CSIRO

QCAT Annual Report 2003-04

Queensland Centre for Advanced Technologies

Government occupants

CSIRO
Exploration and Mining
Minerals
Energy Technology
Manufacturing and Infrastructure Technology
ICT Centre
Light Metals Flagship

Joint Venture
Centre for Low Emission Technology

Cooperative Research Centres
CRC for Coal in Sustainable Development
CRC for Cast Metals Manufacturing (CAST)

Commercial occupants

Advanced Mining Technologies Pty Ltd
Alcan Queensland R&D Centre
Applied Mining Technologies Pty Ltd
Australian Centre for Mining Environmental Research Limited (ACMER)
Cheron Group
Coal Recovery Australia
ComEnergy
Cutting Edge Technology Pty Ltd
GeoTek Solutions
Instinct Television
Jenkins-Kwan Technology Pty Ltd

CSIRO

Queensland Government

Mission

The Queensland Centre for Advanced Technologies will be recognised for the excellence of its contribution to the mining, energy and manufacturing industries.

Our mission is to generate products and processes of high value to Australia's mineral, energy resources, and manufacturing industries with particular focus on those resources and industries located in Queensland.

Goal

The Queensland Centre for Advanced Technologies is a world class facility for research and development for the mining, energy and manufacturing industries.

Our goal is to increase the international competitiveness and efficiency of Queensland's and Australia's resource based and related industries.

History

The Queensland Centre for Advanced Technologies is a collaboration between the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the State Government of Queensland. The establishment of the Centre flows from an agreement between the Australian and Queensland Governments in 1990 to expand and diversify the research and development activities undertaken by CSIRO in Queensland. The Centre commenced operation in 1992 and was officially opened in 1993. Following the construction of new facilities, Stage Two was opened in 2000. Planning for Stage Three is already underway.

QCAT Annual Report 2003-04

Forward

Mining has added more than $500 billion to Australia's wealth over the last 20 years, representing more value to Gross National Product, per person employed, than any other industry. And the pace is quickening. ABARE, the Australian Bureau of Agriculture and Resource Economics, has forecast that for 2005, Australian commodity exports will increase by more than $11 billion and that coal sales are expected to rise 44 per cent to $16.3 billion.

The Australian mining industry is truly a world leader. Its position is strengthened through its focus on innovation and technology, demonstrated by the fact that over 60 per cent of world mining operations use ICT solutions developed by Australian firms.

Queensland is a major player in Australia's resources sector, and continues to strengthen its competitive edge through ongoing investment in research and development (R&D). The Queensland mining industry invested $133 million in R&D in 2002-03. This accounted for 20 per cent of the total R&D spend in Queensland and 25 per cent of mining R&D in Australia. With its strong links to other high technology industries both as a user of their technologies and as a supplier of inputs, mining is a driving force in Queensland's evolution as the Smart State.

The Queensland Centre for Advanced Technologies (QCAT) is a partnership between CSIRO and the Queensland Government. It is a world-class research centre that provides outstanding science, engineering and innovation to the Australian exploration, mining, minerals processing and manufacturing industries. QCAT underpins Australia's leadership in the global resources sector, and demonstrates the commitment of the Queensland Government to maintaining that leadership.

QCAT has established a critical mass of expertise that continues to deliver leading edge technologies, high value products and processes to the resources sector. It is an outstanding example of collaboration between CSIRO, the Queensland Government and industrial partners.

The future brings with it a number of challenges. For instance, while mining itself is booming, exploration activity is in decline. This threatens the future of the resources industry. New, more efficient ways to explore for mineralisation are required and CSIRO is already addressing this problem.

As not only the Queensland Minister for State Development and Innovation, but as State Member for Mount Isa, I am delighted with the work that QCAT is doing to advance this state's major industries. I can only applaud the performance of our investment in QCAT.

Tony McGrady MP
Minister for State Development & Innovation

Executive Manager's report

The continuing development of CSIRO's Queensland Centre for Advanced Technologies over the past 12 months has been deeply satisfying for a number of reasons.

In a period of consolidation and bedding down, we have seen significant benefits flow to the mining industry. For instance, the world's first autonomous conveying and bolting module is just one of a number of major projects delivered during the year.

Much satisfaction comes from working on large, long range projects, and then seeing them operating in the pits. The benefits to industry are impressive, because mining research provides one of the highest returns on investment of all research.

It is also satisfying to see how our researchers and their outputs have come together with industrial partners. It is exciting to know that we are getting better at interacting with industry and our commercial partners, producing real solutions for a real world.

QCAT research focuses strongly on the needs of Queensland with strong collaboration between CSIRO and the Queensland Government.

We have grown into a multi-disciplinary enterprise applying world-leading science and engineering know-how to increase the competitive advantage of the industry, and to help find and mine our mineral heritage for the benefit of all Australians in a socially, economically and environmentally responsible way.

QCAT commenced operation in 1992, and completed Stage Two expansion in 2000. However, we are not resting on our laurels. We are looking to the future to continue and expand our extremely productive partnership with the Queensland Government.

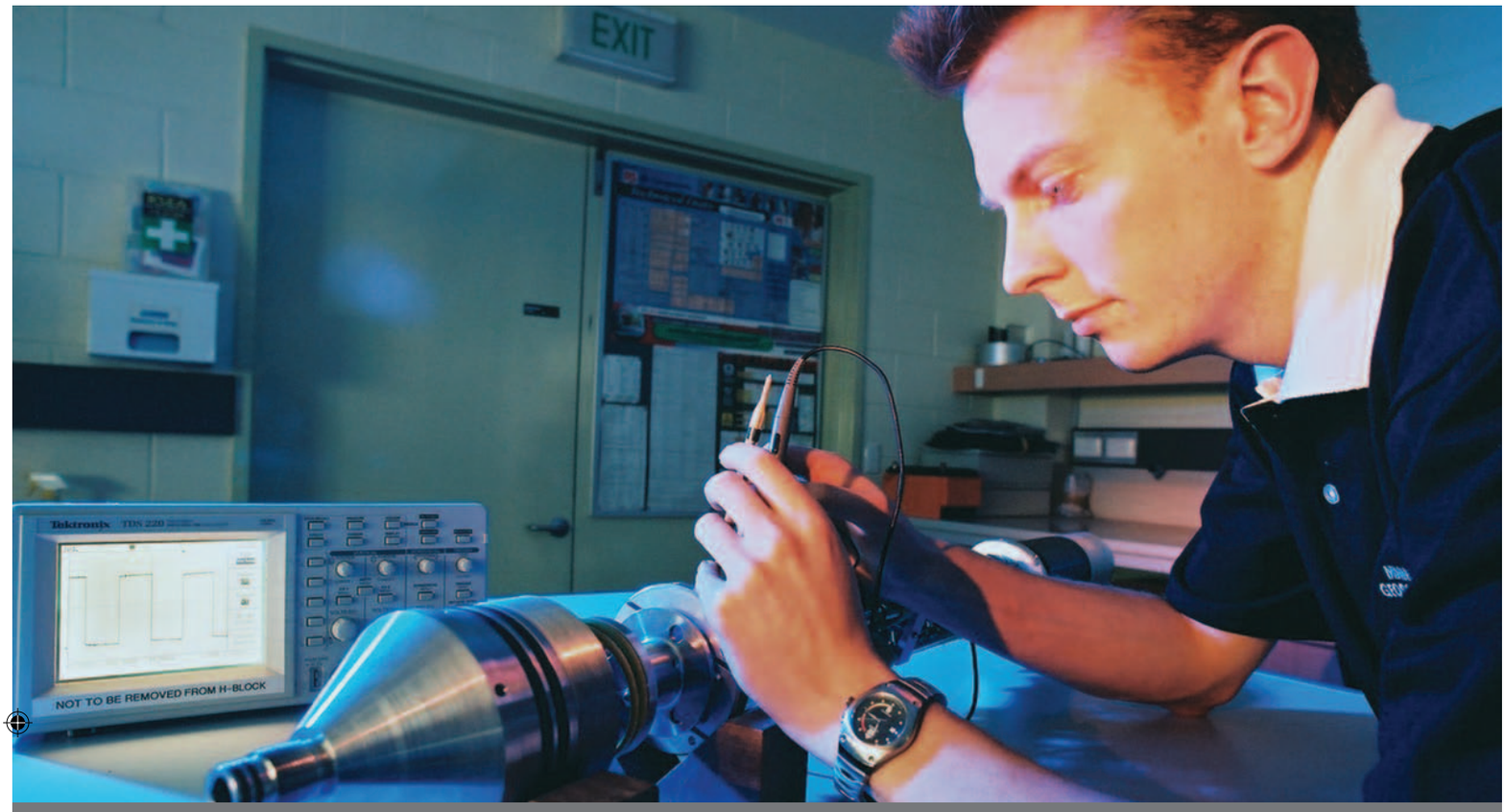
Now we are planning Stage Three expansion. This is projected to follow the established pattern of cooperation between CSIRO and the State Government with inputs from joint venture partners and industry collaborators. It will have the potential to dramatically change the ability of Queensland to exploit and benefit from its strong resource base.

We are already planning innovative research area extensions that will take advantage of these plans for expanded facilities.

The next ten years promise to be very important and very exciting.

Dr Cliff Mallett
Executive Manager
Queensland Centre for Advanced Technologies

Outcomes



Geoscience

Mining activities rely on a comprehensive understanding of the 3D geological picture. This means that the geosciences are crucial to the wellbeing and future growth of the mining industry.

Ongoing improvements in safety, reliability and cost effectiveness will rely on improved geological risk assessment.

Mining Geoscience

The fundamental objective of mining geoscience is to provide solutions that reduce uncertainty associated with the knowledge of the minescale geological environment. This objective has remained unchanged during the past year and has been reinforced through industry consultation and feedback. Our primary focus is to:

- develop new tools for improved orebody and host rock delineation, mapping, modelling and characterisation;
- enhance assessment of ground behaviour during mining;
- effectively integrate geological and geophysical data;
- improve integration of ore quality and material characterisation from mine-to-mill-to-arket;
- develop geological sensing systems for automated and robotic mining systems; and
- expand existing systems to quantify, assess and integrate geological uncertainty in ore reserve estimates.

In 2003-04, CSIRO researchers, in conjunction with industry partners, completed a major Australian Coal Association Research Program (ACARP) project quantifying the interpretation of geophysical logging data for rock mass characterisation. The main objectives were to develop techniques to better estimate coal and rock properties (i.e. strength and permeability), improve lithological interpretation and strata correlation between boreholes, and to develop a rock mass rating scheme for mine design purposes based on geophysical logging. The collective understanding that has been achieved through this project will help to extend the benefits of geophysical logging to the coal mining industry.

CSIRO has developed a data-mining tool, CSIRO Self Organising Maps (CSOM), which is based on an innovative data analysis procedure. CSOM is aimed at providing geoscientists with access to new methods for determining the intricate relationships, within and between spatially-located, complex data sets. The CSOM technique has been demonstrated to the exploration and mining industry as well as other industries. CSIRO is further developing the CSOM software to enhance application and develop new data analysis. A commercialisation strategy for CSOM is currently being developed and implemented.

A mining geoscience report investigating the feasibility of using Nuclear Magnetic Resonance (NMR) and Nuclear Quadrupole Resonance (NQR) for the estimation of copper mineralogy and grade from boreholes was completed in late 2003. The copper industry is a major sector of the Australian and global mining industry and it has been identified that an improvement in the estimation of grade in blast holes and boreholes would be a significant technological improvement that would enhance production and value of the product. The expertise and understanding which has resulted as an outcome of the experiments carried out during the course of this report has the potential to significantly benefit the copper mining industry.

The Mining Geoscience area within CSIRO has continued to develop projects in the research areas of coal and mineral characterisation, spectrometric nuclear logging, theoretical and applied research in the field of microseismicity, as well as the continued development of tools to enhance and benefit the mining industry. Through world class research, Mining Geoscience successfully strives to improve geological understanding of new and existing minesites, whilst contributing to all other mining research and development deliverables.

Outcomes

Mining

CSIRO Exploration and Mining, CSIRO Manufacturing and Infrastructure Technology and the CSIRO ICT Centre work together to provide applied technology solutions to major issues confronting the coal and metalliferous mining industries.

Mining is Queensland's largest export industry. In 2002-03 alone, mining exports totalled $10.2 billion, or 48 per cent of total Queensland exports. The sector is currently responsible for around 19,000 direct and 86,000 indirect Queensland jobs. Mining has evolved into an extremely sophisticated, 21st Century industry and Australia is a global leader in developing new technologies.

Australia also supports a mining technology services industry of more than $3 billion. Computer and communication technology is used throughout for mathematical modelling, mine design and optimisation of all process stages.

Coal mining

Queensland is the largest seaborne coal exporting province in the world, shipping 135 million tonnes in 2002-03, up from 129.2 million tonnes in 2001-02. Queensland has coal reserves for several hundred years. This wonderful resource can provide energy in many forms for centuries, if the industry can adapt to the changing needs and demands of a changing society.

Longwall Automation

The Australian Coal Association Research Program (ACARP) project on longwall automation is developing automation techniques that allow for a longwall face that will operate automatically within pre-defined parameters to enhance health and safety, production consistency, lower operating costs and improve the return on capital. QCAT scientists working on the project trialled an autonomous face alignment module in August 2004. Other modules involving face steering and horizon control will be trialled in November 2004. These modules should be available as commercial prototypes in 2005.

Rope Shovel Automation

Rope shovels are expensive mining assets that play a significant role in coal uncovery and production, but are currently not achieving optimum performance. Even if all operators were equally capable they cannot achieve maximum performance all of the time. Automation offers the potential to factor out this variability and to provide consistent and optimised performance.

Studies indicate that productivity improvements of at least 10% are achievable by improved operation. Further benefits will accrue through less damage to the machine, by eliminating overloads, swinging while engaged and collisions with crawlers and trucks. The task of rope-shovel automation is envisaged as a 3-step process:

1. Demonstration of critical aspects of the digging task on a scale-model rig:
   a. Moving the dipper through the bank
   b. Determining when to disengage the dipper

2. Demonstrate complete automatic cycle on a scale-model rig. This requires development of a reliable truck position measurement system, and a more complete user interface and optimal swing motion.

3. Commissioning and testing on a production rope-shovel.

In this project we have addressed the critical first step of demonstrating automatic bucket filling and determining methods to detect when to disengage the dipper from the bank. We have also demonstrated a laser mapping system which provides information for automatically engaging the bank, as well as potentially providing a situation display for the operator. These achievements allow us to consider proceeding with steps 2 and 3 in future research.

The work was conducted using a scale-model shovel owned and operated by Leslie Consulting.

Inertisation

QCAT scientists and engineers have been working on a number of mine safety projects specifically aimed at controlling gas and fires in underground coalmines and reducing the risk of mine explosions. One such completed ACARP project has developed optimum inertisation strategies to reduce the potential explosion risk during longwall sealing operations and to increase the rate of goaf inertisation. New research began last year on the development of pro-active strategies and technology to reduce the risk of heatings and fires in longwall panels. The research team works in close collaboration with the mining industry and was also involved in some of the recent heatings control operations in operating coalmines.

CSIRO has also been involved with an upgrade of critical components of the GAG jet engine-based inertisation equipment owned and operated by the Queensland Mines Rescue Service. New systems developed for the GAG units include redesigned high energy afterburner spark ignition systems and water recirculation pump controllers. QCAT Electronics Engineer, Stuart Addinell, is a trained GAG operator and participated in the Loveridge USA mine fire response. In this response, the US Government requested Australian assistance to tackle an underground coal seam fire in West Virginia. A total of two six-man crews worked around the clock for three weeks to control the fire.

COSFLOW

COSFLOW, an integrated coal mine strata, water and gas simulation code, was developed as a result of a major five-year NEDO/JCOAL-CSIRO collaborative project that was completed in March 2004. This has provided a major breakthrough for the prediction of mining conditions, especially in the complex conditions associated with: longwall caving; deep mining; and mining over and under or near rivers and stored water (natural aquifers or flooded abandoned mines). This software has major advantages over other commercial and research codes. It provides a completely new and effective approach for predicting and assessing the complex interaction between strata fracture/movement, water and gas flows during coal mining. It has been successfully used to assess mine subsidence, ground water inflows, and gas drainage and emissions at the Appin, West Cliff, Springvale, Central and Wambo Collieries.

Outcomes

Underground Coal Gasification

Australia's rich coal reserves contain many billions of tonnes of coal that are uneconomic to mine or are unmineable, either because they lie too deeply below the surface, contain high levels of ash, or consist of multiple layers. A process called underground coal gasification (UCG) is a proven technology that burns coal underground to produce gas. This gas can be used in a number of ways for electricity generation, as a fertiliser feedstock or for liquid fuel synthesis. CSIRO believes UCG holds great promise for the development of an alternative source of liquid fuels.

UCG requires many different disciplines. CSIRO researchers at QCAT are developing a range of computer models to simulate operations and environmental impact. (For further information, see 'Sustainability'.)

Real-time Risk Management

The Mine Communications and Information System for Real-time Risk Management project seeks to introduce step-change capabilities in the areas of Intrinsically Safe communications hardware and real-time safety and operational management through information capture, integration and rule-based analysis. It will have the capability to monitor several different proprietary safety and productivity data capture systems (SCADA systems) over a fibre optic network, convert them into a common language (TCP/IP &UDP), analyse the data as a whole and integrate the results. Data sources captured will include:

- ventilation monitoring and gas detectors;
- coal seam gas drainage holes;
- fires and spontaneous combustion;
- roof-fall monitoring;
- man and equipment locations;
- operational and productivity data; and
- environmental monitoring.

Once compiled into a database, the Nexsys Real-time Risk Management System will use a series of pre-set program rules (or algorithms) to analyse the data and determine if there are any hazards or unacceptable risks present to allow pre-emptive corrective and preventatives action to be initiated.

All of the data and risk analysis information together with the location of the workers will be displayed on a real-time, 3-dimensional graphic user interface (GUI) that represents the real-time layout of the mine (or workshop) and can be viewed from any computer connected to the local area network (LAN). (For further information, see 'Sustainability'.)

Metalliferous mining

Queensland has a wealth of mineral bodies yielding 30 mineral commodities. Metalliferous mining research at QCAT includes work in rock cutting, geomechanics, automation and new mining techniques. These activities involve staff from CSIRO Exploration and Mining, CSIRO Manufacturing and Infrastructure Technology and the ICT Centre.

SMART*CUT

SMART*CUT picks have shown their true colours with the rotary cutting of 260 MPa granite blocks with Rock Mass Rating 100. The abrasive wear on our diamond composite cutting inserts has been demonstrated to be about one thousand (1,000) times less than the highest quality cemented tungsten carbide (WC) inserts presently available in point-attack picks used in rock cutting operations. Hence these picks offer both the strength to cut hard rocks plus the ability to work in very abrasive conditions so often encountered in even softer rock formations such as shales and cemented sandstones. In a world first, the Rock Cutting & Drilling group has extended the range of tooling from the small point-attack picks used in road graders to the massive picks required in roadheaders, surface and continuous miners, longwall shearers and custom designed mechanical excavation machinery. Field trialling of these picks is currently being undertaken to rate their productivity and to demonstrate the economic benefits to be derived from these tools. High productivity drill bits based on SMART*CUT Technology have come off the drawing board and into hard rocks, demonstrating penetration rates of more than twice that of industry standards with only half the specific energy expended in the process.

ROES™

ROES™ is a new method of extracting ore from underground hard-rock mines and is being developed by CSIRO in collaboration with other companies. ROES™ is expected to deliver savings of the order of 20 per cent compared with existing methods. Designed from the outset to be remote controlled and automated, the method will eliminate the need for people to enter active mining zones. Safety of underground mining

will therefore be greatly enhanced. 'Massive' or highly disseminated orebodies are being targeted initially, but ROES™ is equally applicable to tabular and some narrow vein deposits and in the future may be applied to underground quarrying. ROES™ is expected to be a complementary method to conventional Block Caving methods.

The method combines remote/automated drilling and blasting which is controlled from a central control room located in a safe location, either underground or on the surface. A shaft is first bored through the orebody using conventional methods. Holes for explosives are then drilled into the rock in a radial pattern from within the shaft under remote or automated control. Explosives are then automatically pumped into the blast-holes together with detonators and initiators. When ready, the explosives are detonated and broken ore is recovered from below, probably using automated loaders. Ore can be blasted progressively from the bottom to the top of the shaft or blasted as a large block or a combination of both. ROES™ delivers significant flexibility and simplification of the mining cycle.

Special machines are being developed at QCAT for drilling the blast-holes and a new control system is being developed to ensure the operation is reliable and that the holes are accurately placed. A laboratory has been set up to undertake the development of the drill control system and the equipment. Early trials of drilling control methodology are very positive. The technology will also be applicable to existing manual or automated drilling machines.

CSIRO is also providing mining robotic research to ORICA to help develop a control system for automated placement of explosives – a technology required for ROES™. A prototype system has already been demonstrated that can automatically locate previously drilled blast holes and robotically directed the explosive pump into the hole.

The ROES™ system will integrate a number of other technologies developed at QCAT with support from the Australian Resources Research Centre (ARRC), which is located in Western Australia under funding from CSIRO and the Western Australian Government. These technologies include: photogrammetry and laser scanning for measurement of underground voids, visualisation of geological and geophysical data, radio communications technology and robotic control/ operator interface software.

Automated Vehicles

The development of guidance systems for underground loaders has been undertaken at QCAT using the simulated mine tunnel test track and control room. Guidance systems developed at QCAT have been licensed to DAS through the Caterpillar Elphinstone company and are now a critical component for the commercialised Minegem™ product. Minegem™ is now installed at WMC Resources Olympic Dam Operation in South Australia and at Rio Tinto's Northparkes mine in New South Wales.

Research into automated vehicles continues with an adaptation of the underground loader technology, combined with strategically developed vehicle control systems (see ICT Centre) for automation of a hot metal carrier to be used in the aluminium industry. In-kind contributions are being provided from the smelter at Bell Bay (Tasmania) and funding is being provided through the Light Metals Flagship.

Microseismic monitoring

In 2003, a microseismic trial was carried out by CSIRO Exploration and Mining at Lihir Gold Mine, PNG to investigate the feasibility of using microseismic monitoring as a key input into the management of mine operations in the geothermal systems at the mine. The emphasis of the trial was on the feasibility of employing a microseismic monitoring system in the Lihir environment and the identification of seismic characteristics associated with geothermal activity. This microseismic trial at Lihir has been completed successfully and seismic events associated with geothermal activities and rock fracturing were observed. As the project continues, a more comprehensive microseismic monitoring is planned and supported by Lihir in order to establish the relationship between microseismicity and geothermal activities. The second monitoring project will be carried out for at least 6 months in 2004-05.

Large Open Pit Mine Rock Slope Stability Project

CSIRO Exploration & Mining, through its expertise in the field of slope stability and open pit mining geomechanics, has initiated a major research project involving the stability of rock slopes in large open pit mines. The project has three objectives.

1. Publication of an authoritative new generation Pit Slope Design Manual that links innovative mining geomechanics research together with best practice in open pit slope design.

Outcomes

2. Research that provides vital new knowledge, and design criteria that describe the critical gaps in our current understanding of rock mass failure in large open pit mine slopes. This includes research directed at enabling the effective use of remote data acquisition methods, automated data analysis and interpretation methods, 3D modelling, simulation and design analyses, and uncertainty analysis.

3. Development of enhanced risk management criteria focused on the relationship between risk reduction and the uncertainties of slope design and their impact on mine performance.

The initial study period is for two years and will be funded by a number of international mining companies, including DeBeers sa, Anglo American plc, Newmont Australia Limited, Newcrest Mining Limited, Codelco Chile, Barrick Gold Corporation, Xstrata Copper, and BHP Billiton.

The project will be linked with two other industry-funded mass mining projects being managed by the Sustainable Minerals Institute (SMI) at the University of Queensland (UQ) to create a collaborative joint venture between CSIRO, UQ and the Queensland State Government that will be known as the International Mass Mining Foundation (IMMF). The role of the State will be to provide industry-matching funds for five years to augment the industry-guided IMMF research tasks with fundamental research performed by post-graduate, post-doctoral, other research staff, and invited mass mining specialists at QCAT and the SMI.

Geotechnical support

The development of Sirovision®, an innovative 3D imaging system for the mining and construction industries has continued. Sirovision® is now used globally, and CSIRO has entered into a non-exclusive reseller agreement with Surpac Minex Group to market the system nationally and internationally.

Sirovision® is a high precision 3D imaging technology that supports fast, accurate geotechnical and geological mapping of rock and terrain surfaces in 3D. It has significant implications for mine safety as detailed spatial and orientation information can be collected without staff positioning themselves in high-risk situations.

Pairs of images are captured using a digital camera and then referenced using basic surveying data. Sirovision® produces accurate 3D images with a precision of plus or minus two centimetres from a range of 100 metres.

Processing

Innovative and effective processing of Australia's mineral wealth is essential to the industry. Researchers at QCAT are conducting research and development to assist the industry in Australia and overseas.

Outcomes

Iron ore and non-ferrous mineral processing

Due to unprecedented market growth, the iron ore industry is demanding more from its existing resources and equipment and is developing new resources to expand production. In response to these drivers, CSIRO Minerals at QCAT is continuing to work closely with the industry to meet their needs using CSIRO's unique range of expertise that extends from detailed mineralogical, beneficiation and agglomeration evaluations to predicting the processing performance of sinter, pellets and lump in the blast furnace. The non-ferrous mining industry is under similar pressure to optimise existing operations and reduce costs, particularly in the energy intensive grinding area, so QCAT research staff are also involved in optimising the performance of SAG mills as well as stirred mills.

Predicting processing performance

Research is continuing on the accurate prediction of downstream processing performance for resource evaluation and development. This involves linking ore mineralogy and petrology to metallurgical performance using optical microscopy/computer-based image analysis and mineralogy-based models of unit processes, which will enable more rapid assessment of processing options and the likely viability of new ore deposits. This approach is expected to eliminate expensive laboratory and pilot-scale research on ores that are not promising.

More effective beneficiation strategies

While QCAT research staff continue to be involved in the search for premium grade iron ores and the subsequent evaluation of prospects, more effective beneficiation strategies are also being developed as alternative iron ore sources, such as Marra Mamba and Channel Iron Deposits, that are lower in grade are being exploited. However, there is still a shortfall in supply of traditional hematite/goethite ores to overseas markets, particularly to Chinese steel mills, which has kindled a keen interest in Australia's substantial magnetite ore resources, including a significant resource in Queensland. Research has therefore commenced on beneficiation of magnetite resources, including magnetite rich tailings. The challenge in the latter case is removal of some of the minor elements that cause problems in subsequent pelletising and ironmaking operations.

Agglomeration research

The agglomeration research being conducted at QCAT on sintering and pelletising of iron ore fines continues to be pivotal in proving up new resources for export and local consumption. Together with industry, new ores and ore blends for sintering are being optimised by conducting trials at scales ranging from laboratory to pilot-scale. A key facility in this context is CSIRO's state-of-the-art pilot-scale sinter rig, which is world class with automated computer-based data logging and emission monitoring capabilities, including CO, CO_2, NO_x, SO_x and particulates. The rig is currently being modified to enable deep bed sintering (>0.5 m bed depth), which is being introduced into sinter plants around the world to increase productivity. A small-scale sintering facility has also been commissioned over the last year that allows sintering performance to be assessed on samples of only 5-10 kg, compared to 80 kg for the pilot-scale facility. This enables initial assessments of sintering characteristics to be made on drill hole samples well in advance of bulk samples becoming available, allowing early termination of development if the sintering characteristics are unacceptable. Due to increasing environmental pressures on sinter plants to reduce emissions, research is also in progress on understanding the mechanisms of formation of CO_2, NO_x and SO_x and how to reduce these emissions at the outset, e.g. by using special catalysts or replacing coke with alternative biomass fuels.

Iron ore pelletising

The recently commissioned pilot-scale iron ore pelletising facility has also been in active use over the last year for optimising balling, drying and induration of iron ore pellets, particularly for magnetite feed ores. At present, it is best configured for simulation of straight-grate pellet induration, so it is about to be upgraded to incorporate a rotary kiln for simulating grate-kiln induration, which is growing in favour around the world for iron ore pelletisation. A computer-based simulator called Siro-Indur is also under development for optimisation of straight-grate and grate-kiln pellet induration. It has been applied both in Australia and overseas, and there are potential applications in China.

Plant optimisation

Research for the non-ferrous mining industry on fine grinding (<38 micron) using stirred mills and SAG mill optimisation is continuing. A wide range of laboratory and pilot-scale fine grinding equipment from various manufacturers has been assembled at QCAT, including a tower mill, a Metso detritor and an IsaMill. This provides a unique capability for conducting side-by-side comparisons of the relative performance of these fine grinding machines, including the performance of various fine grinding media. The three-year extension of the AMIRA SAG mill project (P667A) to monitor mill performance via surface vibrations is now under way. It has been demonstrated that the toe and shoulder positions of the charge inside the mill as well as other operating parameters such as mill load can be monitored. A ruggedised industrial monitor with an inertial power supply for continuous operation has just been developed and will soon be trialled on a full-scale SAG mill in Australia.

The Centre for Sustainable Resource Processing

A new area of involvement for CSIRO Minerals at QCAT is the Centre for Sustainable Resource Processing, a

new Cooperative Research Centre established in the last round. In collaboration with research staff and students from the Julius Kruttschnitt Mineral Research Centre (JKMRC), QCAT staff are contributing to a foundation project on 'Eco-efficient Liberation and Comminution'. The objective of the project is to reduce total comminution energy at selected industry sites by 20 per cent or more. CSIRO's role is to assess the benefits of using more energy efficient comminution equipment, such as stirred mills, instead of more conventional grinding mills.

Standards development

Our researchers continue to play a leading role in the development of both ISO and Australian Standards for international trade in iron ore, base metals and coal. Current efforts are aimed at improving the sampling of iron ores, coal and copper, lead, zinc and nickel ores and concentrates, as well as the analysis and physical testing of blast furnace and direct reduction feedstocks for iron and steel making. Recent work includes the development of draft standards for sampling both coal and base metal slurries for which there are no existing ISO or Australian standards.

Coal processing

QCAT-based researchers from CSIRO Energy Technology's Coal Preparation Group are working with the coal industry to improve the quality and competitiveness of Australian coal on international markets.

Supported by the Australian Coal Association Research Program (ACARP) and the coal producers themselves, the group is developing an intelligent plant system using hardware and software that will allow a processing plant to know its current operational performance in real time, and how it compares with optimal standards. This will improve efficiencies and long-term operating costs in coal production plants.

Our researchers are also attempting to identify factors controlling the efficiency of fluid recovery, partition curves and magnetite recovery.

In addition, we are exploring the potential of electrical impedance spectroscopy as a new tool for monitoring unit operations in coal preparation plants, and new capabilities for optimising plant performance. A number of proof of concept projects were completed successfully with dense medium cyclones and coal flotation systems at the pilot scale. Industry funding has been obtained to continue the work with focussed plant trials.

Outcomes

Manufacturing

The manufacturing industry contributed around 11 per cent to Australia's gross domestic product in 2001-02 and accounts for 57 per cent of the value of Australian exports. In 2002-03, manufacturing contributed over $65 billion to Australia's exports.

Work at QCAT benefits the manufacturing industry by supporting and anticipating industry needs and by providing the resource and knowledge bases for technological advance.

Light metals engineering

Research and development at QCAT by CSIRO's Division of Manufacturing and Infrastructure Technology (CMIT) scientists examines productivity, performance and quality issues for the production and use of magnesium and aluminium alloys. The QCAT facilities are unique in the world in the ability to safely handle pilot scale quantities of molten magnesium alloys. The majority of the work conducted is in collaboration with the CRC for Cast Metals Manufacturing (CAST).

Work in magnesium has had a number of successful outcomes. The melt protection system for magnesium (now called AM-cover) that was developed at QCAT has now been successfully licensed internationally and is in use at a number of magnesium casting facilities in three continents. An independent evaluation of the technology by the US EPA and the Australian Greenhouse Office under the Climate Action Partnership showed that this technology results in massive greenhouse gas savings for companies switching to the technology.

The work at QCAT on the cost-effective manufacture of a new zirconium-magnesium grain refiner is one of the enabling technologies for a new low-cost magnesium engine block alloy, undergoing the final stages of evaluation as part of the USCAR program in the USA. The new V6 engine follows on from successful development of a 3-cylinder engine using the new alloy in association with the Austrian engine designer AVL and Volkswagen. Hybrid aluminium-magnesium alloy engines made from a rival alloy will soon be seen in the new 6-cylinder engines to be made by BMW.

The work in aluminium on hot-tearing of aluminium extrusion alloys is being conducted in conjunction with CAST and Camalco and seeks to fine tune alloy compositions to enable faster casting speeds without developing hot cracks. Other work has utilised the excellent fatigue testing facilities at QCAT. The CAST CRC uses the QCAT facilities as part of determining the fatigue properties of the many developmental alloys under consideration. A range of other CSIRO research groups and external organisations such as Ion Automotive also use the CMIT capability to conduct fatigue testing and evaluation of fatigue failures.

Light Metals Flagship

In response to the Australian Government's national research priorities, the Light Metals Flagship links industry and research agencies by focussing on five themes from across the light metals industry – alumina, aluminium, magnesium, magnesium and aluminium manufacturing, and titanium. The Light Metals Flagship's vision is to position Australia as a world leader in sustainable light metals production and manufacture.

The Flagship seeks to transform industrial practices in ways that create opportunities for our industrial partners, and reinforce CSIRO's reputation as the 'R&D innovator of choice' in the light metals industry. Current research at QCAT in magnesium, combined with the decision by Alcan to establish its R&D centre here, provide excellent opportunities for the Flagship to achieve its goals.

Outcomes

Energy

Research into coal utilisation at QCAT includes assessing the gasification performance of coal. The ultimate goal is to improve power generation efficiencies and reduce emissions.

Coal utilisation

Demand for electricity in Australia is predicted to double by 2020. It is therefore very important to seek solutions that improve the performance of Australian power generation technologies while supporting the efficient use of Australian coal in international energy markets. Major scientific projects and facilities at QCAT have been designed to address the environmental and commercial imperatives facing the coal and energy industries. Research encompasses the key stages of coal preparation and utilisation, coal gasification and the development of new 'low emissions' power generation systems.

CSIRO Energy Technology, in collaboration with the Cooperative Research Centre for Coal in Sustainable Development operates an advanced coal gasification facility at QCAT. The facility is used to evaluate the performance of Australian coals under the high temperature, high pressure gasification conditions of advanced power generation processes. This research provides practical information to help demonstrate that coal can be used effectively in 'clean energy technologies' that will form the basis of future coal-based power generation systems capable of operating with low, and ultimately zero, atmospheric emissions. It provides the detailed technical information required to introduce and support coal use in new domestic and international markets based on high efficiency coal utilisation technologies. This research will provide important technical support to assist the domestic power industries assess and implement these technologies in Australia.

Fundamental gasification research at QCAT is addressing the key physical and chemical processes that control the conversion rates of coals and other fuels under intense gasification conditions. This research will help existing power stations optimise their processes and also provides the technical data to match the appropriate coal with emerging, high-efficiency power generation technologies.

In this field, QCAT is a recognised centre of excellence, with the necessary facilities and expertise for the evaluation of coals and technology performance. This work is helping the Australian electricity industry reduce the risks of selecting and implementing advanced power generation technologies and will make an important contribution to the expertise required to evaluate fuel and energy strategies for sustainable energy conversion technologies in this country.

CSIRO Energy Technology is also the major research contributor to the Centre for Low Emissions Technology (cLET), a joint venture initially between CSIRO and the Queensland Government. The cLET focuses on key aspects of coal gasification and the important gas cleaning, processing and separation technologies necessary for CO_2 capture and hydrogen production. These are key technologies at the heart of future low-emissions power generation systems.

This world-class facility and research program is an important part of a broader national effort to increase the competitive advantage of Australia's mining, energy and manufacturing industries.

Outcomes

Sustainability

The Australian minerals industry is crucial to the country's economic and social wellbeing. Without a viable minerals industry we cannot maintain the social, economic and environmental processes that underpin sustainable development.

The industry's long-term future rests not only on how it responds to economic challenges, but also how it responds to the challenges of sustainable development. Research at QCAT provides the industry with strategies and technologies for developing sound sustainability practices.

Sustainable Mining Group

As part of our strong minesite safety portfolio, the Sustainable Mining Group has been developing a real time risk management system which will enable coal mines to respond quickly to hazardous situations by enabling fast and effective communications from underground. The system involves state of the art software and hardware developed to work in tandem with effective minesite hazard management practices. This system will be trialled at minesites over the next year. (For further information, see 'Coal Mining'.)

Work on the mitigation of greenhouse gases from mining continues with a number of research prototypes being developed to generate power from mine ventilation air. The aim is to achieve significantly improved greenhouse efficiencies at minesites by finding ways of using the low and variable levels of waste methane at the site.

Additionally, a system of using solar heat to power a stirling engine has been developed in conjunction with a Queensland engineering firm. This research also seeks to improve the greenhouse efficiencies by providing an alternative power source for remote minesites.

Research into advanced gas drainage using a 'microtunneller' developed over the year, along with an alternate application for the microtunneller, are now being considered. This alternative application is to look at its potential for new ways of drilling as part of the mining process. A prototype microtunneller has been produced and will be trialled at the end of the year.

Research into collision avoidance at minesites has been continued, with the development and delivery of working collision avoidance systems to the Australian Coal Association Research Program (ACARP) at the beginning of the year.

Underground Coal Gasification (UCG) continues to be a major research focus for the Sustainable Mining Group because of its potential to radically change the way Queensland's coal resources are accessed and used. Underground Coal Gasification involves combusting poor quality coal in situ. The resulting gas can be used for a range of things: electricity generation, liquid fuel production or the production of clean liquid fuels and chemicals such as fertilisers. Existing data from the Surat basin has been analysed to assess its potential for UCG and a modelling platform to enable effective operational control that minimises environmental impact has been established. (For further information, see 'Coal Mining'.)

Quantitative tool for managing acid mine drainage and salinity

The objective of this Australian Coal Association Research Program (ACARP) funded project is to develop a practice for incorporating prompt gamma neutron activation analysis (PGNAA) logging in the environmental management of acid mine drainage. Another outcome of the project is to advance the development of the SIROLOG PGNAA tool for measurement of chloride content for in-situ salinity measurements from boreholes as a practical logging tool for salinity investigations in Australia and overseas.

The preliminary phase of the project, which commenced in 2003, showed that laboratory measurements for salinity determination in models using the PGNAA technique have great potential. During 2003-04 a number of field trials were completed and further laboratory testing is currently being carried out. The final report is due for release towards the end of 2004.

New research initiatives

The Centre for Low Emission Technology

Based at QCAT, the Centre for Low Emission Technology is a strategic partnership between CSIRO and the Queensland Government. Other important industry players that have expressed an interest in participating are: the Australian Coal Association Research Program (ACARP); Stanwell Corporation; Tarong Energy; CS Energy; and the University of Queensland. The Centre was officially opened in December 2003.

The primary focus of the Centre is on research and development of next generation low emission electricity generation technologies – specifically coal gasification and gas processing. The Centre will target breakthrough technologies in gas processing needed to facilitate the goal of near zero emission power generation from coal. An additional focus will be on the use of developed technologies and processes to improve the performance of existing coal fired power generation plant in applications such as oxy-firing, coal-renewable hybrid technologies and post combustion capture of carbon dioxide.

Queensland is well positioned for a zero emissions electricity future. In addition to more than 30 billion tonnes of high quality, low cost coal, it also has a number of potential carbon storage sites that are relatively close to energy intensive industries. Queensland also boasts impressive science capabilities at QCAT which are addressing the environmental performance of coal.

The Centre for Low Emission Technology highlights the strong commitment by the Queensland Government, CSIRO and related industries to leading the way in addressing carbon dioxide emission levels in Australia.

Information & Communication Technology

The ICT Centre at QCAT

CSIRO has signalled a new level of focus on information and communication technologies with the creation of the ICT Centre. Now there is a single point of contact within CSIRO for customers and research partners with an ICT interest.

ICT is an enabling technology that is critical to the research and development undertaken by every CSIRO Division at QCAT. The ICT Centre at QCAT is part of the Centre's Autonomous Systems theme and home to the Robotics team, which is internationally recognised for its achievements in field robotics and vision-based control. This year has seen major advances in mining robots and advanced autonomous underwater robotics.

Mining robots

The mining industry is continually searching for improvements in efficiency. This makes mining a fertile ground for the development of automation and robots.

The ICT Centre's work in open-pit coal mines has led to the development of a dragline swing assist system that could be termed cruise control for draglines, plus a digital terrain mapping system and autonomous excavation.

For underground metalliferous mines, developments include the robotic component of an automated explosive loading system for Orica, and, in conjunction with CSIRO Exploration and Mining, an automation system for Load Haul Dump units.

Advanced autonomous underwater robotics

The underwater robotics project is focussed on developing and commissioning sensors, algorithms and processing techniques that can be used to help create truly low-cost, vision-based autonomous underwater vehicles capable of performing tasks such as monitoring, inspection, harvesting and repair.

An autonomous underwater vehicle that can perform these tasks efficiently and cheaply will prove highly valuable to marine services markets.

The submarine prototype is a test bed for the right mix of sensors, smart navigation design, guidance and information processing techniques.

Social & Economic Integration

In the minerals and energy sector, sustainability is seen as a route to increased efficiency and license to operate. Within organisations, incremental advances are already being achieved by considering performance against the triple bottom line of sustainability. In the mining industry, this is evidenced by increased levels of self regulation on issues such as social responsibility and sustainability reporting. At QCAT, considerable effort is being put into growing research looking at the effects of integrating social and economic issues into technology research. This research combines active dialogue with stakeholders with analysis of the social values that affect the uptake and/or acceptance of technology and the institutions that constrain science. A study of public attitudes to carbon capture and storage (geosequestration) was completed, a study into the perceived benefits and impacts of Underground Coal Gasification (UCG) was undertaken in the period and the Sustainable Mining Group were invited to prepare a briefing paper to the National Academies Joint Forum on sustainability.

Moving forwards with Social and Economic Integration, QCAT is leading an initiative on Minerals and Energy in Society within CSIRO that hopes to provide a practical route to achieving sustainability that does not undermine commercial advantage in the minerals industry. Additionally, we have been working with the Sustainable Minerals Institute at the University of Queensland to look at self regulation in the mining industry and the role of water in mining and how that affects water benefits and values in the mining region.

The Technology Transfer Centre

Advanced Mining Technologies

Advanced Mining Technologies (AMT) has made considerable headway with the introduction to market of it's CAS-CAM/RF Collision Avoidance Technology. The AMT system is currently undergoing field evaluation at two mines within Australia and one mine in South America (Chile). Success will result in significant revenues flowing from this development and establish the AMT CAS-CAM/RF technology as the market leader, as well as underpin ongoing development.

Over the past 12 months AMT has also released its next generation Drill Guidance System (DGS) which provides both the underground coal industry and CBM operators with a state of the art electronic measurement whilst drilling steering tool for gas drainage. The new DGS is available in both Intrinsic Safe (IS) configuration for underground and non IS configuration for surface to seam operation. The DGS has received immediate acceptance by industry with orders from both Australia and the USA.

Alcan Queensland R&D Centre

As part of a long-term commitment to bauxite mining and alumina production in Australia, Alcan in 2002 relocated a significant part of its bauxite and alumina research and development efforts to Australia. The move took advantage of the proximity to Alcan's strategic Australian assets including the Gove bauxite mine and alumina refinery in the Northern Territory (100 per cent ownership), Queensland Alumina Limited (QAL) Gladstone, Queensland (41.4 per cent ownership), and the Tomago Aluminium smelter in NSW (51.55 per cent ownership). Alcan has recently announced its decision to proceed with an AUD $2 billion expansion of the Gove refinery, further increasing Alcan's interest in the region.

Alcan's Queensland Research and Development Centre is located on the premises of QCAT in Brisbane. A key consideration when selecting Brisbane as the site for the facility was Alcan's interest in leveraging the existing civil, social and intellectual infrastructure (e.g. the CSIRO and local universities), its accessibility of key locations, and its convenience for international and interstate travel.

Accommodation for 10 staff is currently provided in a temporary laboratory in the QCAT Complex. Completion of a new building to accommodate 12 to 15 Bayer scientists (chemists, metallurgists and chemical engineers) is expected in the first half of 2005. The new laboratory will be a world class facility in the development of Bayer (alumina refining) technology and will set Brisbane (and the QCAT campus) on the world stage with respect to Bayer Research and Development.
The Centre has a world-wide focus and a suite of global customers. It focuses primarily on hydrometallurgy and provides services to Alcan's global and regional operations, as well as third-party refineries worldwide. The Centre is connected to Alcan's research and development laboratories in Canada and France, as well as external research institutions across the globe.

Applied Mining Technologies Pty Ltd

Applied Mining Technologies has played a key role in the successful transfer of mining guidance technologies from research to a commercial, industry accepted solution for highwall mining applications. Machine guidance is considered essential for safe and productive highwall mining and equipment manufacturers are incorporating AMT technology into new and existing production systems. This has resulted in significant improvements in production rates and resource recovery and has provided the enabling technology for advances in automation. In collaboration with major equipment manufacturers and suppliers, AMT has developed a complete and integrated highwall monitoring and control package incorporating inertial and horizon control technologies.

Australian Centre for Mining Environmental Research Limited (ACMER)

ACMER is an incorporated not-for-profit organisation comprising the major groups in Australia carrying out environmental research for the mining industry (CSIRO, the University of Queensland, Australian Nuclear Science and Technology Organisation (ANSTO), Curtin University of Technology, the University of Western Australia), and six of Australia's major mining companies (AngloGold Ashanti Australia Limited, BHP Billiton Limited, Newmont Australia Limited, Placer Dome Asia Pacific Limited, Rio Tinto Limited and WMC Resources Ltd).

ACMER pursues its mission of providing the scientific and technological rigour and support to enable the minerals industry to plan, operate and close mines in an environmentally and socially responsible manner through research, technology transfer and advisory services.

Major research programs include waste rock dump stability, final void use, prevention and remediation of acid mine drainage, tailings disposal and remediation, and ecosystem reconstruction.

The Technology Transfer Centre

In 2003-04, ACMER completed five research projects and commenced five others. Completed projects included:

- Determination of the Reasons for the Deterioration of the Rum Jungle Waste Rock Cover (ANSTO, CSIRO);
- Indicators of Ecosystem Rehabilitation Success (Stage 2) (CSIRO, University of Queensland);
- Guide to the Application of the ANZECC/ARMCANZ Water Quality Guidelines in the Minerals Industry (CSIRO, Australian Government Department of the Environment and Heritage);
- Identification and Management of Dispersive Mine Spoils (Landloch Pty Ltd, University of Southern Queensland, University of Queensland); and
- Development of Rehabilitation Completion Criteria for Native Ecosystem Establishment on Coal Mines in the Bowen Basin (Environmental Management and Research Consultants).

New projects included:

- Risk Assessment of the Effects of Cyanide-Bearing Tailings Solutions on Wildlife (Consultant, National Research Centre for Environmental Toxicology);
- Innovative Techniques for Promoting Fauna Return to Native Ecosystems following Mine Rehabilitation (Curtin University of Technology);
- Designing Effective Store-Release Covers for the Long-Term Containment of Mine Waste – The Role of Vegetation (Stage 1) (University of Queensland);
- Development of Rehabilitation Completion Criteria for Native Ecosystem Establishment on Coal Mines in the Hunter Valley (Environmental Management and Research Consultants); and
- Review of Good Practice in Post-Mining Regeneration in Australia (ACMER).

During the year, ACMER conducted seven short courses and four workshops on a range of topics around the country, in addition to two workshops in South Africa. Four of the Australian workshops addressed cyanide management, and were part of a national program on cyanide use supported by the Regional Minerals Program of the Australian Government Department of Industry, Tourism and Resources. An additional outcome of that program has been the production of a set of four videos on cyanide management and use for the gold industry.

Cheron Group

The Cheron Group established its headquarters at QCAT early in 2004 after successful discussions with various parties in CSIRO and the Queensland Government, specifically the Department of State Development.

It is the intention of Cheron to take all of floor three (west wing) in the Technology Transfer Centre, where the group will consist of eight individual companies, with a staffing level in the region of 30 highly qualified personnel.

Cheron has a non-specific charter to take new or next generation technologies from concept to commercialisation (C-2-C), with one of the eight companies comprising of an Innovation and Investment Fund that will provide sequential (or on-going) volumes of 'investment funding' in $20M tranches, to harvest a variety of early and seed capital stage technologies.
Each technology accepted by the group, may be able to access funding in the $3-5M range. However, it is preferable that each technology should be involved in advanced manufacturing techniques, light metals, and/or environmental and green house gases issues, that genuinely requires access to mechanical, electrical, and fluid engineering specialists.

ComEnergy

ComEnergy was formally established in August 2003 with its headquarters at QCAT. A board has been formed under the stewardship of Chairman Mr. John Ward and representatives from CSIRO and the Liquatech Turbine Company.

The primary role of ComEnergy is to commercialise the Hybrid Coal and Gas Turbine (HGCTS) system patented by CSIRO. The benefit if the system is that it uses mine waste – coal rejects, coal tailings, mine methane including ventilation air – to generate 10mwh of power and in the process clean up the mine site.

During 2003-04 in Australia ComEnergy completed agreements with Mitsui & CO (Australia) and Sumisho Coal Australia (a subsidiary of Sumitomo) to roll the technology out in their Mines. Feasibility and Environmental studies have been completed at the United Colliery in New South Wales and we are awaiting approval of a development application from the Singleton Council. A feasibility study is being undertaking at a Newstan Mine also in New South Wales.

The Premier of Queensland, the Hon Peter Beattie, MLA, continues to strongly support the international marketing activities of ComEnergy and was present at the signing in Zhengzhou China of a contract for a 10mwh system.

ComEnergy (Henan) has been established which has the exclusive license to use the HGCTS in China. China is the major producer of coal in the World and has around 1000 underground coal mines.

ComEnergy (Henan) has signed an MOU with the largest coal mining equipment manufacturer in China who will manufacture the system in China.

Strong international interest has been received from India, the United States and South Africa.

Cooperative Research Centre for Coal in Sustainable Development

The Centre brings together most of Australia's black coal researchers as well as experts in sustainability. Government and industry have committed $61 million over the seven-year period 2001-08 to identify and investigate opportunities for coal chain efficiencies and reducing carbon intensity in energy systems. This will provide a better understanding of Australian coal performance in combustion, gasification and emerging sustainable coal utilisation technologies. Other research includes environmental and social assessment, ironmaking, and by-product and waste utilisation.

The Centre's 19 participants from industry, government departments, CSIRO and the universities provide strong support through their participation in all aspects of the research and development agenda. The Centre's Education Program supports PhD students within the Centre and industry education.

During the year CCSD supported the Australian coal industry's COAL21 initiative by providing significant research input to the Australian Action Plan released in March 2004. Centre research continued to support detailed analyses of Australia's near term energy options in emerging local and international regulatory scenarios. Two new research projects were commenced on oxygen fired pf combustion and fundamental studies of membrane technology for gas separation. Research on environmental issues reported on effort to reduce fine particle and mercury emissions. Memoranda of Understanding were signed to continue the Centre's collaboration with the Central Research Institute for Electricity Production – Japan (CRIEPI) and a new initiative was commenced with the Australian Ash Development Association (ADAA).

GeoTek Solutions

GeoTek Solutions is a geotechnical consultancy specialising in slope stability for open cut mines. The company has operated from the Technology Transfer Centre since its inception and has maintained strong links with CSIRO's Division of Exploration and Mining through the Sirovision technology.

With increasing acceptance of Sirovision on mine sites, niche opportunities have arisen for specialist consulting services using this technology, and GeoTek Solutions has continued to build its small but growing business in this area.

Buoyant economic conditions have meant that GeoTek Solutions has undertaken a number of projects during the year. These have been mainly in Queensland's Bowen Basin coal fields and in metalliferous mines in Papua New Guinea and Indonesia. Notably, GeoTek Solutions has provided geotechnical designs for a number of Greenfield coal mines and is developing a geotechnical design for, potentially, the deepest open cut coal mine in Queensland.

Instinct Television

Television production company Instinct Television based at the CSIRO QCAT centre is busy creating television with a bite, having recently completed production in January 2004 of thirty-nine one-hour episodes of adventure wildlife series 'Killer Instinct with Rob Bredl'. Recent corporate productions have included the 'CAS/CAM RF' promotional DVD and Training programme for fellow CSIRO tenant Advanced Mining Technologies, a Queensland Cancer Fund support video 'Understanding Chemotherapy' and television commercials for 'Novotel Hotel Brisbane'. The company continues to develop and pitch new television programming to international distributors and is currently in negotiations with overseas broadcasters for a future television series. "The QCAT centre is the ideal creative base for our business", says company Director Garry Gibson. "The centre has the infrastructure we need to deliver a quality television programme to a world market"

Jenkins-Kwan Technology Pty Ltd

Jenkins-Kwan Technology is involved in a broad range of R&D projects. Projects at QCAT have focussed on the development and commercialisation of automated instrumentation for the coal mining industry and coal users. With the assistance of ACARP grants we are extending the capabilities of the MACE300 coal petrography system, which involves light-microscope analysis of the organic constituents (macerals) of coal. This includes a recently completed project to enable the analysis of coal blends. Jenkins-Kwan Technology also provided support to CSIRO where a system is being used in flotation research for plant diagnostics. New methods of calibration are being developed to help automate critical applications such as shipment analysis. The MACE300 was recently tested to renew the system's international accreditation for coal petrography. A different project underway is aimed at developing a low-cost portable autonomous monitoring and test station for use in coal preparation plants.

Site conservation

Rehabilitation of the Land for Wildlife area has continued over the past year. Two planting mornings have occurred, increasing the rehabilitated area by some 80 square metres. Plantings undertaken a few years ago adjacent to the creek crossing have become established to the extent that they are now crowding out some of the undesired exotic species. A few dedicated volunteers can be seen working through their lunchtime.

Fish surveys have identified the presence of two local native species, Fire-tailed Gudgeon and Purple-spotted Gudgeon in the creek. A contract is currently being developed to enable water sampling to determine the health of the creek. Establishing levels of faecal coliforms, turbidity, sulphur, iron, magnesium, alumina, ph, and salinity, will enable comparison with earlier readings, and thus provide a measure of the level of environmental impact of QCAT on this sensitive area.

A proposal to create a further wildlife refuge area is being developed by the QCAT Environmental Management System Committee for consideration by the Site Management Committee. If approved, this would allow the creation of an area which other endemic species could colonise, thus adding to the ecological diversity and increasing the value of the site as a wildlife and flora corridor.

Awards

A number of QCAT staff were acknowledged with awards for their efforts during the year.

The Lindsay Ingall Memorial award

Dr Peter Hatherly, who is heavily involved with QCAT's Mining Geoscience group, received the 2004 Lindsay Ingall Memorial award from the Australian Society of Exploration Geophysicists. The citation stated that Dr Hatherly received the award for his energetic and effective promotion of geophysics in the coal industry, and the development of improved techniques tailored to that industry. Dr Hatherly has also been invited by Curtin University to continue as an Adjunct Professor of Geophysics within the Department of Exploration Geophysics, Division of Resources & Environment.

Excellence in Innovation award

Dr Nigel Ricketts and Mr Craig Korn based at QCAT and from CSIRO's Division of Manufacturing and Infrastructure Technology along with Mr Rob Bailey and Dr Simon Cashion (Australian Magnesium Corporation) have won the Excellence in Innovation award from the Cooperative Research Centre Association. The award was received for the group's submission of a new cover gas system to prevent molten magnesium from burning.

American Society of Automotive Engineers

John Griffiths from CSIRO's Division of Manufacturing and Infrastructure Technology shared in the prize for 'One of the Best' technical papers published by the American Society of Automotive Engineers. The paper was titled AMC-SCI: a new magnesium alloy suitable for powertrain applications. Other co-authors were: CJ Bettles, CT Forwood, DS Jones (all from CMIT), MT Frost (Australian Magnesium Corporation), DH StJohn (CAST Cooperative Research Centre), Ma Qian, GL Song (University of Queensland) and JF Nie (Monash University).

Service from Science award

CSIRO's Service from Science award went to members of the Iron Ore team to recognise their efforts over the past few years to build a significant and productive strategic relationship with Robe. The team did not just talk about the idea of proactively generating strategic relationships and alliances, but was out there, actively doing it. Team members were Ralph Holmes, John Clout, Jasbir Khosa and Keith Vining.

Innovation award

CSIRO Minerals Division presented their Innovation Award to Jonathon Campbell from QCAT for the 'SAG Mill Monitor'. Other team members who received the award were located at Clayton in Victoria and Lucas Heights in New South Wales.

Look Out! award

Jacek Charbucinski, Mihai Borsaru, Craig Smith, Andrew Rojc and Tai Johnsen of the Mining Geoscience nuclear group were awarded the CSIRO Exploration & Mining award 2004 for outstanding achievements in the 'Look Out!' award category. The group demonstrated outstanding research, an understanding and appreciation of future industry challenges and innovative electronic development to win the award.

QCAT Consultative Steering Committee

Dr John G Reid – Chairman
Director
Reid Resource Consulting Pty Ltd

Dr Cliff Mallett
Deputy Chief
CSIRO Exploration & Mining
Executive Manager
QCAT

Mr Bob Potter
General Manager, Industry Development
Bureau of Mining and Petroleum
Department of Natural Resources and Mines

Associate Professor John Mott
Director
Centre for Integrated Resource Management
The University of Queensland

Mr Andrew Craig
Director
Queensland Australian Industry Group

Mr Brian Anker
Director
Technology and Service Industries Branch
Department of State Development and Innovation

Neil Phillips
Chief
CSIRO Exploration & Mining

Dr Rod Hill
Executive Chair
CSIRO Sustainable Minerals and Energy Group

QCAT contacts

Queensland Centre for Advanced Technologies

Technology Court Pullenvale Brisbane
PO Box 883 Kenmore
Queensland 4069
AUSTRALIA
t: +61 7 3327 4444
f: +61 7 3327 4455
www.cat.csiro.au

Dr Cliff Mallett
Executive Manager – QCAT
Deputy Chief, CSIRO Exploration & Mining
t: +61 7 3327 4440
f: +61 7 3327 4455
e: cliff.mallett@csiro.au

CSIRO Exploration & Mining

Mining Geoscience
Mark Berry
t: +61 7 3327 4570
f: +61 7 3327 4455
e: mark.berry@csiro.au

Coal Mining
Michael Kelly
t: +61 7 3327 4612
f: +61 7 3327 4455
e: mick.kelly@csiro.au

Geotechnical Support
George Poropat
t: +61 7 3327 4425
f: +61 7 3327 4455
e: george.poropat@csiro.au

Metalliferous Mining
Jock Cunningham
t: +61 7 3327 4699
f: +61 7 3327 4455
e: jock.cunningham@csiro.au

Sustainable Mining
Dr Anna Littleboy
t: +61 7 3327 4180
f: +61 7 3327 4455
e: anna.littleboy@csiro.au

Rock Cutting & Drilling
Dr Jim Boland
t: +61 7 3327 4494
f: +61 7 3327 4455
e: jim.boland@csiro.au

CSIRO Energy Technology

Coal Processing
Dr Bruce Firth
t: +61 7 3327 4500
f: +61 7 3327 4455
e: bruce.firth@csiro.au

Coal Utilisation
Dr David Harris
t: +61 7 3327 4617
f: +61 7 3327 4455
e: david.harris@csiro.au

CSIRO Minerals

Iron Ore and Non-ferrous Mineral Processing
Dr Ralph Holmes
t: +61 7 3327 4452
f: +61.7 3327 4682
e: ralph.holmes@csiro.au

CSIRO Manufacturing and Infrastructure Technology

Light Metals Engineering
Nigel Ricketts
t: +61 7 3327 4638
f: +61 7 3327 4455
e: nigel.ricketts@csiro.au

CSIRO ICT Centre

Robotics
Dr Peter Corke
t: +61 7 3327 4584
f: +61 7 3327 4455
e: peter.corke@csiro.au

CSIRO Flagship

Light Metals Flagship
Dr Raj Rajakumar
Acting Director
t: +61 7 3327 4645
f: +61 7 3327 4455
e: raj.rajakumar@csiro.au

About CSIRO

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's national science agency. In its 77 year history CSIRO has formed strategic alliances with government, industry, business and communities in 80 countries. CSIRO is dedicated to the application of knowledge and science for real-world outcomes for society and industry.

CSIRO's diverse capabilities at QCAT include mining geoscience, coal and metalliferous mining, geotechnical support, iron ore and non-ferrous mineral processing, light metals engineering, coal utilisation, sustainability and ICT.

Contact Us

Phone 1300 363 400
Email enquiries@csiro.au
Web www.csiro.au