly mirror the behaviour of the ASPG for all operational parameters. A front end interface has been built on the ASPG simulator which allows the many values of these operational parameters to be manipulated and extensively tested. The resulting behaviour is recorded for further processing and analysis.

The primary purpose of the simulator was to examine the effect of the ASPG algorithm and the operational parameters on the performance of a number of proposed DSPN network configurations. This has been achieved by extensively testing these configurations with the simulator. The information provided by the simulator has been analysed and provides clear support for the ability of the final configuration proposed by TRL to vastly improve the performance of the DSPN.

A useful by-product of the work is that the simulator provides a detailed insight into the effect of the operational parameters on the performance of any suggested network configuration. Recommendations which are specific to both the operational parameters and to particular bearers may be made. This helps to ensure that any configuration can perform at its best and also gives TRL the direct knowledge necessary to provide detailed advice during both the implementation of the suggested TRL configuration and during the subsequent controlled wind-down of the PDH as SDH is introduced.

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Traffic Management using Network Reconfiguration and Dynamic Routing

A project has been undertaken to quantify the impact of integrating network reconfiguration (bandwidth management) and dynamic traffic routing. A reconfigurable network is one which can quickly change the capacity assigned to origin-destination pairs, at the expense of the capacity assigned to other origin-destination pairs and subject to the transmission capacity of the physical network topology. SDH technology will provide network reconfiguration capability. Dynamic routing algorithms choose the appropriate path for calls depending on the instantaneous state of the network.

Dynamic routing schemes were originally designed for telephone networks without any reconfiguration capability in the transmission network. Also, there has been little research on the performance of dynamic routing algorithms in networks with characteristics similar to Telecom Australia's inter-capital network.

The project investigated:

- the effectiveness of managing network traffic using both network reconfiguration, based on a Linear Programming model developed at TRL; and dynamic routing, using the Dynamic Alternative Routing (DAR) algorithm.
- the relationship between link capacity and the effectiveness of the DAR algorithm.

A comparative study of the two schemes for traffic management was performed on a model of Telecom Australia's inter-capital telephone network, taking into account the following network characteristics:

- there are few alternative paths due to the small number of capital cities.
- a large traffic demand based on real traffic estimates.
- there are high capacity links to meet the traffic demand.

The major conclusions from the study were:

- For the network tested, network reconfiguration was found much more effective than the DAR algorithm, resulting in an increase of up to 5% more traffic through the network while reducing the blocking ratio from 14.6% to 9.8% when there was a 20% overload in the offered traffic. The effect of the DAR algorithm on the network was negligible.
- The Linear Programming model used maximises the throughput of the network under various overload conditions by allocating more capacity to paths for origin-destination pairs which use fewer physical links or transmission resources, and removing capacity from paths which consume more physical links.

- The DAR algorithm is more effective for networks with low capacity links rather than networks with high capacity links. This suggests that call re-routing algorithms will have little effect on the performance of Telecom's inter-capital telephony network.

These quantitative results are important since an appropriate dynamic routing scheme for Telecom Australia's inter-capital network has not yet been finalised.

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FASTPAC Bus Monitor Development

Telecom's FASTPAC is a distributed LAN interconnection service for corporate customers. This service integrates enterprise wide isolated LAN segments into a single large LAN, enabling Telecom customers to overcome data communications barriers in their distributed operating environments. To maintain the high quality service to our customers via the FASTPAC Service, it is a vital requirement to possess sufficient measurement and diagnostic equipment for network performance analysis and troubleshooting.

Optical Networks Section of TRL has embarked on a project for FASTPAC to develop service monitoring equipment to carry out traffic measurements on the FASTPAC network primarily to assist network dimensioning. In addition the equipment under development can be used in performance and stress testing of network elements. Although direct troubleshooting and network analysis tools such as LAN Analysers for Local Networks are widely available, such equipment for DQDB MANs is not commercially available. Thus there exists the need for a DQDB/ FASTPAC network monitoring tool for measurement and debugging purposes. Australian Telecommunications Research Institute (ATRI) of Curtin University in Perth is a sub-contractor to TRL for this development.

The built-in network manager provided by QPSX Communications Ltd., the developer of the networking equipment of the FASTPAC network, provides a range of performance figures related to Customer Network Interfacing Units and core/sub network utilisation in addition to fault alarms. The network manager extracts appropriate information once every few minutes from the relevant network elements. It is not feasible to reduce the sampling interval below this level because of the potential problem of performance degradation of network elements. This is due to the extra functionalities involved in the process of monitoring and extraction of network parameters and the subsequent transmission of extracted parameters to the network manager in addition to their primary task of processing and forwarding packets.

The Bus Monitoring system under development primarily consists of two layers. The first layer consists of a hardware module to interface to the FASTPAC network cluster modules to extract network statistics and information related to network signalling processes. The second layer consists of a PC based software system to interface to the hardware module to process and store the network information in addition to providing the user interface.

The hardware module enables the system under development to extract network statistics such as packet/cell arrival times and related packet lengths in addition to total bus utilisation levels. The bus sampling interval can be adjusted down to 125μs under software control in contrast to the practicable sampling interval, i.e. few minutes, provided by the built-in network manager. The hardware platform of the proposed system has been developed at ATRI.

The PC based software system under development at TRL will provide the user interface and an efficient data storage system as a flexible platform to tailor applications which process the raw information provided by the hardware interface. The initial application developed for the Bus Monitor will enable Telecom to obtain customer traffic statistics in addition to total bus and Router utilisation from the core network level. The software selectable data sampling rates will provide the flexibility to perform detailed analysis of bursty traffic to evaluate the impact of packet bursts on network routing equipment. Further, the Bus Monitoring system can be tailored to identify potential network anomalies enabling improved network management and performance assurance. In addition, the system has the potential to carry out fault isolation procedures in network troubleshooting processes. It is also possible to employ an enhanced version of the Bus Monitor as an automated operational tool in continuous performance assurance.

Therefore it can be expected that the DQDB Bus Monitor would enable improved operational procedures involved in end to end performance assurance processes in addition to fault isolation procedures of the FASTPAC network. Such enhancements to the existing network management procedures will subsequently offer a better quality service to Telecom customer.

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Conclusion of the Telecom CDMA Cellular Radio Trial

Telecom Research Laboratories have recently completed a technology trial of a new digital cellular radio system developed in the USA by Qualcomm Inc.

The system uses a spread spectrum transmission technique with Code Division Multiple Access (CDMA), whereby users are distinguished by unique digital codes (rather than by time-slot or frequency band in conventional cellular systems such as AMPS and GSM).

Telstra's objectives in conducting the trial were to gain first hand experience with this new and promising technology, and also to develop the necessary expertise should Telstra be required to design and operate CDMA networks in Australia or overseas.

The trial equipment was leased from Qualcomm for 6 months from June 1993 to November 1993 and included two radio base stations, a basic switch with connection to the PSTN, an indoor antenna system, several mobile telephones, and various monitoring and data logging equipment. The trial was conducted by Research and Mobile Communication Services staff with technical support from Qualcomm.

The three locations chosen for the field measurements were:

- Suburban Melbourne;
- Melbourne CBD;
- Sydney CBD and Harbour.

Each location exposed the system to progressively more difficult propagation environments. Sydney, in particular, was known to exhibit long multi-paths arising from across the harbour reflections, with the potential to cause problems to the CDMA transmission performance.

The field measurement program was complemented by other activities, covering laboratory testing, speech quality evaluation, network implication studies, EMC issues and costing studies. A series of reports have been issued, detailing major results and conclusions from this work.

Further work is planned by the Radio & Satellite Networks Section to consolidate the large amount of data gathered during the trial into practical planning guidelines and network design tools.

As a result of the CDMA trial, Telstra has established the necessary credentials, should it ever be required to deploy future CDMA systems in Australia or overseas.

Furthermore, Telstra is well placed to evaluate future CDMA technology options as they arise.

(Contact: A.J. Guy, Transmission Networks & Standards Branch, (03) 253 6366)

Hand Held Satellite Telephone Tests

The Radio and Satellite Networks Section is evaluating technologies for satellite based handheld telephone systems, which can provide handheld telephone services in remote and developing regions worldwide.

Various systems of low-orbit satellites are currently proposed. A low-orbit satellite with a multi-beam 1 to 2 metre antenna can detect the low-power transmissions from hand held telephones used outdoors, because although the satellite is much more distant than the ground-range of the telephones, the satellite path is relatively unobstructed. Each satellite can serve a continental-sized region, so can accumulate an economically viable traffic flow from a sparse population of users. However, because low-orbit satellites are non-stationary, it is necessary to put up a complete constellation of satellites to provide continuous service. Hence worldwide service is also a feature of these systems.

Handheld satellite telephone systems are subject to distinctive signal shadowing and fading, dependent on the satellite speed, user movement, and the user's environment. Knowledge of the fading characteristics is crucial to the system design, particularly the dimensioning of the satellite antennas.

Inmarsat, the International Maritime Satellite organisation, operates geostationary satellites which provide telephone and message services to ships and vehicles worldwide, and is developing a low-orbit system for handheld telephones. Telstra Mobile Satellite and Radio Services operates an Inmarsat earth station in Perth, providing services to ships and vehicles in the Asia-Pacific and Indian Ocean regions.

The Radio and Satellite Networks Section has recently completed several radio fading measurement surveys in conjunction with Inmarsat. These surveys have provided a substantial portion of the data used by Inmarsat in their feasibility studies of satellite-based hand-held telephone systems, and have significantly influenced their proposed system.

A helicopter-mounted transmitter, and Inmarsat's Pacific Ocean Region satellite, were used to provide carrier signals while simulating the movement of satellites at various altitudes. Fading was measured indoors and outdoors, in urban and rural environments. Significantly, a freely hand held receiving antenna was used for some of the measurements, whereas most other researchers have previously restrained their receiving antennas, for example by mounting them on poles or carts.

The success and significance of TRL's surveys prompted Inmarsat to conduct a satellite telephone voice quality test in Melbourne. An integrated handset and antenna connected to a portable satellite telephone in place of its folding panel antenna was used, and a more powerful satellite signal was used to compensate for the smaller antenna. These tests, conducted with the assistance of Telstra Mobile Satellite and Radio Services and the R&SN Section, are believed to be the first voice transmissions ever made from a satellite to a freely hand held antenna.

(Contact: F.G. Bullock, Transmission Networks and Standards Branch, (03) 253 6396)

Telecom's First Submarine Cable Repair

Darwin Harbour was recently the site of the first repair of a submarine cable by Telecom in collaboration with the contractor, Commcord. A key feature of the project was the identification of the exact nature and extent of the damage to the fibre-optic cable via a multi-wavelength OTDR technique. This method became possible because of a recent project within the Photonics Section to develop a long-wavelength OTDR operating at 1660nm. The instrument had already proved, on many occasions, its increased sensitivity to faults in the fibre network over conventional OTDR's operating at 1300nm and 1550nm. This sensitivity is due to the reduced degree of guiding provided by a singlemode fibre at the longer wavelength, which causes the light to be more easily lost at any perturbation on the fibre. It was the combination of the data from the 1660nm traces with that taken using a 1240nm OTDR, which is sensitive to molecular hydrogen, that allowed the calculation of both the amount of strain on the fibres and the length of moisture-affected cable. A standard OTDR also provided valuable information about the performance of the affected fibres at the transmission wavelengths of 1300nm and 1550nm. These facts allowed TRL to recommend that a 1 km length of cable should be replaced to avoid early or unpredictable fibre failures, which are known to be caused by the simultaneous presence of stress and water on a fibre.

The technique was also sensitive enough to show that the moisture-affected region did not correspond exactly with the stress-affected region. This information allowed us to predict that the main damage site would be towards one end of a stripped region of cable. Correspondingly, a decision was made that the section to be cut out would not be centred on the main damage site, but should be offset by 200m. This would ensure the complete removal of the affected region. Subsequent recovery of the damaged cable confirmed that these observations had been correct. Interestingly, it was discovered that as well as being sensitive to fibre faults, the 1660nm OTDR is also able to detect the presence of hydrogen in a fibre, but not to the same degree as the 1240nm equipment.

Further use will be made of this technique in monitoring the performance of the submarine joints developed by Commcord for the repair. Telecom is also now better equipped to rapidly respond to such undersea-cable problems in the future.

(Contact: K. Clarke, Telecommunication Science & Technology Branch (03) 253 6693)

National Solar Power Workshop

A National Solar Power Workshop, organised by the Energy and Battery Groups of the Telecom Research Laboratories and the Power & National Standards Branch of Platform Technologies, was recently held in Melbourne.

The aim of the workshop was to establish pathways and processes to achieve national solar power performance standards. Telecom has over 13,000 solar powered installations and is one of the world's largest users of solar power in telecommunications. Some solar powered installations form critical links in Telecom's National Grid. However, there is significant variation in the performance of our solar power systems resulting from local and regional differences in design, implementation and operation.

The workshop was driven by Corporate imperatives of improved service delivery, reduced total cost, reduced system variations, a reduced supplier base and uniform, standardised practices. This was the first time that key design, construction and maintenance personnel with responsibility for Telecom's solar powered sites were together in the one forum to determine national approaches.

TRL was responsible for much of the co-ordination of the 3-day workshop. A pre-workshop questionnaire was issued to help provide the scope of material. The sixteen delegates, representing both regional and national interests, then proceeded to identify the issues relating to existing performance and problems. These issues were split along global and site specific lines, and workshopped by small groups containing a wealth of experience in different aspects of solar power performance. Processes on how to achieve the agreed outcomes and required directions were then established.

In the last session, consensus was gained from the delegates as to the outcomes, which included:

- the preparation of a National Document which clearly defines a solar power design and performance standard, recognising the need to grade sites with different levels of service availability. System costs and maintenance practices need to reflect this service availability criteria.
- the need for adequate documentation on practices and standards to be available to all spheres of responsibility.
- the need for life-cycle support and upgrade strategies to be a balanced assessment between "prop-up" effort and the introduction of new technology.
- an urgent need for operations and maintenance staff to identify, standardise and document work practices in line with the proposed grading of service availability. System performance monitoring is necessary to improve overall system performance.

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The enthusiasm of the delegates was reflected in the establishment of three working parties to further examine unresolved technical issues and identify the scope of the work required to achieve the workshop outcomes. The working parties have until the end of June 1994 to report their findings. TRL will continue to co-ordinate this effort towards a national solar power performance standard.

(Contact: J. Hawkins, Telecommunication Science & Technology Branch, (03) 253 6548)

Photonic Device Research

The Devices Group of the Optoelectronics Section is conducting a programme of research into the technology involved in making cheap and reliable photonic devices such as would be suitable for use in Fibre To The Home (FTTH) systems. The skills developed through this work will be invaluable in future work of ensuring the reliability and quality of optoelectronic FTTH systems and the knowledge gained is immediately applicable to strategic decision making since component cost is one of the principal factors in deciding between alternative system architectures.

A device fabrication cleanroom facility is maintained as part of this programme and a major item of equipment for the fabrication of advanced integrated optical circuits is the Vacutec PECVD/RIE(Plasma enhanced chemical vapour deposition/Reactive ion etching) system. This system allows the deposition of a range of high quality dielectric films and the precise etching of micron scale features in both the films and substrates.

The Vacutec VPS 1532 system comprises two chambers for alternate deposition and etching and is capable of a sequence of up to 50 fully programmable steps. High precision etching of several optoelectronic materials including InP, InGaAs and silica has been obtained, and recently layers of the dielectric material, silicon nitride, have been deposited on 5cm silicon wafers. The Si_3N_4 films showed the high uniformity in thickness and in refractive index required for waveguiding devices. The adaptability of the process has been demonstrated by the deposition of Si_3N_4 films on a range of substrates, with good adhesion obtained on GaAs, silicon and glassy carbon. This technique is being extended the deposition of silicon dioxide and silicon oxynitrides. The latter materials, which can have any composition between silicon dioxide and silicon nitride are potentially very valuable for waveguide structures because the refractive index can be accurately tailored by varying the relative amounts of oxygen and nitrogen.

A cooperative project between TRL and the ANU Electronic Materials Engineering Laboratory has resulted in planar silica waveguides being fabricated with the guiding layers formed through the use of a single step high energy 6MeV Ge ion implantation. These devices are currently being characterised in conjunction with RMIT. Once waveguide fabrication is mastered, then the possibility of a whole range of new compact optoelectronic device types is opened up. These include switching and filtering functions, and eventually amplification through the incorporation of erbium and will be of importance in implementing future photonic networks.

Other devices which are currently being researched include low cost multi-quantum well Fabry-Perot lasers for 1.3 μm systems. These devices utilise the custom-epi approach where the device layers are purchased to the user's specification from a specialist vendor, drastically reducing the cost of doing this sort of research. Delineation and contacting of the individual device structures have been performed at TRL to produce an arrays of lasers of varying dimensions as well as semiconductor optical amplifiers. The sequence of fabrication has required the development of several stages of processing including procedures for precision etching and the formation of metal/semiconductor ohmic contacts. The ridge lasers have a low threshold current of ~30mA. Another recent advance has been the fabrication of InP/InGaAs PIN photodiodes with subnanoamp dark current in the unpackaged condition. Three versions of the pin photodiode with either mesa, diffused or high energy implanted structure for device isolation have been fabricated. The fabrication of the PIN detectors is aimed at the development of an optoelectronic integrated receiver which has cost and performance advantages over the discrete device.

(Contact: P. Leech, Telecommunication Science & Technology, (03) 253 6627)

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 publication 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 are indicated by the '*' included in the publication number. Only the titles of such publications are included hereafter.

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 appended after the lists.

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For Branch Papers the relevant Branch Administrative Managers (BAMs) may be contacted as shown:

- BAM, Customer Services and Systems Branch (03) 253 6483;
- BAM, Switched Networks Branch (03) 253 6401;
- BAM, Telecommunication Science and Technology Branch (03) 253 6674;
- BAM, Transmission Networks and Standards Branch (03) 253 6399.

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8289* – The Prediction of Composite Second Order and Composite Triple Beat Parameters in Coaxial and Optical Systems
Crosby, D.B.

8291* – Rain Attenuation on Satellite Links in Darwin, N.T. (Final Report)
Flavin, R.K.

8292 – Modelling of Rainfall Rate Distributions for Various Cities in Australia
Flavin, R.K.

8294* – GSM Speech and Data Channel Simulation Systems
Findlow, G.A. & Gitlits, M.

8300 – A Satellite Link Rain Attenuation Model for Darwin, Northern Territory
Flavin, R.K.

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

Research Laboratores 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.

TRANSMISSION NETWORKS AND STANDARDS BRANCH

Report 8292 – Modelling of Rainfall Rate Distributions for Various Cities in Australia

A rainfall rate distribution model is proposed which is suitable for all climates in Australia, and which very accurately predicts the average annual rainfall (accumulation). The model is an enhancement of a previous model [Moupfouma] and consists of a properly defined probability density function with three coefficients and the probability of rain. The newly proposed model is called the log-gamma model since it behaves like a log-normal function at low rainfall rates and a gamma function at the higher rainfall rates.

The 6-minute average annual rainfall rate distributions for 14 Australian cities have been derived from long term Bureau of Meteorology rainfall data (strip charts) that cover periods in excess of 28 years for all locations. The diversity of climates for the 14 Australian cities is extensive, with the rain probability extending from 1.2% to 6%, and the rainfall from 281 mm to 2006 mm. Both log-normal and log-gamma distributions have been compared in modelling the long term rainfall rate data and predicting the average annual rainfall. The log-gamma model is superior in describing the results for sub-tropical and tropical climates, and is comparable to the log-normal model in describing arid and temperate climates.

The long term annual rainfall rate distributions (data) for the 14 Australian cities have been compared to log-gamma distributions using calculated coefficients from the model. In general, there is excellent agreement between the data and the proposed model with 12 sites having a maximum error in predicted rainfall rate (at a fixed probability) of 10% over the whole rainfall rate range, and 2 sites having a maximum error of 25%.

Report 8300 – A Satellite Link Rain Attenuation Model for Darwin, Northern Territory

This report presents the results of rain attenuation measurements at 12.566 GHz carried out on a satellite link in Darwin, N.T. during four "wet seasons", ending in April 1992. The experiment also measured rainfall rate simultaneously at five rain gauge sites distributed throughout the Darwin area. The results include cumulative distributions of rain attenuation and rainfall rate for each season, and the concomitant relationship between equi-probable attenuation and rainfall rate. The experiment also provides statistics on the number of fades and fade duration for each season. Finally, long term rainfall rate data from the Bureau of Meteorology has been used to provide average annual and average-worst-month statistics for Darwin.

The experimental results at 12.5 GHz show that satellite service availabilities under worst month conditions are limited to 99.6%, 99.9% and 99.99% when the corresponding earth station rain margins are 10dB, 20dB and 30dB, respectively.

In addition, the experimental results have been modelled. Specifically, initial models for tropical areas of Australia have been developed for rain attenuation, fade duration, and long term average rainfall rate cumulative distributions.

RESEARCH LABORATORIES BRANCH PAPERS

TRANSMISSION NETWORKS AND STANDARDS

General

TNS0358 – Critique on 'Fibre to the Home Cable Television'.
Pettitt, M.J. and Harper, J.S.

In Confidence

TNS0357 – Power Feeding CATV Line extenders.
Owers, R.

TNS0356 – Preliminary Report Availability and ITU-T Draft Recommendation in I.35X 'Availability Parameters and Objectives for International Constant Bit Rate Paths of, or above, the Primary Rate'.
Harris, R.

TNS0355 – CT2 Base Station and Hand-Held Interference Immunity from AMPS and GSM Mobile Networks.
Peavey, N.

TNS0349 – SDH Field Trial Measurement of Pointer Processor Performance.
Bodeit P.

Commercial in Confidence

TNS0354 – Assessment of ADSL Video Switch Alternatives.
Potter P.

TELECOMMUNICATION SCIENCE AND TECHNOLOGY

Technology Trends Report 94/01* – Planar Waveguides'.
Thornton, R; Scott, K

*The Branch Papers marked * are classified as 'IN CONFIDENCE' – For Telecom Australia Use Only'.*

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

Component Analysis Report No.94/006 should be "TAO Only, not general".

'Multiple Bistability In An Optical-Fiber Double-Ring Resonator Utilizing The Kerr Effect', IEEE Journal of Quantum Electronics, Vol.30, No.2, February 1994.
Ja, Y.H.

RESEARCH LABORATORIES PAPERS PRESENTED/ PUBLISHED

IEC/CISPR

'ETSI Spurious Emission Limits For GSM Digital Mobile Telephones Compared With CISPR Radiated Emission Limits For ITE', CISPR/G/ WG2 (Macfarlane) 93-3, May 1993.
Macfarlane, I.P.

'CORRECTIONS TO CISPR/G/WG2 (Macfarlane) 93-3: ETSI Spurious Emission Limits For GSM Digital Mobile Telephones Compared With CISPR Radiated Emission Limits For ITE', CISPR/G/WG2 (Macfarlane) 93-4, May 1993.
Macfarlane, I.P.

Draft Annex B, C.I.S.P.R. Publication 22, Third Edition, Control Of Disturbances Created At Telecommunication Signal Ports, 20 May 1993.
Macfarlane, I.P.

'A Recommendation And Comments On The Common Mode Impedance And LCL Characteristics Of The 2-pair (4-wire) And 4-pair (8-wire) ISNs Proposed In CISPR/ G/WG2 (Amemiya) 93-1', CISPR/G/WG2 (Macfarlane) 93-5, September 1993.
Macfarlane, I.P.

'Suggested New Work: Radio Devices and ITE', CISPR/G/WG2 (Macfarlane) 94-1, March 1994.
Macfarlane, I.P.

ANSI T1E1.4 to Meeting 14-18 February 1994

'Crosstalk limited reach estimation for DMT ADSL systems in the Australian customer access network.
Potter, P.

'Approximate reach estimation for HDSL systems in the absence of a CSA category of access network lines'.
Davies, S.; Ozergun, N.

'Impulsive noise due to ring current trip on Australian '800 Series' telephones'.
Davies, S.;, Cole, T.;, Peacock, S.; Potter, P.; Leach, K.

STANDARDS CONTRIBUTIONS

BIBLIOGRAPHIES

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

Clayton NIRC

94/010 Voice processing applications

94/026 Frame relay and LAN interconnection

94/038 Customer loyalty programs

94/064 Broadband networks – performance and reliability

94/068 Home shopping (last 6 months only)

Melbourne NIRC

94/94 Quality circles in software quality assurance

97/94 Multimedia kiosks

128/94 ISDN and small business – update

131/94 Value chain analysis

137/94 Video games market in Australia

147/94 Video-on-demand and Microsoft

148/94 Video-on-demand and IBM

194/94 Overview of the videoconferencing market

209/94 Asymmetrical Digital Subscriber Loop (ADSL)

216/94 Video-on-demand – markets, trials, technology

219/94 ATM

223/94 Recent developments in operator assisted services

249/94 Narrowcast pay TV in Australia

251/94 High level data link control (HDLC)

268/94 X25 Packet Switching – Trends

269/94 Update on telecommuting

273/94 Mobile data networks

294/94 Telemarketing in Australia

Sydney NIRC

3/94 Communications and remote areas

12/94 Telstra's offshore business

16/94 Regional Headquarters and benefits to host countries

26/94 Text based information services on Pay TV

33/94 Business Process Re-engineering Implementation

39/94 Frequency Management Plan Guidelines

42/94 Home shopping and electronic retailing

43/94 Market demands in telecommunications by yr 2000

49/94 Intelligent Networks

66/94 CMTS and low antenna

76/94 American telepoint and Omnipoint

110/94 Cellular Mobiles in Asia

123/94 Pricing strategies and telecommunications

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

Clayton National Information Resource Centre
M8/770 Blackburn Road,
Clayton, Vic. 3168
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VISITORS TO TRL

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:

January

Bureau of Transport & Communications Economics
Chris Cheah, David Luck, Bernice Owen-Jones, David Swanton, Rohan Melhuish, John Zmood.

Siemens Science School
32 Students and Adults.

Siemens Science School
32 Students and Adults

February

Education Fellowship Students
Susanna Pratt, Robert Oldham, Wilson Lee, Philip McDonald and Tony Robertson.

NRMA
Des Kennedy, Assistant General Manager, Communications; Geoff Norden, Communications Consultant.

National Association of Graduate Careers Advisors
20 Attendees.

NTT
Jiro Yamamoto, Senior Manager, International Affairs Dept.; Noboru Sato, General Manager, Visual Communications Sector; Dr Koichi Asatani, Executive Manager, R&D Information & Patent Centre; Hideo Baba, General Manager, International Affairs Dept.

Packer, Murdoch, Telecom (PMT) Consortium
Sean O'Halloran, Seven Network; Malcolm Colless, David Haslingden, Des Morton, News Corporation; Warren Leigh, Network Ten.

Telecommunications Mission From Brazil
Renato Guerrairo, Erico Zilli, Fisher Toledo, Reinaldo Morilha, Ethevaldo Siquerira, Joseph Soalheira.

Telecom Corporate Strategy
Dennis Hambleton, Group Manager, Regulatory; Vicki MacLeod, Manager, Regulatory Strategy; Adam Smith, Manager Industry Policy (Regulatory Strategy); Mike Bradley, Manager Policy Development (RS); Trevor Hill, Manager Co-ordination & Performance Reporting; Craig Downey, CPR, Regulartory; Rod Kearney, CPR, Regulatory; Mervyn Sewell, Assistant Manager, Technical Regulation; John Fitzsimmons, Manager, Technology Strategy; Vivian Vecchio, Corporate Strategy.

Department of Physics, Monash University
Dr Marshall Stoneham, AEA Chief Scientist; Prof. John Pilbrow, Head, Department of Physics.

Glen Waverley Secondary College Science & Technology Centre Committee
Tony Bell, Principal; Darrell Fraser, Deputy Principal; Diane Peck, Julie Hughes, Alex Galle, Rob Robinson, Committee Members.

Australian Financial Review
Fred Brenchley, Journalist

Alvin Electronics & GME Electrophone
Alan Tomlinson, Managing Director; John Rigg, Marketing Manager; David Jenkins, Warehouse Manager; Paul Sweeney, Manager from Alvin Electronics; Peter Pini, National Sales Manager; Blaire Campbell, Victorian State Manager from GME Electrophone.

March

NTT
Haruo Yamaguchi, Chairman; Yoshiaki Miyawaki, Executive Seccretary to Chairman; Jiro Yammamoto, Senior Manager, Internation Affairs; Ms Kazuko Yoshioka, Interpreter.

Chinese RITT Delegation
Wu Hongguang, Vice Director of TITT; Du Sen, Vice Director of UNDP Project; Ms Weng Yuanju, Senior Engineer; Ms Gao Lan, Assistant Engineer.

CRA
Pat Freehan, Manager Information Technology, CRA Advanced Technical Development; Geoff Tregilco, Manager Communications, Tarong Coal, Qld.

Global Standards Collaboration
35 Attendees.

CommTel
Paul Taylor, General Manager Communications; Baldev Bedi, Assistant General Manager.

Tattersalls
Paul Leonard, Communications Manager; Andrew Russell, LAN & Voice Services Manager; Bill Duncan, Network Supervisor, accompanied by Jeremy Whitehead, Account Executive.

1st Victorian Police Scottish Scout Group
David Menzies, Erica Densy, Blair Heading, Michael Ware, Jennifer Menzies.

Tourism Victoria
Rhett Lego, Director, Policy; Don Richter, Manager, Marketing Operations accompanied by Marissa Di Pasquale, Account Executive; Stuart Allen, Industry Marketer, Travel & Hospitality; Tony Hill, Manager Strategic Development, Victorian Govt.; Allan Makepeace, Industry Consultant.

VISITORS TO TRL

ANZ

Eamon Veaney, Chief Manager, Internation Communications Planning; Ray Gruchy, Chief Manager, C&NS Operations; Mike Stephens, Chief Manager, C&NS Technical Services; Peter Story, Senior Manager, Telecommunicaions Services; Lawry Franch, Manager Voice Services, Telecommunications Services; Scott Craigie, Manager Communications Planning, Telecommunications Services accompanied by Grahame England,Senior Account Executive; Mark Warren, Communications Consultant; Ian Ridge, Communications Consultant, all ANZ Account Team C&G.

Vietnam P & T

Dr Phan Cao Minh, Deputy Director, International Relations & Scientific Development; Mr Nguyen Quoc Thinh, Chief of Administration, accompanied by Neil Crane, General Manager, Telstra.

TRL's Organisation

TRL is headed by the Director of Research and comprises an Executive Group, the National Information Resource Centre and nine Branches. Details of the upper structure of TRL are given in the following table.

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– National Information Resource Centre	NIRC	Helen Rodd	6163	h.rodd@trl.oz.au
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– Human Factors	Gitte Lindgaard	6723	g.lindgaard@trl.oz.au
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– Protocol Engineering	Geoff Wheeler	6415	g.wheeler@trl.oz.au
– Inter-exchange Network Evolution	Robert Ayre	6731	r.ayre@trl.oz.au
– Mobile Communications Systems	John Campbell	6368	j.campbell@trl.oz.au
– Optical Customer Access Network	John Semple	6410	j.semple@trl.oz.au
– Mobile Satellite Networks	Fred Bullock	6396	f.bullock@trl.oz.au
– Wireless Access	Fred Bullock	6396	f.bullock@trl.oz.au
– MANs & Customer Access Management	Phil Potter	6424	p.potter@trl.oz.au
– Caldermeade Antenna Range	Enn Vinnal	6252	e.vinnal@trl.oz.au
– Network Synchronisation	Rod Gray	6182	r.gray@trl.oz.au
Reliability-related Work			
– Electromagnetic Compatibility of Equipment	Stan Davies	6390	s.davies@trl.oz.au
– Bioelectromagnetic Hazards	Ken Joyner	6315	k.joyner@trl.oz.au
– Electronic Component & Equipment	Doug Kuhn	6673	d.kuhn@trl.oz.au
– New Cable Technology	Bruce Chisholm	6642	b.chisholm@trl.oz.au
– Scientific Consultancy	Bruce Chisholm	6642	b.chisholm@trl.oz.au
– Electrical Interconnection	John Godfrey	6552	j.godfrey@trl.oz.au
– High Voltage Studies	Ian Stevenson	6603	i.stevenson@trl.oz.au
– Occupational Health, Safety & Environment	Terry Elms	6583	t.elms@trl.oz.au
– Optical Interconnection	Alfred Kruijshoop	6622	a.kruijshoop@trl.oz.au
– Semiconductor Reliability & Characterisation	Tim Rogers	6636	t.rogers@trl.oz.au
Components/Materials-related Work			
– Optoelectronics	Jim Thompson	6606	j.thompson@trl.oz.au
– Energy Conversion & Storage Systems	Doug Kuhn	6673	d.kuhn@trl.oz.au
– Metallurgy	Tim Keogh	6551	t.keogh@trl.oz.au
– Photonics	Garth Price	6689	g.price@trl.oz.au
– Polymers	Ray Boast	6645	r.boast@trl.oz.au
– Semiconductor Device Fabrication	Peter Kemeny	6686	p.kemeny@trl.oz.au

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Components/Materials-related Work continued			
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– New Communications Fibres	Geoff Stone	6682	g.stone@trl.oz.au
– Scientific Engineering	John Lowing	6470	j.lowing@trl.oz.au
Corporate Facilities			
– National Information Resource Centre	Helen Rodd	6163	h.rodd@trl.oz.au
– Intellectual Property Consultancy	Owen Malone	6519	o.malone@trl.oz.au
– Academic Programme	Geoff Willis	6533	g.willis@trl.oz.au
Physical Standards			
– Standards of Time & Frequency	Rob Harris	6124	r.harris@trl.oz.au
– Standards of Electrical & Optical Quantities	Rob Harris	6124	r.harris@trl.oz.au

TRL BUSINESS PLAN

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 notionally 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.

IN CONFIDENCE

ADDRESS LIST UPDATE

- Are you receiving TRL's RESEARCH QUARTERLY (RQ)? If NO, please tick the "Addition" box and fill out the address form below.
- If you do receive RQ and your present address etc is incorrect, please tick the "Correction" box and fill in your correct address.
- If you wish to nominate others who would benefit by receiving RQ please tick the "Addition" box and fill out the address.
- If you receive RQ now and would like to discontinue receiving it please tick the "Deletion" box and fill out the address form and return it to us.

Thank you for your co-operation.

Addition	Correction	Deletion
☐	☐	☐

Name (in Capitals)_____

Position_____

Department_____

Address_____

_____

Please return to:

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Telecom Research Laboratories (TRL)
P.O. Box 249
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