# A new battery testing facility*

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## Abstract

The reliability of any telecommunications network ultimately depends on the battery Since no single battery technology satisfies all applications, it is most important that Telecom Australia has adequate means to assess the technical merits of various batteries that might be used in the network This paper describes the development and commissioning of a new, versatile, 'universal' battery-testing facility that is capable of performance evaluation of virtually any battery technology likely to be of interest to Telecom Australia now, or in the foreseeable future

## Introduction

The battery is an integral part of the telecommunications network From large capacity, flooded lead/acid cells on standby in telephone exchanges, to nickel–cadmium and lead/acid cells in RAPS service, to the small equipment-based primary and secondary cells in modern telecommunications equipment, the importance of the battery cannot be understated Telecom Australia has, therefore, a significant stake in batteries At about $20M/year in purchases alone, such investment warrants research and development effort at the Telecom Research Laboratories (TRL) in the testing and performance evaluation of batteries

## 'PICSES' system

The predominant use of batteries by Telecom is for standby applications. The organization has considerable experience in the use of flooded lead/acid batteries in traditional, centrally-powered, telecommunications architectures This expertise, in part, is reflected in the 'PICSES' Automated Battery Testing Facility at TRL PICSES was specifically designed for the testing of the preferred 25/45/90/200/500/1140/2170/3200 A h capacity cells traditionally used by Telecom. The fixed design of PICSES was not, however, easily adaptable to more versatile testing strategies Thus, while

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PICSES had been used successfully for more than 10 years, it was of limited value in TRL efforts to characterize some new battery types

## New 'TAURUS' system

A new battery testing facility, known as 'TAURUS', was developed because of the limitations of PICSES In particular, the development was initiated by an urgent need to test and evaluate valve-regulated (VR) lead/acid batteries for use in standby applications. Recent trends to distributed power architectures in telecommunications demanded that Telecom build on its limited experience in the use of VR cells

The design basis of TAURUS is illustrated in Fig 1 A computer-controlled modular approach has been adopted Three 'modules' — (i) d.c power supply; (ii) 'active' load; (iii) data acquisition system — form the basic testing circuit with the test module (battery)

The fixed current limitations of PICSES have been avoided in TAURUS by employing 'active' loads (variable resistances) instead of selectable resistances. The active load effectively becomes an infinitely variable power resistor The system is arranged so that during a charge cycle, the power supply is series connected to the battery and the load is effectively switched out of circuit During discharge, the load is in series with both the power supply and the battery and is controlled by the supply in order to maintain programmed conditions across the battery Data acquisition into the same computer enables complete sampling and control of any test

In TAURUS, the active loads have been designed with power MOSFET technology which, coupled with switch-mode d c power supplies, provide considerable space/size savings over linear designs of similar power used in older battery testing systems

Short descriptions of some of the components used in TAURUS are listed in Table 1 These components largely reflect the fact that the original development was primarily driven by the need to test VR cells of up to 500 A h capacity ($C/10$ rate)

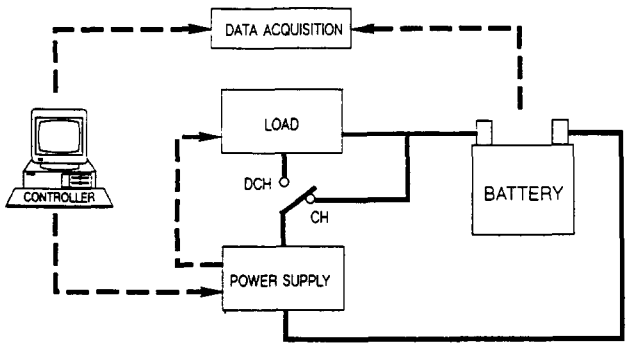


Fig 1 Basic concept used in TAURUS

TABLE 1

Some components used in TAURUS

| Module | Description |
|---|---|
| d c Power supply | Hewlett-Packard HP6031A system power supply (switch-mode) 120 A/20 V/1000 W max limits |
| Load | In-house designed and built, uses power MOSFET technology, nominal 500 W load limit |
| Data acquisition system | In-house designed and built, 48-channel, 16-bit integrating ADC with selectable-gain input instrumentation amplifier, address mapped into IBM PC AT I/O bus structures |
| Controlling computers | IBM PC AT or compatible |
| Software | Microsoft BASIC, in-house development of all control, data acquisition, and file handling software |

The importance and scope of the modular approach soon became obvious In principle, the concept could be easily 'sized' according to the desired application by selection of the power supply (current limit) and the load (power limit). Thus, with the appropriate use of standardized modular interfacing, the versatility of the design was not hardware limited but, primarily, a software task.

Software, written in BASIC, has been developed with the intention that, in this design, a battery test can be considered as a sequence of real-time control operations to the power supply. Thus, constant current, voltage or power charge, or discharge cycles, remote-area power simulation profiles, AS1981 testing regimes, or VR cell charging schemes can all be relatively easily accommodated by the TAURUS software

In total, TAURUS is a complete Battery Evaluation Centre, as illustrated in Fig 2 Up to eight independent battery testing 'stations' connect into a single controlling computer to form a test 'bay'. Thus, up to eight completely independent and unrelated real-time testing regimes can be supported on a bay at any one time One or more bays connect to a supervisory Master Controller and to a database workstation via a Local Area Network (LAN) An interactive user-interface on the Master Controller allows the non-specialist easily to program a test regime while database application software on the work station allows comprehensive processing and analysis of test results

To date, two bays (16 stations) have been installed with the nominal 500 W load system It is planned that at least two additional bays, one of

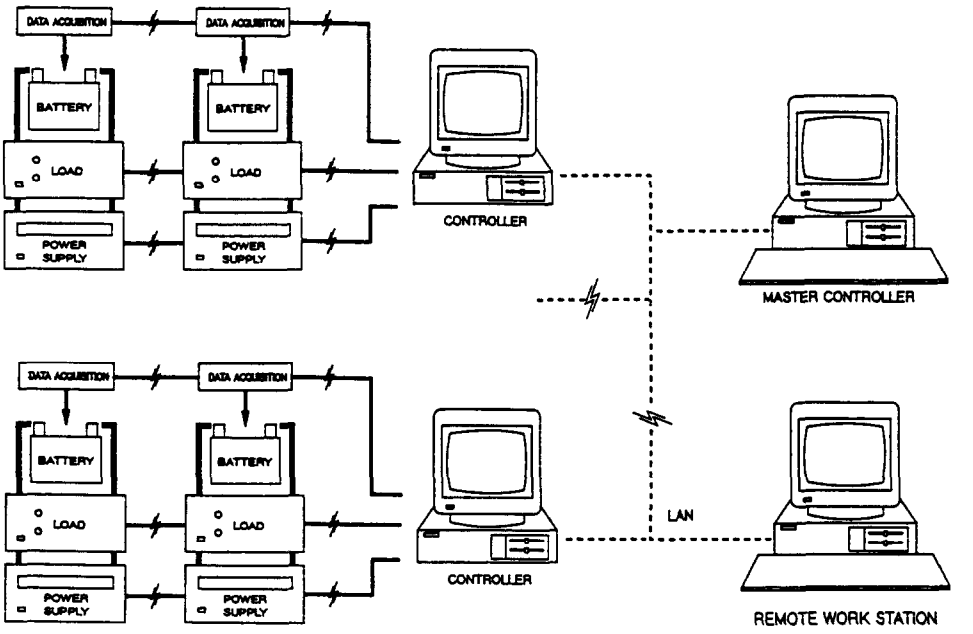


Fig 2 Full structure of TAURUS

higher and the other of lower capacity will be introduced as the next stage of the development.

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