



## **CSIRO Operational Plan 2008-09**

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By igniting the creative spirit of our people we deliver great science and innovative solutions for industry, society and the environment.

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The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is an independent statutory authority constituted and operating under the provisions of the Science and Industry Research (SIR) Act 1949. The Act lays out the functions, powers and structure of governance of the organisation.

In summary, CSIRO's primary functions (Section 9) are:

- to carry out scientific research for the purpose of assisting Australian industry, furthering the interests of the Australian community, contributing to the achievement of national objectives or the performance of national and international responsibilities;
- to encourage or facilitate the application or utilisation of the results of scientific research; and
- to carry out services, and make available facilities, in relation to science.

Secondary functions specified in the Act include:

- liaison with other countries in matters connected with scientific research;
- training of research workers in the field of science, and co-operation with tertiary education institutions in relation to science education;
- establishing research fellowships and studentships, and making grants in aid of research;
- co-operation with associations of persons engaged in industry for the purpose of carrying out industrial scientific research;
- collection, interpretation and dissemination of information on scientific and technical matters; and
- publication of scientific and technical reports, periodicals and papers.

This document has been prepared in accordance with Section 35 of the Act which requires CSIRO to formulate an annual Operational Plan, that sets out details of:

- the strategies the Organisation proposes to pursue;
- the activities the Organisation proposes to carry out; and
- the resources the Organisation proposes to allocate to each activity during the year, giving effect to the relevant Strategic Plan.

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## FOREWORD

CSIRO's Core Purpose, stated in the Organisation's Strategic Plan for 2007-2011, is...

*By igniting the creative spirit of our people we deliver great science and innovative solutions for industry, society and the environment.*

Our Strategic Plan articulates Organisational vision and aspirations, and describes a broad path to achieving these through a set of strategic initiatives and objectives. This Operational Plan provides an overview of the activities and resourcing decisions that will put our Strategy into effect over the year ahead. In particular, it highlights the planned activities, outputs and resourcing associated with each of the four 'output groups' represented in our 2008-09 Portfolio Budget Statement, namely:

- National Research Flagships;
- Core Research;
- Science Outreach: Education and Scientific Publishing; and
- National Research Infrastructure: National Facilities and Collections.

The delivery of these outputs is underpinned by the capabilities that reside in our research Divisions, Joint Ventures and Corporate areas. The Operational Plan therefore also provides an insight into planned development of our research capabilities and an overview of enterprise support activities. The Plan is organised as follows:

- Part 1 provides an overview of the Organisation's 2007-2011 strategy and of our operational and governance arrangements for strategy implementation; *ADD Planned KPI's success*
- Part 2 outlines the planned activities and outputs in each of the four output groups;
- Part 3 outlines the planned activities for building on our strengths in science and technology (developing our capabilities);
- Part 4 provides an overview of the enterprise level functions that support our research; and
- Part 5 provides a summary of resource allocation and planned financial performance.

Over the period 2008-09, CSIRO will pay particular attention to the following strategic initiatives:

- Further clarification, focus and enhancement of CSIRO's external engagement processes and activities to achieve greater impact from, and increased resources for CSIRO research;
  - Continued development of CSIRO's capability management framework, aligning and integrating capability related activities around people, infrastructure and organisation; and
  - Improved effectiveness and efficiency of CSIRO through appropriate simplification and integration of business processes, practices, procedures, governance arrangements and structures.
- } report in APR*

CSIRO plays a unique and significant role in the Australian Innovation System, particularly in conducting large-scale, multidisciplinary research focused on major national challenges and opportunities. We are an organisation of enormous and diverse capability, with a proud record of achievement over 80 years. This Operational Plan for 2008-09 reflects our continuing commitment to build and apply our capabilities in ways that deliver real benefits for Australia.

I commend the plan to all staff and interested stakeholders.

Geoff Garrett  
Chief Executive  
June 2008

# 1. STRATEGY AND GOVERNANCE

## 1.1 CSIRO's Roles

Public research organisations contribute to national wellbeing in different ways. For CSIRO, the focus is on delivering scientific solutions to Australian industry and communities, while building Australia's science base to meet ongoing challenges and opportunities. By specifying our roles and functions explicitly, CSIRO is able to build cohesive research teams, prioritise funds across our portfolio and demonstrate the benefits science brings to Australia.

Creating clarity around our responsibilities is an important first step towards ensuring that the 6,400 scientists and staff within CSIRO are able to focus their activities where they will have the greatest impact. Clarity around CSIRO's roles is also important in facilitating collaboration with industry, community and other players in the Australian innovation system.

Five core roles, a number of satellite roles, and two enabling functions for CSIRO have been identified by answering the following questions:

- What is the value of the role to Australia?
- Is CSIRO the best party to fulfil the role?
- What is the relative long-term benefit of the role to Australia?
- How would CSIRO prioritise and allocate resources to the role?
- What is the opportunity cost for investing (or not investing) in the role?
- How important is the role in delivering on CSIRO's existing core activities?

The roles can be represented diagrammatically as a house (Figure 1). CSIRO's core roles are illustrated at the centre of the diagram, surrounded by a number of satellite roles. Enabling functions are represented as the roof and floor of the house, highlighting the support they provide to the other roles. The diagram illustrates the continuum at CSIRO between industry driven activities (left side of the house) and community driven activities (right side of the house). The strength and effectiveness of each role supporting the house contributes to the ability of CSIRO to deliver beneficial outcomes for the public good.

### Core roles

The core roles are the principal means by which CSIRO delivers impact for Australia. They are areas in which CSIRO is, or has the potential to be, distinctive and can deliver high value for Australia. There are currently five core roles for delivering impact.

#### 1. Advancing frontiers of science.

Paradigm-shifting science aimed at advancing fundamental scientific understanding takes place within all of CSIRO's core roles. Some of CSIRO's biggest scientific breakthroughs have come from work being driven through other roles.

Research aimed at advancing fundamental scientific understanding is vital in its own right. It helps to maintain world-class scientific skill in Australia; it is critical for maintaining connectivity with the international research community and for creating options for advancing new application areas in the long-term.

This role balances high risk in terms of project success rate with the high returns that successful projects generally provide, and develops world-class scientific talent in Australia. It also has the potential to

*defn KPI's / benchmark  
depend on post*

generate new science, technical platforms, capabilities and intellectual property. Frontier science is important to the sustainability of all our other core roles.

## 2. Solving major national challenges.

Within Australia, CSIRO is unique in the breadth and depth of our expertise and in our ability to perform research focused on solving major national challenges. This research is important for CSIRO and for Australia, and represents CSIRO's third core role.

The national (as opposed to regional or local) nature of CSIRO, together with its collaborative and multidisciplinary culture, makes solving major national challenges a critical role for the enterprise. If CSIRO did not participate in this role, many of these challenges would continue unchecked.

## 3. Creating new or significantly transforming industries.

There are not many organisations in Australia with the scale necessary to perform R&D that leads to the creation or transformation of industries. By sustaining high-risk, long-term projects in partnership with business, CSIRO is able to lead outcome-focused, R&D-intensive, mission-directed strategic research aimed at creating the next generation industries, products, services and businesses.

CSIRO's scale and long-term perspective is the key to its differentiation and ability to perform this role. Only a small number of other organisations, consortia or government bodies could lead such projects and ensure delivery. In this role, CSIRO aims to increase the competitiveness and sustainability of Australian industry through dramatic innovations.

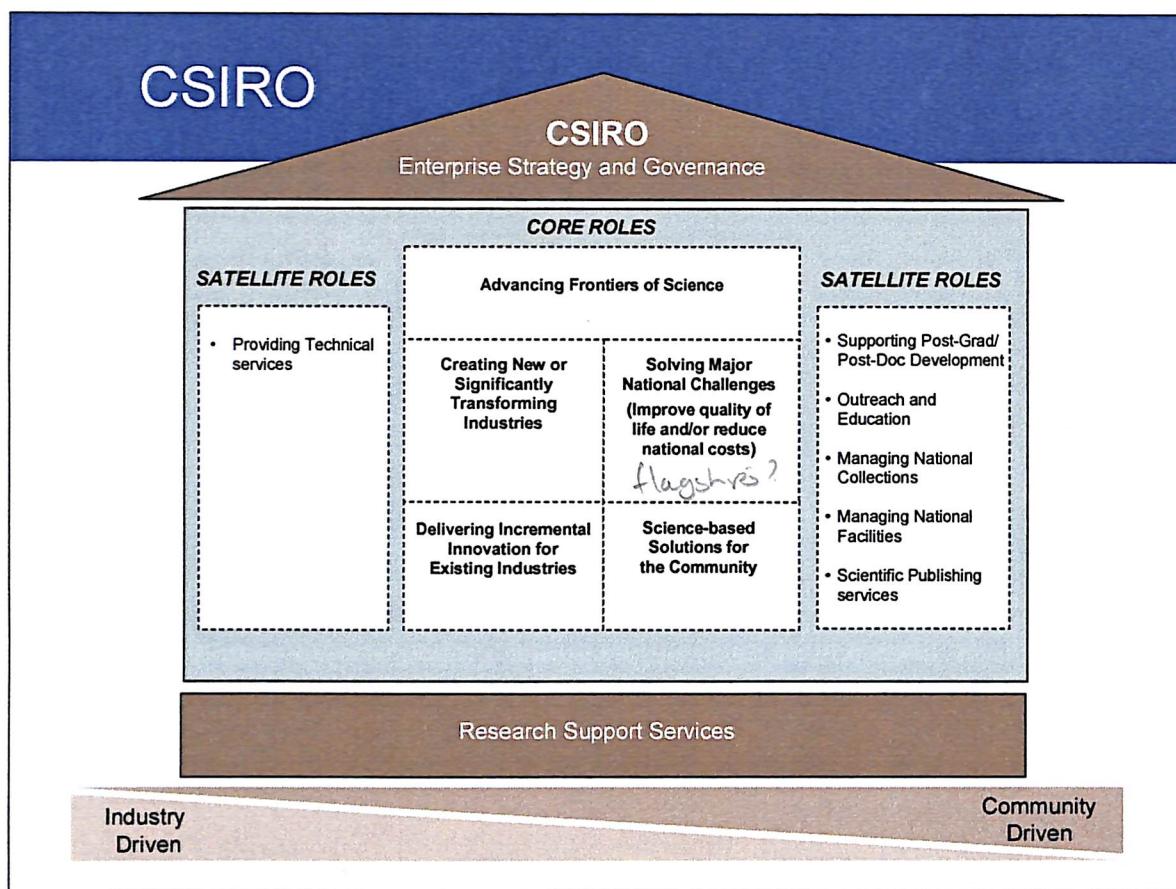


Figure 1: The CSIRO Role House (Source: CSIRO Strategic Plan 2007-2011)

#### **4. Science-based solutions for the community.**

Few other organisations are able to conduct targeted community-interest research with a national perspective, and deliver it locally. Through this role, CSIRO provides advice, information, research, and specific community solutions to inform and protect society and the environment. Through this role, CSIRO builds connections with communities and industry and informs Government policy.

#### **5. Delivering incremental innovation for existing industries.**

For many companies, the difference between success and failure may be a few points of profit margin. Applied R&D can give an important boost to industry profitability and sustainability. At the same time, financial pressures from the day-to-day operations of a business can make it hard for companies to justify significant in-house R&D. This is especially true for Australia's numerous small and medium enterprises.

CSIRO helps solve this problem by delivering incremental innovation to improve the efficiency, effectiveness and competitiveness of existing industries. CSIRO's skill base, capability set, infrastructure, client focus, track record, relationships and reputation are distinctive in delivering in this role.

### **Satellite roles**

CSIRO performs six ancillary or "satellite" roles related to our core science activities to enhance their impact, as illustrated in Figure 1.

#### **1. Supporting Post-Grad/Post-Doc Development**

Supporting undergraduates, post-graduates, and post-doctoral researchers helps to boost the calibre of researchers working in the Australian community. CSIRO gives young researchers experience in technology transfer and uptake, which is important for Australia's future innovation capacity.

#### **2. Outreach and Education**

Promoting the importance of science and its application to students, parents, teachers and the Australian community has long been one of CSIRO's great strengths. CSIRO is strongly positioned to help create a knowledgeable society, by raising scientific literacy and communicating the outcomes, impacts and benefits of scientific research, so the community can engage with major issues related to science.

#### **3. Managing National Collections**

The creation, enhancement and maintenance of National Collections is a service for the present and future of Australian science. They are a valuable resource for researches, industry and others, and also go to enhance Australia's standing as a global science leader. CSIRO supports this through management of several collections including, the Australian National Herbarium; the Australian National Insect Collection; Australian National Fish Collection; and the Australian National Wildlife Collection.

#### **4. Managing National Facilities**

Accessing world-class infrastructure is important in many areas of research. Retaining core capabilities for Australia requires Australia to host and run key facilities. CSIRO fulfils this role by managing the Australian Animal Health Laboratory, the Australian Telescope National Facility, and the National Facility Vessel Southern Surveyor.

#### **5. Scientific Publishing Services**

A reflection of CSIRO's longstanding commitment to knowledge diffusion and technology transfer, CSIRO Publishing operates as an independent entity, publishing science and technology books, journals, papers, and technical reports. With a global reputation for quality products and services, CSIRO Publishing has approximately \$9 million in annual turnover.

## **6. Providing Technical Services**

CSIRO offers industry, the community and government access to deep scientific knowledge not available through private sources. In many cases, these services fill an important market gap, assisting where a market for the service required does not yet exist, has not adequately developed or is not economically viable due to Australia's relatively small scale. This role is particularly important for small and medium enterprises, which are often unable to develop the services they need in-house.

## **Enabling functions**

Two key supporting activities enable CSIRO to fulfil our core and satellite roles, as illustrated in Figure 1.

### **1. Research Support Services**

Research support services functions include laboratory management and support, corporate finance and accounting, corporate property management, payroll and human resources benefit administration, communications, procurement, and management of IT systems.

### **2. Enterprise Strategy and Governance**

Ensuring a well-communicated and understood strategic and operational framework exists helps CSIRO staff fulfil their duties and helps external organisations interact more effectively with us. CSIRO must invest in effective strategy and governance to ensure appropriate processes are in place for strategic direction setting and to guide key management decisions. It must also effectively communicate these frameworks externally to foster and nurture valuable relationships with key stakeholders.

## **1.2 CSIRO's Strategy and Strategy Implementation**

Consistent with the roles described in Section 1.1, CSIRO's Strategy for 2007-2011 is designed to ensure that "*Australia has a strong capability in scientific research and development that delivers ongoing economic, social and environmental benefits and provides science and technology solutions relevant to current and emerging national challenges and opportunities.*"<sup>1</sup>

Our Strategy aims to grow our impact by delivering great science and innovative solutions for industry, society and the environment through three major elements (Figure 2):

- Addressing national challenges and opportunities, faster and better;
- Focusing and strengthening our core science capability and delivery; and
- Strengthening our enterprise and enhancing operational excellence.

The Strategy is underpinned by six Key Messages: *greater focus on major scientific challenges and opportunities for Australia with a strong outward-looking emphasis, stronger partnerships with universities, other science agencies and industry with a 'service from science' culture, a unified One-CSIRO, maximising our collective strengths and growing our impact and relevance in service to the nation.*

<sup>1</sup> This is the formal statement of the outcome or purpose for which the government appropriates funds to CSIRO through the budget appropriation bills. See CSIRO's 2008/09 Portfolio Budget Statement at [http://www.innovation.gov.au/Section/AboutDIISR/Documents/CSIRO\\_2008-09\\_PBS.pdf](http://www.innovation.gov.au/Section/AboutDIISR/Documents/CSIRO_2008-09_PBS.pdf)

Over this planning cycle CSIRO will deliver ...

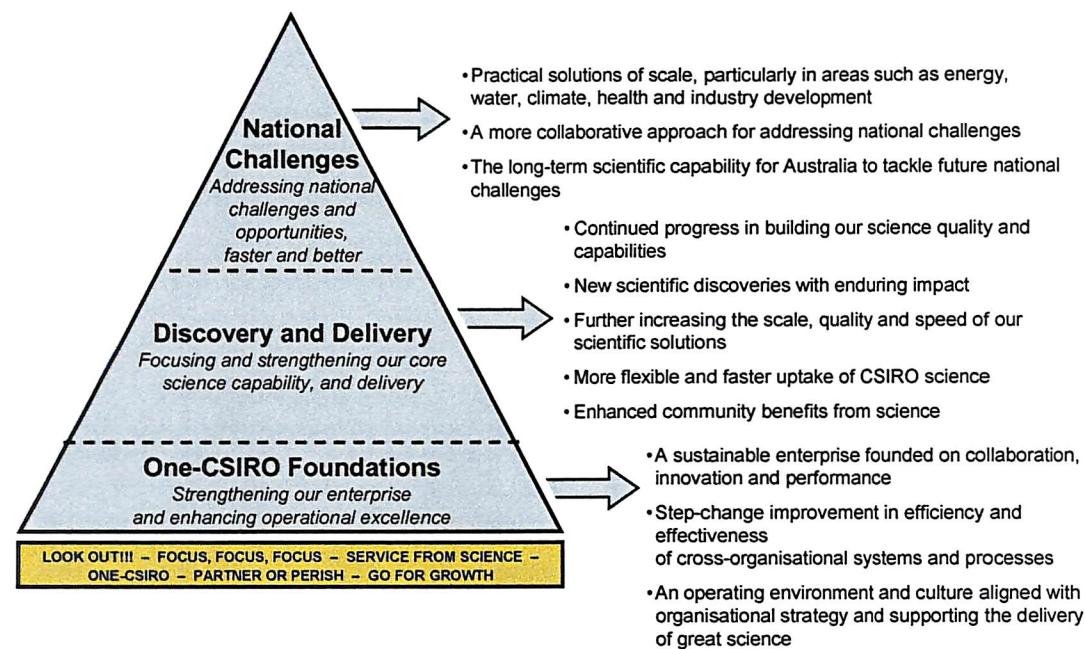


Figure 2: Strategic Elements and Medium-Term Planned Outcomes (Source: CSIRO Strategic Plan 2007-2011)

The areas where CSIRO delivers substantial economic, social and environmental benefits for Australia are represented by 'Outcome Domains' (Figure 3). The diagram provides an overview of our current focus and the connections across the areas. The sizes of the ellipses reflect the current approximate investment in each outcome domain area. It is our ability to effectively transfer knowledge and deliver and communicate CSIRO's impact in these outcome domains that ensure our ongoing success in the eyes of our key stakeholders.

The Strategy is delivered through the integration, coordination and realisation of a number of powerful strategic initiatives with specific objectives (Figure 4). While each initiative is important to the enterprise in its own right, it is the skilful combination of those initiatives that will deliver substantial and sustained value to the Organisation, our collaborators and partners, key stakeholders, and the Australian community.

The effective sponsorship, ownership and coordination of strategy implementation is vital. Each Strategic Objective is sponsored, and driven, through a combination of Executive Team owned Strategy Implementation Goals, annual performance agreement objectives of individual CSIRO Executives, and business unit and portfolio annual performance goals. The delivery and sponsorship draws upon expertise and resources from across the breadth of CSIRO (and beyond) to deliver the necessary outcomes.

Steering committees are established to support the effective governance of the largest and most complex strategic initiatives – membership includes CSIRO Executives, relevant Project Directors and other internal and external experts.

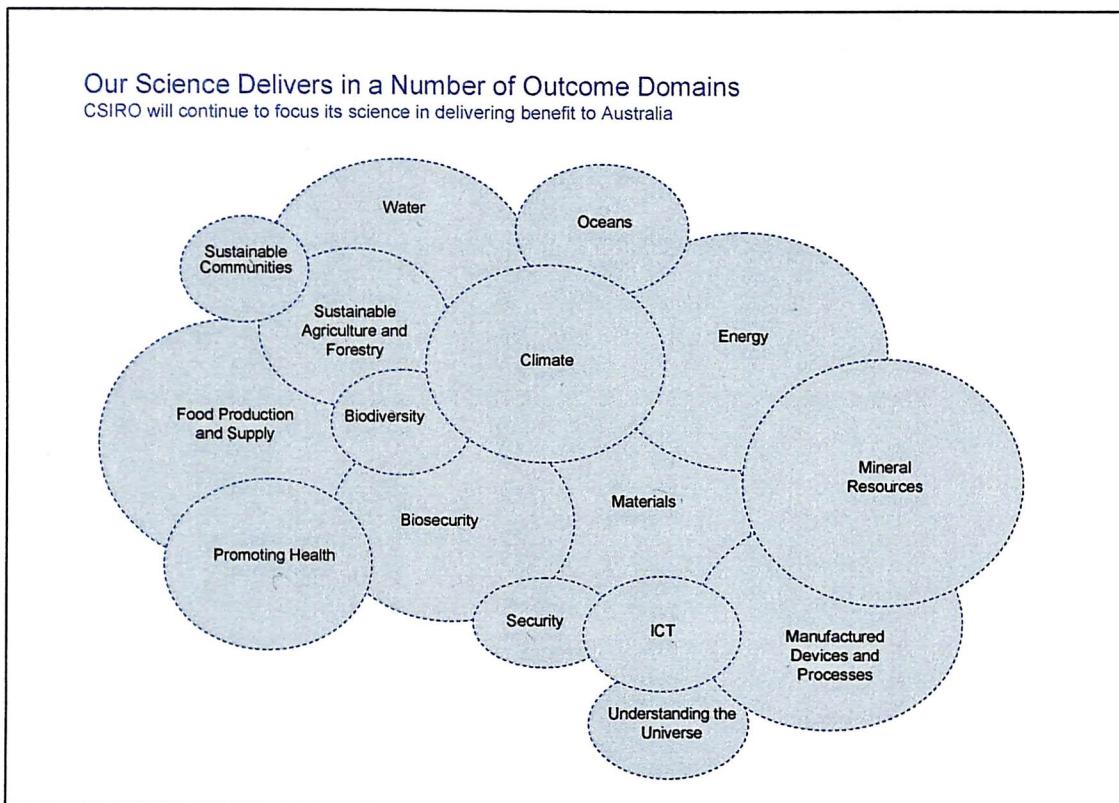


Figure 3: CSIRO's Outcome Domains (Source: updated from CSIRO Strategic Plan 2007-2011)

Change management activities are implemented alongside and as part of the strategic initiatives. The Change Partner Network supports the communication and implementation of strategy on the ground in Divisions, Corporate Groups and Flagships. Change partner workshops continue to be important elements in communicating and coordinating change initiatives, and this network has been and will continue to be active in supporting the implementation of strategy.

A number of major strategic initiatives moved into full implementation during 2007-08, and they hold us in good shape as we move forward. The Strategy Implementation Goals provide important, enterprise wide, focus areas for 2008-09 and collectively they will build a strong basis upon which the 2007-2011 Strategy will be delivered.

In addition to organisational business as usual, we will focus attention on a small number of enterprise significant activities in 2008-09 (that will complement other arrangements established for implementation of our strategy including thematic and portfolio goals) which underpin the implementation of our Strategy. Specifically, the three focus areas will address:

- Further clarification, focus and enhancement of CSIRO's **external engagement** processes and activities to achieve greater impact from, and increased resources for CSIRO research.
- Continued development of CSIRO's **capability** management framework, aligning and integrating capability related activities around people, infrastructure and organisation.
- Improved effectiveness and efficiency of CSIRO through appropriate **simplification** and integration of business processes, practices, procedures, governance arrangements and structures.

STRATEGIC ELEMENTS	STRATEGIC INITIATIVES	STRATEGIC OBJECTIVES
<b>National Challenges</b> <i>Addressing national challenges and opportunities, faster and better</i>	1.1 Building on Flagship Success	<p><b>1.1.1 Accelerating and Expanding Flagships</b> – Grow targeted National Flagships to more rapidly address key national challenges and opportunities.</p> <p><b>1.1.2 Growing Flagship Collaborations</b> – Accelerate our delivery of Flagship goals by increasing the level of collaboration with world-leading research partners, both nationally and internationally.</p>
	1.2 Power Partnerships	<p><b>1.2.1 Building Major Partnerships</b> – Boost science capability to achieve more effective science and technology solutions for the Australian community, industry and the environment through targeted partnering, alliances and ventures.</p> <p><b>1.2.2 Developing Science Hubs through Co-locations</b> – Continue to build nationally significant integrated clusters of science capabilities with others in the National Innovation System to facilitate the development of critical mass, to help enhance science delivery for Australia.</p>
<b>Discovery and Delivery</b> <i>Focusing and strengthening our core science capability, and delivery</i>	2.1 Focused Science	<p><b>2.1.1 Progressing Science Direction Setting</b> – Continue to focus CSIRO's science investment, capability development and performance in areas of greatest impact and relevance.</p> <p><b>2.1.2 Building Transformational Capability Platforms</b> – Ensure long-term sustainability and future impact of the organisation by strengthening vital cross-organisational capabilities in transformational biology, advanced materials, computational and simulation sciences, and sensor network technologies.</p> <p><b>2.1.3 Ensuring Sustainable National Facilities and Collections</b> – Management and delivery of national and international research infrastructure that underpins the CSIRO and National Innovation System research portfolio.</p>
	2.2 Increased Adoption	<p><b>2.2.1 Developing our Business</b> – A step-change improvement in our business relationships to ensure effective science and technology uptake, sustainably.</p> <p><b>2.2.2 Accelerating Science and Technology Transfer</b> – Ensure effective technology transfer to partners by continuing to develop flexible and fast adoption pathways.</p> <p><b>2.2.3 Enhancing Communications</b> – Promote the contribution of science in driving innovation and support the delivery of societal benefit from CSIRO science.</p>
<b>One-CSIRO Foundations</b> <i>Strengthening our enterprise and enhancing operational excellence</i>	3.1 People and Organisational Development	<p><b>3.1.1 Nurturing our Innovative Culture</b> – Foster a safe environment where innovation, collaboration, flexibility and performance flourish.</p> <p><b>3.1.2 Working Effectively and Efficiently in our Enterprise</b> – Utilise common systems, structures and improved processes to support our matrix operations and optimise the use of our facilities, equipment and information assets.</p>
<b>LOOK OUT!!! – FOCUS, FOCUS, FOCUS – SERVICE FROM SCIENCE – ONE-CSIRO – PARTNER OR PERISH – GO FOR GROWTH</b>		

Figure 4: Strategic Initiatives and Objectives (Source: CSIRO Strategic Plan 2007-2011)

## **1.3 Science Investment and Planning**

CSIRO adopts a systematic approach to prioritising research investments and to ensuring that skills and resources are built and focused on the most important issues for Australia. Since its inception in 2004-05, the Science Investment Process (SIP) has been of critical importance in:

- Appropriately aligning CSIRO's research portfolio with the strategic direction stated in the CSIRO Strategic Plan;
- Enhancing the level of cross-organisational collaboration in order to more effectively provide research-based solutions to Australia's challenges and opportunities;
- Promoting increased transparency of planning, performance reporting and resource allocation to ensure science outputs are translated into adoption and impact for the benefit of Australia.

The SIP comprises two major components. Details of the 'relevance and impact' criteria used to guide the decision making process are set out in Appendix 1. In the first phase - 'Broad Direction Setting' (BDS) - the senior executives of the organisation, taking into consideration a large array of internal and external factors, translate CSIRO's Strategy into medium term investment priorities. A baseline set of broad science directions against which CSIRO's future directions and performance will be reviewed was published in the CSIRO Strategic Plan 2007-2011. These broad science directions are refined annually as part of the Science Investment Process, most recently in December 2007. The resulting Broad Direction Setting Update is published on the CSIRO intranet to inform the second phase of the SIP.

The second phase involves Divisions, Groups and Flagships responding to these high level directions through an iterative process to give effect to required directional shifts and deliver specific outcomes through investment in Themes and capability development. A Theme refers to a significant area of research that is directed towards a specified outcome with a clear strategic purpose. CSIRO will invest in over 100 clearly defined Themes in 2008-09, as detailed in Part 2 of this Operational Plan. A summary list of Themes is provided in Appendix 2.

A challenge in making investment decisions for 2008-09 and beyond was to manage the impact on CSIRO's direct appropriation funding from Federal Government savings measures. Inclusive of the impact on external revenue, which is highly leveraged against appropriation, the net effect on CSIRO's total income is likely to be in the region of \$25m to \$30m per annum.

Within this challenging environment, the investment decisions made by the Science Sub-Committee (SSC) in May 2008 have supported the recommendations in the BDS Statement to:

- Increase funding for Transformational Capability Platforms;
- Redirect funding to provide capability leaders with a greater capacity to optimise the competitiveness of the Organisation's current and future capabilities;
- Increase funding in the Water, Energy, Climate and Materials outcome domains; and
- Redirect appropriation funding from near-market and incremental research in the Food Production and Supply domain to address more systematically issues affecting the long term viability of Australian agriculture and food.

All investment decisions by the SSC took into consideration theme progress and performance, path-to-impact and overall relevance and impact. Additionally, in finalising investment decisions, and faced with a decrease in appropriation, the SSC considered strategies and mechanisms which would minimise losses in scientific capability and continue to maintain CSIRO's strategy by better positioning the Organisation for the future. These included:

- Opportunities to enhance efficiencies and science impact through refocusing and/or combining activities and locations (including consolidation of Business Units (Divisions) and sites);
- Varying levels of readiness for ramp-up, recognising challenges of recruitment and other proposed re-organisations of theme portfolios;
- The completion of changes signalled in previous SIP cycles.

Parts 2 and 3 of this Operational Plan set out, respectively, the planned activities and outputs associated with the portfolio of themes and the capability development activities planned in response to these broad science directions and investment decisions. CSIRO's research portfolio will continue to remain closely aligned with the Australian Government National Research Priorities<sup>2</sup>.

## **1.4 Managing Our Research**

### **National Research Flagships**

The National Research Flagships program addresses major national challenges and opportunities through large-scale multidisciplinary research partnerships. One of the largest research endeavours ever undertaken in Australia, Flagships extend traditional models of science to deliver scientific solutions to advance Australia's most pressing national objectives, delivering as well major benefits to Australia's people, environment, industries and economy.

Flagships target clearly defined goals, framed from a deep analysis of the needs of people and enterprises. Flagships operate on a large scale and with long timeframes, and have a strong focus on impact and adoption to deliver real benefits in the Australian economy, community and environment.

Recognising that complex challenges require collaboration of the best and brightest researchers, the Flagships form partnerships with Australian universities and publicly funded research institutions, the private sector, and selected international organisations. Continued interaction and engagement with these bodies is crucial to ongoing success and delivery and adoption of research outputs in order to maximise impact for Australia.

Communicating the outcomes of the Flagships' research is vital to the success of the program. By ensuring effective engagement throughout the research programs, and demonstrating the significance of the research outcomes to key stakeholders, the Flagships will improve adoption rates and deliver the expected national benefits.

Three new Flagships were created in 2007-08: Climate Adaptation, Minerals Down Under and Niche Manufacturing. A significant expansion of the Energy Transformed Flagship in the area of alternative transport fuels is currently underway. During 2008-09 major reviews, with independent external participation, are planned for the Food Futures, Light Metals and Preventative Health Flagships.

### **CSIRO's Research Groups**

Research delivery and the development of research capability is managed through five CSIRO Groups: Agribusiness; Energy; Environment; Information and Communication Sciences and Technology; and Manufacturing, Materials and Minerals.

Each Group is led by a Group Executive who is a member of the Executive Team, and all Groups are committed to pursuing their objectives through partnerships in the private and public sectors, both within Australia and internationally. Delivery against Group objectives, and the impact of research, provides a

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<sup>2</sup> Information on the National Research Priorities is available at [www.dest.gov.au/priorities](http://www.dest.gov.au/priorities).

focus on connectivity between Flagships, Themes and CSIRO strategy. Outcomes of research group activities are communicated to our collaborators, partners, key stakeholders, and the Australian community, supporting engagement and reinforcing CSIRO's role in the National Innovation System.

## **Agribusiness**

The Agribusiness Group serves large and vital sectors of the Australian economy including the agri-food and fibre industries, and the human health sector. The Group's objectives are to enhance the global competitiveness and sustainability of agribusiness industries and to improve human well-being and community health by performing world-class and strategic research. The Group also carries responsibility for policy oversight of biotechnology/bioeconomy, including regulation of gene technology research.

The following National Research Flagships, Divisions and joint ventures are included in the Group:

- Food Futures National Research Flagship
- Preventative Health National Research Flagship
- CSIRO Entomology Division
- CSIRO Livestock Industries Division
- CSIRO Plant Industry Division
- Food Science Australia (Joint venture with the Victorian Government)

## **Energy**

The Energy Group aims to develop and apply leading-edge energy research that meets Australian needs. It encompasses both community and industry driven research and is important for government policy development, for producing technologies for industry, and for meeting societal needs for knowledge and practical solutions to the wider energy sustainability challenge.

The Group looks at the ways in which the processes of generation and consumption of energy and power can be made more efficient and better for the environment. It seeks to deliver science and solutions vital to maintaining a globally competitive and sustainable Australian energy industry, and is providing Australia with a key capacity to discover, protect and realise the benefits of our ocean territories.

The following National Research Flagships and CSIRO research Divisions are included in the group:

- Energy Transformed National Research Flagship
- Wealth from Oceans National Research Flagship
- CSIRO Energy Technology Division
- CSIRO Petroleum Resources Division

## **Environment**

The Environment Group aims to support the development of production sectors while at the same time minimising current and potential adverse environmental impacts.

Australians have stewardship of a beautiful, diverse and unique environment. The cumulative consequences of the last 200 years of development of natural resources leaves us with a legacy of environmental challenges juxtaposed with opportunities for new economies for Australia that address the triple bottom line imperative.

CSIRO's Environment Group is responding to these challenges and opportunities by providing systems understanding, developing and applying new technologies and supporting our clients, partners and stakeholders in carefully balancing economic development with ecological conservation.

The following National Research Flagships and CSIRO Divisions are included in the Group:

- Water for a Healthy Country National Research Flagship
- Climate Adaptation National Research Flagship
- CSIRO Land and Water Division
- CSIRO Marine and Atmospheric Research Division
- CSIRO Sustainable Ecosystems Division

### **Information and Communication Sciences and Technology**

The Information and Communication Science and Technology Group contains the core of CSIRO's research focus in the sectors of astronomy, information communication technology (ICT) and mathematical services.

The aims of the operational units in the Group are to: understand the universe and its origins; develop globally applicable technologies to respond to genuine needs in the ICT and service domains; and develop innovative technologies and services through mathematical and information sciences research and prototypes.

The Group is comprised of the following CSIRO Divisions:

- Australia Telescope National Facility (ATNF)
- CSIRO Information and Communication Technology Centre
- CSIRO Mathematics and Information Sciences Division

### **Manufacturing, Materials and Minerals**

The Manufacturing, Materials and Minerals Group contains the core of CSIRO's research focus in the materials, manufacturing, minerals, mining, chemicals, health and infrastructure sectors. The focus of the operational units in the Group is to: stimulate and support the creation of sustainable value from Australia's minerals resources over the full market value chain; maximise value to the manufacturing sectors by developing and transferring innovative transformational technologies; and develop new materials and products for application in the health and chemical industries.

The following National Research Flagships and CSIRO Divisions are included in this group:

- Light Metals National Research Flagship
- Minerals Down Under National Research Flagship
- Niche Manufacturing National Research Flagship
- CSIRO Exploration and Mining Division
- CSIRO Materials Science and Engineering Division
- CSIRO Minerals Division
- CSIRO Molecular and Health Technologies Division

### **Developing Research Capability**

In order to maintain CSIRO's position as Australia's premier mission orientated strategic research organisation, CSIRO must maintain excellence in both science and its delivery through research Themes that represent the outcomes toward which CSIRO's investment is directed. Research projects draw on the research capabilities of CSIRO and its research partners. In this way CSIRO is able to create multidisciplinary teams that can effectively deliver Theme outputs. The Flagship Programs are prime examples of this "one-CSIRO" approach. Communication across Themes therefore is an important element in the success of the "one-CSIRO" approach. The ability to communicate Theme

success both internally and externally will serve to reinforce CSIRO's multidisciplinary and cross-boundary capabilities.

Research capabilities are integrated combinations of people (disciplinary skills, experience and know-how), assets (such as research equipment and facilities) and relationships. Each of CSIRO's research Divisions has a number of research capabilities. Capability leaders provide leadership with a focus on science excellence and work collaboratively with Theme leaders on maintaining and developing capability as well as assigning capability to support the delivery of Theme objectives. Part 3 of this Plan provides a description of each capability residing in the CSIRO Divisions, and the key development activities planned for 2008-09.

CSIRO will invest in four Transformational Capability Platforms (TCPs) in 2008-09 with the aim of ensuring the long-term sustainability and future impact of the Organisation by strengthening key cross-organisational groups of capabilities in:

- Sensors and Sensor Network Technologies – develop cross-organisational networks to accelerate the development of capability in these areas.
- Advanced Materials – harness, leverage and integrate current strengths in physics, engineering, chemistry and biology, and remain at the current edge of international advanced materials science for the foreseeable future.
- Transformational Biology – achieve greater integration across existing biological capability, and in particular between biology and mathematics.
- Computational and Simulation Science – this TCP will continue to underpin and provide cross-cutting support to the three TCPs listed above and combine scientific expertise for large-scale deployment of sensor applications.

CSIRO has established a rolling program of rigorous peer review of its science capabilities by independent experts, from both Australia and overseas. The keystone of the review process is the testing by the review panel of each Division's self-assessment of its capabilities. The assessment rating criteria are provided in Appendix 3. Findings by the review panels are provided to the CSIRO Board, along with management's response plans, with a follow up on post review implementation due 12 months later.

## **1.5 Measuring CSIRO's Performance**

### **Performance Measurement Framework**

CSIRO's success is primarily dependent on delivering results with relevance and impact for Australia. This in turn is dependent on:

- Building and maintaining strong relationships with customers, partners, staff and other stakeholders;
- Performing high-quality science; and
- Effective and efficient resourcing of activities.

Taken together, indicators of performance over time in these four crucial dimensions will provide a snapshot of the overall effectiveness of CSIRO's strategy. To provide such a snapshot we have selected key indicators (Figure 5) that pick up important measurable dimensions of the four success factors.

<p><b>Impact: Delivering Results with Relevance and Impact</b></p> <ul style="list-style-type: none"> <li>• <i>Economic, Social, Environmental and Intangible Benefits</i></li> <li>• <i>Progress to National Flagship Goals</i></li> <li>• <i>Intellectual Property and Client Reporting</i></li> </ul>	<p><b>Relationships: Building and Maintaining Strong Relationships</b></p> <ul style="list-style-type: none"> <li>• <i>CSIRO Customer and Partner Feedback</i></li> <li>• <i>CSIRO Staff Satisfaction</i></li> <li>• <i>Health, Safety and Environmental Performance</i></li> </ul>
<p><b>Science: Performing High Quality Science</b></p> <ul style="list-style-type: none"> <li>• <i>Scientific Output</i></li> <li>• <i>Science Infrastructure and Outreach</i></li> <li>• <i>Capability Assessment</i></li> </ul>	<p><b>Resources: Effective and Efficient Resourcing of Activities</b></p> <ul style="list-style-type: none"> <li>• <i>Revenue Mix</i></li> <li>• <i>Staff Composition</i></li> <li>• <i>Investment in Science</i></li> </ul>

Figure 5: CSIRO's Success Measures and Indicators (Source: CSIRO Strategic Plan 2007-2011)

The selection of indicators has been informed by the availability and reliability of data, potential behavioural implications and the needs of a variety of stakeholders.

As illustrated in Figure 6, information on these success measures and indicators is drawn from an underpinning Performance Measurement Framework (PMF) that plays a crucial role in keeping us 'on track' toward our goals. Using the PMF, CSIRO's management and Board regularly review progress and assess performance in four key dimensions:

- Strategy Implementation;
- Program (Theme) Performance;
- Organisational Health; and
- Outcomes (Adoption and Impact). <sup>3</sup>

Taken together, the four dimensions of the performance measurement framework cover strategic and operational considerations relating to performance over both the short and longer term. They incorporate both historical and forward looking perspectives – thus providing a strong foundation of information for analysis and management action – and they provide the information foundation for reporting in accordance with CSIRO's obligations under the Government's 'Outcomes and Outputs' Framework as set out in the following tables from the Portfolio Budget Statements.<sup>4</sup> The CSIRO Annual Report is the key mechanism for reporting our performance to external stakeholders.

<sup>3</sup> Progress against each area of performance is considered by the Executive Team and reported to the CSIRO Board three times a year in an Organisational Performance Report, providing a strong linkage between our plans and our management reporting processes.

<sup>4</sup> For general information on the Outcomes and Outputs Framework see [www.finance.gov.au](http://www.finance.gov.au). CSIRO's section of the Portfolio Budget Statements 2008-09 can be found at [http://www.innovation.gov.au/Section/AboutDIISR/Documents/CSIRO\\_2008-09\\_PBS.pdf](http://www.innovation.gov.au/Section/AboutDIISR/Documents/CSIRO_2008-09_PBS.pdf)

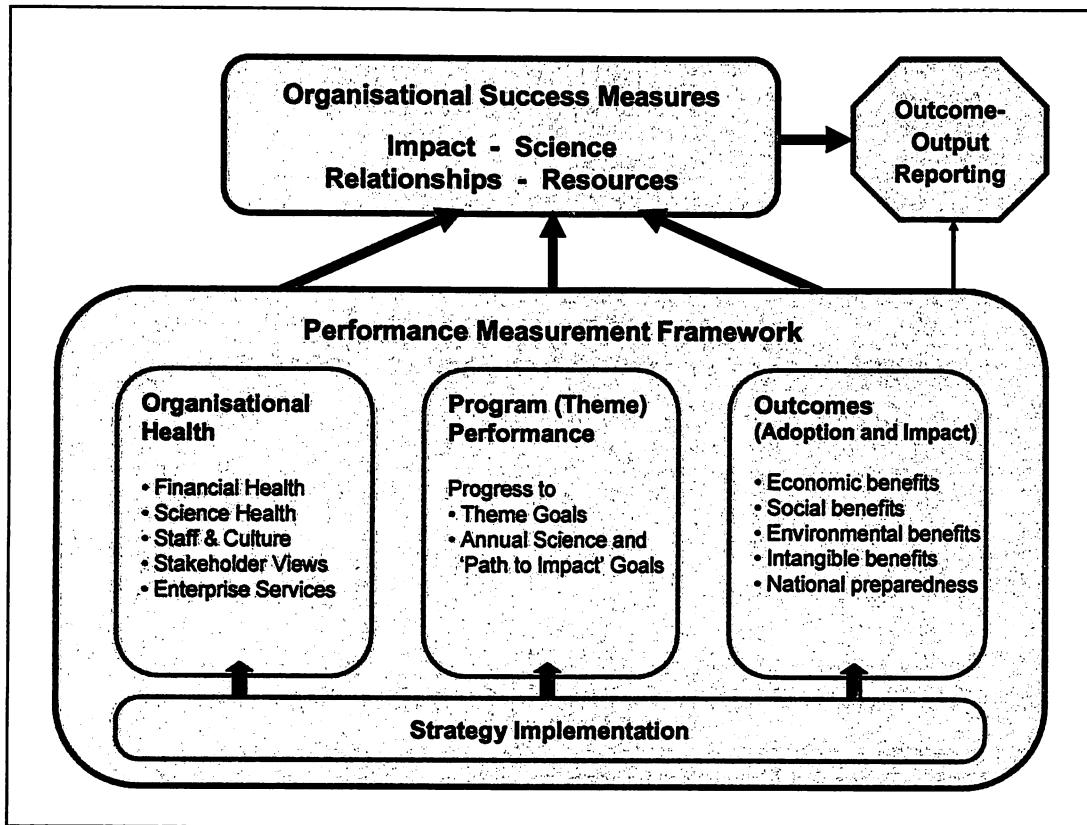


Figure 6: Performance Measurement Framework (Source: CSIRO Strategic Plan 2007-2011)

## Performance Indicators and Targets

The Portfolio Budget Statement for 2008-09 identifies key performance indicators and targets for each of CSIRO's four Output Groups. Each of the indicators is linked to the success measures in the measurement framework outlined above.

<b>Output Group 1: National Research Flagships</b>	
<b>Key Performance Indicators</b>	<b>2008-09 Target</b>
Economic, social, environmental and intangible benefits (Impact)	Demonstrated adoption and impact of Flagship outputs in relation to, for example: Marketed products and services Human health, safety and skills Natural resource management.
Progress to Flagship goals (Impact) Significant progress toward each Flagship goal over the strategic planning period, 2007-2011.	All Flagships have developed a 'path to impact' with reference to major scientific/technical milestones and to the development of relationships or events critical to the achievement of Flagship goals.

<b>Customer and Partner Feedback (Relationships)</b> Improve customer feedback metrics over the strategic planning period.	Continued financial support by Flagship partners. Clusters and other partnerships within each Flagship established as per agreed plan.
<b>Scientific Output (Science)</b> Maintain or increase scientific output and quality.	Maintain or increase the number of refereed publications and new inventions per researcher. Maintain the quality and impact of CSIRO's publications (compared with relevant benchmarks) as indicated by CSIRO's average citation rate and average 'impact factor' of journals in which CSIRO papers are published.
<b>Investment in Science (Resources)</b> Effective and efficient resourcing of activities.	Maintain total investment in National Research Flagships. Investment of the Flagship Collaboration Funds as per agreed plan.

<b>Output Group 2: Core Research</b>	
CSIRO's core research activities contribute across the breadth and depth of the national innovation system by delivering new and improved technologies, management systems, intermediate and final products, catalyst services for business, advice relevant to policy development, and new knowledge and skills.	
Key Performance Indicators	2008-09 Target
Economic, social, environmental and intangible benefits (Impact)	Demonstrated adoption and impact of outputs from Core Research themes in relation to, for example:  Marketed products and services Human health, safety and skills Natural resource management.
Intellectual property and client reporting (Impact)  Increasing commercial use of CSIRO intellectual property assets and continuing delivery of client-focussed reports.	Maintain revenue from intellectual property. A minimum of 8,000 client-focussed reports.
Customer and Partner Feedback (Relationships)  Improve customer feedback metrics over the strategic plan period.	Positive customer feedback and continued financial support by partners.
Scientific Output (Science)  Maintain or increase scientific output and quality.	Maintain or increase the number of refereed publications and new inventions per researcher. Maintain the quality and impact of CSIRO's publications (compared with relevant benchmarks) as indicated by CSIRO's average citation rate and average 'impact factor' of journals in which CSIRO papers are published.
Investment in Science (Resources)  Effective and efficient resourcing of activities.	Demonstrate shifts in investment in accordance with CSIRO's broad direction setting and specific science investment portfolio decisions.  Maintain staffing profile in line with effective delivery of strategic initiatives.

### **Output Group 3: Science Outreach: Education and Scientific Publishing**

CSIRO conducts a range of science education programs for primary and secondary school students and their teachers and hosts the CSIRO Discovery Centre in Canberra. CSIRO also operates CSIRO Publishing as an independent science and technology publisher with a global reputation for quality products and services covering a wide range of scientific disciplines, including agriculture, the plant and animal sciences, and environmental management.

<b>Key Performance Indicators</b>	<b>2008-09 Target</b>
Delivery of quality post-graduate student supervision and teacher- and student-centred CSIRO Education programs.	Maintain or increase the number of participants and visitors in CSIRO Education programs. Maintain or increase the number of post-graduate students sponsored and/or supervised. Maintain high levels of positive feedback from participants, visitors and students.
Delivery, through CSIRO Publishing, of innovative, quality information products and services in the science, technical, health and education sectors.	CSIRO Publishing returns a positive net revenue result. Increase the range and number of publications (comprising journals, books, multimedia and magazines).

### **Output Group 4: National Research Infrastructure: National Facilities and Collections**

CSIRO hosts three major National Research facilities (the Australian Animal Health Laboratory, the Australia Telescope, the Marine Research Vessel Southern Surveyor), as well as the Australian National Fish Collection, the Australian National Insect collection, the Australian National Herbarium and the Australian National Wildlife Collection.

<b>Key Performance Indicators</b>	<b>2008-09 Target</b>
Impact through high quality science	Demonstrated high quality scientific contributions in support of National Research Flagships, CSIRO Core Research and external users. Effective response (and preparedness to respond) to national events.
Relationships	Continued high rates of access to and utilisation of the collections and facilities.
Resourcing	Progress toward the development of effective management arrangements that promote long-term financial viability of, and access to, the National Facilities and Collections.

## **1.6 Managing Risk**

The identification and articulation of risk was integral in the development of the 2007-2011 CSIRO Strategic Plan. Consideration of risk in determining the likelihood of successfully implementing and achieving CSIRO's strategic objectives has resulted in;

- The identification of specific risks associated with the strategy
- Re-calibration and revision of the strategy in light of those risks
- Development of mitigation strategies consistent with the overall strategy

Strategic risks have been identified and categorised in a manner consistent with CSIRO's Performance Framework and Measures of Success. This framework describes how CSIRO's success comes from delivering results with relevance and impact for Australia and this in turn is dependent upon ensuring effective and efficient resourcing of activities, to perform high quality science that is delivered through

strong relationships across all stakeholder groups. Consistent with the overarching thrust of CSIRO's strategy, risks have been identified only where it is clear that the resulting event would hinder CSIRO's ability to achieve impact. In summary, CSIRO's key strategic risks are;

- Risks associated with the resourcing of the enterprise through implementation of major organisational change initiatives, development of enterprise business processes, governance, leadership and infrastructure
- Risks associated with our core science including broad direction setting, attracting talent and developing capabilities
- Risks associated with our relationships in managing the expectations of key stakeholders, partnering and collaborating effectively and achieving growth through commercial relationships
- Risks directly associated with the achievement of impact through the Flagship program, influencing policy and demonstrating impact to the broader community

Operational risks are owned and mitigation strategies implemented by line management. Risk identification is undertaken by the Enterprise Risk Advisory Committee (ERAC), reviewed by the Risk Assessment and Audit Function and monitored by the Board Audit Committee. This is a dynamic process with risk rankings and categorisations reviewed and adjusted on a regular basis.

## 1.7 CSIRO's Board and Management

CSIRO is an Australian Government statutory authority constituted and operating under the provisions of the *Science and Industry Research Act 1949* (SIR Act). Reporting, accountability and other rules for CSIRO's operations are set out in the *Commonwealth Authorities and Companies Act 1997* (CAC Act).

CSIRO is part of the Innovation, Industry, Science and Research portfolio and under the responsibility of the Minister for Innovation, Industry, Science and Research, Senator the Hon. Kim Carr MP. In June 2007, the Minister responsible for CSIRO at that time, the Minister for Education, Science and Training, the Hon. Julie Bishop MP, provided CSIRO with a Statement of Expectations and the CSIRO Board responded with a Statement of Intent. These documents outline the Government's expectations regarding the strategic direction, governance, communication, monitoring and review of the Organisation. The Statements should be read alongside the 2007-08 to 2010-11 Quadrennium Funding Agreement and the 2007-2011 CSIRO Strategic Plan.

The CSIRO Board is responsible to the Australian Government for the overall strategy, governance and performance of CSIRO and gives directions to the Chief Executive. It operates partly through Remuneration, Audit and Commercial Committees and in accordance with a written charter, which is consistent with CSIRO's legislation.

The Chief Executive is responsible to the Board for the overall development of strategy, management and performance of CSIRO. The Chief Executive and Executive Team manage the Organisation in accordance with the strategy, plans and policies approved by the Board.

The Chief Executive is supported by the Executive Management Council which incorporates the Executive Team, Business Unit and Portfolio Leaders and some Corporate General Managers and provides a high level forum for consideration and communication of strategic and management issues. An organisational chart is at Figure 7 and a full list of Executive Management Council Membership is provided in Appendix 4.

The CSIRO Governance Framework incorporates overarching external and internal elements (such as the governing legislation and structures, delegation and advisory mechanisms); and the enabling elements related to directing, controlling and managing and assuring (such as the science investment

process, strategic and operational plans, policy framework and science assessment and performance measurement framework).

The CSIRO Governance Framework and practices were updated during 2007-08 to incorporate and implement amendments to the SIR Act (September 2007), anticipated amendments to the CAC Act, and other outcomes of the Government's Review of the Corporate Governance of Statutory Authorities and Office Holders (the Uhrig review). The CSIRO Authorities Manual was revised to align with Organisational Design Principles and provide information on authorities by position and policy area.

In 2008-09, the Organisation will build on these changes to further improve the Governance Framework and the understanding of roles and responsibilities through better communication.

CSIRO is required to complete an annual Compliance Report to the Government regarding the Organisation's compliance with the CAC Act and its financial sustainability. Internal control mechanisms are in place to support this declaration.

Further information for staff is available on the CSIRO Board and Governance intranet page at <http://intranet.csiro.au/intranet/governance/index.htm>.

**Minister**

The Honourable Senator Kim Carr  
Minister for Innovation, Industry, Science and Research

**CSIRO Board**

Chairman : Dr John Stocker AO

CSIRO Board Members

Prof. Suzanne Cory AC, Dr Terry Cutler, Dr Eileen Doyle, Dr Geoff Garrett,  
Mr Brian Keane, Ms Deborah O'Toole, Prof Alan Robson AM, Mr Doug Rathbone, Prof Tom Spurling AM

**CSIRO**

**Dr Geoff Garrett AO**  
**Chief Executive Officer**

**Dr Alastair Robertson: Deputy Chief Executive**  
**Science Strategy & Investment**  
• Flagships  
• Science Performance Framework  
• Science Strategy  
• Science, Society and Policy  
• Science Investment Process

**Mr Mike Whelan: Deputy Chief Executive**  
**Operations**  
• Governance/CSIRO Board Office  
• Government Relations  
• Risk Assessment and Audit  
• Communications

**Dr Michael Eyles**  
**Executive Director, People and Culture**  
**and Organisational Development**  
• People and Culture

**Mr Craig Roy**  
**Executive Director, Strategic Change Programs**  
• Program Office  
• Health Safety and Environment  
• Business Process and Enabling Technology  
• Research Support Services  
• Project Leadership Initiative

**Mr Nigel Poole**  
**Executive Director, Business Services**  
• Business Development  
• Commercialisation  
• Contract Administration  
• Information Management & Technology  
• Legal  
• Property

**Mr Allan Gaukroger**  
**Chief Finance Officer**  
• Finance

**Dr Joanne Daly**  
**Group Executive, Agribusiness**  
• Entomology  
• Food Science Australia  
• Livestock Industries  
• Plant Industry  
• Food Futures Flagship  
• Preventative Health Flagship

**Dr Bev Ronalds**  
**Group Executive, Energy**  
• Energy Technology  
• Petroleum Resources  
• Energy Transformed Flagship  
• Wealth from Oceans Flagship

**Dr Andrew Johnson**  
**Group Executive, Environment**  
• Land and Water  
• Marine and Atmospheric Research  
• Sustainable Ecosystems  
• Climate Adaptation Flagship  
• Water for a Healthy Country Flagship

**Dr Alex Zelinsky**  
**Group Executive, Information and**  
**Communication Sciences & Technology**  
• Australia Telescope National Facility  
• ICT Centre  
• Mathematical and Information Sciences

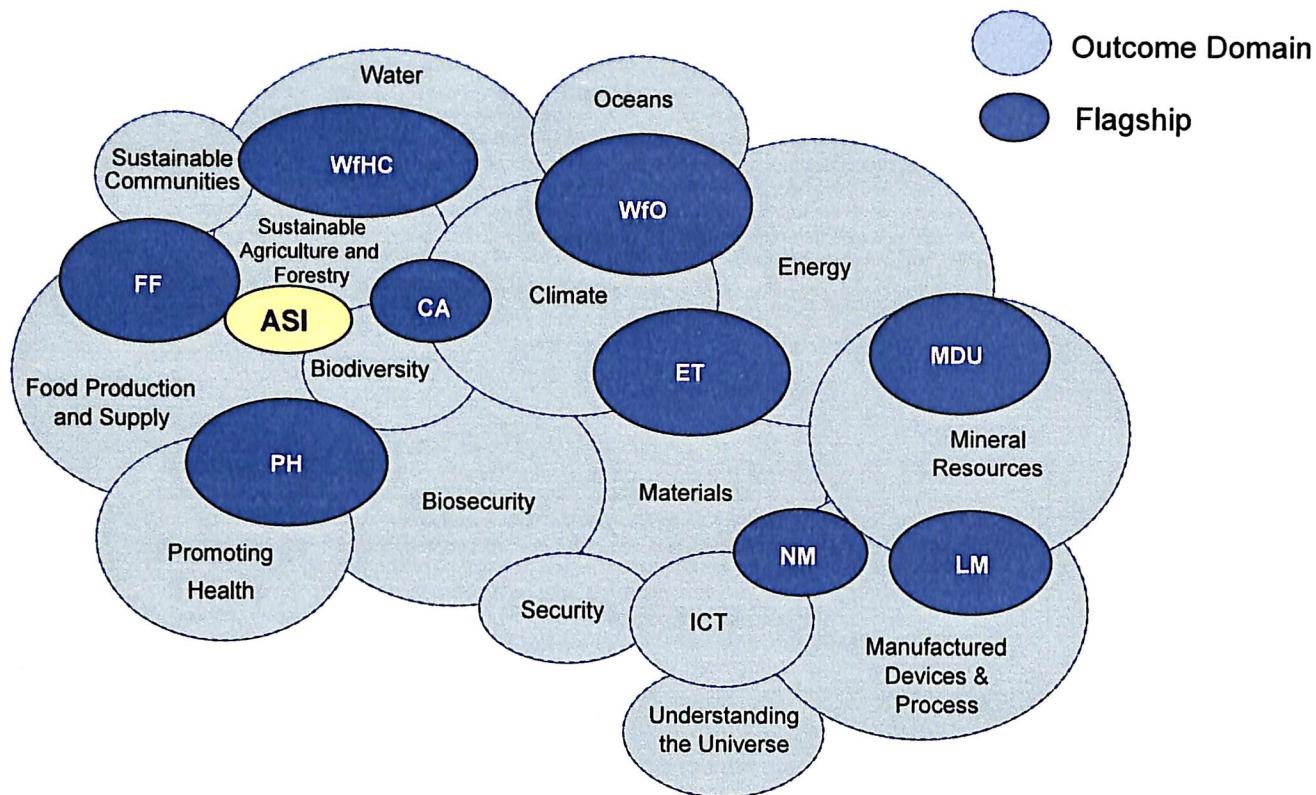
**Dr Steve Morton**  
**Group Executive, Manufacturing,**  
**Materials & Minerals**  
• Exploration and Mining  
• Materials Science and Engineering  
• Minerals  
• Molecular Health Technologies  
• Light Metals Flagship  
• Minerals Down Under Flagship  
• Niche Manufacturing Flagship

Figure 7: CSIRO Organisational Chart (as at 1 July 2008)

## 2. RESEARCH THEMES, ACTIVITIES AND OUTPUTS

### 2.1 National Research Flagships

There are currently nine National Research Flagships which contribute across a range of Outcome Domains as illustrated in the diagram below. The following pages set out the key activities and outputs planned for 2008-09 for each Theme within these nine Flagships.



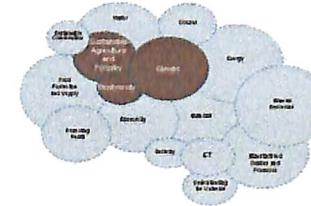
**Key:** WfHC = Water for a Healthy Country    FF = Food Futures    CA = Climate Adaptation    WfO = Wealth from Oceans    PH = Preventative Health  
ET = Energy Transformed    MDU = Minerals Down Under    NM = Niche Manufacturing    LM = Light Metals

The Agricultural Sustainability Initiative (ASI) is currently represented as a portfolio of core research Themes in the Agribusiness Group (page 53).

## 2.1.1 Climate Adaptation

**Director: Andrew Ash**

*Primary Outcome Domains: Climate; Sustainable Agriculture and Forestry; Biodiversity*



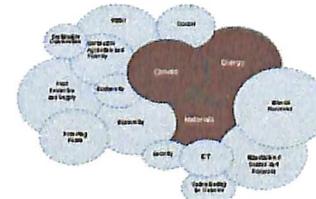
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1155 Pathways to adaptation  (Bryson Bates)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1155 provides underpinning science to assist adaptation in Australia, with a major focus on producing climate change projections and seasonal predictions. By working with end-users to understand their information and engagement needs, and by considering drivers of change other than the direct impacts of climate, the theme will ensure that this information is delivered with more relevance to end users and with reduced uncertainty. Through linkages with other CSIRO Themes and external science partners, such as the National Climate Change Adaptation Research Facility, the theme will deliver consistent and effective approaches to assessing vulnerability and adaptation options across all Australian sectors and regions.</p>	\$6.5m	<p>Future Climates – improving the utility of climate forecasts and projections.</p> <p>Future Vulnerabilities – identifying capability and priorities for adaptation or transformation at national and regional scales through the study of patterns of exposure to climate-related hazards, sensitivity to hazards and resilience.</p> <p>Future Adaptation – developing and testing of approaches for building adaptive capacity that are feasible, minimise adverse economical conditions, recognise new opportunities that enable benefits to be realised, and recognise social considerations such as equity, fairness and justice.</p> <p>Future Drivers – providing the international context within which Australia must respond to climate</p>
1156 Sustainable Cities and Coasts  (Allen Kearns)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1156 provides Australian governments, communities and industry with the knowledge required for effective urban and coastal climate adaptation and sustainable urban development. The theme will develop tools and processes for integrated urban planning, design and development including display projects that demonstrate the adoption of new practices, products and policies that respond to climate change. Through collaborations with standards organisations, and federal, state and local governments, the theme will provide input to adaptation options, rating systems and management strategies that take account of interactions between engineering, economic, social and ecological ways of thinking about people and their needs in buildings, neighbourhoods, cities and urban coasts.</p>	\$9.7m	<p>It is essential that urban management of climate change risks is based on reliable and detailed information, with clear articulation of uncertainties. While there is significant and growing demand for such information, limited data are available for Australian cities and urban coastlines. New research seeks to quantify these risks and uncertainties.</p> <p>Development of targeted partnerships in climate adaptation priority areas and application of new and improved methods for assessing climate change risks for materials and built structures in Australian cities and urbanising coastlines.</p> <p>Improved understanding and identification of key urban and coastal vulnerabilities.</p> <p>Development and acceptance of a framework of agreed urban archetypes that readily inform and allow for investment in climate adaptation and mitigation responses in the built environment.</p> <p>Better understanding of community, government and industry attitudes to risk, urban and coastal vulnerabilities and alternative climate adaptation options to address increasing climate-driven threats.</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1157 Managing Species and ecosystems  (Trevor Booth)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1157 delivers adaptation options to protect Australia's marine and terrestrial species, ecosystems and the services they provide in the face of climate change. The theme is developing the underpinning knowledge needed by ecosystem managers to anticipate and quantify the changes in species and ecosystems, to understand their implications, and to design effective responses to minimise the loss of species and services and to capture opportunities for positive change. The theme will assist all levels of government, private enterprise, natural resource management and conservation agencies to incorporate adaptation into policies and management implementation, particularly in the areas of bushfires, invasive alien species and habitat.</p>	\$5.5m	<p>Develop a long-term perspective of biomass and carbon stocks of rainforests to assist prediction of climate change feedbacks in the terrestrial carbon cycle and development of adaptations to protect biodiversity.</p> <p>Deliver a research adoption program, including preliminary information on climate change, to both land management agencies and volunteer fire fighters, to implement a new dry eucalypt forest fire behaviour prediction system across Australia.</p> <p>Produce new fire behaviour prediction systems for mallee heaths and guidelines for prescribed burning suitable for changing climatic conditions.</p> <p>Sample selected coral reefs south of Tasmania to a depth of 3 kms. Assess the impact of climate on likely viability of these deep-water reefs and outline adaptation options.</p> <p>Develop a Marine Climate Change Report Card for Australia to provide information on how climate change is impacting our marine environment and a basis for developing adaptation responses.</p>
1158 Adaptive enterprises, industries and communities  (Mark Howden)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1158 delivers economic benefits and improved livelihoods for Australia's primary industries and fisheries, and their associated communities, by developing adaptation options in response to a variable and changing climate. The research explores both incremental adaptation to change and the potential need for significant transformation in some communities. The theme builds upon proven participatory action research approaches with stakeholder communities to ensure the relevance and credibility of the management techniques and technologies. Key partners include the Department of Climate Change and Department of Agriculture, Fisheries and Forestry and State equivalents, as well as Rural Research and Development Corporations and innovative farmer groups.</p>	\$5.7m	<p>Review and re-focus existing research on managing climate variability to address new issues, new forecast systems and more effective communication.</p> <p>Progress the assessment of adaptation options in a range of industries leading to better understanding of residual vulnerability to climate change.</p> <p>Determine strategic adaptation needs of resource and extractive industries.</p> <p>Develop approaches to more transformative adaptation options with stakeholders taking into account possible pathways for change.</p> <p>Research will be progressed into technologies for adapting to climate change.</p> <p>Identify mitigation options that may be critically affected by climate change as well as adaptation options that significantly influence greenhouse emissions.</p> <p>Advance relationships with the broad range of clients and stakeholders, leading to joint projects and more effective communication strategies.</p>

## 2.1.2 Energy Transformed

**Director: John Wright**

*Primary Outcome Domains: Energy; Materials; Climate*



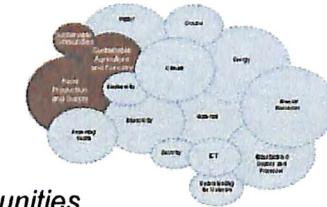
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1016 Energy Futures  (Paul Graham)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1016 develops a range of techno-economic scenarios for the stationary energy and transport sectors and provides tools, data and modelling capability to industry and government departments responsible for policy assessment and investment decision making in the energy, transport and climate domains. This theme will deliver advanced assessment tools that rigorously address social, economic, environmental and technological dimensions of the issue. The theme will build on past engagements and work with other leading Australian modelling teams to assess the role of different energy technologies and their impact on the feasibility of alternative greenhouse gas emission reduction targets.</p>	\$3.2m	<ul style="list-style-type: none"> <li>Develop an appropriate process and engage with partners in examining the feasibility of deep emission cuts in the energy sector by 2020</li> <li>Increase the rigour and transparency of processes for projecting technological change</li> <li>Expand trials of the "Energymark" process for tracking attitudes to energy technologies and climate change</li> <li>Enhance our capability for modelling at multiple temporal and spatial scales</li> </ul>
1017 Low Emissions Electricity  (Jim Smitham)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1017 will move low emissions electricity generation technologies from the laboratory to demonstration projects at a scale that allows those in the large scale stationary energy generation industry to make informed decisions regarding the adoption of technologies. Research areas include post combustion capture, geological storage of carbon dioxide, gasification and renewables. The Theme works closely with industry partners including major Australian power suppliers, the largest power company in China, as well as the government sector and research collaborators, to deliver cost effective solutions and reduce greenhouse gas emissions.</p>	\$27.9m	<ul style="list-style-type: none"> <li>Partner with electricity generators to provide pilot plant scale evaluation of technologies for post combustion capture of CO<sub>2</sub> from power plants to provide industry options for large scale deployment (APP).</li> <li>Develop the models and partnerships required to demonstrate CO<sub>2</sub> storage through enhanced coal bed methane production.</li> <li>Partner with the CO<sub>2</sub> CRC in key aspects of Australia's first geological storage of carbon dioxide demonstration at the Otway project.</li> <li>Develop the linkages and partnerships to capitalise on the Federal National Clean Coal Initiative and Solar Institute</li> <li>Develop the path to commercialisation of cLET gas cleaning technologies through small scale demonstration and partner engagement.</li> <li>Develop the industry and government partnerships for MW scale deployment of CSIRO's SolarGas technology.</li> <li>Demonstrate at the CSIRO Energy Centre, new energy storage concepts to reduce the intermittency of renewable electricity generation.</li> </ul>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1018  Low Emissions Transport  (Mick Wilson)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1018 seeks to reduce greenhouse gas emissions from the Australian transport sector through research in biofuels, synthetic fuels and mobile energy storage. Collaborative arrangements with petroleum companies, car and battery manufacturers, and developing biofuels companies within Australia, USA, and Europe are critical to the success of this Theme. In partnership with industry, CSIRO seeks to develop a secure supply of low-greenhouse gas fuels for the transport sector via research in fossil and biofuels and battery technology.</p>	\$14.3m	<p>Prepare Li-Li symmetrical cells with an electrolyte that allows them to complete 1000 charge-discharge cycles at a current density of 0.5 mA/cm<sup>2</sup>, with &lt;20 increase in average polarization (voltage loss) across the cell.</p> <p>Develop a carbon based supercapacitor that will operate safely at ≥ 3 Volts for more than 100,000 charge/discharge cycles, representing~30% improvement in energy density over current 2.5V devices.</p> <p>Develop a light weight, affordable, safe, high power/high energy and long life combined supercapacitor/lead-acid Ultrabattery for PHEV application and Aluminium battery for PHEV and EV applications.</p> <p>Achieve first production Ultra batteries in Japan, production plan for other territories and engagement for ongoing research.</p> <p>Develop a patentable aluminium battery, with voltage greater than 0.8 V when the cell is discharged at 20 mA cm<sup>-2</sup>.</p> <p>Negotiate Ultrabattery sub-liscence agreements for Europe and China</p> <p>Demonstrate liquid fuels from coal viable at USD \$200/bbl</p> <p>Demonstrate liquid fuels from gas viable at USD \$200/bbl</p> <p>Dimension Australia's biofuel capacity from sustainable crops and evaluate the viability of liquid fuels from biomass.</p>
1019  Low Emissions Distributed Energy  (Terry Jones)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1019 will develop small scale energy technologies and distributed energy systems that facilitate deployment of low emissions, improved efficiency energy to consumers and utilities. Research will be conducted in partnership with industry and other research agencies to achieve wide scale deployment of distributed energy solutions that improve the utilisation of waste heat, and deliver energy management solutions such as coordinated operation of low emission distributed power generators. Theme outputs will inform government policy and provide new technologies that reduce emissions and improve the efficiency of energy systems. We expect to demonstrate economic, environmental and efficiency gains together with reduced greenhouse gas emissions by deployment of distributed energy solutions.</p>	\$9.6m	<p>Construction and commissioning of the VAMCAT demonstration unit. Secure additional funding for demonstration in China. Launch the Zero Emissions Home project in two States with external partners</p> <p>Build a prototype and characterise the performance of a novel desiccant wheel concept for Residential Cooling and engage partners.</p> <p>Design and model a residential scale solar cooling prototype with an industry partner and finalise APP project with India</p> <p>Manufacture and test an initial proof of concept multilayer ceramic thermoelectric module with improved electrical and thermal contact and define path to market.</p> <p>Construct and demonstrate; an energy management system for commercial enterprises that optimises the efficiency of local electrical loads and a domestic-targeted energy management agent. Engage with a commercial partner.</p> <p>Provide reports and simulations of the value proposition for Distributed Energy in Australia.</p>

## 2.1.3 Food Futures

**Director: Bruce Lee**

*Primary Outcome Domains: Food Production and Supply; Sustainable Agriculture and Forestry; Sustainable Communities*



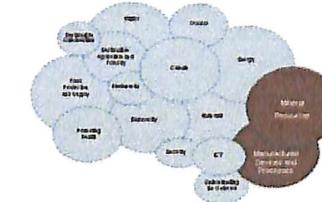
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1020  Future Grains, Grain-based foods & Feed  (Mathew Morell)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1020 seeks to deliver premium grain, grain-based foods and feed products that deliver economic benefits to the Australian grains and grain processing industries, and deliver human health benefits to domestic and overseas consumers. Products such as cereal grains with dietary fibre and digestibility tailored to unmet market needs, low GI rice, and new cereals for premium markets such as celiac friendly cereals, and high value food products for the Asian market are expected from this Theme. CSIRO will continue to partner with industry entities such as commercial food manufacturing organisations, and Australian and international research partners.</p>	\$18.2m	<ul style="list-style-type: none"> <li>Complete the germplasm development phase for two advanced breeding strategies for enhancing the resistant starch and dietary fibre content of wheat.</li> <li>Complete proof of concept studies for two alternative genetic mechanisms linking wheat productivity to enhanced product quality.</li> <li>Evaluation of alternative genetic strategies for high level expression of long chain omega-3 fatty acids in two crop species.</li> <li>Validate the value proposition for a wheat genetic technology for feed grains enhancing yield and grain digestibility.</li> <li>Execute a communications plan promoting Theme research on the bowel and digestive health benefits of grains designed to enhance adoption by industry, health professionals and consumers.</li> </ul>
1021  Breeding Engineering  (Nigel Preston)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1021 seeks to boost the value of Australia's food industries by identifying and utilising genes or gene markers in key traits that underpin the eating and food qualities of products derived from a species. Technologies will be developed by CSIRO in collaboration with the livestock and seafood sectors and research collaborators. Livestock with a higher proportion of high quality muscle groups, and salmon, abalone and prawn breeds with superior growth, disease resistance and market quality are examples of outputs to be delivered through this Theme.</p>	\$12.6m	<ul style="list-style-type: none"> <li>Complete analysis of consumer attitudes to testes stem cell transfer technology. Optimize the production of enriched in vitro cultured beef cattle spermatagonial stem cells and demonstrate their viability in recipient testes.</li> <li>Generate bovine gene muscle networks that are ten fold larger than the current networks and evaluate the impacts of their use to optimize the production of high value muscle phenotypes.</li> <li>Complete the development and IP protection of programmable ultra rapid genetic analysis technology (100 times faster than current processes) and evaluate its effectiveness in enhancing livestock selective breeding programmes.</li> <li>Evaluate the efficacy of the newly refined vaccine against amoebic gill disease (AGD) in Atlantic Salmon using sea cage trials.</li> <li>Achieve a four fold increase in prawn breeding partnerships with Australian prawn farmers and quantify the realized economic benefits of the research at each farm.</li> <li>Complete characterization of bioactive compounds in the patented novel aquafeeds and quantification of their impacts on growth rates in farmed prawns</li> </ul>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1022  Designing Food and Biomaterials  (Ingrid Appelquist) 1022	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1022 seeks to add value to the Australian Agrifood industry by designing tailored raw ingredients for use in the development of healthier foods that meet consumer expectations and demands. Low-energy ingredients and foods with therapeutic properties are examples of the expected outputs of this Theme. Research in the fields of structure engineering and materials science is conducted in collaboration with UK, European Union and Asian, and other Australian research entities. Linkages within the food manufacturing sector have been, or will be established.</p>	\$14.5m	<ul style="list-style-type: none"> <li>Develop technologies that help retain native nutrients, colour and flavour of fruit and vegetables in food products</li> <li>Develop hierarchical structure-function models for proteins in the wet and solid state</li> <li>Demonstrate effects of mucosal interactions with food components on sensory aspects such as lubrication and flavour perception</li> <li>Develop and characterise novel structured ingredient systems with designed textural and flavour delivery properties</li> <li>Demonstrate interdependency between structure, material and sensory properties of full and reduced fat foods and apply approach in delivering optimised concept products for processed cheese, meat and bakery goods</li> </ul>
1023  Quality Biosensors  (Stephen Trowell)	<p><b>Dominant Role: Frontier Science</b></p> <p>The goal of this theme is to deliver a platform technology based on an aroma-sensing technology for understanding, measuring and optimising flavour throughout the wine value chain to meet consumer appeal and improve the competitiveness of the wine industry. Economic benefits are expected to accrue to the Australian wine, grains, horticulture, meat and dairy industries as a result of developing a Cybernose® and biosensors. Research conducted within Theme 1023 is characterised by industry collaboration with commercial entities such as Foster's wine Estates and Orlando Wyndham group.</p>	\$7.2m	<ul style="list-style-type: none"> <li>Optimise performance of the odorant sensor transduction process that was demonstrated in 07/08</li> <li>Determine the specific contributions that grapes make to wine flavour.</li> <li>Determine the relative contributions of sensory and non-sensory attributes in influencing choice amongst wine offerings.</li> </ul>

## 2.1.4 Light Metals

**Director: Raj Rajakumar**

*Primary Outcome Domains: Mineral Resources; Manufactured Devices and Products*



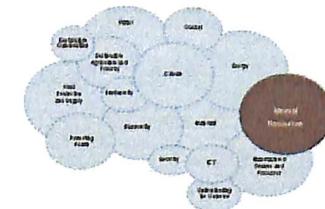
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1000 Aluminium and Magnesium Manufacturing (Kevin Rogers)	<p><b>Dominant Role: Transforming Industry</b></p> <p>The aim of Theme 1000 is to develop technologies to position Australia as a global leader in manufacturing technologies for Aluminium and Magnesium alloy products and deliver economic benefits to Australian industry. Lightweight metal components allow the global automotive industry to manufacture more fuel-efficient cars and trucks, and this theme engages with innovative companies and industry organisations in Europe, the US and Japan to deliver outputs such as diecast aluminium components with superior toughness and fatigue strength, a new casting process for magnesium alloys, and magnesium products with increased strength and less susceptibility to corrosion.</p>	\$8.1m	<p>The high pressure die casting heat treatment technology will be used in production and validated through testing of critical products by global companies.</p> <p>The MagSheet technology will be in production via a business partnership or the technology will be archived.</p> <p>Further develop the Australian partnership in Light Metals Research (the Flagship, CAST CRC, and the ARC Centre of Excellence for Design in Light Metals) via a more integrated approach to global marketing and commercialisation.</p>
1001 Alumina (Chris Vernon)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1001 seeks to increase Australia's share of global alumina production and to improve the environmental performance of the alumina industry. A key target is the development of an economic process for extracting alumina from high-silica bauxite to double Australia's useable Bauxite reserves. It also aims to develop technologies to eliminate the process and environmental problems caused by organic impurities in bauxite, and manage and re-use the large quantities of red mud residue produced. CSIRO will maintain strong relations with alumina refining companies and engineering companies providing services to the industry to ensure timely uptake of the new technologies.</p>	\$8.9m	<p>Complete research to enable PCT patent application for novel high silica bauxite processing technology and bring the technology to an engineering company or a refinery (preferably both) to assess commercial implementation.</p> <p>Commence a major multi-party project on the in-situ remediation of bauxite residue.</p> <p>Deliver to the Asia Pacific Partnership Bauxite Residue project, and the High Silica Bauxite project, collaborating with Indian and Chinese researchers.</p> <p>Conduct fundamental studies of oxidation of organics under bauxite digestion conditions to obtain mass balance and design optimisation data that will enable more efficient Wet Oxidation technology to be patented.</p>
1002 Aluminium (TBA)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1002 seeks to substantially reduce the cost, energy requirement and greenhouse gas impact of aluminium production. Electricity is a major cost for the industry which consumes around 10% of the national supply, most of which is coal-based, so cost, energy and greenhouse benefits are strongly linked. Effort is focussed on transforming the established Hall-Heroult process through new cell configurations, materials, automation, electro-chemistry and waste energy recovery. A new low-temperature process is being developed for a longer term solution. CSIRO links closely with Australian and international companies to achieve this goal through regular industry forums and other activities.</p>	\$7.7m	<p>Develop with industry partners new technologies which include low energy Drained Cathode Cell Technology, electrodeposition of aluminium from ionic liquids and carbothermic production of aluminium, and automation in smelters and implement results in pilot projects.</p> <p>Demonstrate effectiveness of anode coating technology in multiple, full-scale smelter trials and secure license agreements.</p> <p>Investigate the performance of prospective new materials and bath composition for aluminium cells which enable new low-energy electrolytic cell designs.</p> <p>Launch Collaboration Fund Cluster on Aluminium to enhance national research in aluminium production technologies</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1003 Magnesium  (TBA)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1003 aims to develop a magnesium production process that is low cost, energy efficient and has a reduced environmental footprint. This would enable globally competitive magnesium production in Australia to meet predicted strong growth in demand flowing from weight reduction pressures, particularly in the automotive industry. The focus is on a superior carbothermic process to supersede the existing environmentally unsustainable Pidgeon process used elsewhere. Engagement with prospective partners and State Government is expected to result in the development of a pilot stage plant, with full-scale commercial plant design by commercial partners expected in the longer term.</p>	\$1.4m	Achieve technology milestones agreed with partners, secure partner investment and proceed to pre-pilot stage of the MagSonic Process.
1004 Titanium  (Raj Rajakumar)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1004 seeks to contribute to the development of a world-scale titanium industry in Australia through new technologies which significantly reduce the current costs of both metal production and product manufacture, to make titanium competitive with stainless steel. Titanium's superior strength and resistance to corrosion would then grow demand strongly. The focus on production of metal powder and its consolidation directly into products is to allow continuous processing at lower temperatures, and reduce processing steps, contamination, and waste. A major Australian resource processing company and a key global end-user company are investing in scaling up the current laboratory technologies to pilot plant.</p>	\$10.5m	<p>Complete the Stage 1 Feasibility study for a titanium pilot plant with the industry partner subject to satisfactory commercial agreements.</p> <p>Demonstrate continuous production of titanium – aluminium alloys using the Alloy process. Deliver to the agreed joint research and development programs with end user partner.</p> <p>Demonstrate commercial standard product from one powder consolidation technology and form a partnership to commercialise the technology.</p>

## 2.1.5 Minerals Down Under

**Director: Peter Lilly**

*Primary Outcome Domain: Mineral Resources*



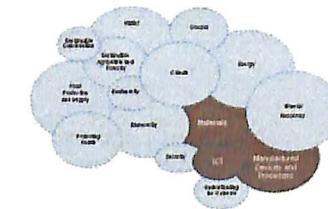
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1160 Discovering Australia's Mineral Resources  (David Gray - Acting)	<p><b>Dominant Role: Transforming Industry</b></p> <p>CSIRO is working with Australian mineral explorers and government agencies to increase Australia's prospectivity and reduce the cost of ongoing discovery of new ore deposits. Theme 1160 seeks to develop technologies to improve the efficiency of targeting and routine 3D geological interpretation and significantly reduce the average cost of discovery. The discovery of new Australian mineral resources is critical to the ongoing sustainability of this industry, and this Theme is strongly aligned across the entire exploration industry from large multinationals to service providers to achieve this goal.</p>	\$22.2m	<p><b>Mineral System Life Cycles and Targeting</b>. Develop and deploy predictive simulation capability including linking geochemistry to geophysics; furthering fundamental understanding of the formation of mineral systems by working with industry in a 3D environment; improve the understanding and technology around detection of the signals of mineral system processes; and the effective collaborative transfer of knowledge and technology to industry and research partners.</p> <p><b>Terrane-Scale Technology Applications</b>. Continue to strengthen relationships and collaboration with Geological Surveys; implement the NCRIS plan for the AuScope Virtual Core Library and AuScope National Data Grid; establish the 3D Mineral Mapping Centre of Excellence; and the ongoing growth of applied terrane-scale projects with the Geological Surveys.</p> <p><b>3D Mapping Technologies</b>. Develop new algorithms for joint geophysical inversion; initiating the Computer Aided Geological Interpretation Project; and the refine spectral and magnetic methods for use in a wide range of imaging and logging applications.</p>
1161 Transforming the Future Mine  (Jock Cunningham)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1161 seeks to transform the Australian mining industry and deliver economic and social benefits through the development and application of safe, next generation geologically intelligent mining and drilling systems that are automated and/or controlled via secure internet connection. Specifically this Theme seeks to develop integrated light weight drill rigs delivering real-time rock characterisation data, rock extraction and sorting systems with optimised real-time mine planning, and non-entry underground mining technologies. Research is conducted by CSIRO in collaboration with equipment manufacturers, service providers and mining companies.</p>	\$13.6m	<p><b>Enhancing Knowledge from Drilling</b>. Demonstrate a scientific understanding of rock-bit interactions; field test an automated drilling optimisation control system; apply microseismic analysis methods to locate drill bits while drilling; test the use of SMART CUT technology in percussive drill bits; and collaborate with industrial partners and clients to transform drilling technologies. Strong planning support will be given to AMIRA to apply for a new Cooperative Research Centre (Deep Exploration CRC).</p> <p><b>Geologically Intelligent Surface Mining</b>. Engage with industry partners to develop and demonstrate in the field the long range teleremote operation of selected mining equipment with trials of machine-mounted mineral sensors. Human factors science and geological sensors will be integrated into the design of machine control systems.</p> <p><b>Non-entry Underground Mining</b>. Industry funded projects will begin to develop and trial new, remote-controlled, non-entry mining systems in the field and to develop concepts for the underground extraction of unconsolidated material such as mineral sands. An industry partner will be engaged to begin transforming the way that mines are constructed by use of hard rock cutting mining machines.</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1162 Securing Australia's Future Ore Reserves  (Jonathan Law)	<p>Dominant Role: Major National Challenge</p> <p>The goal of Theme 1162 is to develop new processing technologies for iron ore, copper, gold, nickel and mineral sands to allow new or currently uneconomic deposits to become both technically and economically viable, thus "unlocking" an expected \$650B worth of value by 2030. CSIRO collaborates with both large and small organisations to identify potential solutions to current mining and processing problems and to ensure improved processing technologies are being developed, more broadly tested and readily adopted.</p>	\$9.8m	<p><i>Systems Geometallurgy for Next Generation Iron Ore &amp; Mineral Sands.</i> Demonstrate new methods for efficient impurity removal from iron ores and the conceptual development of advanced processing strategies that are directly linked to the geological characteristics of fine-grained mineral sands.</p> <p><i>Controlled Leaching of Low-Grade and Refractory Nickel, Copper &amp; Gold Ores.</i> Link surface chemistry, microbe interactions and the kinetics of leach performance tests; develop preliminary integrated models of leaching techniques for lateritic ore; and assess the performance of alternative ligands for the leaching of complex gold systems.</p> <p><i>Towards the "Invisible" Mine.</i> Develop an integrated concept for the in-situ leaching of base metals and gold.</p>
1163 Driving Sustainable Processing Through Systems Innovation  (Sharif Jahanshahi)	<p>Dominant Role: Transforming Industry</p> <p>Theme 1163 will develop technologies to reduce average unit greenhouse gas emissions, average unit water usage, and average unit residue production of the Australian minerals sector. A key platform of CSIRO's work in this Theme involves extensive engagement with industry, regulators, NGOs, government agencies, universities and others to define and meet the Australian minerals industry's 'social license to operate'. Major mining companies such as BHP Billiton, Rio Tinto, BlueScope Steel, OneSteel and Xstrata are engaged in this Theme to ensure technology uptake.</p>	\$7.7m	<p><i>Mineral Futures.</i> Commence a participatory scenario development and assessment program (the Mineral Futures Forum) and link Minerals Down Under into existing strategies for Indigenous engagement, effective mine closure planning and sustainable regional planning.</p> <p><i>Technologies for reducing GHG Emissions and Fresh Water Usage.</i> Demonstrate heat recovery, dry granulation of slag, steel re-carbonisation and high-intensity water treatment.</p> <p><i>Maximising Resource Utilisation – Towards Zero Waste &amp; Emission.</i> Proof-of-concept for the early removal and safe disposal of trace metals from waste streams and the demonstration of geo-polymer fabrication from waste materials.</p>

### **2.1.6 Niche Manufacturing**

## **Acting Director: Greg Simpson**

## **Primary Outcome Domains: Manufactured Devices and Processes; ICT; Materials**



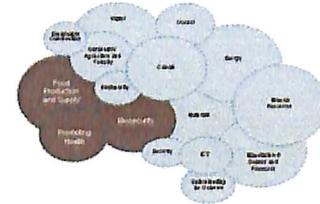
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1090 Electroactive Materials  (Gerry Wilson)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1090 works with domestic and international partners from industry and academia to develop radically new polymer technologies for use in plastic electronics. Potential deliverables of this Theme include photovoltaic cells capable of converting solar energy to electricity, printable polymer electronics use in printable electronic circuits, smart documents and textiles, flexible displays, zero emissions power generation and energy efficient lighting systems. As a result of uptake of technologies developed within this Theme, economic benefits are expected to be delivered to the energy, materials and health sectors, and environmental benefits are also anticipated.</p>	\$9.0m	<p>Develop new organic photovoltaic materials. Meet material and device efficiency milestones within the SERD-funded project.</p> <p>Develop new charge transport polymers. Establish fully funded projects with industrial partners.</p> <p>Build HTPS capability. Successfully implement the ODF <math>\geq 2</math> seconds into world leading HTPS labs.</p>
1166 Nanomaterials for Medical Discovery  (John Tsanaktsidis)	<p><b>Dominant Role: Transforming Industry</b></p> <p>This Theme seeks to develop a new polymeric nanomaterials platform for utilisation within the medical delivery sector. The goal of Theme 1166 is to transform the Australian biomedical industry through the development of next generation, polymer-based drug delivery technologies that will lead to safer, more effective medicines. The theme seeks to engage with industry partners to deliver economic and social benefits to the medical sector. The initial focus, by 2013, will be on the design and development of therapeutic targets for oncology, diabetes and infectious diseases that will be transferred to the Australian pharmaceutical manufacturing sector by 2015.</p>	\$2.5m	<p>Initiate research program into the design and synthesis of attachable RAFT agents.</p> <p>Initiate research program into the synthesis of polymer conjugates of small-molecule drug, therapeutic protein and RNAi targets.</p> <p>Initiate research program into new modelling and simulation technology.</p> <p>Validate Theme approach through engagement and collaboration with external (national and international) groups and potential receptor companies.</p>
1167 Analysis at a Point of Sampling  (Tim Davis)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1167 seeks to develop new ways of sensing chemicals, biochemicals and biological entities using nanotechnology and to apply this technology in the areas of environmental sensing and biomedical sensing to address the needs of end-users. Environmental sensors will be developed to detect bacterial pathogens, nutrients and organic contaminants in water, and deliver substantial benefits to a broad range of industries. Biomedical sensors and diagnostics will detect biological entities such as proteins and viruses and deliver benefits to the medical and health sectors.</p>	\$3.3m	<p>Complete evaluation and trials of the alpha prototype developed by an external company for the nanoBang technology and develop a commercialisation plan for the technology if the evaluation outcomes are positive.</p> <p>Develop a laboratory prototype of a Surface Enhanced Raman Spectrometer to determine its suitability as a low-cost point-of-sample chemical sensor and report on the feasibility of miniaturising the technology.</p> <p>Foster capability development in sensors and sensor systems through strategic research into sensing and transduction technologies and produce at least three scientific publications.</p> <p>Engage at least two end-users and/or potential manufacturers of sensor technologies to develop a plan for commercialising existing technologies and for directing research to address sensor needs.</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1168 Carbon Nanotube Yarn  (Shaun Smith)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1168 aims to support the establishment of an innovative Australian business in the production of carbon nanotube yarn. Carbon nanotube yarn has potential application in the biomedical and high strength materials sectors. Particular novel properties of carbon nanotube yarn include exceptional strength, as well as electrical and heat conductivity. The theme seeks to develop superior carbon nanotube yarn by 2009, and work in collaboration with industry partners to incorporate the yarn into high strength materials and biomedical devices by 2010.</p>	\$1.8m	<ul style="list-style-type: none"> <li>Complete yarn properties investigation to deliver target technical requirements of high strength and conductivity.</li> <li>Select the best reactor design model to take forward to pilot scale facility stage.</li> <li>Scale up yarn production from 6m/hr to 60m/hr through superior spinning and automated wafer handling.</li> <li>Develop a prioritised list of the top prospective commercial partners and select application areas that represent the highest potential for industry take up. Sign non-disclosure agreement with one likely end-user.</li> </ul>
1169 Nanosafety  (Maxine McCall)	<p><b>Dominant Role: Major National Challenge</b></p> <p>The purpose of the Nanosafety Theme is to ensure that nano-research and product development is performed in a safe and socially responsible way. Theme 1169 seeks to assess and understand the impacts of nanomaterials and nanomaterial-containing products on human health and the environment. It aims to develop rapid and inexpensive bio-assays to monitor human exposure to nanomaterials in the workplace, and to determine the impact on ecosystems from exposure to these nanomaterials. It is anticipated health benefits will be delivered as a result of this research. The theme engages with the Australian Office of Nanotechnology's Health, Safety and Environmental Working Group for Manufactured Nanomaterials, and the OECD Program for Safety Testing of Manufactured Nanomaterials.</p>	\$1.8m	<ul style="list-style-type: none"> <li>Methods developed for measuring physical and chemical properties of nanoparticles, both in pristine and bio-fouled conditions.</li> <li>Bio-assays developed to measure the impact of nanoparticles on living systems.</li> <li>Methods developed for tracking nanoparticles in the environment and in living systems.</li> <li>Engagement with Australian Government agencies to develop an Australian consortium for testing toxicities of manufactured nanomaterials in an international programme coordinated by the OECD.</li> </ul>

## 2.1.7 Preventative-Health

**Director: Richard Head**

*Primary Outcome Domains: Promoting Health; Food Production and Supply; Biosecurity*



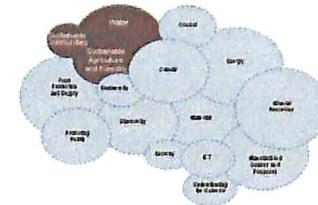
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1025 Colorectal Cancer and Gut Health  (Trevor Lockett)	<p>Dominant Role: Major National Challenge</p> <p>Through closer integration of CSIRO, university, clinical and consumer-focused research efforts, Theme 1025 seeks to reduce the incidence, morbidity and mortality from colorectal cancer (CRC) and inflammatory bowel diseases (IBD) in Australia. Benefits include improved quality of life and productivity for CRC and IBD sufferers; a reduced rate of increase in Government health expenditure on chronic diseases of the gut; and financial returns for Australian enterprises. These benefits will be delivered via successful commercialisation of protective foods and diagnostics, their uptake into the clinic and community, and by influencing government or clinical guidelines relating to prevention, detection and screening.</p>	\$14.3m	<ul style="list-style-type: none"> <li>Initiate a clinical trial on ileostomy patients to test the delivery and impact of microencapsulated Omega 3 oils. Continue animal studies on the impact of omega 3 oils on the prevention of CRC.</li> <li>Initiate a two year, diet-based clinical trial with Starplus™ evaluating Starplus™ for suppression of colorectal cancer in familial cancer patients.</li> <li>Initiate human clinical trial with Starplus™ in oral rehydration solutions for the treatment of infectious diarrhoea in India. Projected funded by the IndoAustralia Fund.</li> <li>Initiate two co-funded clinical trial with Starplus™ on the prevention of diarrhoea on pre and post weaning piglets.</li> <li>Two candidate novel protective foods evaluated preclinically for their ability to suppress colon cancer formation by June 2009</li> <li>Consumer Risk Perception. (1) Commence activities on successful NHMRC and SA Cancer Council grants and (2) design and implement a 2 year program aimed at enhancing bowel screen uptake to approximately 60%</li> <li>High throughput sequence analysis of one lead chromosomal region-of-interest to identify a candidate gene within potentially predisposing carriers to familial colorectal cancer completed</li> <li>Complete colorectal cancer protein-biomarker case/control qualification study in stool in collaboration with a commercial partner</li> <li>At least ten new candidate protein biomarkers of colorectal cancer evaluated in case and control blood samples</li> </ul> <p>Complete first evaluation of potential down regulated biomarkers of colorectal cancer in humans using DNA methylation assays</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1026  Neurodegenerative disease, mental disorders and brain health  (Jose Varghese-Acting)	<p><b>Dominant Role: Major National Challenge</b></p> <p>The increasing health costs and lost productivity from neurodegenerative diseases, exacerbated by an ageing population, is a major national problem. Theme 1026 seeks to delay the onset of Alzheimer's and other neurodegenerative diseases through early detection and prevention, including lifestyle changes, by developing (a) highly sensitive and specific biomarkers for early stage disease diagnosis, (b) a preventive strategy including protective agent discovery, and (c) functional neuro- and molecular imaging approaches to delineate structural and molecular changes in the brain. Clinical alliances and collaborations, commercialisation partnerships, government policy engagement, and direct advice to the Australian public on exercise and diet programs are central to the delivery of this theme's goals.</p>	\$9.8m	<p>Complete follow-up (18 month) evaluation for the AIBL (Alzheimer's disease) Cluster Study</p> <p>Enter into at least two further research collaborations using the AIBL Study outputs with commercial partners.</p> <p>Collaborate with an Australian SME on peptide interactions with A-beta and development of a diagnostic kit</p> <p>Develop a prototype non-invasive neuroimaging technology for diagnosis of neurodegenerative diseases</p> <p>Test lead molecules that have been demonstrated to interact with beta-amyloid in an animal model of Alzheimer's disease</p>
1027  Health Data & Information  (Christine O'Keefe)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1027 is developing new ICT, mathematical and statistical methods needed to generate useful information from complex multi-media, cross-scale, longitudinal and linked biological and health data sets. Improved privacy-respecting integration and analysis of these health data will enable a better understanding of initiation, progression, diagnosis, treatment and prevention in the key disease states of interest to the Preventative Health Flagship (colorectal cancer, Alzheimer's, obesity). Applying these methods in collaboration with other scientists, clinicians and government stakeholders will enhance evidence-based clinical care and guide the development of health policy – thus helping to improve the health and wellbeing of Australians and to curtail health care costs.</p>	\$7.6m	<p>Demonstrate on-site use of the Patient Journey Browser to assemble and view patient timelines from data integrated with HDI</p> <p>Complete development of a concept demonstrator to deliver tailored weight management information and facilitate family engagement in healthy living</p> <p>Build a proof-of-concept system to enable P-Health biological experimental data to be shared, integrated, analysed and visualised in a collaborative online environment</p> <p>Progress the Australian Cancer Grid collaborative research projects as planned and agreed</p> <p>Complete prototype colonoscopy simulator and progress towards agreement for its transfer to a commercial partner</p>
1146  Obesity and Health  (Peter Clifton)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Rates of obesity in Australia are increasing in all age groups with a consequent explosion in Type 2 diabetes as well as increasing cardiovascular disease. Theme 1146 seeks to arrest the rise in obesity by delivering solutions - lifestyle strategies, novel functional food products/ingredients and pharmaceutical interventions - that assist individuals to control their weight. The theme combines disparate disciplines such as social and environmental science, nutrition, exercise physiology and biochemistry to design, produce and substantiate the efficacy of these solutions – and will translate results into products for industry and information for the public, health professionals and government.</p>	\$5.9m	<p>Refocus Theme 1146 on fewer targeted areas with emphasis on partnership with Government agencies by June 2009</p> <p>Undertake community trials through general practice of the heart health diet program. Handbooks for children's health. Studies to assess, understand and influence children's food intake</p> <p>Determine the influence of high protein diets on human health in particular bone and kidney health</p> <p>Identify one inhibitor of fatty acid synthesis by June 2009</p>

## 2.1.8 Water for a Healthy Country

**Director: Tom Hatton**

*Primary Outcome Domains: Water; Sustainable Agriculture and Forestry; Sustainable Communities*



Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1006 Urban Water  (Alan Gregory)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1006 provides government and industry clients with affordable solutions to key challenges in integrated urban water management to balance supply and demand, conserve and recycle water, improve treatment and distribution processes, protect receiving environments and manage pollution, improve urban design, and optimise infrastructure management to ensure that policies and infrastructure investments maximise social, environmental and economic benefits and that chosen strategies can be successfully implemented. Well-established relationships with State water planning agencies and utilities, the NWC and the e-Water CRC, help inform choices that minimise greenhouse impacts, optimise infrastructure investment decisions and facilitate growing public confidence in the performance of urban water systems to protect public health and meet service expectations.</p>	\$27.3m	<p>Hydro Planner integrated water quantity and quality model implemented at catchment scale in South East Queensland, supplemented by development of a Life Cycle Assessment framework and downscaled climate change data to evaluate the water quantity, nutrient and energy impacts of future water strategy alternatives. Energy impacts of current and future Australian and New Zealand water utility operations evaluated in collaboration with the Water Services Association of Australia.</p> <p>Alternative approaches to water recycling and stormwater harvesting progressed through development of risk based national guidelines for managed aquifer recharge, evaluation of stormwater options in the Australian Capital Territory and South East Queensland, assessment of decentralised water service developments for the National Water Commission, development of non-potable recycled water cross connection detection technologies.</p> <p>Further development of the Pipeline Asset and Risk Management System (PARMS) asset management forecasting tools through ongoing infrastructure deterioration research and increased engagement with Australian water utilities via a collaborative partnership with the Water Services Association of Australia.</p> <p>Potential public health and ecological risks identified in the wastewater network and storage reservoir treatment barriers for South East Queensland's purified recycled water supply scheme and monitoring methods for management of these risks evaluated. Ongoing social acceptance research to inform the Queensland Government community engagement program.</p> <p>Ongoing development and evaluation of new membrane materials to reduce energy required for desalination and recycling in collaboration with Advanced Membrane Cluster. Membrane distillation pilot project applied to waste stream recovery in industry.</p>

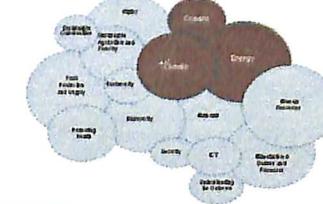
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1010 Water Resources Observation Network  (Ross Ackland)	<p><b>Dominant Role: Major National Challenge</b></p> <p>By developing knowledge and tools at the interface between information systems and water resource science, Theme 1010 is establishing the science and technology platform to transform Australia's water resources data into a nationally accessible, consistent and timely information system that delivers water accounts, assessments and forecasts to meet the demand for improved management, reporting and forecasting of water resources. Partnerships with the Bureau of Meteorology (the Water Information Research and Development Alliance), and with State based agencies and water data custodians, contribute to the definition of research directions and also provide delivery pathways to research users, regulatory and monitoring agencies and a range of industry sectors.</p>	\$15.0m	<p>Work with the Bureau of Meteorology to deliver WRON research under the Water Information Research and Development Alliance (WIRADA). This will include working with the Australian Water Resources Information System (AWRIS) team to define the architecture for AWRIS. Develop Water Resources &amp; Assessment tools and stream flow forecasting and prediction tools.</p> <p>Convergence of the WRON Reference Model standards for water observations with international standards.</p> <p>Major state based engagement through delivery of the National Water Commission funded Condamine Balonne project.</p> <p>Continued deployment of sensor networks through Tasmania ICT Centre. In collaboration with the Tasmanian Department of Primary Industries and Water and the Bureau of Meteorology set up real time rainfall monitoring network in South Esk region to enable flow event management.</p>
1136 Healthy Water Ecosystems  (Bill Young)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1136 provides support for the development and application of plans, strategies and actions to (a) protect and restore the health of water ecosystems, and (b) increase their ecological, social and economic benefits to Australian communities in the face of climate change and development pressures. Integrating hydrology, ecology, economics and sociology, the Theme works collaboratively with research partners and government agencies to develop (i) methods and tools for environmental flow determinations; (ii) frameworks for assessing water ecosystem condition/health; and (iii) approaches for establishing different levels of protection for water ecosystems around the country, that are scientifically robust, nationally applicable and recognise both ecosystem values and socio-economic needs.</p>	\$18.3m	<p>Demonstration environmental water management model which allows quantitative analysis of hydrologic and ecological changes, including scenario analysis for climate change and river management impacts on ecosystem health of the entire River Murray to support development of the new River Murray Water Allocation Plan and the new Murray-Darling Basin Plan.</p> <p>Draft guidelines for Barmah-Millewa Forest Icon Site Asset Managers on prioritisation of goals and targets for conservation and management of flood-dependent native vegetation communities in relation to climate change and environmental flow scenarios. Guidelines presented to Goulburn Broken Catchment Management Authority.</p> <p>Transfer of ecosystem monitoring approach to management including (i) draft monitoring protocol for the Living Murray initiative to underpin the MDBA Integrated Basin Reporting; and (ii) guidelines for assessment, monitoring and evaluation of water quality aspects of ecosystem health in the Great Barrier Reef.</p> <p>Demonstration of capacity to carry out large scale integrated assessments to support policy development in the Great Barrier Reef region through analysis of the post-2013 impacts of Reef Rescue. Partnerships and collaborations established, and model and data assembly completed.</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
			Review of the knowledge on sources, dynamics and ecological functions of dissolved organic matter in coastal water ecosystems and identification of research priorities to guide estuarine management.
1137 Better Basin Futures  (Glen Walker)	Dominant Role: Major National Challenge  Theme 1137 will provide options for managing river basins and allocating groundwater resources based on the integration of hydrological, social, institutional and economic analyses at the basin scale. It will enhance water supply, substitution and productivity through design, analysis and testing of river basin-wide system management options, including more accurate prediction of the impacts of future climate and land use. Systems knowledge and analytical tools needed to support reliable and secure water allocations for irrigation, towns and the environment will be developed and implemented through partnerships with water managers, government agencies, Australian and international research collaborators, and the engineering professional service industry.	\$28.0m	<p>Water Assessments for Northern Australia, South West Western Australia and Eastern and Northern Tasmania for different climates and land uses. Quantified changes in water availability and reliability of surface and groundwater resources for the three different regions.</p> <p>Measurement and modelling of groundwater-surface water exchanges. Models, modelling protocols, measurement protocols and a series of measurements at significant scales for both gaining and losing streams.</p> <p>Analysis of historical and future climate for South-Eastern Australia and how it relates to surface water generation. Future climate scenarios, stream forecasting methods, downscaling methods for South-Eastern Australia and predictions of climate-streamflow impacts.</p> <p>Irrigation Infrastructure Hotspots Assessment. Comprehensive knowledge database of irrigation water information across Australia and an agreed standardised methodology to identify the causes and quantity of water losses in their delivery systems.</p> <p>Development of new river modelling tools. Generic river planning models incorporating water management rules, groundwater surface interactions and response to interception activities.</p>

## 2.1.9 Wealth from Oceans

**Director:** Kate Wilson

*Primary Outcome Domains: Oceans; Climate; Energy*



Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1064 The Dynamic Ocean  (Andreas Schiller)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1064 will create and exploit knowledge of ocean variability and change that is critical for the safe, efficient and sustainable use of Australia's marine wealth (fisheries, oil and gas, tourism) and for climate-sensitive terrestrial industries. Focusing on physics and biogeochemistry, we will build a strong platform for other Themes' research on ocean and climate issues, and deliver robust tools and knowledge to decision-makers in industry, government and the community. Key external stakeholders include the Royal Australian Navy, Australian Marine Safety Authority, the oil and gas industry, Department of Climate Change, Bureau of Meteorology, WA Government, Australian Fisheries Management Authority, maritime transport operators and investors in ocean renewable energy.</p>	\$12.4m	<p>BLUElink II: Progress development of an enhanced ocean forecasting system due for delivery to BoM and RAN in 2010; including forecasting capability for the littoral zone.</p> <p>Capitalise on National Collaborative Research Infrastructure Strategy (CRIS) funding of the Integrated Marine Observing system (IMOS) initiative supporting BLUElink and climate work in this Theme.</p> <p>Through the Western Australian Marine Science Institution, initiate research activities on Indian Ocean predictability and its impact on regional currents, the Leeuwin current and its impact on shelf ecosystems.</p> <p>Through participation in the Australian Climate Change Science Program (ACCSP) and the Antarctic Climate and Ecosystems (ACE) CRC provide improved estimates of sea-level rise, ocean carbon cycle/acidification and Southern Ocean circulation changes due to climate change.</p> <p>Complete due diligence studies in "ocean renewable energy" and "operational coastal ocean observing systems &amp; forecasting".</p>
1065 Ocean based industry development and growth (Blue GDP)  (Edson Nakagawa)	<p><b>Dominant Role: Transforming industry</b></p> <p>Theme 1065 aims to deliver transformational benefits to Australia's most promising ocean-based industries. A major focus is on developing technologies to enable economically viable extraction of Australia's offshore oil and gas reserves, thus contributing to Australia's energy security, wealth creation and transition towards lower emissions energy. The theme also seeks to develop and support other marine based industries (eg novel biotechnology products based on marine organisms, new technologies for monitoring and detection in the marine environment, exploitation of seabed resources, and antifouling technologies for the shipping industry). Partnerships with industry, academia and government agencies ensure the required capability is brought to bear and facilitate path to adoption and impact.</p>	\$23.0m	<p>Manufacture improved and effective surfaces with quantified fouling prevention based on iterations of the initial materials and new materials</p> <p>Parameterize a predictive model based on laboratory simulations that describes the response of reservoirs to MEOR and conduct scaled simulations to test sensitivity</p> <p>Advance Multi-physics Rock Characterization methods using phase contrast x-ray imaging to reveal gas water interfacial structure at pore level</p> <p>Launch CSIRO's active contribution to the International Ocean Drilling Program (IODP), the world's largest collaborative geo-science project in the ocean domain</p> <p>Conclude TURI project delivering to four industry sponsors outcrop-seismic- and drilling- based models of reservoir connectivity and impacts on oil production in water drive scenarios</p> <p>Finalise technology transfer phase of Integrated Predictive Evaluation of Traps and Seals (IPETS) consortium project with diverse delivery of techniques for petroleum trap identification, appraisal and risking</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
			<p>Build and test a high pressure gas-liquid separator prototype</p> <p>Implement Near Wellbore Characterisation Tool for completion optimization of horizontal wells in two field cases and finalise development of the multi-lateral wells module</p> <p>Perform screening and comparison of Relative Permeability Modifiers and further develop novel chemical structures with enhanced characteristics</p> <p>Perform initial experiments on hydrates transportability in gas dominant flows on hydrates flow loops at CSIRO and IFP</p> <p>Secure external engagement in: (a) at least 2 of the projects in Novel Ocean-based Industries Stream; (b) multi component hydrocarbon sensor, after establishing IP position; (c) designer fluids; (d) pipeline monitoring; and (e) Shale Research Centre (SHARC) (at least one strategic partner and three consortium industry collaborators)</p> <p>Commercialise Near Wellbore Characterisation Tool (single horizontal well module)</p>
1066 Ocean based regional development and growth (Marine Nation) (Bill de la Mare)	<p>Dominant Role: Major National Challenge</p> <p>Australia's huge marine and coastal ecosystems are subject to growing pressures, arising from rapid coastal population growth and development, catchment degradation, marine industries (eg tourism, aquaculture, shipping, fishing, oil and gas) and climate change. Theme 1066 provides integrated information systems and predictive / planning tools to support effective multiple-use management of these ecosystems for sustainable economic, social and environmental benefits. The theme conducts multi-disciplinary research that spans spatial and temporal scales (eg biophysics, observation technologies, modelling and risk assessment, socio-economics), and supports the implementation of research findings through close linkages to policy makers, planners and management authorities.</p>	\$16.0m	<p>Develop calibrated Ningaloo multiple-use system model for Ningaloo Collaboration Cluster.</p> <p>Integrate Derwent/Huon underwater sensor network with biogeochemical models</p> <p>Develop management strategy model for Derwent/Huon aquaculture</p> <p>Develop stage 2 management strategy model for the SE Queensland Healthy Waterways Partnership.</p>
1133 Sustainable Australian Fisheries and Ecosystems (David Smith)	<p>Dominant Role: Major National Challenge</p> <p>Australia's marine fisheries have a large, social, ecological and political footprint. They are of great importance to regional communities and support significant export industries - but overexploited resources and pressure on marine ecosystems risk significant loss of resource productivity and biodiversity. Theme 1133 will develop the integrated multi-disciplinary scientific understanding, robust policy advice and management tools required to support the transformation of Australian fisheries, and those of our Pacific neighbours, to an economically productive and ecologically sustainable future. The Theme's path to impact comprises direct partnering with key Commonwealth and State agencies; engagement in scientific assessment groups reporting to management advisory committees; partnerships with industry; and key roles in a number of regional fisheries management organisations.</p>	\$16.0m	<p>Extend package of ecological risk assessment tools for Commonwealth fisheries</p> <p>Assist the Australian Fisheries Management Authority (AFMA) to meet its obligations from the Ministerial Direction through implementation and evaluation of scientifically based harvest strategies for key fisheries</p> <p>Develop options for integrated spatial management for fisheries</p> <p>Develop and evaluate the efficacy of new observation technologies for understanding marine resources</p> <p>Progress towards developing standards to measure performance against triple-bottom line objectives</p> <p>Develop integrated tools that couple ecological, economic and social models to support sustainability at whole-of-fishery level</p>

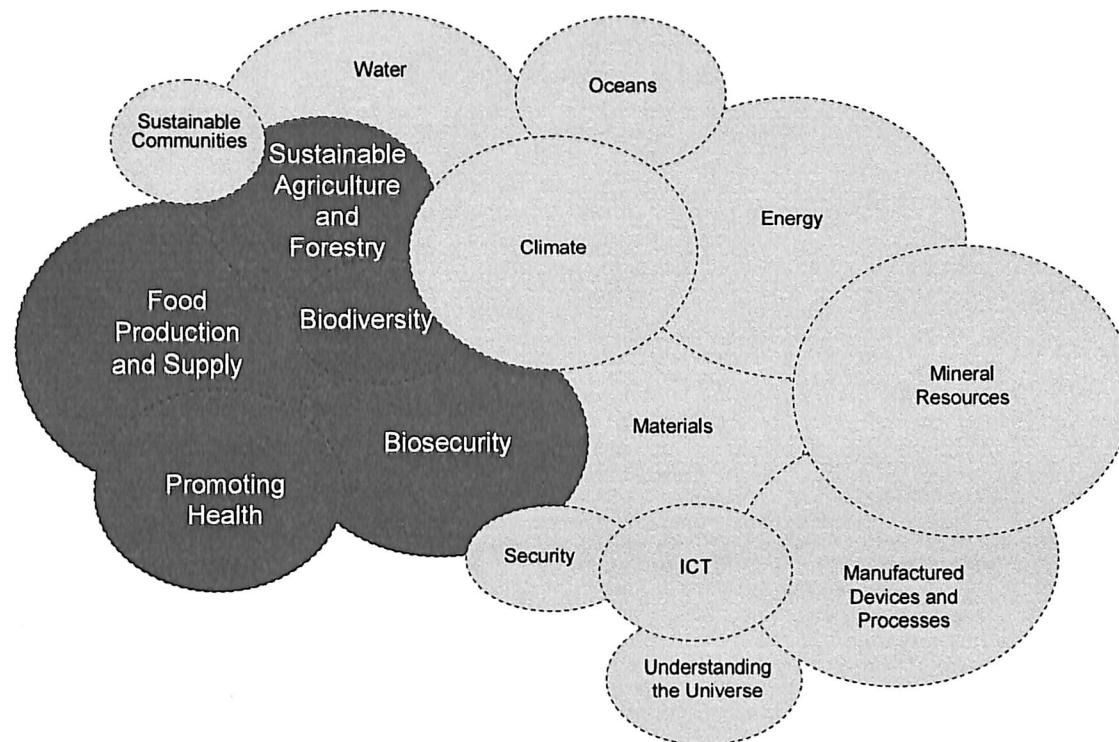
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1134 Marine Conservation and biodiversity Management  (Nic Bax)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1134 will work with marine managers to provide scientific understanding and tools to underpin conservation of marine biodiversity in Australia's vast and largely unexplored exclusive economic zone (EEZ). Using a multidisciplinary, systems-level approach – ranging from Voyages of Discovery and marine to mathematical modelling, economics and social incentives – the Theme will develop approaches to (a) estimate abundance, distribution, connectivity, biodiversity and species richness, and (b) evaluate alternative conservation strategies in a multiple-use environment. Our primary delivery partners are Commonwealth agencies who will adopt Theme outputs to address marine biodiversity decline, develop and manage the national marine protected area network, and manage threatened species, marine debris, and seabird conservation.</p>	\$5.9m	<p>Engage in major international biodiversity initiative (Census of Marine Life) using extensive Wealth from Oceans (WfO) marine biodiversity holdings in high profile international publications, and demonstrating Australia's scientific leadership in this area.</p> <p>Engage with Australian government agencies and NGOs to develop a world-leading approach to conservation planning and monitoring that can be applied in Australia and overseas.</p> <p>Initiate a process and national discussion for a risk-based approach to threatened species listings to provide scientifically-based ranking of at-risk-species, enabling improved targeting of scarce conservation resources.</p> <p>Develop abundance estimates of juvenile white shark in support of the National White Shark Recovery Plan</p> <p>Work with government and aid agencies to develop incentives and financial tools to support marine conservation in Australia and overseas.</p>

## 2.2 Core Research

### 2.2.1 Agribusiness Group Portfolios

*Group Executive: Joanne Daly*

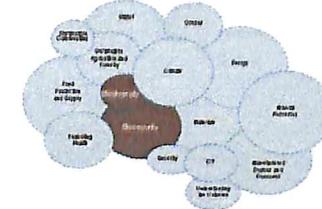
Core Research in the Agribusiness Group is currently managed through five portfolios. These portfolios contribute across a range of Outcome Domains, primarily those illustrated in the diagram below. The following pages set out the key activities and outputs planned for 2008-09 for each Theme within these five portfolios.



Agribusiness – Core Research Portfolio 1

## **Portfolio Leader: Mark Lonsdale (Chief, CSIRO Entomology)**

### ***Primary Outcome Domains: Biodiversity; Biosecurity***



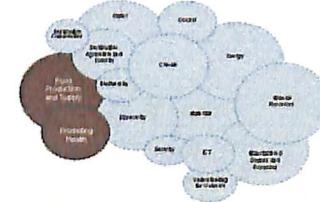
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1077  Biosecurity and Invasive Species  (Andy Shephard)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Invasive species cost Australia at least \$8 billion per annum in damage to agricultural systems and the environment. Theme 1077 works to reduce the impacts of critical invasive weeds and pests on both Australia's primary production industries and the environment through conducting research in preparedness, ecology, evolution of invasive plants, and post-harvest product integrity. The research underpins a whole of government biosecurity strategy around responsiveness to current incursions and preparedness and prediction for future incursions. Along with the Commonwealth and State Governments, NRM bodies, peak industry bodies, RDCs and CRCs are also party to the Australian Biosecurity System (AusBIOSEC).</p>	\$11.9m	<p>Complete the planning of integration of invasive species and biosecurity research into the Theme from Themes in other Portfolios and complete emigration of climate change related biosecurity activities into the Climate Adaptation Flagship.</p> <p>Align research priorities and activities to AusBIOSEC framework and sectorial strategies for both the bioeconomy and the environment.</p> <p>Delivery of milestones and deliverables in active projects with 3 CRCs (AWMCRC, NPBCRC, IACRC) around invasives, biosecurity preparedness and management of impacts to food security.</p> <p>Develop strategies that reduce impacts of existing and emerging national priority invasive pests and weeds threatening Australian plant health and ecosystems.</p>
1080  Building Bioindustries with Synthetic Biology  (Peter East)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1080 aims to create biological-based technologies to enhance and transform the environmental and economic sustainability of Australia's bioindustrial manufacturing industries; particularly the industrial materials and agricultural sectors. These industries need to move to higher value products, reduce petrochemical inputs with renewable feedstocks, and reduce their environmental footprints. Research will produce, for example, crop biofactories for the large scale production of novel biomaterials from non-food crops and enzyme bioremediation technologies for pesticides and other pollutants. The theme partners with CRCs, RDCs and government agencies and engages with domestic and international chemical companies to facilitate commercialisation through market-pull mechanisms.</p>	\$10.5m	<p>Platform IP positions capturing novel lipid pathways for metabolic engineering of crops for production of various industrial chemicals.</p> <p>Provide technical proof-of-principle in plant pest/weed/disease models for input trait portfolio and develop commercialisation strategy for delivery of proven technology to commercial partner(s).</p> <p>Delivery of optimised enzymes for remediation of environmentally stable pollutants in agricultural and industrial waste streams.</p> <p>Develop thermochemical technologies for transformation of biomass waste to products readily integrated into existing chemical value-chains.</p>

Note: Theme 1173 National Collections is reported in Section 2.4 National Research Facilities and Collections (page 80), and is managed by CSIRO Entomology.

## Agribusiness – Core Research Portfolio 2

**Portfolio Leader: Anthos Yannakou (CEO, Food Science Australia)**

*Primary Outcome Domain: Food Production and Supply; Promoting Health*



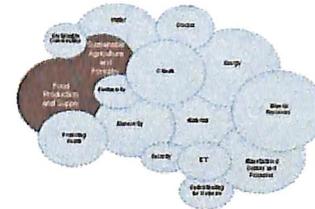
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1030 Processing Innovation  (Lyndon Kurth)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1030 will develop and exploit innovative technologies and processes to deliver compelling product differentiation for processed Australian agrifood raw materials. This will contribute to the competitiveness and sustainability of Australian food manufacturers and reduce their environmental footprint. There is a focus on understanding how physical stressors can influence the behaviour of food components and influence their reactivity. The theme works closely with the Food Futures and Climate Adaptation Flagships and the Agricultural Sustainability Initiative, State governments and universities. The theme models and validates science based solutions for processing optimisation to industry corporations, individual companies, and SMEs.</p>	\$7.1m	<p>Develop and apply innovative processing technologies combined with knowledge of the structural biology and chemistry of agribusiness raw materials to create designed food structures (products) with predictable sensory and nutritional impacts in the body; and thus provide a market advantage which improves the competitiveness and sustainability of the Australian food industry. Sign non-disclosure agreements with at least 4 companies to demonstrate proof of concept for the new technology applications</p> <p>Optimise efficiency in unit process operations and supply chains through the use of advanced sensing and measurement techniques to capture data which allows optimisation modelling and experimental validation of process innovations that will increase efficiency, leading to greater market competitiveness. In particular collaborate with other CSIRO initiatives such as the Agriculture Sustainability Initiative to develop technologies to minimise and reuse water in food processing as well as to minimise energy requirements for food processing.</p>
1032 Food Safety and Quality  (Gary Dykes)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1032 is working towards optimising the safety and quality of the Australian food supply chain, and is the only fully dedicated and integrated program in safety and quality in Australia. The theme works closely with industry bodies and individual firms as well as having a close relationship with government to provide advice on controlling food safety hazards. Key areas of work include using a transformational biology approach to understand how food borne pathogens enter and persist in animal derived food products and survive antimicrobial hurdles in processed food products, and to understanding food sensory quality to drive acceptance of food innovations and improve flavour quality for consumers.</p>	\$9.4m	<p>Investigate selected pathways of transmission and the mechanisms of the survival and persistence (as related to food and environment structure) of at least four bacterial species of concern in food environments. In so doing provide the science base to enhance food safety and security for government, industry and the consumer as indicated by publication of at least ten scientific papers, three new industry relationships and broad consultation of government and regulators with the theme.</p> <p>Examine the application of novel technologies and food formulations in controlling at least five major spoilage and pathogenic bacteria and fungi and determine the underlying effect of these processes at a single cell and molecular level. In so doing develop novel ways for Australian food manufacturers to process food for microbiological safety and quality as indicated by engagement with commercial clients to generate at least \$1M in funding and by the publication of at least five scientific papers.</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
			Explore the influence of animal diet and polyphenolics on food flavour, cross-modal sensory interactions and panel performance studies on sensory perception, and the role of sustained acceptance and children's diets on consumers. In so doing allow food producers and manufacturers to enhance food quality and consumer acceptance of new and existing products as indicated by engagement with at least four new industry clients and the publication of at least five scientific papers.
1033 Food and Nutrition  (Michael Fenech)	<p><b>Dominant Role: Frontier Science</b></p> <p>The goal of this Theme 1033 is to use the frontier science technologies of nutrigenomics and nutrigenetics to (a) develop a suite of high-throughput diagnostics of genome health; (b) identify, formulate and design micronutrient supplements, functional foods and dietary patterns for improved genome health and cognitive function in individuals from diverse genetic backgrounds and (c) support the development and establishment of Genome Health Clinics to prevent diseases caused by DNA damage including cognitive decline. To achieve this goal the theme is partnering with the National Health and Medical Research Council, supplement/functional food companies, and via the international HUMN project which is coordinated by this theme.</p>	\$4.5m	<p>Define the impact of folate status on telomere length maintenance.</p> <p>Develop a micro-culture system for a minimally invasive high-throughput method for measuring DNA damage.</p> <p>Determine the impact of intake of different food groups on DNA damage <i>in vivo</i> in humans.</p>

## Agribusiness – Core Research Portfolio 3

**Portfolio Leader: Alan Bell (Chief, CSIRO Livestock Industries)**

*Primary Outcome Domains: Food Production and Supply; Sustainable Agriculture and Forestry*

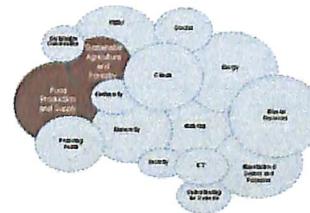


Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1044 Transforming Animal Biosecurity  (Deborah Middleton)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1044 develops and transfers knowledge and tools to underpin effective prevention and mitigation strategies for significant new and emerging animal disease threats to Australia, safeguarding against the social, economic and environmental impacts of potentially devastating livestock plagues, newly emerging animal diseases and diseases that spread from animals to people. The theme is a key component of the Australian Biosecurity System (AusBIOSEC), working closely with Government and industry to shape policy, and is also engaged with key international bodies including the World Animal Health Organization (OIE) and the World Health Organisation (WHO). Additionally the theme has relationships with key global and domestic pharmaceutical companies to enable commercialisation of vaccine and therapeutic products.</p>	\$25.3m	<ul style="list-style-type: none"> <li>Develop species specific knowledge (transcriptomics) and tools (cell lines and immunological reagents) essential for understanding bat-virus interactions</li> <li>Develop and transfer a diagnostic test for a serious emergency animal disease from the research group to Theme 1047 - Diagnosis, Surveillance and Response.</li> <li>Investigate the molecular basis of pathogenicity of avian influenza virus in birds and mammals.</li> <li>Further develop proof-of-concept for RNAi-based control of avian influenza in poultry</li> </ul>
1045 Transforming the Animal and its Products  (Ian Puris)	<p><b>Dominant Role: Incremental Innovation</b></p> <p>This research increases the economic contribution of livestock industries to the Australian economy through the application of transformational biology, ultimately delivering higher quality products which satisfy consumer needs for healthy, safe, nutritious food while utilising fewer resources. By increasing and applying understanding of underlying biological processes, Theme 1045 develops effective breeding strategies and designs interventions which transform our ability to predict the animal's performance. The theme works closely with RDCs, industry bodies, CRCs, has commercialisation relationships with global genomics companies and contributes to the development of policy through the Australian Animal Welfare Strategy.</p>	\$17.7m	<ul style="list-style-type: none"> <li>Develop a practical technique for individual animal measurement of livestock gas emissions to underpin future management of livestock in the Australian landscape</li> <li>Provide enhanced genomic tools focusing on key traits relating to consumer preferences and animal health and reproduction.</li> <li>Deliver genetic solutions/alternatives for painful livestock husbandry procedures, such as mulesing in sheep and dehorning in cattle.</li> </ul>

## Agribusiness – Core Research Portfolio 4

**Portfolio Leader: Jeremy Burdon (Chief, CSIRO Plant Industry)**

*Primary Outcome Domains: Food Production and Supply; Sustainable Agriculture and Forestry*



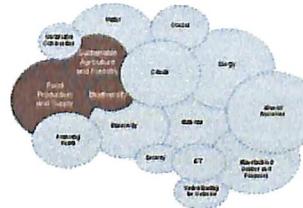
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1038 New Horizons in Plant Science  (Frank Gubler)	<b>Dominant Role: Frontier Science</b> Theme 1038 will deliver new tools and genes for advanced plant breeding to improve the crops underpinning Australia's major food, fibre and biofactory production systems. The approaches being developed allow for both GM and non-GM solutions. The theme is focussed on cutting edge plant biology research such as gene silencing and gene network analysis, and the development of strong national and international collaborations. The scientific outputs from the theme will feed into other CSIRO themes focussed on addressing key problems facing the plant-based industries.	\$11.0m	Develop novel strategies to manipulate and control complex reproductive and development traits with major impact on yield, seed quality and early plant development. Improve the understanding of small RNAs and their role in the control of gene expression. Develop technologies that permit highly specific control of genes for the expression of novel traits in existing and new crops. Link functional genomics and bioinformatics to enhance understanding of key processes in plant production.
1039 Delivering Quality Crops for Consumer Choice and Improved Industry Competitiveness  (Mark Peoples)	<b>Dominant Role: Transforming Industry</b> Theme 1039 is working to provide Australian plant-based industries a competitive advantage through the development and delivery of crop cultivars containing traits that result in better appearance, smell or flavour of food and wine for consumers; and by providing new practices and rootstocks that lower costs, improve the efficiencies of production, and enhance the consistency of supply of high valued products. The theme uses key outputs from theme 1038 to research the integration of management and genetic influences on product quality. The theme has close collaborative and commercialisation links with industry, in particular the wine sector.	\$9.7m	Through application of advanced genetic technologies, physiology and phenotypic selection techniques identify the genes and genetic loci controlling key quality attributes, and develop new knowledge of the function and performance of horticultural crops Utilising the modern tools available through conventional (markers) and new breeding technologies to package the genes controlling quality attributes of products into elite germplasm. Provide industry with new cultivars and post-harvest strategies to deliver differentiated products with increased consumer appeal and preference. Through understanding the effects of interactions of genotype with environment and management practice on quality, develop improved rootstocks and resource efficient on-farm strategies to enhance the consistency of supply of high valued products with a reduced environmental footprint.
1040 Plant Fibre and Biofactories for New Agricultural & Industrial Products  (TJ Higgins)	<b>Dominant Role: Transforming Industry</b> Theme 1040 is developing and delivering the technologies and products needed to maintain and improve the current cotton, sugarcane and oilseed industries and to enable their transformation over the longer term into sources of high-value industrial raw materials, for example to create renewable resource industries that can replace scarce petroleum-based industrial feedstock. Work covers the full spectrum from discovery of key genes through plant breeding to processing resulting fibres/products. The theme is linked to the more fundamental research in theme 1038 and has strong relationships with the cotton, sugarcane and oilseed industries, as well as with a number of key commercial companies.	\$21.9m	Utilising traditional plant breeding and enhanced genetic technologies, develop improved germplasm for the Australian cotton industry, and with efficient management practices, deliver better water use efficiency, higher yields and improved fibre quality. Apply advanced genetic technologies for developing improved breeding parents and varieties for the Australian sugar industry; develop strategies for the development of diversified products for the sugar industry.

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
			<p>Establish the feasibility of producing high-value industrial fatty acids in oilseed crops by developing enabling metabolic engineering technology.</p>
1041 Designing Crops for Australian Environmental Challenges  (John Manners)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1041 combines skills in genetic, physiological and cellular understanding of plant mechanisms to improve crop adaption and productivity in response to the environmental challenges confronting Australia such as drought, salinity, climate change and associated pest and disease threats. Identification of and incorporation of novel genetic traits into new plant cultivars and to industry via Australian and international plant breeding entities will provide a significant improvement in yield for Australia's major crop production regions. The theme has long term collaborations with industry bodies such as GRDC and major commercial companies.</p>	\$22.6m	<p>Develop innovative solutions to major plant pests through selective breeding and development of improved management practices.</p> <p>Utilise the latest breeding and gene discovery technologies for the development of innovative solutions to major plant diseases.</p> <p>Identify novel genes and control pathways for the development of new crop varieties with improved adaptation to drought and temperature stresses.</p> <p>Combine genetic and management approaches to investigate root function and plant-soil interactions important for overcoming chemical and physical constraint that are common in the majority of Australian soils.</p>
1042 Biodiversity and Conservation  (Andrew Young)	<p><b>Dominant Role: Community Solutions</b></p> <p>Theme 1042 works to improve the management of native plant ecosystems, enhance the quality and functionality of Australian landscapes and conserve Australia's unique flora by providing land holders, land manager and state and federal government agencies with appropriate biological information. The science challenge is to understand the species, population and evolutionary processes influencing the nature and extent of plant biodiversity at genetic, species and community levels in these rapidly changing environments. Outputs of this research are quantitative knowledge of biodiversity pattern, underpinning ecological/genetic processes and effects of threatening processes, which generate outcomes in terms of better science-based NRM management and biodiversity policy from local/regional through to state and federal levels.</p>	\$2.6m	<p>Quantify processes important in determining species recruitment, persistence and abundance in native vegetation communities.</p> <p>Metagenomic analysis of the response of soil bacterial communities to native revegetation of agricultural land</p>

## Agribusiness – Core Research Portfolio 5: Agricultural Sustainability Initiative

**Portfolio Leader: Brian Keating**

*Primary Outcome Domains: Sustainable Agriculture and Forestry; Food Production and Supply; Biodiversity*



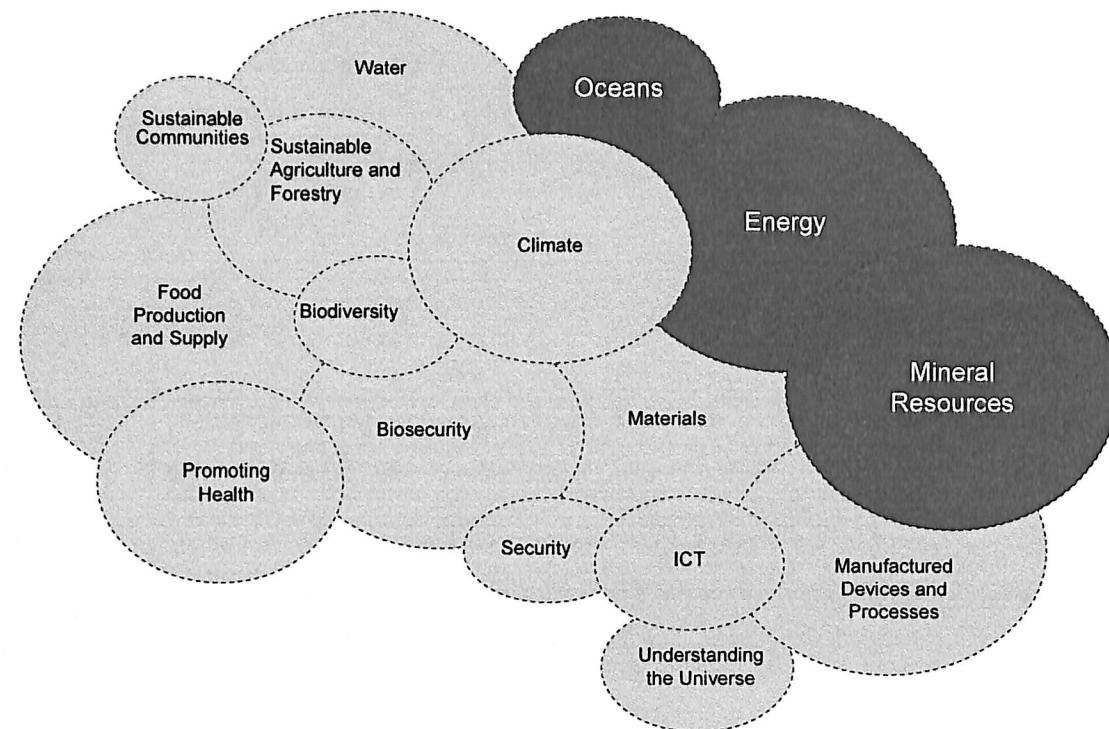
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1129 Australian Agriculture Transformed  (Vacant)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1129 works to achieve transformational sustainable change in Australia's agricultural industries and regions in the face of emerging economic, environmental and social drivers. There are three areas of focus, (a) reducing greenhouse gas emissions from agriculture and increasing carbon storage in the Australian landscape; (b) transforming high rainfall zone agriculture for sustainable food production and environmental outcomes and (c) contributing to assessments of Northern Australia as a region for new agricultural investment. The theme has long-term successful relationships with industry bodies and RDCs and is active in providing policy advice to government.</p>	\$8.4m	<p>Reducing greenhouse gas emissions from agriculture and increasing carbon storage in the Australian landscape</p> <p>Transforming high rainfall zone agriculture for sustainable food production and environmental outcomes</p> <p>Investigating Northern Australia as a region for new investment in agriculture</p>
1130 Economic and Environmental Performance of Australian Agriculture  (Peter Carberry)	<p><b>Dominant Role: Incremental Innovation</b></p> <p>Theme 1130 applies integrated ecological, agricultural, economic and social science to design and deliver management options for agricultural producers and value chain processors for enhanced economic and environmental performance. Key area of focus are fostering smart farming at the frontiers of technology; driving farm-level adaptation to reduced irrigation water availability; and reducing the environmental impact of food and fibre value chains. Work is characterised by participatory approaches and involvement of industry groups, RDCs, SMEs, farmers and community groups, with a strong focus on the policy interface with all levels of government.</p>	\$16.2m	<p>Develop a systems approach towards a 3% pa productivity growth for Australian agriculture</p> <p>Assess on-farm water use -assist irrigated agriculture in transition</p> <p>Conduct research directed at reducing the environmental impact of food and fibre value chains</p>
1131 Agroecosystem Function and Prediction  (Peter Thrall)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1131 utilises CSIRO's biophysical and modelling capabilities to underpin agricultural sustainability policy, planning and management. It does this by quantifying the dynamic processes and feedbacks that determine sustainable agro-ecosystem performance and identifying robust strategies to protect, manage and improve ecosystem function in the face of land-use change. Work includes developing environmental stewardship initiatives, investigating soil health as a foundation for sustainable agriculture, and modelling land use systems. The theme delivers to related themes as well as having collaborators and clients amongst RDCs, NRM groups, Catchment Management Authorities, farm managers and government agencies.</p>	\$14.3m	<p>Advance soil health as a foundation for sustainable agriculture</p> <p>Develop a one-CSIRO capacity to model land use systems at the enterprise and landscape scale</p> <p>Advance environmental stewardship for biodiversity conservation and ecosystem services in agricultural landscapes</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1139 Managing Australia's Soil and Landscape Assets  (Mike Grundy)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Australia won't solve the interacting national challenges for food and fibre production and landscape sustainability and deal with carbon, energy and water constraints without renewed focus on better soil and land management. Theme 1139 assists improved management of Australia's soils and landscapes by providing decision makers with definitive forecasts of the key processes in the function of Australia's soils. The theme build spatial data infrastructure to monitor and forecast soil resilience and condition and interactions with land management. The Theme operates the National Soil Information Centre and has important relationships with NRM, greenhouse and agricultural government agencies as well as with the GRDC.</p>	5.1m	<p>Develop rapid methods of proximate and remote soil analysis and provide open access to the best available information on the nation's soils through development of the Australian Soil Resource Information System (ASRIS).</p> <p>Provide new capability to predict soil carbon and nutrient cycling dynamics and support the national carbon accounting process by enhancing the understanding of greenhouse gas emissions from soil.</p> <p>Contribute to national standards and emerging policies on soil protection in collaboration with the <a href="#">National Committee for Soil and Terrain</a>.</p> <p>Provide new methods for assessing and monitoring threats to soil function (e.g. acidification) and identify the suitability of land for sustainable development including niche locations (opportunities) for high-value enterprises.</p>
1171 Sustaining Australia's Forest Ecosystems Resources  (Michael Battaglia)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1171 will develop prediction, planning and management tools to help manage Australia's forest resources for national benefit. Research areas include the supply of forest products, storage of carbon, water quality and yield and the protection of biodiversity values. There is a focus on forests as systems and the quantification of risks and benefits of adaptive actions – this will be increasingly important with the creation of a carbon-trading market in Australia. The theme has long standing relationships with industry, key government agencies, NRM managers and also provides research consultancy services to the forestry sector.</p>	\$8.2m	<p>Partnerships developed with relevant CRCs, state water authorities and industry to develop program of research to evaluate the trade-offs between water, wood and carbon benefits at scales from stands to catchment.</p> <p>Regional evaluation of climate change impacts on the risk and productive potential of Australia's plantation estate, estimation of range of outcomes for timber supply, potential distribution of pests and effects of this on net primary production.</p> <p>Application of wood property model (Cambium-CABALA) for dendrochronological analysis of long lived tree species to reconstruct past climates.</p> <p>Establish dedicated services and consultancy unit within theme.</p> <p>Identification of overseas regions posing major pest threats to forestry under current and future climate scenarios.</p>

## 2.2.2 Energy Group Portfolios

*Group Executive: Beverly Ronalds*

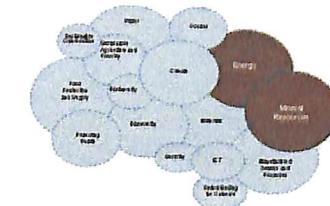
Core Research in the Energy Group is currently managed through two portfolios. These portfolios contribute across a range of Outcome Domains, primarily those illustrated in the diagram below. The following pages set out the key activities and outputs planned for 2008-09 for each Theme within these two portfolios.



## Energy – Core Research Portfolio 1

**Portfolio Leader: David Brockway (Chief, CSIRO Energy Technology)**

*Primary Outcome Domains: Energy; Mineral Resources*

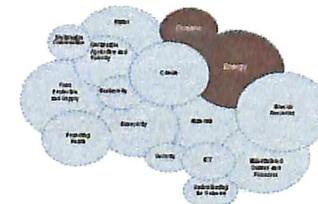


Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1140  Secure and Sustainable Energy Technologies  (John Carras)	<p><b>Dominant Role: Transforming Industry</b></p> <p>The goal of Theme 1140 is to develop energy technologies that increase the security, sustainability and wealth creating capacity of Australia's rich endowment of solar energy and coal resources. In particular, this Theme seeks to develop new energy efficient technologies through advances in energy generation, storage and supply; develop new coal preparation technologies; and develop methods for the quantification of gaseous and particulate emissions from the emerging fuel and energy technologies. CSIRO engages with a broad range of Australian and international research and delivery partners including large industrial corporations, SMEs and universities.</p>	\$10.7m	<ul style="list-style-type: none"> <li>Advance the science of organic photovoltaic devices through national and international partnerships.</li> <li>Commercialise core fuel cell and ionic technologies.</li> <li>Develop personal energy generation and storage technologies for mobile applications.</li> <li>Characterise fine particle composition and volatile organic compound speciation from emissions from transport fuel use.</li> <li>Increase the productivity and quality of export coal through intelligent plant sensing and control technologies.</li> <li>Develop processes for optimising whole of cycle coal use from preparation through to high efficiency utilisation.</li> </ul>

## Energy – Core Research Portfolio 2

**Portfolio Leader: Beverley Ronalds (Chief, CSIRO Petroleum Resources)**

*Primary Outcome Domains: Energy; Oceans*

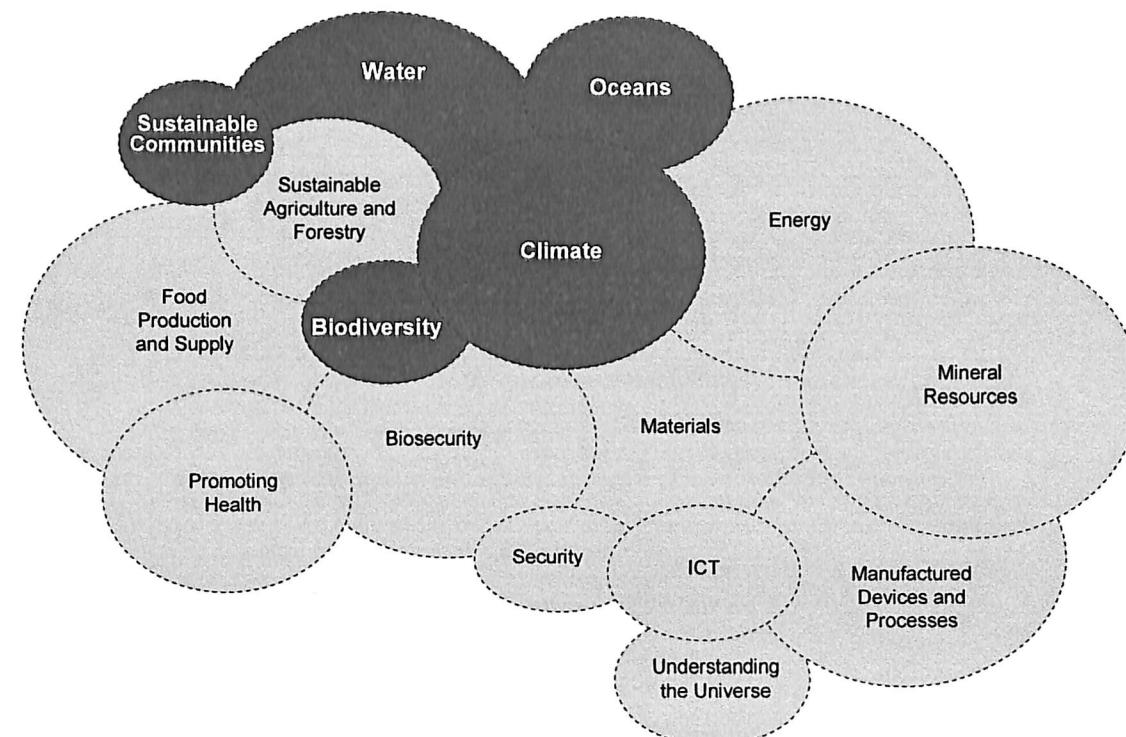


Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1092  Maximising Australia's Petroleum Self Sufficiency  (Peter McCabe)	<p><b>Dominant Role: Incremental Innovation</b></p> <p>Theme 1092 aims to provide science and technology solutions that enable continued profitable and secure access to petroleum resources beyond 2015. Improved exploration and production efficiency of Australian on-shore petroleum resources is expected to deliver economic and environmental benefits for the oil and natural gas industries and consumers. The Theme works in collaboration with other government agencies and private companies to develop an improved regional understanding of the nation's petroleum resources. Technologies are developed in collaboration with a broad range of industry and research partners to ensure research outputs are highly relevant to end users.</p>	\$12.5m	<p>Partner with State Surveys, oil companies, and other interested parties to identify areas and research projects where new technology can improve exploration and development success, with a particular focus on onshore areas.</p> <p>Develop novel approaches to reservoir characterisation and engineering, well stimulation, enhanced oil recovery, improved drilling technology, and identification of prospective petroleum basins.</p> <p>Examine the feasibility of cleaner oil shale exploitation and coal seam gas development, and establish new protectable IP.</p>

## 2.2.3 Environment Group Portfolios

*Group Executive: Andrew Johnson*

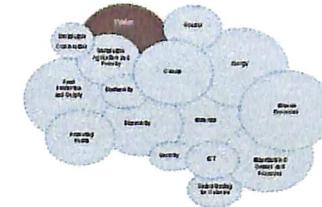
Core Research in the Environment Group is currently managed through three portfolios. These portfolios contribute across a range of Outcome Domains, primarily those illustrated in the diagram below. The following pages set out the key activities and outputs planned for 2008-09 for each Theme within these three portfolios.



# Environment – Core Research Portfolio 1

**Portfolio Leader: Neil McKenzie (Chief, CSIRO Land and Water)**

*Primary Outcome Domain: Water*

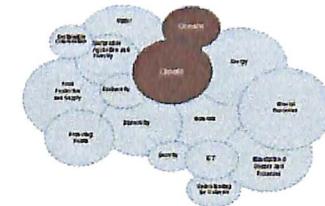


Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1119 Centre for Environmental Contaminants Research  (Simon Apte)	<p><b>Dominant Role: Major National Challenge</b></p> <p>The Centre for Environment Contaminants Research (CECR) is the largest contaminants research group in Australia. Working with environmental authorities, regulatory agencies, universities, industry and others within Australia and internationally, Theme 1119 (a) advises industries and governments on the environmental impact of proposed developments, and on the safe usage of solid wastes, wastewaters and recycled water; (b) informs the development of national, state or industry contaminant measurement, control and management guidelines; (c) evaluates the risks posed by emerging contaminants of concern, and responds to contaminant emergencies; and (d) develops improved risk assessment protocols and tools for routine use by industry and environmental agencies.</p>	\$9.8m	<ul style="list-style-type: none"> <li>Improve the protection of Australian natural resources through the development of new guidelines and frameworks to measure, control and manage contaminants (e.g. National Environmental Protection Measures, Water and Sediment Quality Guidelines).</li> <li>Assist industry and allay public fears by providing an objective evaluation of the risks posed by emerging contaminants of concern (endocrine disrupting chemicals, pharmaceuticals, flame retardants, nanoparticles).</li> <li>Provide guidance on the safe usage of solid wastes (e.g biosolids), wastewaters and recycled water in Australia.</li> <li>Assist in the sustainable development of Australian industry by providing sound and trusted advice on the environmental impact of proposed developments (e.g. the mining and minerals and water utilities industries).</li> <li>Provide national and international leadership in the characterisation and management of Acid Sulfate Soils by leading projects and sub-committees under the auspices of the National Committee for Acid Sulfate Soils.</li> <li>When required, mobilise high level scientific capability in response to national emergencies and urgent government needs such as characterising major chemical spills for industry and providing expert advice to formal Inquiries.</li> </ul>

## Environment – Core Research Portfolio 2

**Portfolio Leader: Greg Ayers (Chief, CSIRO Marine and Atmospheric Research)**

*Primary Outcome Domains: Oceans; Climate*

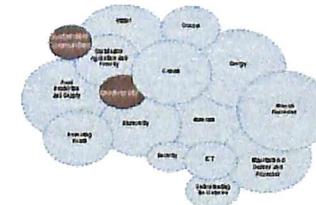


Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1132 Climate and Atmosphere  (Tony Hirst)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Using advanced climate observation and modelling systems, Theme 1132 contributes to (a) identifying the nature of human-induced changes in the earth system, (b) developing mitigation strategies, and (c) improving management of the social, economic and environmental risk associated with climate variations, weather extremes and air pollution hazards. Key paths to impact include: the Centre for Australian Weather and Climate Research (a strategic alliance with the Bureau of Meteorology); long-term partnerships with government departments which directly inform policy-making; linkages to international programs such as the World Meteorological Organisation Global Atmospheric Watch Program and participation in the IPCC Assessment process; and licensing, consulting and direct public communication.</p>	\$22.4m	<ul style="list-style-type: none"> <li>Lead the development of ACCESS as a modelling system able to participate in the IPCC AR5 modelling program completing the coupling of model components and initiating test simulations.</li> <li>Analyse data from baseline monitoring of the Australian and global atmospheric environment to ascertain long-term changes and regional exchanges, and develop a resources plan for extension of baseline monitoring into data-void regions of Northern Australian key to understanding the carbon cycle and its changes in the tropics.</li> <li>Undertake extensive analyses of Australian indoor and outdoor atmospheric composition, and lead developments in wind energy forecasting and low wind dispersion modelling and applications</li> <li>Represent CSIRO and provide Key Account Management and outreach services for CSIRO activities with the Australian Department of Climate Change.</li> </ul>

## Environment – Core Research Portfolio 3

**Portfolio Leader: Dan Walker (Acting Chief, CSIRO Sustainable Ecosystems)**

*Primary Outcome Domains: Sustainable Communities; Biodiversity*

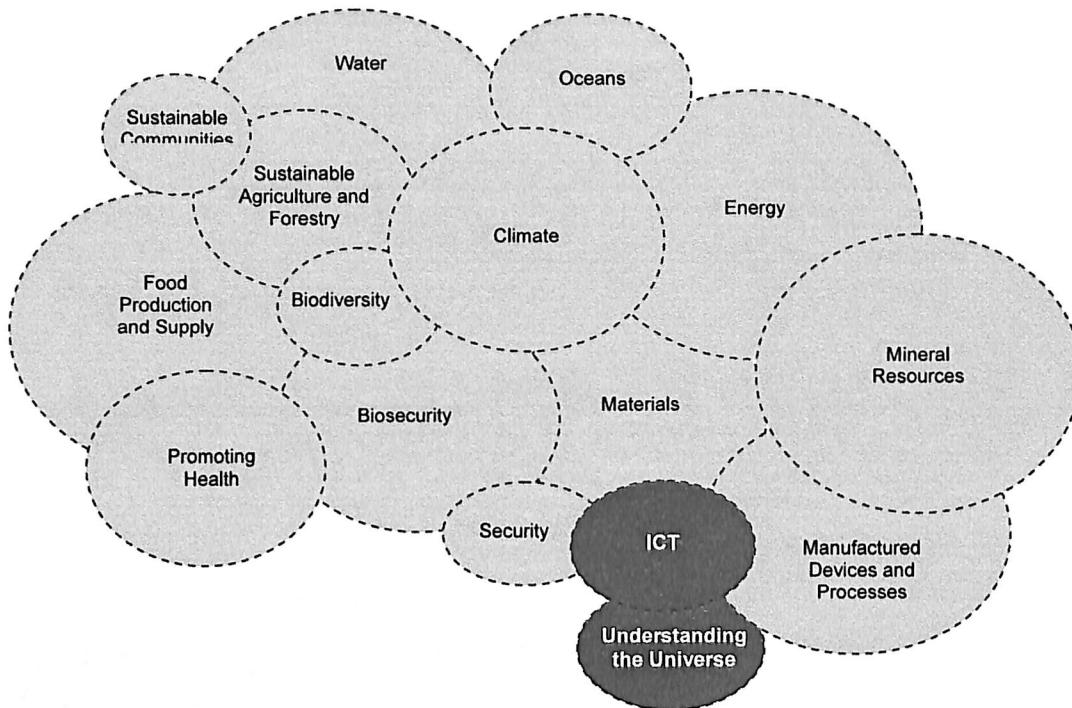


Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1012 Sustainable Regional Development  (Vice- Dan Walker)	<p><b>Dominant Role: Community Solutions</b></p> <p>Theme 1012 undertakes research to facilitate the development of resilient regions supporting prosperous communities through sustainable, wealth-creating use of natural, built and human resources. It delivers research on integrated economic-environmental models, triple bottom line investment appraisal, social impact assessment, governance arrangements and market based instruments. Indigenous engagement is an important component with researchers identifying new industries and job opportunities. Another focus is supporting investment decisions, worth \$6.5 billion since 1990, under Australia's natural resource management programs. By helping governments and companies choose the right policy options this theme is contributing to a healthy natural environment, strong economic growth and community well being.</p>	\$13.5m	<ul style="list-style-type: none"> <li>Develop tools for integrating community level triple-bottom-line assessments of proposed macro policy interventions into policy design</li> <li>Investigate the biophysical integrity and economic and institutional feasibility of carbon-economy based schemes at national, regional or local scales for public, private and NGO clients</li> <li>Undertake case studies through the Sustainability Communities Initiative on the use of CSIRO sustainability science to support communities to adapt or transform to achieve sustainability transitions</li> <li>Develop improved tools to plan, monitor and evaluate livelihood strategies appropriate to Indigenous Australian communities</li> <li>Develop and test of institutional and market-based options for achieving collective regional goals.</li> </ul>
1014 Healthy Terrestrial Ecosystems  (Iain Gordon)	<p><b>Dominant Role: Community Solutions</b></p> <p>Healthy terrestrial ecosystems sustain native biodiversity and provide a range of economic, social and cultural values. Theme 1014 works to ensure that Australia has at its disposal the knowledge and tools necessary to address the critical issues associated with the management of its terrestrial ecosystems and biodiversity assets by undertaking research to: (a) develop a predictive understanding of the processes determining the distribution, status and dynamics of Australia's biota, ecosystems, and the services they provide; (b) develop, test, and evaluate management and policy options for achieving biodiversity outcomes at a range of scales. To ensure alignment with industry, community and government priorities, research is conducted in collaboration with these groups.</p>	\$8.2m	<ul style="list-style-type: none"> <li>Development of modelling frameworks that incorporate a mechanistic understanding of invasive spread in landscapes.</li> <li>Design and testing of practical applications of first generation outcome-oriented stewardship incentives for improving biodiversity conservation and ecosystem services on privately managed land</li> <li>Support and conduct research directed at systematic, biogeographic and population genetic understanding of vertebrate diversity of Australia and the surrounding region.</li> </ul>

## 2.2.4 Information and Communication Sciences and Technology Group Portfolios

*Group Executive: Alex Zelinsky*

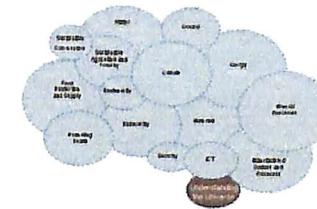
Core Research in the Information and Communication Sciences and Technology (ICST) Group is currently managed through three portfolios. These portfolios contribute across a range of Outcome Domains, primarily those illustrated in the diagram below. The following pages set out the key activities and outputs planned for 2008-09 for each Theme within these three portfolios.



Information and Communication – Core Research Portfolio 1

**Portfolio Leader: Brian Boyle (Director, Australia Telescope National Facility)**

*Primary Outcome Domain: Understanding the Universe*



Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1068 Technologies for Radio Astronomy  (Graeme Carrad)	<p>Dominant Role: Frontier Science</p> <p>Theme 1068 builds on ATNF's reputation as a supplier of quality instruments for radio astronomy and spacecraft tracking applications for the ATNF's telescopes and other facilities around the world. The Theme supports important spacecraft tracking programs in collaboration with NASA, and undertakes strategic collaborations with other radio astronomy institutes. This Theme focuses on the development of new instrumentation for existing Australian telescopes, as well as developing and facilitating the supply of radio astronomy instrumentation to international organizations including observatories in Britain, Europe and China.</p>	\$3.0m	<ul style="list-style-type: none"> <li>Compact Array Broadband Backend (CABB) – Extending the backend bandwidth of the Australian Telescope Compact Array (ATCA) by a factor of sixteen to take advantage of broadband receivers.</li> <li>20/13 and 6/3cm Broadband Compact Array receiver upgrade – Increasing the capability of the original receivers to utilise the capabilities of CABB.</li> <li>Enhance already demonstrated technologies for high-speed data transfer enabling an increased data rate for use in real time eVLBI and make real time eVLBI available as a production tool</li> <li>Supply five Digital Filter Bank units to international observatories</li> <li>Develop a new 13mm receiver for Parkes, with a threefold increase in sensitivity in the 16-26GHz frequency range.</li> </ul>
1069 Astrophysics  (Robert Braun)	<p>Dominant Role: Frontier Science</p> <p>Theme 1069 undertakes major observational research projects resulting in world-class science that directly influences international astronomical research and shapes our understanding of the Universe. The astrophysics theme also defines new observational techniques and instrumentation goals that help keep the current ATNF telescopes at the leading edge of radio astronomy research. Theme 1069 is playing a key role in setting the scientific and technical specifications for the radio telescopes and instrumentation of the future including the Australian SKA Pathfinder (ASKAP) and the Square Kilometre Array (SKA). The Theme features extensive national and international collaborations.</p>	\$6.0m	<ul style="list-style-type: none"> <li>Produce 100 refereed publications, more than 60 to be in journals in highest impact quartile, plus citation counts for ATNF researchers.</li> <li>A minimum of 12 invitations to speak at international scientific meetings, and minimum of 16 symposia/colloquia at other institutes.</li> <li>Ongoing leadership of the ASKAP (SKA) science case with detailed simulations to support/influence engineering.</li> </ul>
1070 ASKAP: The Australian SKA Pathfinder  (David DeBoer)	<p>Dominant Role: Frontier Science</p> <p>Theme 1070's goal is to build a world-class radio telescope, the Australia SKA Pathfinder (ASKAP); develop the infrastructure for a new remote observatory in WA; and participate in the international SKA design effort. Most significantly, this theme will exploit Australia's unique combination of global position, technical expertise and radio-quietness to deliver another world-leading instrument to study the southern sky and address the biggest questions regarding our knowledge of the universe. ASKAP is directly supported by the Federal Government and WA Government, and is collaborating extensively with international astronomical consortia and industry. This is a key plank in the strategy to maximize Australia's involvement in the Square Kilometre Array (SKA).</p>	\$9.2m	<ul style="list-style-type: none"> <li>Indigenous Land Use Agreement (ILUA) completed for MRO site access</li> <li>Contracts for ASKAP antenna and fibre awarded</li> <li>Full system architecture for ASKAP and System Project Design Review (PDR)</li> <li>On-site commencement of ASKAP control building and/or MRO support building (stretch goal)</li> <li>Full phased array feed/beamformer system in full-speed testing on the Parkes Test Facility, demonstrating acceptable noise performance (&gt;100K, goal of 50K) on an astronomical object</li> </ul>

## Information and Communication – Core Research Portfolio 2

**Portfolio Leader: Alex Zelinsky (Director, CSIRO ICT Centre)**

*Primary Outcome Domain: ICT*



Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1057 e-Health  (Bruce Barraclough)	<p><b>Dominant Role: Major National Challenge</b></p> <p>National and International health bodies have repeatedly identified that better management, integration and processing of health information for decision-making will improve the quality and safety of healthcare for patients. Theme 1057 aims to create new ICT-based technologies that can securely and seamlessly acquire (from a variety of sources), manipulate, interpret and present data relevant to healthcare professionals. The Theme participates in interactions/collaborations with a wide variety of State and Federal health agencies, institutes and organisations, and leverages the current expertise of several major world-class initiatives including health data integration, medical imaging, surgical simulation and tele-presence projects from the ICT Centre and The Australian e-Health Research Centre.</p>	\$4.2m	<p>Acquiring and Integrating Information Data Types: Research on semantics and health data to improve query and reporting on heterogeneous, linked data sets, including longitudinal data. Development of prototype release software for further validation and deployment within health sector. Conducting research to improve cancer stage classification algorithms using knowledge encoded in report metadata and medical terminologies, as well as information from other modalities, such as radiology reports. Development of prototype release software for further validation and deployment within health sector.</p> <p>Locally managed care: The development of software prototype tools to enable quantitative measures of functional capacity with the underlying physiological parameters for clinical assessment of chronic disease patients in the community.</p> <p>Model based transformation of medical information. Develop tools and algorithms to extract, analyse and fuse information across imaging modalities to improve diagnosis and enhance the safety and quality of care for patients.</p>
1058 Service Science, Technologies & Architectures  (Dimitrios Georgakopoulos)	<p><b>Dominant Role: Major National Challenge</b></p> <p>By integrating Web services, information management, search, delivery, layered security and access control through a seamless user experience, Theme 1058 aims to develop service science, technologies and architectures that provide useful information based on user needs and context that will enhance remote work place collaboration in business, the sciences and medicine. The market for these services is extremely broad ranging across Government at all levels, national and multinational entities and other CSIRO Themes and Flagships.</p>	\$5.3m	<p>Research into methods of discovery and extraction of data from heterogeneous sources. Research into methods for data summarisation over multiple text sources. The investigation of social tagging of information sources. The development of adaptive presentation based context.</p> <p>The development of a middleware architecture for dynamic collaboration. The development of an 'e-Contract semantics for dynamic collaboration.</p> <p>The development of a Foundational model for automatic composition of web services. The development into a predicate calculus query model. Research into a design trust model for interactions. The development of a top-down service change management architecture.</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
			<p>Publication of the research in leading scientific journals and conferences; visits and engagement of prominent international visitors from academic, commercial and government organisations; strong engagement with universities through PhD student supervision; visiting and honorary positions at leading universities granted to CSIRO researchers.</p>
1059 Broadband Wireless for Connecting Australia  (Jay Guo)	<p><b>Dominant Role: Frontier Science</b></p> <p>The ability to connect people and machines with broadband, and to access the wireless Internet "any time, anywhere" is becoming a necessity in the global economy. Technologies developed in Theme 1059 will facilitate the integration and seamless inter-working of different networks, increase network robustness and reliability, and deliver higher speed and improved quality services. The Theme will deliver underpinning technologies to a number of Flagships and other CSIRO Themes. The Theme has established national and global partnerships in wireless networking which serve as pathways to the global market. IP developed will also give Australian SMEs and key application industries, such as mining, the opportunity to deliver the technology to the world.</p>	\$5.5m	<p>Conduct research in Reconfigurable radio (analogue devices and protocols), adaptive wireless (algorithms and microwave systems, and self-tuning end-to-end quality-of-service internet that ensures CSIRO is a world leader in future broadband wireless communication networks.</p> <p>Develop strong partnerships with global ICT players – NEC, Rockwell Collins, CETC and Boeing and develop stronger engagement with universities.</p> <p>Publish high-impact publications scientific journals and conferences, plenary speeches at international forums and attract prominent international visitors to the ICT Centre</p> <p>Develop our portfolio of intellectual property in the fields of cognitive wireless communications and self-tuning end-to-end quality-of-service internet</p>
1062 Sensor Networks  (Peter Corke)	<p><b>Dominant Role: Major National Challenge</b></p> <p>There exists a large and growing demand for quantitative information, at all spatial and temporal scales, which will transform the understanding of natural environments and provide the ability to better manage and exploit Australia's resources. Theme 1062 will develop novel sensors and sensor networks to increase the quality and reduce the cost of collecting this data thus providing researchers, policy makers and natural resources and environment managers the technology to directly query the natural environment for relevant data. The Theme will engage with national and international commercial enterprises.</p>	11.0m	<p>Sensors: Develop low cost water quality, pathogen, audio, video/multi-media sensors for deployment in water, animal agriculture, marine, horticulture, and ecological applications.</p> <p>Develop a mobile calibration unit for deployment on boats, ground robots, UAV and submarines.</p> <p>Completion of the environmental energy budget analysis and the development of energy harvesting and storage devices.</p> <p>Development of the sensor platform and communications – technology transfer to PowerCom, research into coverage analysis and geographical distribution planning.</p> <p>Conduct research into gaining information from data – develop and validate an anomaly detection algorithm- Deploy that algorithm in a sensor network.</p> <p><i>Theme 1062 may be merged with the Sensors and Sensor Networks Transformational Capability Platform in 2008-09</i></p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1083 Facility Management / Canberra Deep Space Communications Complex  (Miriam Baltuck)	<b>Dominant Role: Satellite</b> Theme 1083 is responsible for meeting the Government's obligations under the USA-Australia Agreement for deep space tracking and communications. The management of the purpose-built standards and physical science facility at Linfield allows NMI and OFT to meet their community and regulatory objectives through the delivery of high quality on-site services.	\$4.7m	Manage the NASA facility to deliver agreed outcomes while maintaining and enhancing the NASA relationship.

## Information and Communication – Core Research Portfolio 3

**Portfolio Leader: Bronwyn Harch (Acting Chief, CSIRO Mathematical and Information Sciences)**

*Primary Outcome Domains: This Portfolio delivers underpinning science and technologies across many domains*

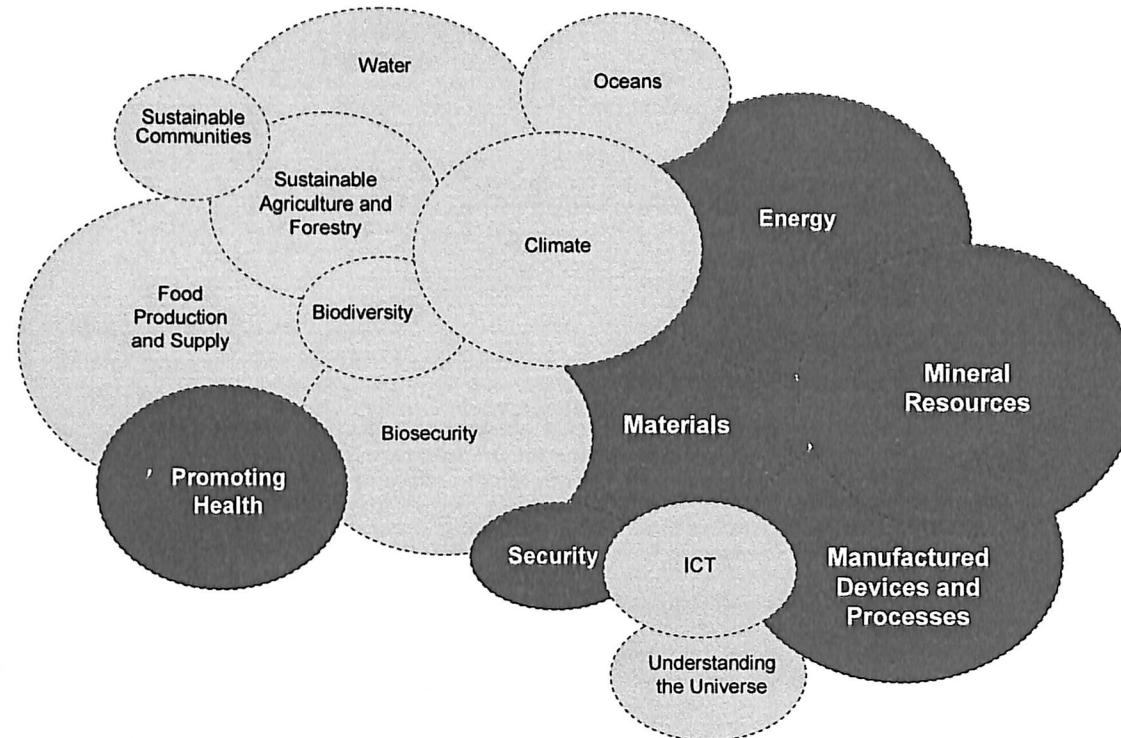
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1084 Discovery Bioinformatics and Imaging  (David Lovell)	Dominant Role: Transforming Industry  The massive increase in rate, volume and variety of agricultural and health data creates information specific research challenges that can only be addressed by development of innovative mathematical and information science solutions. The aim of Theme 1084 is the development and deployment of quantitative methods for information-intensive measurement platforms for use in the biosciences allowing not only analysis of these vast amounts of data but also making sound inferences and valid generalisations. The Theme interacts directly via collaborations, usually with biological researchers, both internally and externally with other research institutes. The Theme is also engaged by SMEs and multinationals.	\$0.3m	Increase the impact from our ongoing development of new tools and methods in statistical genetics by partnering more closely with plant and animal breeders. Develop proposal for statistical genetics in Computational and Simulation Science.
	Establish collaborations in, and develop tools and methods for the analysis of eco- and metagenomic data. Explore opportunities arising from existing strengths and relationships in Theme 1086 (Environmental Monitoring and Modelling)		
	Secure and develop co-investment in bioimaging with the Garvan Institute. Ensure two joint CSIRO-Garvan project activities are underway by the end of 2008-09 as part of this co-investment		
1085 Decision Technologies  (Andrew Dingian)	Dominant Role: Transforming Industry  Theme 1085 works on the 'science of risk', developing models and drawing conclusions for large, complex, multi-scale processes, understanding their structure and predicting future behaviour of materials, systems and processes. The overall aim is to develop evidence based decision-making platform technologies to reduce and manage decision uncertainty for industry, services and the community. The Theme works towards a diverse range of outcomes including more cost-effective health services; higher yield mining operations, lower cost financial services, allocation of water to the most (economically) valuable activities and reduced environmental footprint within transport and logistics. The Theme partners with innovative and 'early adopter' external private sector clients as well as collaborating with a range of Flagships and other CSIRO Themes.	\$9.3m	With key Finance and Insurance sector companies develop and validate risk/risk pricing estimation systems, model long term P&L risk distribution of large portfolios and apply real options theory to mathematical pricing of infrastructure investments. Leverage the IP through creation of evidence based decision tools and apply to other sectors eg Energy, Utilities and Supply chains
	Increase the impact of research by expediting commercial adoption of decision support software including DVASS vehicle routing/tracking, Reditus options pricing platform, eRostering toolkit, Chasm stockpile blending tool and the fluid simulation software for the film visual effects industries.		
	Develop evidence based decision tools for supply chain network optimisation and "negotiated scheduling" in complex, capital intensive decision environments and apply these results in industries in which Australia has a competitive advantage such as Steel, Coal, Wine and Logistics.		
	Integrate and couple Discrete Element (DEM) and Smooth Particle Hydrodynamics (SPH) methods to create high value, cross-platform technologies delivering computational modelling and process visualisation solutions to mining, mineral processing, industrial & urban systems and the digital content/motion picture industries		

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
			<p>Develop decision tools for global airspace management that improve the safety, efficiency and capacity of airspace</p>
1086 Environmental Monitoring and Modelling (TBA)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Theme 1086 aims to develop innovative statistical and mathematical methodologies to extract knowledge from the vast array of available data and modelling outcomes generated during the monitoring and analysis of complex environments at landscape, national and international scales. The Theme strategically partners with Local, State and Federal Government agencies, natural resource managers, resource planners, financial institutions and influential industry bodies enabling risk-informed decision making leading to evidence-based policy formulation, ecosystem stewardship, infrastructure planning and environmental services. These tools will provide greater certainty in the measurement, monitoring, assessment and reporting of environment performance, and aid in better public understanding of the issues.</p>	\$5.4m	<p>Undertake trials of Australia's carbon accounting system internationally to underpin carbon trading, eg China.</p> <p>Establish monitoring baselines to enable effective monitoring and management of urban and coastal environments using digital aerial photography.</p> <p>Develop methodology for estimation of whale population size &amp; distribution and estimated use for management by the International Whaling Commission.</p> <p>Focus on "<i>Innovation for Environmental Services</i>" through continued development of broadly applicable analytic technologies directed towards government's required NRM outcomes. Deepening partnerships with "service" companies able to deploy our methodologies</p>
1087 Tetrabyte Science (John A Taylor)	<p><b>Dominant Role: Major National Challenge</b></p> <p>There is a clear trend in scientific investigation to acquiring large (often massive) amounts of complex data, particularly for large scale research to address national challenges. However, there is consensus that the ability to collect data has already exceeded our capacity to analyse it. To enable CSIRO to maximise scientific benefits derived from new measurement technologies and computational science that produce large datasets, including images and streaming data, Theme 1087 aims to develop new technologies for the analysis, visualisation and integration of these large data sets. Theme 1087 outcomes will initially be via collaboration with a variety of industry facing CSIRO Themes in areas such as sensor networks, bioinformatics, materials, imaging and health. These interactions will form the basis for establishing international networks and collaborations for future work.</p>	\$5.5m	<p>Develop new tools and capability in Computational and Simulation Science, particularly in imaging and in modelling complicated biophysical systems.</p> <p>Develop a vibrant community of practice in CSIRO by establishing a computational and simulation science network that has strong national and international external linkages.</p> <p>Develop facilities for sharing technology for addressing computational and simulation science problems.</p>

## 2.2.5 Manufacturing, Materials and Minerals Group Portfolios

*Group Executive: Steve Morton*

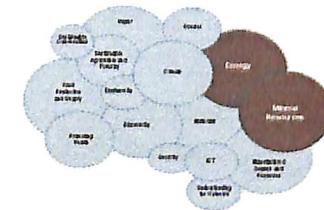
Core Research in the Manufacturing, Materials and Minerals Group is currently managed through four portfolios. These portfolios contribute across a range of Outcome Domains, primarily those illustrated in the diagram below. The following pages set out the key activities and outputs planned for 2008-09 for each Theme within these four portfolios.



## Manufacturing, Materials and Minerals – Core Research Portfolio 1

**Portfolio Leader: Mike McWilliams (Chief, CSIRO Exploration and Mining)**

*Primary Outcome Domain: Mineral Resources; Energy*

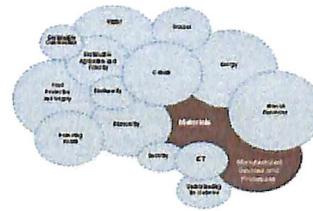


Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1115 Maximising the Value of Mining  (Hua Guo)	<p><b>Dominant Role: Transforming Industry</b></p> <p>In Maximising the Value of Mining, we develop and refine technologies and equipment that create continuous and step-change improvements in coal and metalliferous mining to ensure international competitiveness and sustainability of this critical sector of the economy. Theme 1115 works directly with mining companies, mining services providers and peak industry bodies to maximise mine productivity and recovery, enhance mine health and safety conditions and reduce the environmental impacts of mining. Principal research areas include new mining systems, mine operational control, geological and geotechnical characterisation, mine automation, sensing and communications, mine subsidence and ground water management, and coal mine methane emission reduction.</p> <p><i>Coal - Energy</i></p>	\$15.0m	<p><b>Improving Recovery, Efficiency and Safety</b></p> <p>Through integrated field research and numerical modelling, develop advanced planning methodology and design procedures for integrated coal and methane extraction in deep mining environments with multiple seams.</p> <p>Further develop and demonstrate advanced methods for large open pit slope design and management by extending existing research to include the effects of ground water on the stability of closely-jointed rock.</p> <p>Demonstrate improved coal milling processes to optimise coke quality by detailed coal grain analyses and pilot-scale coke quality testing.</p> <p><b>Enhancing Coal Mining Technologies</b></p> <p>Conclude technology licensing agreements with LASC Technology for longwall automation and with NEXSYS for real time risk management research outcomes.</p> <p>Implement real-time microseismic mine monitoring system at the Moranbah North Mine.</p> <p><b>Minimising Environmental Impacts</b></p> <p>Develop and demonstrate new horizontal coalmine methane post-drainage technologies to reduce greenhouse gas emissions.</p> <p>Further develop and demonstrate CSIRO's advanced prediction method of hydrogeological responses to longwall extractions in varying mining conditions to reduce the environmental impacts of coal mining.</p>

## Manufacturing, Materials and Minerals – Core Research Portfolio 2

**Portfolio Leader: Calum Drummond (Chief, CSIRO Materials Science and Engineering)**

*Primary Outcome Domains: Materials; Manufactured Devices and Products*



Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1103 Advanced Engineering Technologies  (Barrie Finnin)	<p><b>Dominant Role: Major National Challenge</b></p> <p>Through the development and commercialisation of technologies for the production of advanced engineered components, Theme 1103 seeks to improve the competitive position of Australia's manufacturing industry, maintaining cost competitiveness, creating new business, promoting vertical integration and reducing environmental impact. Benefits flow to the Australian economy through partnerships with SMEs and MNEs including automotive manufacturers, broader indirect industry engagement through CRCs and specialist engineering companies servicing manufacturing industries.</p>	\$7.3m	<p>Industry projects in: Materials development (metals and advanced ceramics); Technology development (casting and forming technologies) to achieve weight reduction (eg auto applications); Sustainable materials and manufacturing (eg reduced GHG emissions and lower cost manufacturing); Safety and Durability (eg armour and surface engineering) and Vehicle Drive Systems (based on advanced magnetic materials (reduced GHG emissions).</p> <p>Strategic research focused on: developing new alloys through rapid cooling (eg in conjunction with CET for CO<sub>2</sub> or H<sub>2</sub> membranes); Multi-scale modelling (for corrosion, fatigue mechanisms, etc); development of high ballistic performance ceramic materials and the Cold Spray direct fabrication process.</p>
1104 Sustainable Polymeric Materials  (Stuart Bateman)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1104 contributes to the chemicals, materials and technical textiles sectors of the Australian manufacturing industry, maintaining global competitiveness and establishing new industry opportunities. In conjunction with developments in nano-composites, improvements in economic and environmental sustainability are sought from substitution of natural fibres and biomass for dependence on petroleum based product feedstock. In partnership with leading global product end-users, local manufacturers are identified to commercialise new technologies and products, whilst local industry is engaged both directly and through CRC joint ventures, with some spin-off companies created to seed new industries.</p>	\$11.8m	<p>Development of multi-functional and self-repair nanocomposites through design and fabrication of multi-functional nanofillers &amp; achievement of nanodispersion by surface/interface molecular design.</p> <p>Understanding of biodegradation mechanisms for design and development of high performance bio-derived plastic materials with triggered biodegradability.</p> <p>Development of combinatorial approach and methodologies, and their integration with particular relevance to nanocomposites and bioplastics R&amp;D.</p>
1106 Industrial Research Services  (Mark Burgess)	<p><b>Dominant Role: Community Solutions</b></p> <p>Theme 1106 provides technical testing services to Australian industry in line with the satellite function of the Role House. The theme helps companies introduce innovative products into the Australian market and helps demonstrate to consumers the safety and reliability of the products they use through rigorous product performance testing. The theme complies with competitive neutrality policy.</p>	\$5.5m	<p>Provision of: research and development services; complex testing and consulting services to a range of companies, particularly SMEs; and evidence of Australian products complying with Australian and international standards which allow Australian companies to gain access to export markets. This service is provided to a range of small to larger companies.</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1142  Manufactured Devices: Growing Globally Competitive  (Scott Martin)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1142 is working to develop new manufactured devices from innovative materials science to grow segments of the Australian economy. The products will be high-technology and knowledge intensive, with high profit margins and large export revenue. Physics is a key enabling discipline. The theme's approach is to increase interaction with appropriate Australian manufacturers and end users in areas of national and global importance leading to industry-pull R&amp;D product development – using inputs from industry to prioritise research areas. As well as partnering for commercialisation the theme is establishing trusted advisor relations with a number of SMEs and bigger companies.</p>	\$11.8m	<p>The dysphagia catheter technology will be developed to the point at which it will transfer out of CSIRO.</p> <p>Successful detection of UneXploded Ordnances (UXOs) with rotating gradiometer in a field trial with commercial partner. Secure funding from industrial partner for commercialisation of a SQUID-based metal-in-food detector targeting the meat safety market.</p> <p>Step-change improvements in thermoelectric energy conversion efficiencies using novel nanoparticle composites. Possible routes for synthesis and fabrication of such new thermoelectric materials will be investigated by adopting high-throughput approaches to determine whether real devices will capture the potential predicted by theory.</p> <p>Building on the successful technology transfer of the process rheometer to a local manufacturer in 06-07, increase production efficiency in one or more local processing industries via adoption of high-power ultrasound devices.</p>
1145  Nano-Additives for the Fine Chemicals Industry  (Tony Hughes)	<p><b>Dominant Role: Transforming Industry</b></p> <p>Theme 1145 is working to transform the Australian fine chemical industry by partnering with leading global and domestic companies to identify, prioritise and provide new materials for niche markets for Australian fine chemical companies to manufacture value added additives. This will create positive environmental and services impacts by using nano-based materials that replace toxic materials, provide service life improvements and reduce environmental emissions. The theme is focusing on inorganic and hybrid inorganic/organic materials designed from the molecular level. The theme collaborates with SMEs, as well as multinational companies, to ensure markets are primed for the ultimate products.</p>	\$8.3m	<p>Identify areas where regulatory (safety and environmental)compliance is driving a search for replacement materials. As an example, the theme has partnered with Odour Emission Technologies (OET) in WA to develop environmental catalytic systems for the reduction of malodorous emissions.</p> <p>The theme aims to transform material design in order to increase component life in critical application by up to 5 times. We will continue the partnership with Chevron through the development of Geopolymers for LNG storage in Northwestern Australia.</p> <p>The frontier area of advanced materials is directed at the design of responsive materials and includes self healing coatings and the incorporation of thixotropic materials in fabrics to achieve hardening on impact.</p>
1034  Building Sustainable protein Biofibre Industries  (Anthony Pierlot)	<p><b>Dominant Role: Incremental Innovation</b></p> <p>Theme 1034 is working to enhance Australia's existing wool industry while endeavouring to build new protein fibre industries. This will be achieved by: (a) using modern genetics to produce superior wools more efficiently in order to help maintain wool's position as a premium apparel fibre; (b) extracting greater value by identifying unique properties from the cellular components of wool for high-end technical applications; and (c) developing new products and markets for protein fibres. The theme has well-established networks for achieving impact with the Australian wool industry and the associated global machinery and chemical suppliers.</p>	\$4.1m	<p>Identify the extent that fibre physical properties eg fibre moduli and scale height, vary due to genetic and environmental factors and their affect on fabric handle.</p> <p>Develop preferred prototype skin comfort meter and validate response with wear trials (the development of the instrument and associated QA system will enable end products to be routinely tested objectively to ensure that consumers will have a satisfactory and indeed positive skin comfort response from approved garments containing fine Australian wool.</p>

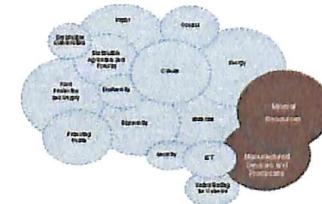
Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
			<p>Identify (i) the effects of various oxidative and reductive bleaching treatments on the clean colour and photostability of Ecowash SR treated wool sliver provided by The Merino Company. (ii) the effects of trace metal content on the clean colour and photostability of the Merino progeny in the CRC Information Nucleus flocks.</p> <p>Benchmark and make recommendations to major Chinese spinning mills on top dyeing and spinning performance of superfine Australian wools</p>
1036 Advanced Fibrous Materials  (Niall Finn)	Dominant Role: Transforming Industry	\$7.7m	<p>Demonstrate the efficacy in a clinical environment of the Sensor-sock for early detection of pressure induced ulcers in diabetics.</p> <p>Demonstrate the application of CNT core-spinning technology to hollow filament membrane production and to implantable electrodes.</p> <p>Develop fabric anodes for a textile lithium battery to be developed as part of the FIED project with DSTO.</p> <p>Second generation impact and strain sensing fabrics and garments demonstrated in conjunction with the AIS for boxing and motion monitoring applications.</p>
			<p>Show the feasibility (or otherwise) of large textile based lightweight parabolic reflectors for solar and microwave applications. In the event of technical success engage with the SKA project and a commercial partner for further development.</p>
1172 Transformed Forest Industries  (Jamie Hague)	<p>Dominant Role: Incremental Innovation</p> <p>Theme 1172 will deliver new products and new technology and processes to improve the economic value and reduce the environmental impact of the Australian Forest Industry. The Theme will transform existing commodity-based companies into manufacturers of high value functional products by developing new tailored germplasm for new industries, new biofibre-based processing industries, and new biomaterials and bio-products. Global forestry companies, Australian forestry and forest product companies, other companies with an interest in bio-product development, and other lead research agencies are involved in this research. The Theme will deliver benefits across the entire forestry value-chain in Australia.</p>	\$15.2m	<p>Integrate CFB and CPI capability to enable cross-species functional analysis of biofibre genes (fibre-omics project). 100 genes identified which control key traits for existing and potential future industries: fibre structure, lignocellulosic yield, xylem and extractive chemistry, water use efficiency.</p> <p>First incorporation of molecular data into quantitative germplasm improvement strategies – high impact publications.</p> <p>Establish genetic improvement plans for forest species suitable for intensive plantation forestry in the tropics and subtropics based on populations identified following the assessment and analysis of existing field trials. Partnership to deliver this germplasm to identified clients (ITC Ltd, QWI) developed with QDPI, regional universities.</p> <p>Bioinformatics framework developed for modelling of climate change impacts on forest products quality.</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
			<p>Integration of Phenomics measurement technologies and mega-data handling for biofibre structural and matrix chemistry analyses: completion of second phase validation for prediction of softwood and hardwood chemistry. Validation of predictive models for product performance, climate adaptability – optimization of flow, complexity management etc. – and preliminary commercialisation stage reached for services provision.</p> <p>Research program established on the isolation of cellulose nanocrystals from xylem tissues and their application as reinforcements for thermosetting plastics.</p> <p>Determine the suitability of Super Critical CO<sub>2</sub> treatments for processing (moisture and extractives removal) eucalypt xylem tissue.</p> <p>Framework established for determining the role and contribution of forest products to carbon sequestration.</p> <p>Develop a strategic R&amp;D relationship with The Laminex Group, aimed at minimising the environmental footprint of wood composites.</p>
1174 Advancing Human Performance (Richard Helmer)	<p><b>Dominant Role: Transforming Industry</b></p> <p>CSIRO, the AIS, and affiliated organisations will accelerate Australian Sport's technical advantage by applying CSIRO's knowledge and capability in Advanced Materials, ICT and Modelling to forward our international sporting competitiveness and success.</p> <p>Theme 1174 will address needs related to physical and psychological performance advancement (including aspects for prevention, management and recovery from illness and injury, skill learning, body form and capability), using intelligent materials, wearable technologies, and expert knowledge systems. The theme will precipitate a cluster of businesses in manufacturing and knowledge services to generate new business activity related to human performance advancement that leverages Australia's sporting culture of success.</p>	\$1.5m	<p>Performance management - Develop and apply wearable mobile technologies that can be used for determining location and task performance in the field and include aspects of injury prevention and rehabilitation.</p> <p>Advanced Infrastructure and Equipment – Review and Demonstrate in elite sport the 'synergy' program that aligns CSIRO's diverse expertise and capability technologies with human performance needs.</p> <p>Engagement - Establish collaborative relationships with AIS elite international athletes and coaches, with community based programs for developing future sporting talent, and with Australian companies with technologies and products that can be adapted and/or applied to sport.</p>

## Manufacturing, Materials and Minerals – Core Research Portfolio 3

**Portfolio Leader: Bart Follink (Chief, CSIRO Minerals)**

*Primary Outcome Domains: Mineral Resources; Manufactured Devices and Processes*

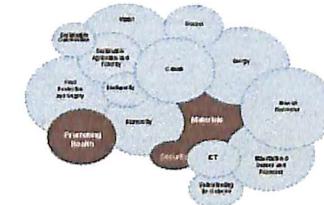


Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1053 Iron ore – Maximising export marketability  (Ralph Holmes)	<p>Dominant Role: Incremental Innovation</p> <p>In light of declining ore grade and the emergence of attractive international prospects, Theme 1053 seeks to sustain the viability of the Australian iron ore industry by maximising the value-in-use of Australian ores. The industry accesses the benefits of the research both directly, through collaborative research with major and minor producers, as well as indirectly through the development of standards and partnership with industry bodies. The Theme will focus on ore characterisation, process modelling and measurement advances, blending, beneficiation, agglomeration, and the evolution of new products.</p>	\$4.6m	<ul style="list-style-type: none"> <li>Develop new methodologies in iron ore characterisation, in partnership with end users.</li> <li>Develop sintering and pelletising methodologies for Australian iron ore producers.</li> <li>Develop alternative agglomeration methods for Australian iron ores, in partnership with end users.</li> <li>Develop referee XRF methods for analysis of trace elements in iron ores, in partnership with end users</li> </ul>
1054 High-performance mineral processes for Australia  (John Farrow)	<p>Dominant Role: Incremental Innovation</p> <p>The purpose of Theme 1054 is to enhance the competitiveness of the Australian mineral processing industry by improving the performance of existing and contributing to development of the next generation of technology for mineral extraction and processing. Proportionately small improvements in this area will result in significant economic and environmental benefits to the Australian community. Research is conducted in collaboration with major and minor mining houses, equipment and service providers and industry research bodies. Research work spans fundamental generation of concepts and capability, development of generic solutions for complex processing issues and application of those solutions to particular situations.</p>	\$11.5m	<ul style="list-style-type: none"> <li>Develop generic solutions to complex mineral processing issues for multiple end-users.</li> <li>Customise mineral processing concepts for application within specific industry domains.</li> <li>Develop new mineral processing capabilities to support emerging industry engagement.</li> </ul>
1055 Instrument Systems for On-Line Analysis  (Nick Cutmore)	<p>Dominant Role: Major National Challenge</p> <p>Developing and advancing technology, Theme 1055 seeks to benefit the mineral processing industry by improving efficiency, resources utilisation and environment performance, whilst also applying technology outputs to security applications. This is being done in collaboration with mining companies and instrument developers, as well as through engagement with government agencies and a private joint venture. Technology in mineralogy, elemental analysis, particle size analysis and soft sensing is being developed into market-ready instrument products for industrial application in minerals recovery and processing. Air cargo scanning technologies are being commercialised with a global partner.</p>	\$6.9m	<ul style="list-style-type: none"> <li>Develop new on-line analysis capabilities and implement technology transfer strategies for instruments for the (mineral) process industry.</li> <li>Develop novel technologies and commercialisation strategies for security (scanning) applications.</li> <li>Develop and trial commercial prototype instruments with industry partners to support and accelerate instrument commercialisation strategies.</li> </ul>

Manufacturing, Materials and Minerals – Core Research Portfolio 4

## **Portfolio Leader: Megan Fisher (Acting Chief, CSIRO Molecular and Health Technologies)**

#### ***Primary Outcome Domains: Materials; Promoting Health; Security***



Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1048  National Security Technology Partnerships  (Peter Osvath)	<p>Dominant role: Major National Challenge</p> <p>Theme 1048 aims to build national security partnerships with industry, DSTO, ANSTO, Geoscience Australia, and State and Federal Agencies to enhance the security of Australian society against technically sophisticated terrorist, criminal and natural threats. The theme also fulfils CSIRO's responsibility to the Publicly Funded Agencies' Collaborative Counter-Terrorism Program (PACCT). Research utilises key capability from the biological and physical sciences, and focuses on technologies to protect against chemical and biological attack, border surveillance and intrusion detection, product authentication and risk assessment. The path to impact for technologies relies on both commercialisation and the development of regulatory policy by government.</p>	\$9.8m	<ul style="list-style-type: none"> <li>Fulfil CSIRO's responsibility to the Publicly Funded Agencies' Collaborative Counter-Terrorism program (PACCT) and provide Secure Australia cluster coordination</li> <li>Provide authentication solutions to deter identity and commercial fraud and crime</li> <li>Develop handheld sensor devices for rapid emergency worker use in chemical, biological and explosives detection</li> <li>Develop rapid and reliable technologies for the detection of concealed weapons/chemicals based on multi-spectral imaging</li> <li>Develop technologies for rapid and effective information sharing, integration and exploitation, leading to enhanced situational awareness and improved collaboration across multi-organisational teams in all phases of crisis management</li> </ul>
1088  Australian Biotech Growth Partnerships  (Tim O'Meara)	<p>Dominant role: Transforming Industry</p> <p>Theme 1088 exists to provide key scientific capabilities to support the establishment and growth of promising Australian biotechnology companies in the agricultural, veterinarian and health sectors. Partnerships are focussed towards the greatest opportunity to add value through technically challenging research with SMEs and mid-tier firms who are likely to have the greatest commercial growth opportunities. Relationships with other research agencies and a number of multinationals are also important. The Theme draws on capabilities including protein engineering, characterisation and production; peptide mimetic chemistry; X-ray crystallography; and fragment based ligand design to develop an appropriate science solution to individual company needs.</p>	\$9.6m	<ul style="list-style-type: none"> <li>Add value to the biotech industry by partnering with selected biotech companies in their discovery pipeline and growth strategies. For example, using a multi-disciplinary approach, develop new ligands that inactivate HIV replication (\$6m Avexa collaboration).</li> <li>Contribute protein engineering, fermentation, animal trials and medicinal chemistry to the new CRC for Cancer Therapeutics.</li> <li>Assist in the establishment of the \$15 million bioprocessing facility at Clayton, based on NCRIS, Victorian Government, and CSIRO commitments. This consortium-run facility will be a focal point for tissue culture and microbial fermentation in Australia.</li> </ul>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1089 Biomedical Materials and Regenerative Medicine  (Keith McLean)	<p>Dominant role: Transforming Industry</p> <p>Theme 1089 aims to develop, evaluate and secure Intellectual Property in new platform biomedical materials capable of regulating biological function (smart biomedical materials) for application in tissue repair, replacement and regeneration – in particular novel ophthalmic devices; smart polymers and surfaces for biomanufacturing including the expansion of stem cells; novel scaffolds for regenerative medicine including wound repair and novel biomedical adhesives and sealants. This will result in positive health benefits to the Australian community as well as growing the value and economic return of high technology industries. The Theme has strong relationships with industry and academia.</p>	\$12.6m	<p>Develop and evaluate new platform biomedical materials capable of regulating biological function ("smart biomedical materials") for application in tissue repair, replacement and regeneration.</p> <p>Work with end users to develop novel, smart polymers and surfaces for biomanufacturing including the expansion of stem cells; commercialise novel materials and surface coatings for ophthalmic devices; develop novel synthetic, natural and recombinant scaffolds for regenerative medicine including cardiac, neural and wound repair applications and novel biomedical adhesives.</p>
1144 Imaging for Early Disease Detection  (Peggy Stasinos)	<p>Dominant role: Major National Challenge</p> <p>Theme 1144 aims to improve the health and well-being of the Australian community by reducing the impact of diseases such as cardiovascular disease, colorectal cancer and neurological diseases through early detection achieved by advances in medical imaging technologies. The theme will produce innovative targeted contrast reagents, novel detection and image processing systems including hardware, firmware and software, and novel X-ray imaging methods and instruments. The Theme aims to develop licensing arrangements with multinational companies and with SMEs who supply diagnostic technologies to the health care sector.</p>	\$6.7m	<p>Develop nanostructured contrast agents for Medical Imaging applications based on the synthesis and formulation of colloidal systems, nanoparticles and/or microbubble platforms.</p> <p>Develop <i>new coatings</i> to allow the stabilisation of nanoparticles <i>in vivo</i> to enable effective bioconjugation of targeting reagents.</p> <p>Develop <i>target specific imaging technologies</i> to enable tissue or cell specific imaging at greater levels of functionality.</p> <p>Develop novel x-ray imaging methods and instruments, especially involving phase contrast imaging and synchrotron systems</p>

## 2.3 Outreach and Education

### CSIRO Publishing, Discovery and Education

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1151 Discovery Centre  (Jim Peacock)	The CSIRO Discovery centre is a purpose-built, public complex showcasing CSIRO research. Its philosophy is the presentation and communication of ongoing and completed research and technology. Science is presented in an entertaining way to demystify it, and educate people of all ages about the fascinating world of research and innovation. Theme 1151 via CSIRO Discovery is also home to a great range of public events and, as a working laboratory, it offers the public a unique insight into science at work.	\$2.2m	<ul style="list-style-type: none"> <li>• Exhibitions. Focussing mainly on communicating Flagship topics - energy, climate change, health and wellbeing.</li> <li>• Schools programs. 90 minute program about current research and its benefits provided to visiting schools from around Australia.</li> <li>• Events and public programs. Events coordinated for external and internal clients. Public programs and community outreach through special interest exhibitions, lectures, films, seminars, conferences.</li> <li>• Public relations. Providing an overview of CSIRO for high-profile stakeholders, international groups and companies.</li> <li>• Information centre. Distribution of detailed information and other resources specific to CSIRO and research.</li> </ul>
1153 Education Programmes  (Ross Kingsland)	Theme 1153 offers a range of science education projects to alert school students, their families and teachers to the contribution of scientific research to our community.	\$8.9m	<p>Nine CSIRO Science Education Centres (CSIROSECs), including the Lab on Legs program, the Student and Teacher Research Schemes and the Cutting-Edge Lecture Series showcasing Australian science.</p> <p>CSIRO's Double Helix Science Club, incorporating the club's magazines The Helix and Scientriffic as well as hundreds of club events and an online club shop.</p> <p>The Science by Email weekly e-newsletter for families and teachers and the SCOPE television program produced with Network Ten.</p> <p>Scientists in Schools links scientists with teachers to create learning experiences for students and all involved.</p> <p>The CREST program enables students to design and undertake their own science and technology research projects.</p> <p>The BHP Billiton Science Awards is the national student research competition and also rewards outstanding teachers.</p>
1154 CSIRO Publishing  (Paul Reekie)	CSIRO Publishing operates as an independent science and technology publisher with a global reputation for quality products and services. The internationally recognised publishing program covers a wide range of scientific disciplines, including agriculture, the plant and animal sciences, and environmental management. Theme 1154 outputs include journals, books, magazines and CD-ROMs. Content is published in print and online and editorial standards and production methods are at the forefront of e-publishing standards.	\$10.4m	<p>Journal Publishing: Grow the number of journals published; Reposition existing journal editors in the community to attract high impacting science; Prepare for an Open Access environment.</p> <p>Book Publishing: Grow the range &amp; type of books being commissioned; Increase the number of books published: Seek co publication contracts &amp; new agency business; Identify new book lists for acquisition.</p>

<b>Theme (Leader)</b>	<b>Theme Description</b>	<b>Budget 2008-09</b>	<b>Activities and Outputs for 2008-09</b>
			<p>Multimedia: Expand multimedia &amp; e-learning contract business; Provide on demand multimedia services to CSIRO; Develop the ScienceImage service for CSIRO &amp; external customers.</p> <p>Magazines: Reposition existing &amp; develop new magazine products; Manage CSIRO magazines (ECOS, Farming Ahead relationship) on behalf of the Organisation; Revamp the ECOS web environment to build a "sustainability" community</p>

## 2.4 National Research Facilities and Collections

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
1047 Diagnosis Surveillance and Response (AAHL)  (Peter Daniels)	<p>Dominant Role: Managing a National Facility</p> <p>Theme 1047 seeks to deliver CSIRO's national service responsibilities in the area of emergency terrestrial animal and fish diseases, including diseases of wildlife and zoonotic diseases. This Theme utilises the facilities of the Australian Animal Health Laboratory (AAHL) to provide diagnostic services and contribute to the biosecurity of animal and human populations in Australia and the Asia Pacific region, and enhance the international competitiveness of Australia's animal industries through application of excellent science and provision of scientific advice.</p>	\$28.2m	<p>Implement the key diagnosis, surveillance and response service deliverables agreed under the MOU with DAFF.</p> <p>Contribute to the control of H5N1 Avian Influenza in Southeast Asia through implementation of AusAid and ACIAR biosecurity programs and participation in OFFLU and OIE activities in the region.</p> <p>Provide leadership in the ongoing development of animal health laboratories into coordinated national/international networks and promote the implementation of underpinning quality assurance systems (eg analysis of internal quality control (IQC) data, provision of proficiency testing, etc)</p>
1067 Australia Telescope National Facility Operations  (David McConnell)	<p>Dominant Role: Managing a National Facility</p> <p>Theme 1067 operates the radio telescopes at Narrabri, Mopra, and Parkes, and manages the use of the NASA Tidbinbilla station for the purposes of radio astronomy. The telescopes are used by astronomers from around the world in order to maximise the value of the scientific research.</p> <p>The theme is preparing for operation of a new telescope – ASKAP – in Western Australia which is being developed under Theme 1070. To facilitate this, ATNF's operations are undergoing a substantial restructure which will see the establishment of a single Science Operations Centre in Marsfield serving all ATNF facilities, and reorganisation of the Theme into a Science Operations stream and an Engineering Operations stream.</p>	\$15.3m	<p>Continue to operate the radio astronomy facilities (Parkes, ATCA, Mopra, LBA) in order to serve the Australian and International scientific community.</p> <p>Commission and characterise the new 7mm band on the ATCA and the new 13mm receiver on Parkes; continue building the quality of support for mm-wave science on Mopra and the ATCA.</p> <p>Plan and introduce increased data storage capacity to cater for CABB data and astronomical data archives.</p> <p>Design a new operating model for ATNF facilities that will meet the expected demands of 2012 and beyond.</p>
1099 Marine National Facility Operations  (Fred Stein)	<p>Dominant Role: Managing a National Facility</p> <p>Theme 1099 enables critical marine research which provides key information and analysis to government and industry for policy development and implementation on issues such as global climate change, natural resource management, resource extraction, extreme events, sea operations and rescue, national defence and biotechnology. This Theme enables the Australian science community to undertake innovative, world-class blue water marine research through the provision of facilities and equipment, peer review of scientific applications to use the facility, and cost effective management of infrastructure and facilities.</p>	\$9.5m	<p>In partnership with DIISR realign the level of investment in blue-water research vessel capability provide at least one, dedicated ~80 metre multi-disciplinary blue-water research vessel operating full time in Australia's regional seas and oceans.</p> <p>Continuous improvement of the delivery of MNF capability to the Australian marine science community.</p>
1173 National Biological Collections  (Mark Lonsdale)	<p>Dominant Role: Managing National Collections</p> <p>The purpose of Theme 1173 is to create an on-line, dynamic knowledge base of Australia's unique biodiversity and catalyse new synergies between CSIRO's five major national biological collections: (a) the Australian National Fish Collection; (b) the Australian National Herbarium; (c) the Australian National Insect Collection, (d) the Australian National Wildlife Collection; and (e) the CSIRO Collection of Living</p>	\$16.2m	<p>Build cross linkages with other CSIRO collections to provide greater efficiencies in collection management.</p> <p>Provide duty of care to the Australia National Insect Collection.</p> <p>Maintain the Australian National Herbarium (ANH) as the national focus of an Australia-wide set of botanical collections,</p>

Theme (Leader)	Theme Description	Budget 2008-09	Activities and Outputs for 2008-09
	<p>Microalgae. Information provided by the Theme provides managers and government agencies with verifiable biological information and assists in meeting Australia's commitments under the National Strategy for the Conservation of Australia's Biological Diversity.</p>		<p>Make information about the ANH collections and Australian plant diversity, occurrence and distribution freely accessible through collaborative database projects and the Internet for research, community benefit and government policy development and decision-making for management, conservation and sustainable use of biodiversity.</p> <p>Incorporate 70% of plant names covering 80% of angiosperm families into web-based Australian Plant Census, following assessment and national agreement.</p> <p>Curate and manage the facility and its collection of Australian, Antarctic and Indo-Pacific fishes, their data, photographs, radiographs, genetic samples and taxonomic reprints to enable research on biodiversity and biogeography of Australian and Indo-Pacific fishes</p> <p>Maintain and build the national reference collection of vertebrates of Australia and the surrounding region.</p>

### **3. CAPABILITIES – OUR STRENGTH IN SCIENCE AND TECHNOLOGY**

#### **3.1 Agribusiness Group – Business Units and Capabilities**

*Group Executive: Joanne Daly*

##### **Entomology**

*Chief: Mark Lonsdale*

Total Budget: \$15.390m (2008-09)

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Enzymology and biochemistry (Peter East)	Manipulate enzyme and structural protein function and structure to create new biochemical pathways and biomaterials.	41	<ul style="list-style-type: none"><li>Appoint a new indefinite Research Scientist with skills in enzyme reaction chemistry and protein structural biology to meet emerging needs in enzyme design and in vitro evolution.</li><li>Strengthen capability and capacity for gene/enzyme discovery through continued engagement with the <i>Helicoverpa</i> genome and gut metagenomics components of the Transformational Biology Capability Platform initiative.</li></ul>
Molecular Cell Biology (Sylwek Chyb)	Understand the biomolecular basis of odour and taste detection. Developing virological biocontrol methods. Developmental biology.	17	<ul style="list-style-type: none"><li>Pursue CRC National Plant Biosecurity funding for detection of insects in stored grain.</li><li>Set up a collaborative project on insect vector sensory biology strengthening the exiting Ento- UQ Vector Biology capability.</li><li>Engage with FFF Designed Foods and Ingredients Theme re CyberTongue.</li></ul>
Invertebrate Systematics (Adam Slipinski)	Defining evolutionary processes using systematics, taxonomy and molecular biology. Characterising the identity and relationships of the Australian fauna and seeking to interpret its evolutionary origins. Developing novel approaches to deliver the knowledge required for biodiversity conservation and as indicators of environmental sustainability.	37	<ul style="list-style-type: none"><li>Develop further cross-cutting capacity in systematics by integrating morphology and molecular approaches with new investments and appointments (molecular technician, postdoctoral fellows in Diptera and Coleoptera - Tree of Life).</li><li>Increase curatorial activities in ANIC that are critical for delivering information to the Atlas of Living Australia (ALA) and CERF Taxonomy Hub by appointing a Collection Manager with a broad leadership role in ANIC as well as curatorial support positions.</li><li>Appoint a Digital Data Manager in order to increase the bandwidth and volume of digital data being supplied from the collection to the ALA and CERF Taxonomy Hub.</li></ul>
Genomics and Genetics (Rod Mahon)	Understanding the genetics of resistance to transgenic crops by insects including the characteristics of the pest and its host plant	23	<ul style="list-style-type: none"><li>Assemble and annotate the <i>Helicoverpa armigera</i> genome through the Transformational Biology capability platform and in collaboration with multiple teams around the world.</li><li>Improve in-business unit genome bioinformatics capability via an OCE Science Leader proposal.</li></ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
	that impact on resistance evolution. Plant-animal interactions.		
Invasion Ecology (Andy Sheppard)	Ecology and evolution of invasive plants and animals in a management context. Risk and economic analysis of plant biosecurity and invasive species threats at species, landscape and industry scales	31	<ul style="list-style-type: none"> <li>• Complete tenure reviews for key early career research staff in invasive plant ecology and eco-physiology</li> <li>• Seek co-investment for postdoctoral expertise in molecular insect pathology</li> <li>• Engage key capability in NPBCRC and CAF activities</li> <li>• Increase engagement with Vertebrate capability in other Divisions through Theme 1077.</li> </ul>
Functional and Spatial Ecology (Saul Cunningham)	Developing management systems at landscape scales for invasive pests, beneficial invertebrates and biodiversity in agricultural and native ecosystems.  Understanding soil fauna and its impact on plant performance.	23	<ul style="list-style-type: none"> <li>• Secure access to high level skills in the modelling and analysis of spatially explicit data.</li> <li>• Increase linkages between soil ecology and transformational biology.</li> <li>• </li> </ul>
Biocontrol (Louise Morin)	Use branches of applied ecology to develop environmentally-friendly solutions to manage alien invasive plants. Undertake selection, testing and risk management of biocontrol agents for nationally important invaders, develop and implement release strategies and monitor their impact.	25	<ul style="list-style-type: none"> <li>• Finalise planning for the new containment facility to be built at the Qld Ecoscience precinct, Brisbane.</li> <li>• Actively engage in the new Weed Research Centre to be established by the Australian Government.</li> </ul>

## Food Science Australia

CEO: Anthos Yannakou

Total Budget: \$19.450m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Food Architecture and Structure (Leif Lundin)	Designing functional food and ingredient microstructures by understanding materials/product behaviours and the underlying physics of structuring processes and the behaviour of food in physiological environments	18	<p>Capability development activity will focus on mechanics of protein and protein containing composites and biopolymer networks, divided into three parts:</p> <ul style="list-style-type: none"> <li>Assembly of protein composite networks: Solvent and process effects on protein solution behaviour and kinetics of network formation. Investigating effect of different unit processes on structural organisation of proteins. This part of the program will also contribute to the development of high resolution time resolved visualisation techniques and mechanical measurements probing structures at all length scales nm-mm.</li> <li>Mechanical properties of composite networks: including their properties under large deformation and fracture. Special focus on protein fibre composite materials.</li> <li>Hierarchical multi-scale modelling of a complex protein composite material: Developing structure function models for protein gels and composites.</li> </ul>
Food Chemistry and Biochemistry (Mary Ann Augustin)	Design, manipulate and characterise specific flavours, textures and functionalities in agrifood materials through knowledge of chemical interactions and processing of natural and synthetic compounds	53	<ul style="list-style-type: none"> <li>Develop tribology techniques to allow analysis of food films deposited on tongue papillae (or other cell systems) with the aim of understanding food matrix effects on the transfer of ions or flavour molecules through the food matrix to flavour receptors on the tongue.</li> <li>Develop an enhanced understanding of the effect of innovative processing stressors (pulsed electric fields, high power ultrasound) on the hydrodynamic and colloidal properties of food components.</li> </ul>
Food Microbiology (Gary Dykes)	Control of microbes across the entire food chain using conventional and transformational technologies.	34	<ul style="list-style-type: none"> <li>Adopt a transformational biology approach to characterise the empirical and mechanistic response of specific and industrially-relevant target microorganisms to these three important formulation and processing strategies.</li> <li>Develop flow cytometry, small angle x-ray scattering and neutron scattering to understand the physiological changes occurring in bacterial endospores and fungal ascospores when subjected to different thermal profiles.</li> </ul>
Food Process Engineering (Jay Sellahewa)	Conceptualisation, design and development of processes to transform agrifood raw materials into intermediates or safe to eat consumer products with defined structures and desired sensory attributes together with the required nutritional and functional characteristics.	42	<ul style="list-style-type: none"> <li>Develop and enhance core capabilities in food process engineering to build an improved understanding of process systems to integrate the food process chain.</li> <li>Work in collaboration with other CSIRO business units to apply these capabilities to sustainable food processing with a focus on water and energy use efficiencies in-plant.</li> </ul>

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Nutrition & Health - including sensory (Michael Fenech)	This capability focuses on determining the impact of dietary patterns, functional foods and micronutrients on different but important aspects of human health. It also explores those factors that determine the sensory acceptance of foods. This research is then translated into programmes and initiatives aimed at improving public health generally and within the context of weight management strategies.	65	<ul style="list-style-type: none"> <li>• Employ post-docs or equivalent solely dedicated to new applications of the Becton Dickinson flow cytometer and the Metasystems Image cytometer (both cytometers which we already have) that may also be deployed for high content analysis, albeit in a less efficient mode than Laser Scanning Cytometer.</li> <li>• Capability will also be deployed to develop novel seamless non-invasive methods (e.g. breath condensate analysis) of diagnosing DNA damage, altered gene expression and metabolic/nutritional status.</li> </ul>

## Livestock Industries

*Chief: Alan Bell*

Total Budget: \$20.406m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Pathogen identification and characterisation (John Lowenthal)	Identifies and characterises new and emerging human and livestock pathogens and their vector relationships. Develops novel platforms and methodologies to establish rapid pathogen profiling and tracking	45	<ul style="list-style-type: none"> <li>• Utilise NPP funds to recruit several new positions in veterinary pathology</li> <li>• Develop enhanced skills in diagnostic pathology and animal experimentation using animal infection models over the next three (3) years.</li> <li>• Further develop advanced tomography capabilities through NCRIS Capability Program 5.3.3 Live-cell imaging consortium</li> </ul>
Diagnostic sciences (Mike Johnson)	Performs quality-assured diagnostic testing in an advanced biosecurity environment. Provides advice to government agencies on disease control and transfers diagnostic capability as appropriate	65	<ul style="list-style-type: none"> <li>• Commission Diagnostic Response Emergency Laboratory (DERL) in July 2008</li> <li>• Continue to engage actively in NCRIS initiatives to develop and promote collaboration with and the wider use of AAHL's biocontainment capabilities by researchers from other organisations conducting biosecurity research</li> <li>• Develop enhanced capacity in molecular diagnostics and veterinary epidemiology through application of NPP and NCRIS funds</li> <li>• Engage in national animal health network initiatives to focus specialist remote diagnostic capability within AAHL and extend information-sharing capabilities to ensure increased technology transfer to state veterinary laboratories</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Host defence against pathogens (John Lowenthal)	Through the study of the host-pathogen interactions, seeks to understand effective defence mechanisms and so to develop prophylactic and therapeutic measures	50	<ul style="list-style-type: none"> <li>• Cease work in plant toxicology</li> <li>• In the light of SIP3 outcomes, review capability spread to focus into high-impact areas</li> </ul>
Animal genomics and genetic analysis (Gene Wijffels)	From a foundation of genetic information, analyses genetic variation in natural populations to provide enhanced tools for animal selection. Applies computational tools to the understanding of tissue and whole-animal biology.	40	<ul style="list-style-type: none"> <li>• Reduce overall capability in genomics in response to SIP3 funding outcomes</li> <li>• Focus efforts to seek Transformational Biology funding to develop complementary cross-CSIRO post-genomics capabilities</li> <li>• Utilise Rendel Fellowship to enable placements for early to mid-career scientists in laboratories with international reputations in livestock molecular physiology/phenomics</li> </ul>
Cellular, reproductive and developmental biology (John Lowenthal)	Working at the cell, tissue and whole animal level, develops science for the modulation of the animal through advanced reproduction, transgenesis and other novel technologies.	18	<ul style="list-style-type: none"> <li>• Jointly with the University of Queensland, appoint an established leading scientist as Professor of Advanced Reproduction and Developmental Biology</li> <li>• Recruit a science leader for advanced reproduction in Armidale.</li> <li>• Utilise proceeds from sale of Catapult-Genetics to expand capability platform in post-genomics</li> </ul>
Bioindustry product development (Gene Wijffels)	Applies basic biological science, with an emphasis on genomics and protein biochemistry, to the development of novel products for the food, animal health and human pharmaceutical industries	12	<ul style="list-style-type: none"> <li>• Maintain commitment to shared proteomics facility with University of Queensland Institute of Molecular Biosciences at the QBP</li> <li>• Continue to deliver capabilities in advanced materials and separation technologies into other portfolios</li> </ul>
Microbial biology and metagenomics (Rob Kelly)	Application of metagenomics to understand the structure and function of microbial communities and their interactions with their surroundings, to positively impact on agriculture, health and the environment.	20	<ul style="list-style-type: none"> <li>• Under the auspices of the CEO Science Leader scheme and working closely with the "Animal genomics and genetic analysis" and "Livestock-environment interactions" capabilities, maintain capability in metabolomics to study genome-environment interactions in livestock</li> </ul>
Livestock-environment interactions (Rob Kelly)	Examines the interaction between livestock, plants and the environment on a farm or landscape scale to minimise environmental impacts, increase the efficiency of production and promote animal welfare.	25	<ul style="list-style-type: none"> <li>• Relocate key staff from JM Rendel Laboratory, Rockhampton to CSIRO tropical research facilities in Townsville to build critical mass, while maintaining crucial research facilities at Belmont Research Station</li> <li>• Appoint science leader for Pastures from Space work as ASI SIP3 funding outcomes allow.</li> <li>• Lead the development of ARWA co-location and capability-sharing initiatives in WA</li> </ul>

## Plant Industry

*Chief: Jeremy Burdon*

Total Budget: \$45.177m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Cereal Crop Improvement (Richard Richards)	Pre-breeding and breeding of novel biotic and abiotic traits adapting wheat to distinct Australian conditions.	46	<ul style="list-style-type: none"> <li>Establish High Resolution Phenomics Facility and equipment and train staff to use that capacity to link phenotype to genotype.</li> <li>Build expertise through graduate training in Wheat Streak Mosaic Virus resistance to enhance our capability to respond to a potential major threat to the wheat industry.</li> <li>Develop new capabilities in genetic control of wheat tillering through graduate training.</li> <li>To apply DNA-based technologies to understanding of biological processes in soil, and the interactions between soil biology and ecosystem function.</li> </ul>
Conservation Biology and Sustainable Production Systems (Andrew Young)	Integration of production and biodiversity conservation outcomes in high input agricultural environments	56	<ul style="list-style-type: none"> <li>Development of soil metagenomics capability – this will include retraining of current technical staff and development of a LIEF bid with ANU for a long read 454 sequencing platform.</li> <li>Enhancement of population modelling capability – this will be through development of an OCE PDF application for a demographic/genetic modeller.</li> </ul>
Dryland Cropping Systems (Karam Singh)	Strategic issues underpinning plant production in dryland cropping. Molecular biology of plant responses to insect and pathogen attack, water and nitrogen use efficiency, and the impact of climate change and climate variability and molecular responses to biotic stress, all with a particular emphasis on the plant-soil interface.	32	<ul style="list-style-type: none"> <li>The appointment of an early career RS in the area of wheat/legume genetics, potentially in partnership with UWA. This would help link the crop physiology work with the molecular/genomic work.</li> <li>Initiating the development of enhanced capacity in the root/soil area, particularly in the area of biological nitrification inhibition in cereals through opportunities such as the OCE PDF scheme and/or other initiatives.</li> <li>Dealing with the pressing facilities and infrastructure issues raised earlier in terms of the glasshouse/growth cabinets and the cramped laboratory space for the Biotech group.</li> </ul>
Horticultural Crop Improvement (Simon Robinson)	Understanding of the function, performance and genetics of horticultural crops which is applied to develop improved management practices and to identify key traits for improved germplasm, with a particular focus on grapevines.	41	<ul style="list-style-type: none"> <li>Succession planning to maintain capability in grapevine physiology.</li> <li>Further develop skills in analysis of plant secondary metabolites.</li> <li>Expand bioinformatics and biostatistics capability to support functional genomics.</li> <li>Integrate winegrape research with Merbein.</li> </ul>
Horticultural Production Systems (Rob Walker)	An integrated approach involving pre-breeding, breeding and crop management to develop and deliver new differentiated scion varieties and improved rootstocks, with a focus on grapevines and citrus.	27	<ul style="list-style-type: none"> <li>Discontinue research previously focussed on the development of new scion varieties and improved rootstocks for the Australian citrus industry.</li> <li>Discontinue research aimed at development of new varieties and improved root stocks to the Australian table grape and dried grape industries.</li> <li>Realign winegrape research with Horticultural Crop Improvement capability group based in Adelaide.</li> </ul>

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Host-Pathogen Interactions (Jeff Ellis)	This capability provides CSIRO with the access to cloned resistance and avirulence genes from rust fungi for understanding basic and applied questions leading to increased control of cereal rusts. It also provides understanding of the basis of virulence and host range of Fusarium diseases of cotton and potential new routes to disease control in cotton	32	<ul style="list-style-type: none"> <li>• Develop new approaches for identification of stem rust effector proteins based on transformational biology approaches.</li> <li>• Set up screen for modified L6 rust resistance specificities based on direct interactions between R proteins and Avr proteins.</li> <li>• Develop diagnostic assay for the cotton pathogen <i>Fusarium oxysporum vasinfectum</i>.</li> </ul>
Irrigated Field Crop Improvement (Greg Constable)	Coordinated plant breeding and crop management developing and delivering viable and sustainable crop management systems for Australian conditions.	50	<ul style="list-style-type: none"> <li>• Despite challenges from losses in external (drought related) and internal funding (budget related), this Program will continue enhancing our strategic relevance and training of future research scientists. There are currently three post graduate students at Narrabri being trained in crop nutrition, plant water relations and plant physiology. One new position in plant breeding will be filled in 2009.</li> </ul>
Plant Genomics (Frank Gubler)	Genetic and epigenetic control of gene expression in plant development at both the genetic and epigenetic level. The use of state-of-the-art tools including genomics, transcriptomics and bioinformatics to assess patterns of gene expression and identify targets for manipulation in transgenic plants and through conventional breeding.	81	<ul style="list-style-type: none"> <li>• Develop bioinformatic and visualization tools to map short DNA sequence reads to plant genomes.</li> <li>• Develop technology to identify and quantify individual small RNAs.</li> </ul>
Plant Metabolic Engineering (Allan Green)	Genetic modification of protein, carbohydrate and lipid biosynthetic pathways in grains to bring about altered proportions of existing components or introduce novel components. The capability is currently deployed to generate grains with enhanced nutritional, functional or industrial properties.	58	<ul style="list-style-type: none"> <li>• Enhancement of capability to undertake detailed biochemical analysis of metabolic pathways in seeds engineered to synthesise and accumulate novel products is essential for obtaining accurate scientific insights about successful and unsuccessful strategies directed at achieving our end product goals. Initial need is in lipid modification and this will require recruitment of a specialist plant lipid biochemist to take responsibility for this area.</li> </ul>
Systematics, Collections and Information Management (Judy West)	Taxonomy and systematics to understand the Australian flora, and its evolutionary relationships. Development and delivery of biological collections databases, and botanical information to users.	44	<ul style="list-style-type: none"> <li>• Develop capability in population genetics analyses to apply to systematics questions on the Australian flora</li> <li>• Improve research support and collection management capability in the Australian National Herbarium</li> <li>• Develop GIS expertise in research and information management groups</li> <li>• Improve basic data management capabilities of personnel within the program</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Tropical and Sub-Tropical Plant Biology (Graham Bonnett)	Application of this capability leads to an understanding of how tropical plants grow, develop and respond to their environments. Currently the capability is applied to understanding yield and economically valuable traits in crop plants and their genetic improvement.	85	<ul style="list-style-type: none"> <li>• Development of skills to investigate cell wall composition and fine structure through collaboration and establishment of student and PDF projects.</li> <li>• Plan succession in capability available for application to wheat genetics.</li> <li>• Secure access to glasshouse facilities to replace those that will be lost at Long Pocket site.</li> </ul>

NOTE: The following Capabilities are expected to be transferred to Plant Industry from the former Division of Forest Biosciences in 2008-09:

- Advanced Genetics and Propagation (Harry Wu). Approx 10 FTE. The group conduct research on quantitative and statistical genetics, advanced tree breeding and propagation strategy, and integration of genomics with tree breeding.
- Applied Biotechnology and Genomics (Simon Southerton). Approx 9.5 FTE. The group focussed on identifying and characterising novel and critical target genes involved in cell wall and fibre biosynthesis, and environmental adaptive traits in forest trees (e.g. water use efficiency) using tools including genomics, transcriptomics and bioinformatics. Developing a ground-breaking biotechnology platform of phenotypic trait prediction (in trees) using DNA variant analysis based on association genetics and single nucleotide polymorphisms.
- Genetic Resources (David Bush). Approx 13 FTE. This group is centred on applied tree breeding and domestication expertise. Our scientists are skilled in taxonomy, field-based quantitative techniques, data analysis, population genetics, plant propagation and skill development, training and teaching

## **3.2 Energy Group – Business Units and Capabilities**

*Group Executive: Beverley Ronalds*

### **Energy Technology**

*Chief: David Brockway*

Total Budget: \$14.378m (2008-09)

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Low emissions fossil fuels (David Harris)	Development of physico-chemical processes and technologies for utilisation of fossil fuels with reduced greenhouse gas emissions.	66	<ul style="list-style-type: none"><li>• Establishment of syngas simulation facility to further develop capabilities in low emission technology systems.</li><li>• Focus on laboratory and pilot plant post combustion capture activities.</li><li>• Focus on new high efficiency coal cycles for low emission electricity generation.</li></ul>
Renewable Energy, Management and Storage (John Carras)	Energy technologies for the utilisation of renewables and distributed generation.	76	<ul style="list-style-type: none"><li>• Recruitment of new staff in solar thermal technologies and construction of an organic photovoltaic (OPV) fabrication facility for scaling up from laboratory size OPV.</li><li>• Develop synergies between energy storage applications, distributed energy and small scale power generation.</li><li>• Focus on carbon electrochemistry for energy storage applications and direct carbon fuel cell.</li></ul>

## Petroleum Resources

*Chief: Beverley Ronalds*

Total Budget: \$12.461m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Petroleum Engineering (Lincoln Paterson)	Reservoir, drilling, production and facilities engineering combined with geomechanics and chemical / process engineering focused mainly on petroleum production, gas processing and CO2 storage. There are strong national and international links with the petroleum industry and the related research community.	51	<ul style="list-style-type: none"> <li>• Growing capability in monitoring and verification related to geological storage of CO2</li> <li>• Establishing a presence in Perth for expanded GtL R&amp;D based on new Fischer Tropsch rigs currently under construction</li> <li>• Training and development of postdoctoral fellows and new appointments toward positions of enhanced responsibility in response to the tight recruitment market.</li> <li>• Hosting of long-stay students as a path to recruitment.</li> </ul>
Petroleum Geoscience (David Dewhurst)	Refining petroleum systems analysis through the integrated application of geological, geomechanical, geochemical and geophysical expertise focused mainly on hydrocarbon exploration and production. There are strong national and international links with the petroleum exploration and production industry and the related research community	61	<ul style="list-style-type: none"> <li>• Growing capability in monitoring and verification related to geological storage of CO2</li> <li>• Developing integrated geophysics capability to be directed at oil and gas exploration and production together with geological storage of CO2</li> <li>• Engagement of industry through integrated structural, geophysical and petrophysical research projects which impact on exploration, development and production.</li> <li>• Developing links with the UWA Centre for Petroleum Geology by staff secondment from CSIRO to UWA under the WA-ERA umbrella</li> <li>• Training and development of postdoctoral fellows and new appointments toward positions of enhanced responsibility in response to the tight recruitment market.</li> </ul>

### 3.3 Environment Group - Business Units and Capabilities

*Group Executive: Andrew Johnson*

#### Land and Water

*Chief: Neil McKenzie*

Total Budget: \$34.998m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Capability Development Fund (Chris Smith)	Capability Development Funds provide flexibility for exploring new capability areas, with the aim of initiating new capability or extensions of existing capability.	n/a	<ul style="list-style-type: none"> <li>Funds to support well-defined, innovative research projects that renew and establish our position at the forefront of land and water science and technology.</li> <li>Funds to develop and support communities of practice through improved linkages, information sharing, and processes and behaviours that strengthen communities of practice in the Division and across CSIRO</li> <li>Funds or the development of key scientific and technical position papers, study tours (particularly for young researchers), secondments and attendance at conferences that are likely to spark new cross-disciplinary perspectives and opportunities; to support travel, and short-term appointments of visiting scientists; and for initiatives that improve diversity and equity across the Division.</li> </ul>
Social Science (Geoff Syme)	Application of social and economic analysis to key areas of urban and rural decision making at local, regional, state and federal levels using social and economic science theory and methods.	29	<ul style="list-style-type: none"> <li>Capability will remain stable for 2008-09. Note that an amalgamation with CSE capability is being looked at for 2008-09</li> </ul>
Aquatic Biogeochemistry and Ecology (Andy Steven)	Research aimed at predicting how our river, estuarine and coastal environments will respond to changes in landuse and climate, and thereby provide management options to sustain and improve the health of aquatic ecosystems.	42	<ul style="list-style-type: none"> <li>Capability to be expanded in ecological modelling and systems ecology capacity</li> </ul>
Surface and groundwater hydrology (Chris Smith)	Hydrological modelling, hydroclimatology, and land use impacts to deliver hydrological science to improve water resources management including irrigation science	78	<ul style="list-style-type: none"> <li>Capability to be expanded in catchment hydrology capacity</li> </ul>
Urban and Industrial Water	Our research focuses on the biological, physical and geochemical treatment processes that affect the quality of urban	75	<ul style="list-style-type: none"> <li>Capability will remain stable for 2008-09</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
(Peter Franzmann)	water. In this way, we provide integrated solutions for regulators, managers and industries concerned with water supply and quality.		
Environmental Sensing, Prediction and Reporting (Stuart Minchin)	Earth observation, image analysis, radiative transfer modelling, coupling of biophysical and biogeochemical models with at-sensor measured radiances, model data assimilation methods and application of remote sensing techniques to aquatic and terrestrial natural resource management problems	61	<ul style="list-style-type: none"> <li>• Capability will remain stable for 2008-09</li> </ul>
Soil and Landscape Science (Neil McKenzie)	Pedology, geomorphology, soil physics and soil chemistry aimed at improving the sustainability of Australia's soil and land resources	40	<ul style="list-style-type: none"> <li>• Capability to be expanded in digital soil mapping, pedology, pedometrics and carbon dynamics</li> </ul>
Environmental chemistry and ecotoxicology (Simon Apte)	Environmental chemistry and ecotoxicology focussing on the development and application of state-of-the-art chemical and ecotoxicological techniques which allow improved assessment of the risks posed by contaminants.	35	<ul style="list-style-type: none"> <li>• Capability will remain stable for 2008-09</li> </ul>

## Marine and Atmospheric Research

*Chief: Greg Ayers*

Total Budget: \$38.061m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09 (Within the parameters of the Capability Development Plan and investment envelope)
Management Strategy Evaluation, Risk Assessment and Ecosystem Modelling (Scott Condie - Acting Southern MSE) (Peter Rothlisberg - Acting Northern MSE)	This includes the Sub Capability Units: <ul style="list-style-type: none"> <li>Population dynamics modelling</li> <li>Fisheries stock assessment</li> <li>Fisheries MSE</li> <li>Multiple Use Management MSE</li> <li>Ecosystem and trophic modelling</li> <li>Risk Assessment</li> <li>Economic and bio-economic modelling.</li> </ul>	52	<ul style="list-style-type: none"> <li>Grow capability in whole of systems modeling (eg coastal and ecological) and associated sustainability science areas including socio-economic capability.</li> </ul>
Spatial observations, processes and modelling (Barry Bruce - Southern SOPM) (David Brewer - North and Western SOPM)	This includes the Sub Capability Units: <ul style="list-style-type: none"> <li>Population biology</li> <li>Marine ecology</li> <li>Observational technology</li> <li>Spatial dynamics modelling</li> <li>Habitat characterisation and modelling.</li> </ul>	66	<ul style="list-style-type: none"> <li>Invest in ability to better integrate spatial data and modeling processes with planning, management and political environment with planned appointment of two software engineers.</li> <li>Increase and reshape capability in spatial processes and management, spatial dynamics, marine conservation planning and quantitative marine ecology.</li> </ul>
Genomics and taxonomy (Phillip England)	This includes the Sub Capability Units: <ul style="list-style-type: none"> <li>Population genetics &amp; molecular ecology</li> <li>Molecular biology</li> <li>Quantitative genetics</li> <li>Environmental &amp; population genomics</li> <li>Taxonomy</li> <li>Aquaculture breed engineering</li> </ul>	33	<ul style="list-style-type: none"> <li>Appoint a quantitative geneticist to support aquaculture breeds engineering skills</li> <li>Increase capability in molecular ecology for "ocean scape genetics" to increase understanding of connectivity and dispersal in marine environments and enhance modeling linkages.</li> <li>Build on existing OCE post doc and success in Transformational Biology funding to potentially develop a strategic capability in marine environmental genomics (allied to other Divisions capability in advanced genomics) with a particular focus on genomic tools development.</li> </ul>
Biogeochemical observations, processes and modelling (John Volkman)	This includes the Sub Capability Units: <ul style="list-style-type: none"> <li>Plankton and microbial ecology and physiology</li> <li>Aquaculture production and biochemistry</li> <li>Marine geochemistry</li> <li>Marine biogeochemical modelling</li> </ul>	35	<ul style="list-style-type: none"> <li>Grow capability in hydrodynamic and biogeochemical modeling with a focus on better integration of biogeochemical and ecological models and linking of shelf to coastal scales.</li> <li>Increase capability in novel aqua feeds through the appointment of a senior aquaculture nutritionist.</li> <li>Where possible grow skills in zooplankton expertise and microbial ecology.</li> <li>Review and assess biogeochemical capability linkages existing within the Ocean, Observation, Assessment and Prediction capability residing within CAWCR (The Centre for Australian Weather and Climate Research - a partnership between CSIRO and the Bureau of Meteorology).</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b> (Within the parameters of the Capability Development Plan and investment envelope)
Ocean observation, assessment and prediction (Diana Greenslade and Trevor McDougall)	<p>This includes the Sub Capability Units:</p> <ul style="list-style-type: none"> <li>• Observing system technology</li> <li>• Ocean physical and biogeochemical processes</li> <li>• Ocean and marine weather modelling and prediction</li> <li>• Satellite remote sensing</li> </ul>	27 (plus 8 BoM)	<ul style="list-style-type: none"> <li>• Address identified gaps in wave modeling, internal waves, ocean renewable energy, tropical ocean atmosphere physics and coupling (ENSO) and ocean remote sensing capability.</li> <li>• Await outcomes of CSIRO's remote sensing review to inform strategic response.</li> </ul>
Coupled Earth Systems Modelling (ACCESS) (Kamal Puri CAWCR – BoM)	<p>This includes the Sub Capability Units:</p> <ul style="list-style-type: none"> <li>• Atmospheric modelling</li> <li>• Coupled ocean and climate modelling</li> <li>• Coupled land-surface-carbon-water modelling</li> <li>• Data assimilation</li> <li>• Model evaluation</li> <li>• Model systems</li> </ul>	30 (plus 24 BoM)	<ul style="list-style-type: none"> <li>• Grow capability in atmospheric coupled modeling, climate coupled modeling, data assimilation, hydrology and model systems including by priority appointments in coupled modeling, cloud modeling, sea ice modeling, atmosphere physics, and hyper spectral remote sensing (some of these will be proposed BoM appointments through CAWCR).</li> </ul>
Weather and Environment Prediction (John McBride CAWCR – BoM)	<p>This includes the Sub Capability Units:</p> <ul style="list-style-type: none"> <li>• Forecast systems</li> <li>• Numerical weather prediction and applications</li> <li>• Predicting high impact weather</li> <li>• Very short term environmental forecasting</li> <li>• Air quality and chemistry prediction.</li> </ul>	15 (plus 32 BoM)	<ul style="list-style-type: none"> <li>• Address identified gaps following development of the ACCESS strategic plan in particular and clearer identification of research needs flowing from CSIRO and BoM output planning processes.</li> <li>• Invest in mesoscale / wind energy modeling capability as a priority.</li> </ul>
Atmosphere and Land Observation and Assessment (Peter May CAWCR – BoM)	<p>This includes the Sub Capability Units:</p> <ul style="list-style-type: none"> <li>• Measuring atmospheric composition (gases and aerosols)</li> <li>• Cloud, radiation and precipitation processes</li> <li>• Biogeochemical cycles (carbon and water)</li> <li>• Micrometeorology</li> <li>• Observing system technologies</li> <li>• Remote sensing and data assimilation.</li> </ul>	51 (plus 8 BoM)	<ul style="list-style-type: none"> <li>• Development of a strategic plan for ALOA recognizing ACCESS, DCC and NCRIS drivers including developing a clear roadmap for observation infrastructure and better integration of carbon cycle capability across ALOA and CAWCR.</li> <li>• Ensure alignment of capability consistent with ACCESS strategic plan and development of a strategy for remote sensing capability needed in CAWCR.</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Seasonal prediction, climate variability and climate change (Oscar Alves – Seasonal Prediction and climate variability - CAWCR – BoM) (Penny Whetton – Climate Change)	This includes the Sub Capability Units: <ul style="list-style-type: none"><li>• Seasonal to inter annual climate variability and prediction</li><li>• Integrated assessment of climate variability, climate change impacts and adaption</li><li>• Climate change analysis, prediction and projection</li><li>• Climate change detection and attribution.</li></ul>	42 (plus 24 BoM)	<ul style="list-style-type: none"><li>• Invest in programming support and increase socio economic skills to underpin climate adaptation predictive ability.</li><li>• ACCESS and support of it is a key activity for this capability. There is a need to develop the science to provide a seamless approach to weather, climate analysis and forecasting.</li></ul>
Capability Development Fund (John Gunn)	Capability Development Funds provide flexibility for exploring new capability areas, with the aim of initiating new capability or extensions of existing capability.	NA	<ul style="list-style-type: none"><li>• Progress priority recruitments</li><li>• Promote education and career development activities e.g. internships</li><li>• Provide ongoing support to the Quantified Marine Science Program with the University of Tasmania</li><li>• Increase support for post doctoral opportunities</li><li>• Promote the Visiting Scientist Program</li></ul>

## Sustainable Ecosystems

*Acting Chief: Dan Walker*

Total Budget: \$25.562m (2008-09)

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Agricultural Systems (Peter Stone, Ian Watson)	This capability provides systems-based approaches to contemporary and challenging issues of agricultural land management. It places particular emphasis on integrating research into its application context by identifying issues and exploring and implementing solutions in conjunction with stakeholders, including policy makers and land managers.	59	<ul style="list-style-type: none"><li>• Provide staff development opportunities, such as funding attendance at science skills courses and seminars (to deepen or broaden our science skills base) and to attend more generic "workplace skills" courses such as those offered by CSIRO's L&amp;D team.</li><li>• Enabling capability to be deployed effectively and efficiently to multiple projects and management points will be critical to success of the matrix and CSIRO. We seek to improve the ability of staff to formally plan projects so that skills can be accessed and managed and delivery assured irrespective of the institutional "homes" of staff and projects.</li><li>• Creating structured and unstructured forums that enhance awareness of the skills and projects of scientists working in related fields, regardless of their institutional home, so that CSIRO can better assemble project teams with new and unique skills combinations.</li></ul>

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Terrestrial Biodiversity and Ecology (Peter Stone, Ian Watson)	This capability involves predictive and descriptive understanding of natural systems and their ecosystems processes at various spatial and temporal scales in response to landscape change processes (e.g. land use change, invasive species, climate change). This understanding is applied to landscape and conservation management and policy issues at local, regional and national scales.	91	<ul style="list-style-type: none"> <li>• As for Agricultural Systems.</li> <li>• CSE's Capability Development Fund will fund an ecologist of international repute to provide leadership in the ecosystems management domain.</li> <li>• The appointment of a research group leader to the Alice Springs laboratory will be a significant boost in skills for this capability group in Australia's arid zone and will be used to build capability in the region more broadly.</li> <li>• </li> </ul>
Social and economic research for sustainable development (Melinda Spink, Ian Watson)	This capability integrates the human dimensions of natural resource management to satisfy triple bottom line objectives. It considers social, economic and biophysical factors as part of complex systems, across a range of scales and systems.	>50	<ul style="list-style-type: none"> <li>• Capacity development in this area will depend on the decision of a proposed 1 July merger of socio-economic capacity from CSE and CLW. If the merger takes place a strategic planning exercise will include workforce planning in order to identify areas of growth and potential to best position the new program within CSIRO, Australian and international research and policy environments, and determine new arrangements in capacity groups, line management and leadership over the next 12 months.</li> <li>• A proportion of CSE's Capability Development Fund will be deployed to a) support the establishment of the community of practice, linking the merged CLW-CSE capability with smaller numbers of social and economic scientists throughout CSIRO and b) support external linkages between CSIRO's social and economic science community with relevant expertise nationally and internationally through visiting scientists, staff exchanges etc., and c) fund 2 senior leadership positions in the social and economic sciences in line with reorganisation of capability detailed above.</li> </ul>
Urban Systems (Matthew Inman)	This capability develops and integrates scientific knowledge to underpin sustainable infrastructure design, construction and management in urban environments. It is also concerned with integrated urban design and development, and improved urban planning and management.	52	<ul style="list-style-type: none"> <li>• Provide access to staff development activities, such as funding attendance at science skills courses and seminars to deepen or broaden our science skills base and to attend more generic "workplace skills" courses such as those offered by CSIRO's L&amp;D team.</li> <li>• The Capability Development Fund will support structured and unstructured forums that bring together CSIRO researchers working on urban related challenges. While the Urban Systems Program represents a focal point for this capability, the breadth of Themes that address urban research issues (Energy Flagship, Water Flagship, Climate Flagship as well as other Themes) ensure that there is a much wider cross-divisional community of practice. The purpose of the Capability Fund here is to support the urban capability in CSE extending and developing relationships with research staff in other Divisions who share a passion for cities and urban sustainability. This will help to catalyse future project teams and drive greater integration across the comparatively domain specific Flagships.</li> </ul>
Capability Development Fund (Dan Walker)	Capability Development Funds provide flexibility for exploring new capability areas, with the aim of initiating new capability or extensions of existing capability	na	<ul style="list-style-type: none"> <li>• The Internal Venture Capital Fund (IVCF) will continue to fund innovative research projects that are "ahead of the market".</li> <li>• The Strategic Capability Fund will make the initial investments in new capability ahead of the readiness of the Theme portfolios to invest via funded project activities.</li> <li>• The Strategic Staff Development Fund will support an active staff development program at the divisional level. Examples include; continuing CSE's continuing involvement in supporting staff participation in the Australian Rural Leadership Program (ARLP), short term secondments of staff to</li> </ul>

### 3.4 Information and Communication Sciences and Technology Group – Business Units and Capabilities

*Group Executive: Alex Zelinsky*

**Australia Telescope National Facility**

*Director: Brian Boyle*

Total Budget: \$10.063m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Astronomy and Astrophysics (Robert Braun)	Expertise in observational astronomy (the detection of natural radiation primarily, but not exclusively, at radio wavelengths) and in its interpretation in terms of the physical processes and systems that comprise the universe beyond our solar system.	22	<ul style="list-style-type: none"> <li>Following acceptance of candidate for new ARC Federation Fellowship entitled "Cosmic reionization and the formation of the earliest galaxies and super massive black holes", we will undertake recruitment of the required additional research team members.</li> <li>A staff position to replace retirements is planned for advertisement in September. Effective fulfilment of this position will provide the planned outcomes and balance the technical support capabilities.</li> <li>3. Following successful conclusion of our 2008 international conference 'Merging Black Holes in Galaxies', the proceedings will be disseminated to astrophysics community via conference website.</li> </ul>
Astronomical Software Development (Tim Cornwell)	Expertise in the development of highly specialised computer software for the acquisition, transport, processing and storage of astronomical data.  Contributes to all areas of activity in the ATNF and the Understanding the Universe outcome domain.	10	<ul style="list-style-type: none"> <li>CSIRO business/SAP skills training as appropriate</li> <li>Updating technical skills – e.g. training for high performance computing, service oriented architecture.</li> <li>Add one staff member with high level synthesis computing skills (funded by ASKAP)</li> </ul>
Radio Science and Engineering (Graeme Carrad)	This broad capability encompasses radio-frequency engineering in extremely low signal to noise applications at frequencies from 500MHz to 100GHz, including 'front-end technologies' (reflectors and detectors) and 'back-end technologies (data transport and processors).	55	<ul style="list-style-type: none"> <li>Recruitment of new staff (technician, apprentice, &amp; university intern) to provide the basis for the next generation in this capability.</li> <li>Maintenance of existing capability and building of new high performance teams through on-the-job training and experiential skill development.</li> </ul>
Radio Telescope Operations (Jessica Chapman)	Technical management and specialist understanding of very complex radio astronomy facilities, and the delivery of those facilities to a broad spectrum of international researchers on a 24hour/7day basis.	54	<ul style="list-style-type: none"> <li>Restructure ATNF Operations staff into Science Operations and Engineering Operations.</li> <li>Appoint two Senior Systems Scientists, one at the Parkes Observatory and one at the Narrabri Observatory.</li> <li>Facilitate transition to new roles for new project leaders, Site Managers and Technical Coordinators.</li> </ul>

## Information and Communication Technologies

*Chief: Alex Zelinsky*

Total Budget: \$21.892m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Autonomous Systems (Michael Brünig)	The Autonomous Systems Laboratory develops technologies which, without human intervention, generate intelligent, goal directed behaviour by gathering information, then using that information to learn and adapt.	68	The focus areas for the lab in terms of capability development will be: <ul style="list-style-type: none"> <li>• Cooperative robotics</li> <li>• 3D perception</li> <li>• Mobile sensor networks</li> <li>• Distributed node level processing</li> </ul>
eHealth (Gary Morgan)	Conducts research to improve the quality and safety of healthcare for individuals and communities through an ICT research program focused on applied outcomes and active adoption by the health system	45	The focus areas for the centre in terms of capability development will be: <ul style="list-style-type: none"> <li>• Medical Imaging</li> <li>• Web Services</li> </ul>
Information Engineering (Darrell Williamson)	The Information Engineering Laboratory develops better tools for information workers – tools which are intelligent, adaptable and fit for purpose.	40	The focus areas for the lab in terms of capability development will be: <ul style="list-style-type: none"> <li>• Information/data interaction.</li> <li>• Web Services</li> <li>• Information Retrieval</li> </ul>
Networking Technologies (John Zic)	We create new economic and social opportunities by researching, creating, promoting, applying and commercialising new network technologies and applications with an emphasis on real-time, networked collaboration.	45	The focus areas for the lab in terms of capability development will be: <ul style="list-style-type: none"> <li>• Security and Privacy</li> <li>• Network Science</li> <li>• Human Factors</li> </ul>
Wireless Technologies (Jay Guo)	The Wireless Technologies conducts research in the areas of wireless communication, wireless sensor networks, imaging, and antennas and propagation to create world-leading technologies to transform the wireless industry and solve problems of national priority.	68	The focus areas for the lab in terms of capability development will be: <ul style="list-style-type: none"> <li>• Cognitive antennas including wideband arrays and reconfigurable antennas</li> <li>• Co-operative wireless communications</li> <li>• THz detectors for imaging</li> <li>• Seamless positioning</li> <li>• Nano Radio</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Capability Development Fund (Trevor Bird)	Capability Development Funds provide flexibility for exploring new capability areas, with the aim of initiating new capability or extensions of existing capability.	na	<ul style="list-style-type: none"> <li>• Twelve Science Leaders will allocate 20% FTE to pure research and mentoring staff.</li> <li>• Postdoctoral Fellows will spend 20% of their time for pursuing longer term science objectives as spelt out in the CSIRO Program for Fellows.</li> <li>• The Capability Development Fund will support a CEO Science Leader 50% and a CSIRO Fellow for 40% for developing long term research.</li> <li>• PhD scholarship and Vacation scholarship program will be supported.</li> <li>• Hosting 5 interns from international organisations</li> <li>• Increased interaction with the international research community through long term visits from distinguished scientists (1 month to 6 weeks). Funding is allowed for up to six such visitors.</li> <li>• </li> </ul>

## Mathematical and Information Sciences

*Chief: Bronwyn Harch (Acting)*

Total Budget: \$13.909m (2008-09)

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Computational Mathematics (Richard Jarrett)	Development and implementation of innovative numerical algorithms and packages that bridge gap between abstract concepts and numerical implementation.	32	<ul style="list-style-type: none"> <li>• Train staff in areas crucial for leveraging existing IP and for future research in computational mathematics, including; <ul style="list-style-type: none"> <li>- parallel/distributed algorithm design and programming.</li> <li>- multiprocessor and grid computing</li> <li>- visualisation of numerical solutions of complex simulations</li> </ul> </li> </ul>
Image segmentation & classification (TBA)	Development and application of methods for segmentation and classification of (multiband) image data into homogeneous areas and classification of individual pixels	14	<ul style="list-style-type: none"> <li>• Develop expertise in imaging spectroscopy where methodology for handling hyperspectral data within computationally efficient systems will enable global scale carbon monitoring.</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Simulation & Optimisation (TBA)	Development of novel algorithms and software for solving hard graph, network or combinatorial optimisation problems.	24	<ul style="list-style-type: none"> <li>• Develop joint Monash-CSIRO centre for combinatorial optimisation (encompassing constraint programming, operations research, AI heuristics) with aim of increasing postgraduate student numbers and providing critical mass in this area for attracting visitors.</li> <li>• Develop expertise in stochastic optimisation problems where risk or uncertainty is a significant factor.</li> <li>• Develop a capability around the linkage between risk and logistics planning</li> </ul>
Mathematical & Statistical Modelling & Inference (Frank de Hoog)	This capability is associated with the development of mathematical models that provide quantification and insight to biological, industrial and environmental processes and to the application of advanced methods for making statistical inferences from the integration of different types or sets of measurements or data collected at a number of spatial or temporal scales	73	<ul style="list-style-type: none"> <li>• Develop leading edge expertise in the analysis of spatial data through: <ul style="list-style-type: none"> <li>- Workshops in spatial statistics and in time series analysis led by visiting collaborators from the Universities of St Andrews (in partnership with National Ocean &amp; Atmospheric Administration) and Göttingen.</li> <li>- Attracting acknowledged world experts from the Australian National University, Ohio State University and Harvard to visit and work on CSIRO projects</li> <li>- Developing a substantive collaboration with the University of Western Australia on spatial point patterns</li> </ul> </li> <li>• Develop co-ordinated approaches to risk modelling across a range of disciplines, including environmental, governmental and biosecurity areas.</li> <li>• Develop methodology for combining deterministic and stochastic modelling to better predict modelling uncertainty.</li> </ul>
Capability Development Fund (Frank de Hoog)	Capability Development Funds provide flexibility for exploring new capability areas, with the aim of initiating new capability or extensions of existing capability.	1	<ul style="list-style-type: none"> <li>• Establishment of a new project aimed at developing new statistical techniques for analysing large spatial data sets with application in astronomy, neuroscience and environmental monitoring. This will include the appointment of Post-Doc fellows.</li> <li>• Strengthen our software engineering capability through the appointment of a Software Engineering Leader specialising in numerical computation</li> </ul>

### **3.5 Manufacturing, Materials and Minerals Group – Business Units and Capabilities**

*Group Executive: Steve Morton*

#### **Exploration and Mining**

*Chief: Mike McWilliams*

Total Budget: \$17.043m (2008-09)

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Computational Geoscience (James Cleverley)	Computational Geoscience delivers the science and technologies necessary to utilise geoscience data more effectively. There is a strong focus on prediction of orebody location and characteristics through computational simulation of geological processes and geophysical inversion, backed up by major efforts in software algorithm development, e-science, data standards and interoperability.	31	<ul style="list-style-type: none"><li>• Through Minerals Down Under Theme 1160 Discovering Australia's Mineral Resources, continue to develop and verify ore system simulation software as a response to the termination of Predictive Mineral Discovery CRC support of this activity on 30 June 2008.</li><li>• Develop a substantive engagement with the CSIRO Computational and Simulation Science Transformational Capability Platform.</li><li>• Develop and test our thermal and fluid flow systems modelling capability through the new WA Geothermal Centre of Excellence.</li></ul>
Mineral and Environmental Sensing (Thomas Cudahy)	Mineral and Environmental Sensing utilises the interpretation of data collected by remote and proximal geophysical and spectral sensing technologies to characterise the spatial variations in the mineralogy of rock masses, particularly mineralised systems, and to map temporal and spatial changes in natural and human environments.	23	<ul style="list-style-type: none"><li>• Continue to develop our hyperspectral remote sensing capability through the new WA 3D Mineral Mapping Centre of Excellence.</li><li>• Respond to the CSIRO review of remote sensing capabilities (a positive outcome is expected).</li><li>• In collaboration with the Minerals Down Under Flagship, investigate strategies for developing our geophysical inversion capability, following the SIP3 decision not to fund a senior position through CEM's Chief's Capability Development Fund. Geophysical inversion capability is vital to the long-term success of MDU Theme 1160 Discovering Australia's Mineral Resources.</li></ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Mining Automation (David Hainsworth)	Development of control, communications and sensing systems for automation, monitoring and remote control of underground and surface mining equipment.	20	<ul style="list-style-type: none"> <li>• In collaboration with CEM Theme 1115 Maximising the Value of Mining and MDU Flagship Theme 1161 Transforming the Future Mine, investigate strategies for development of our mining systems engineering capability, following the SIP3 decision not to fund a senior position through CEM's Chief's Capability Development Fund.</li> <li>• Progress the development of critical mining hydrogeology capability in collaboration with CSIRO Land and Water.</li> <li>• Secure support for the QCAT Virtual Mining Centre proposal through CSIRO's Computational and Simulation Science Transformational Capability Platform in concert with the CEM, Minerals Down Under and ICT Centre Theme Portfolios.</li> </ul>
Mining Geoscience (Graham O'Brien)	Develop new technologies and systems to characterise and predict mineral and energy resource material and mining conditions for the safe, efficient mining, processing and utilisation of the resource. Engage public opinion/debate about the costs and benefits of minerals and energy extraction and about climate change and energy technologies that can help mitigate greenhouse gas emissions.	37	
Mining Systems (Rao Balusu)	Development of innovative mining systems, new simulation tools and techniques, and advanced mining hazard control technologies for both coal and metalliferous mining, and enabling technologies on mine environmental sustainability.	35	
Ore System Science (Brent McInnes)	Ore System Science uses the latest analytical techniques in geology, mineralogy and geochemistry to develop a systems understanding of ore formation processes at all scales. This understanding is fundamental to mineral exploration and provides the framework that underpins CSIRO's Exploration Geoscience research.	15	<ul style="list-style-type: none"> <li>• Improve the integration of the CEM Melbourne Extreme Chemistry Team with other divisional capabilities.</li> <li>• Develop a Flagship Collaboration Fund Cluster in Metal Sources and Fluids led by The University of Western Australia.</li> </ul>
Regolith Geoscience (Ravinder Anand)	Regolith Geoscience uses multidisciplinary approaches in understanding the nature of the interaction between the Earth's surface, the hydrosphere, the atmosphere and the biosphere to develop geological, geochemical and geophysical approaches to ore discovery in Australia's deeply weathered landscape.	19	<ul style="list-style-type: none"> <li>• Develop and implement a succession strategy for capability renewal in regolith geoscience as a response to recent and impending retirement of critical staff.</li> </ul>

## Materials Science and Engineering

*Chief: Calum Drummond*

Total Budget: \$40.053m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Fluid Dynamics (Ilija Sutalo)	Aims to develop novel technologies and devices from a basic understanding of fluid flow, multiphase mixing/separation, mass and heat transfer, and fluid/surface interactions	27	<ul style="list-style-type: none"> <li>Developing microscale surface flow imaging facility</li> <li>Expanding microfluidics and sonofluidics (microdroplet /microbubble lab)</li> <li>Separator and pipeline expansion and development</li> </ul>
Microstructure and Properties (Daniel Liang)	Aims to develop materials that fully utilise the advantages of both conventional and new processes, so that they have unique structural and/or functional properties	19	<ul style="list-style-type: none"> <li>Strengthen our capability to model deformation behaviour in metals.</li> <li>Develop our capability to manipulate the non-equilibrium structure of metal systems.</li> </ul>
Materials Performance (Mark Burgess)	Supports our Industrial Research Services, and aims to ensure that our consulting and testing services are accurate, reliable and up to date	31	<ul style="list-style-type: none"> <li>Develop a new management and operational structure for IRS</li> <li>Develop a coherent vision for IRS</li> <li>Build R&amp;D capability as well as testing</li> </ul>
Integrated Nano-Science (Lech Wieczorek)	Aims to integrate nano-scale properties (including quantum properties) and structures into materials to develop greatly enhanced control of functional properties.	35	<ul style="list-style-type: none"> <li>Investigate fundamentals of quantum-effect enhanced transport properties of nanostructured materials</li> <li>Commission the Physical Properties Measurement System (PPMS) and SEM/FIB in CSIRO lab at Lindfield</li> <li>Development of modelling capability for predicting properties of nano-particles and nano-systems</li> <li>Development of nano-system design and synthesis for producing new sensing materials</li> </ul>
Designed Polymer Interfaces (Dong Yang Wu )	Aims to design and manipulate the interfaces between nano-scale blocks to manage the functional and structural properties of polymeric and composite materials	43	<ul style="list-style-type: none"> <li>Development of modelling capability for predicting structure-property relationships of polymers</li> <li>Development of nano-particle synthesis methods to produce particles with controllable, tunable, and switchable properties</li> </ul>
Innovation in Process and Production (Mark Gibson)	Aims to develop processing routes to improve the performance, cost and environmental impact of new and existing structural and functional materials	38	<ul style="list-style-type: none"> <li>Develop our capability to transform (blends of) powder materials into net shape engineering components using novel processes such as viscoplastic prosessing, plasma transferred arc and spark plasma sintering</li> <li>Enhance our capability to develop greener metal casting and fabrication processes.</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Superconductivity and Magnetics (Keith Leslie)	Expertise in magnetic and superconducting materials and the physics and creation of new components, devices, machines and fully engineered systems for a range of industry sectors.	27	<ul style="list-style-type: none"> <li>Create a capability to investigate the new superconductor and nano-scaled magnetic materials that are currently finding their way into the scientific literature.</li> <li>Enhance our current capability in the nano-fabrication of materials via acquisition of a FIB/ AFM machine.</li> <li>Build up capability in making low-noise measurement at mK temperatures.</li> </ul>
Surface Coating (Deborah Lau)	Aims to control surface reactions, from coating formation to the completion of coating lifecycle, to enhance the structural and functional performance of materials.	36	<ul style="list-style-type: none"> <li>Development of modelling capability for prediction of energetics of metastable and non-equilibrium phases in coating systems</li> <li>Development of high throughput characterisation methods (using multiple techniques with micron resolution registration on different instruments)</li> <li>Development of Divisional microscopy and imaging capability through consolidation of TFT and Clayton Forest Bioscience resources, with specific emphasis on improvement of the TEM imaging facility and improving ultra-microtomy skills in staff.</li> </ul>
Wave Physics (Gareth Moorhead)	Expertise in the interactions of electromagnetic and ultrasonic waves with materials, with an emphasis on the creation of new sensors, techniques, processes and instruments by using or creating advanced material properties	49	<ul style="list-style-type: none"> <li>Effective integration with Australian Synchrotron, NCRIS nanofabrication facilities, T8 medical imaging centre, and related facilities, forming key a CSIRO interface and fully exploiting CSIRO investment in these collaborative resources</li> <li>Implementing one or more ultrasonic processing systems to the stage of effective industrial engagement</li> <li>Develop advanced nanostructured sensing system design, modelling, fabrication and testing laboratory and computational resources</li> <li>Develop large scale, high speed distributed embedded sensing and intelligence platforms exploiting synergies between Clayton and Lindfield</li> </ul>
Nanofibrous Materials (Robin Cranston) *	The production and manipulation of fibres on the nano-scale to produce useful macrostructures.	27	<ul style="list-style-type: none"> <li>Continue to develop electrospinning skills particularly for the production of ceramic nanofibres.</li> <li>Build enhanced skills in fibre extrusion.</li> <li>Recruitment of staff with skills in carbon nanotube synthesis and carbon nanotube electrochemical sensors.</li> </ul>
Fibre Processing and Textile Products (Geoff Naylor) *	The specification and manipulation of fibres to form novel textile structures to meet requirements for new products both in traditional apparel areas as well as in emerging high performance fabrics and clothing.	24	<ul style="list-style-type: none"> <li>Strengthen cotton textile processing capability</li> <li>Broaden application of structure/function capability beyond traditional fibre &amp; textile applications</li> <li>Identify strategies for developing novel applications of the core fibre metrology and manipulation capability in both traditional textile products as well as new emerging advanced textile applications.</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Fibre and Protein Chemistry (Tony Pierlot) *	Fibre chemistry with a particular capability in biopolymer and surface chemistry.	17	<ul style="list-style-type: none"> <li>2 CSIRO staff members will undertake PhD's supported by the Sheep CRC. An environmental/analytical chemist has recently commenced employment as part of the group's succession plan.</li> </ul>
Fibre and Textile Engineering (Stuart Lucas) *	Sensors, instruments and fibre manipulation machinery development through to commercial prototypes. Skills in embedding electronics into textiles/flexible structures and wireless interfacing to remote computers are a developing capability. This Program is supported by specialist mathematics and CAD/CAM software packages and extensive workshop facilities including CNC machines.	13	<ul style="list-style-type: none"> <li>Continue to develop novel flexible textile/electronic device capability</li> <li>Further develop our computational modelling and CAD CAM expertise</li> <li>Ensure our engineering (Electronic, Mechanical, and Software) continue to highly regarded.</li> </ul>

\* Asterisked capabilities were formerly in the Division of Textiles and Fibre Technology.

NOTE: The following Capabilities are expected to be transferred to Materials Science and Engineering from the former Division of Forest Biosciences in 2008-09:

- Advanced Biopolymers (Nafty Vanderhoek). Approx 13 FTE. This group uses its knowledge of lignocellulose chemistry and fibre structure to develop new bio-derived materials and high value products and processes.
- Biofibre Processing (Brad Ridoutt). Approx 11 FTE. This Group has specialist capability in the development of industrial processes for lignocellulosic materials. This also includes the management of end-of-life products and the development of re-use and recycling options. The Group forms an interface between forest growing and processing through understanding the effects of genetics, silviculture and environment on wood quality and product potential. The Group has unique semi-industrial scale research equipment.
- Bioproduct Assessment (Laurie Cookson). Approx 10 FTE. This group conducts and develops trials that will determine the properties or effectiveness of new bioproducts. Trials include pulp and paper making assessments for the wood and fibre industries, termite and fungal trials of wood preservatives and durable timbers, and SEM services for a wider range of materials.
- Commercial Services (Steve Spencer, Simon Potter). Approx 3-10 FTE. This group provides: (1) technical lab based services to commercial clients, providing high resolution fibre based data (Density, Microfibril Angle, cell characteristics, fibre length, pulp yield & pulping data) and (2) the sale and support of research instrumentation and hardware to commercial clients.
- Phenomics and Sensor Informatics (Roger Meder). Approx 21 FTE. This PSI group (1) develops novel non-destructive tools for rapid phenotype assessment of biofibre quality and (2) undertakes multi-sensor assessments of biofibres on both a temporal and spatial scale to understand growth effects of site, genetics and environment.

## Minerals

*Chief: Bart Follink*

Total Budget: \$24.891m (2008-09)

Capability Name (Program/Group Leader)	Capability Description	FTE as at 1/7/2008 (approx)	Key Actions for Developing the Capability for 2008-09
Capability Development Fund (Bart Follink)	Capability Development Funds provide flexibility for exploring new capability areas, with the aim of initiating new capability or extensions of existing capability.	10	<ul style="list-style-type: none"> <li>Appoint OCE Science Leader (Prof M Chen) and establish a team to explore novel interfacial chemistry and microbiological approaches to future Minerals' processes.</li> <li>Test and incubate novel ideas and opportunities for transformational mineral processing.</li> </ul>
Fluids Process Modelling (Phil Schwarz)	The capability to develop modelling platforms, modelling techniques, and unit operation models based on fundamental and phenomenological principles to develop or improve the performance of equipment and processes	17	<ul style="list-style-type: none"> <li>Development of multi-scale (including molecular) models of unit processes, with special focus on multi-phase and interfacial effects</li> <li>Development of automated optimisation of unit processes based on CFD models</li> <li>Large Eddy Simulation of turbulence in multiphase reacting flows</li> </ul>
High-Temperature Processing (Shouyi Sun)	The capability to apply a range of disciplines to develop and optimise high temperature processes for extracting of metals from ores, refining of metals, treating of wastes and processing of materials	24	<ul style="list-style-type: none"> <li>Fundamentals of biomass pyrolysis</li> <li>Development of novel thermodynamics to understand energy degradation, dissipation and its effect on environmental impact</li> <li>Enhancement of ionic liquids-based minerals processing</li> </ul>
Hydrometallurgy <i>(combined statement for Alumina, Base Metals, and Gold)</i> (Dave Robinson, Matthew Jeffrey, Chris Vernon)	The capability to apply a range of disciplines to develop relevant fundamental understanding allowing both the establishment of new and the optimisation of current processes for the extraction of metals from ores using wet-chemical routes	57	<ul style="list-style-type: none"> <li>Enhancement of understanding of particle - particle, - microbe and - reagent interactions under a variety of physical and chemical conditions</li> <li>Improved understanding of interfacial science and solution speciation in hydrometallurgical processes</li> <li>Understanding the linkages between ore mineralogy, physical pre-processing and beneficiation and both leaching and dewatering performance in a hydrometallurgy circuit</li> <li>Understanding impurity deportment in hydrometallurgy circuits to combat decreasing resource quality.</li> <li>Science breakthroughs impacting on environmental performance with regard to water and energy usage, tailings disposal, reagent recycling and by-products.</li> </ul>
Materials Characterisation (Howard Poynton)	The capability to characterise minerals and materials relevant to a range of (minerals) research themes by applying state-of-the-art techniques and to develop new relevant characterisation methodologies	12	<ul style="list-style-type: none"> <li>Improve predictive capabilities based on understanding relationship ore genesis – chemical / mineralogical properties – metallurgical performance</li> <li>Further improve and strengthen working relationships with ANSTO, Australian Synchrotron and Monash University Centre for Electron Microscopy</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Mineral Processing and Agglomeration (Warren Bruckard - acting)	The capability to apply a range of disciplines to improve the efficiency of mineral processing and (iron ore) agglomeration systems and develop higher value products	30	<ul style="list-style-type: none"> <li>• Development of process modifications for "difficult" Australian ores</li> <li>• Development of ore characteristics – down stream process performance linkages</li> </ul>
On-line Analysis and Control (Mike Millen)	The capability to develop on-line measurement technologies and prototype instruments applicable to mining and minerals processing and security screening using a diverse range of technologies including nuclear, laser, ultrasonic, microwave, X-ray and radio-frequency analysis	22	<ul style="list-style-type: none"> <li>• Development of sensing platforms for minerals industry</li> <li>• Development of techniques to model design, performance and accuracy of analysers</li> </ul>
Process Engineering (Alan Manzoori)	The capability to carry out complex process evaluation and development and scale-up through proof of concept and pilot plant testing	37	<ul style="list-style-type: none"> <li>• Enhancement of reaction engineering and flowsheet modelling</li> <li>• Development of numerical simulation to expedite process development and Evaluation</li> <li>• Development of novel process for nano-structured and environmentally relevant organic (biomass) materials</li> </ul>

## Molecular and Health Technologies

*Chief: Graeme Woodrow*

Total Budget: \$30.223m (2008-09)

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Biomaterials (John Ramshaw)	We design, make, characterise and evaluate new materials (including surfaces) that provide appropriate interaction (biocompatibility) with tissues and tissue components (including cells), especially for use in medical implants.	48	<ul style="list-style-type: none"> <li>• Develop capability in self-assembling systems, especially as applied to bioscaffold development for tissue engineering</li> <li>• Further integrate our surface chemistry and extracellular matrix biology skills to develop advanced materials for stem cell application to medical products.</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
Biotransformation (Geoff Dumsday)	Use of organisms and enzymes to effect specific (bio)chemical transformations. Products being developed include small molecules (e.g. novel fatty acids), larger molecules (e.g. proteins and enzymes), or whole cells.	8	<ul style="list-style-type: none"> <li>Address low critical mass. The capability is very small and has very limited resources. Should integration into another capability be considered (e.g. functional small molecules)</li> <li>Increase the external profile of CSIRO's biotransformation research through collaborations and publications.</li> <li>Start to build metabolic engineering expertise particularly with applications in peptide and protein biosynthesis and biotransformation of small molecules.</li> </ul>
Nanostructured Materials (Patrick Hartley)	To understand nano-scale atomic, molecular, surface and colloidal interactions which enable the synthesis, characterisation and exploitation of functional materials with unique microstructure and exceptional size-dependent properties.	31	<ul style="list-style-type: none"> <li>Focus on biomimetic materials discovery, by further integrating self assembly physical chemistry and bioconjugation expertise across the portfolio and beyond</li> <li>Develop deep collaborative links with life sciences / medical groups to enable further exploration of the health-nanostructured materials interface</li> </ul>
Protein structure function (Tom Peat)	We look at the function of proteins using a variety of techniques, including structural information. Most of the studies look at protein-protein and protein-small molecule interactions.	30	<ul style="list-style-type: none"> <li>Continued investment in hardware and software to develop higher throughput platforms for protein expression, protein purification, crystallisation and structural biology.</li> <li>Continued investment in new technologies: 2D crystallography, coherent synchrotron radiation, membrane protein crystallisation, etc.</li> <li>Develop a biophysical centre for the characterisation of novel proteins.</li> </ul>
Polymeric materials (Fit for Function Polymers) (Graeme Moad)	The capability has as its core disciplinary strength in the design and synthesis of polymers, monomers and reagents to control polymerization. Recent work has built on it's strong track record in polymer chemistry with a shift to greater focus on new polymeric materials with increased functional complexity in the fields of electronic properties.	34	<ul style="list-style-type: none"> <li>Acquisition, development and use of facilities for high throughput polymer synthesis.</li> <li>Development of new and existing methodologies to facilitate polymer synthesis in keeping with designated focus areas.</li> </ul>
Functional Small Molecules (Peter Duggan)	Design, synthesis and evaluation of low molecular weight compounds for uses ranging from biological applications through to advanced materials.	24	<ul style="list-style-type: none"> <li>Investment in the development of proprietary platform technologies for peptide and protein mimicry.</li> <li>Recruit or train leader in high throughput technologies that can be applied to small molecule synthesis.</li> <li>Continued investment in high throughput equipment that can be applied to small molecule synthesis.</li> </ul>
Photoinduced Processes (Peter Osvath)	Measuring, characterising, understanding and controlling photophysical, photochemical and optical effects.  Designing molecules, structures and complex assemblies with photophysical and photochemical properties fit for their targeted function.	16	<ul style="list-style-type: none"> <li>Completing the refit of the laser laboratory</li> <li>Commissioning the Edinburgh Laser Flash Photolysis Equipment, and training key personnel</li> <li>Developing protocols for the measurement of charge mobility for the EAP Group</li> <li>Setting up glove boxes for synthesis, characterisation and fabrication of materials and devices for integrated plastic electronics applications</li> <li>Commissioning the prototype Frequency Modulation Spectrometer, training key personnel and</li> </ul>

<b>Capability Name (Program/Group Leader)</b>	<b>Capability Description</b>	<b>FTE as at 1/7/2008 (approx)</b>	<b>Key Actions for Developing the Capability for 2008-09</b>
			benchmarking the instrument
Protein Engineering (Tim Adams)	This capability encompasses two broad research areas: (1) The design, production and characterisation of novel recombinant proteins for applications in biotechnology and molecular medicine. (2) The application of nucleic acid- based technologies (sequencing, microarrays, bioinformatics) to enhance our understanding of complex biological systems.	65	<ul style="list-style-type: none"> <li>• Investment in scale-up technology for fast-tracking the production of preparative amounts of recombinant protein from mammalian cells.</li> <li>• Designing new properties for proteins through site-specific (e.g. RAFT) modification and molecular evolution.</li> <li>• Appointment of two scientists with skills in genome-wide genetic and epigenetic approaches and technologies. Enhancing bioinformatic capacity through increased interactions and shared space with CMIS scientists.</li> </ul>
CMHT Capability Development Fund (Andrew Groth)	Capability Development Funds provide flexibility for exploring new capability areas, with the aim of initiating new capability or extensions of existing capability.	10	<ul style="list-style-type: none"> <li>• Through CSIRO Advanced Materials network build a broad high throughput materials capability across multiple divisions and Flagships including CMHT, CMSE, NMF, WfaHC and Minerals.</li> </ul>

## 3.6 Enterprise Capability Development

*Deputy Chief Executive: Alastair Robertson*

### ***Transformational Capability Platforms***

As noted in Section 1.4, CSIRO will invest in four Transformational Capability Platforms (TCPs) in 2008-09 with the aim of ensuring the long-term sustainability and future impact of the Organisation by strengthening key cross-organisational groups of capabilities in four key areas.

SIP No.	Capability Name (Lead Group Executive)	Budget 2008-09 (\$m)	Activities and Outputs for 2008-09
TCP01	Transformational Biology (Joanne Daly)	9.0	CSIRO's capability in Transformational (modern post-genomics) Biology will be developed through increased integration of existing biological and mathematical capabilities, in particular through redirection of staff from the former Theme 1084:Biotechnology and Imaging. This TCP will also manage the interface between CSIRO and the NCRIS European Molecular Biology Laboratory initiative to create an increased formal international alliance.
TCP02	Advanced Materials (Steve Morton)	2.1	The Advanced Materials TCP will develop new capabilities in the following areas: bio-mimetic materials at the intersection of nanotechnology and biotechnology; the application of computational and simulation science for 'materials by design'; and materials informatics and modelling as well as high throughput synthesis, screening and characterisation.
TCP03	Computational and Simulation Science (Alex Zelinsky)	5.8	Computational and Simulation Science will be built and deployed through specific demonstration projects (eg computational approaches in transformational biology or innovation technologies) running through advanced materials and into manufacturing. Computational and Simulation Science provides cross-cutting support to the other TCPs.
TCP04	Sensors and Sensor Networks (Alex Zelinsky)	11.3	The Sensors and Sensor Networks TCP will support the development of multi-divisional teams at the confluence of physics, biology, chemistry, mathematics and ICT with a view to the development and application of sensor networks which are both ultra-high resolution and multi-functional.

## **Science Development**

*Portfolio Manager: Attila Brungs / Jim Peacock*

SIP No.	Science Development Initiative	Budget 2008-09 (\$m)	Activities and Outputs for 2008-09
1148	Science Communication / Science Front	1.1	Promote CSIRO's cross organisational science interaction through regular science speakers at Executive Management Council meetings. Assist career development and generate a wide appreciation of science and its relation to industry through our Regional and CSIRO Science Days. Facilitate increased scientific discussion across CSIRO, university collaborations and interactions with top international experts through a series of science symposia.
1149	Frontier Science Seed Funding	1.0	Reposition the Emerging Science Initiative to increase our investment in identified transformational capability platforms.
1150	Scientist Development / Science Resources	8.0	Develop and enhance programs including the Postdoctoral Fellowships, Postgraduate Scholarships, CEO Science Leaders. Develop and enhance programs to support excellence and reward outstanding scientists through the Julius Career Awards, the Payne-Scott Awards and the Newton Turner Awards. Encourage and promote interactions with external organisations through our Distinguished Visiting Scientist program ensuring exposure to world leading concepts.

## **4. SUPPORTING THE RESEARCH ENTERPRISE**

### **4.1 Office of the Chief Executive**

*Chief Executive: Dr Geoff Garrett*

*Total Budget 2008-09: \$8.0m*

#### ***Executive Office***

*Kathy Dunn / Lisa Brennan*

The Executive Office provides leadership, strategy and governance framework for the organisation and ensures effective management of critical external relationships. The Executive Office manages operations of the Office of the Chief Executive, the Executive Team and Executive Management Council.

#### ***Science Team***

*Jim Peacock*

The Science Team encourages, promotes and supports science excellence through the development of scientists, the attraction of world leading talent and propagation and communication of scientific issues. The Science team is responsible for a range of programs including Postdoctoral Fellowships, Postgraduate Scholarships, CEO Science Leaders, and Distinguished Visiting Scientist programs. Additional activities are planned to facilitate increased scientific discussion across CSIRO, university collaborations and interactions with top international experts through a series of science symposia and science workshops. The Science Team also manage, through a program of regular assessments by external review panels, Science Reviews to assure the quality and vitality of CSIRO's science base and scientific outputs.

#### ***International***

*James Moody*

CSIRO International is focused on helping the enterprise reach its vision of global reach by sourcing the best scientists from the global talent pool, creating opportunities for our researchers on projects of international significance and aligning with other government priorities such as increasing our engagement in China and India. The group will also enhance CSIRO's strong connections within the global system of innovation in order to harness international science and technology for the benefit of Australia.

### **4.2 Office of the Deputy Chief Executive – Science Strategy and Investment**

*Deputy Chief Executive: Dr Alastair Robertson*

*Total Budget 2008-09:\$2.8m*

The Deputy Chief Executive – Science has oversight for science strategy and investment in CSIRO with particular responsibility for the management and development of the National Research Flagship Program, the Science Investment Process, Operational Performance and Science Strategy. This Office is also responsible for the managing the development of an enterprise level Capability Management Framework in conjunction with the Science Team.

## **4.2.1 Science Investment, Strategy and Performance**

*Attila Brungs*

### **Flagship Office**

*Mike Edwards*

The Flagship Office provides governance, support and coordination for CSIRO's National Research Flagship Program through the Flagship Oversight Committee and the Flagship Operations Office. The Flagship Office will continue to manage activities related to the Flagship Collaboration Fund and oversee a program of individual Flagship reviews.

### **Science Investment**

*Attila Brungs*

The Science Investment Group develops and puts in place processes and frameworks to ensure that CSIRO remains focused on outcomes which have tangible and sustained impact on Australia's economic prosperity, societal wellbeing and environmental sustainability. The group ensures that science investment policies and processes continue to support and signal key investment areas (both capabilities and outcomes), are aligned with organisational strategy, and are linked to performance measurement processes.

### **Operational Performance**

*Tim Yapp*

The Operational Performance Group develops and facilitates operational planning and organisational performance measurement and reporting processes that contribute to the successful implementation of CSIRO's Strategic Plan and meet CSIRO's Statutory obligations.

### **Science Strategy**

*Kathy Dunn*

The Science Strategy Group is responsible for the development of high-level, cross-organisational strategic arrangements which provide the basis for forward managing CSIRO's extensive capability to anticipate and address national research needs. The group's focus is on process integration, strategy implementation, collaboration and science policy.

## **4.3 Office of the Deputy Chief Executive – Operations**

*Deputy Chief Executive: Mr Mike Whelan*

### **4.3.1 Office of the Deputy Chief Executive**

*Total Budget 2008-09: \$11.9m*

The Deputy Chief Executive – Operations has direct oversight of the Government Relations team, the Board Office, Risk Assessment & Audit and Communications and Marketing; and also works closely with People & Culture and Strategic Change Programs to ensure well-integrated systems and processes across 'one-CSIRO'.

## **CSIRO Board and Governance**

*Phillip Moore*

The office of the CSIRO Board and Governance is a small Canberra based team that works to enhance the integration and effectiveness of the CSIRO Governance Framework and to provide high level support to the CSIRO Board.

## **Government Relations**

*Les Rymer*

The Government Relations team is a medium sized Canberra based team whose goal is to support CSIRO staff members in positioning the organisation as the primary and trusted source of scientific and policy advice to the Federal Government and to provide information and advice to the Minister and to CSIRO staff to assist CSIRO in meeting its legislative and administrative responsibilities. The team implements proactive management arrangements for CSIRO relationships with key Federal Government agencies.

## **Risk Assessment and Audit**

*Mike O'Loughlin*

Risk Assessment & Audit is a medium size Melbourne based team responsible for the audit of policies, systems, internal controls and practices across CSIRO and the development of a framework for the ongoing assessment and management of strategic and operational risk.

## **Communications/Marketing**

*John Curran*

By understanding end-user needs and deploying a wide range of communication tools, Communications/Marketing supports the promotion of the role of science in driving innovation, informing policy and delivering benefit to society. Communication outputs include an integrated series of events, newsletters and other publications, together with a focussed web-presence.

### **4.3.2 People and Culture and Organisational Development**

*Executive Director: Michael Eyles*

*Total Budget 2008-09: \$16.8m*

#### **People and Culture**

*Trevor Heldt*

CSIRO People & Culture provides support and leadership on people issues to leaders and staff across CSIRO. Our goal is to develop high performing teams working across boundaries to deliver science solutions for Australia.

There are two key themes to our work: nurturing our innovative culture by fostering a safe environment where innovation, collaboration, flexibility and performance flourish; and, working effectively and efficiently in the enterprise by using common systems, structures and improved processes to support our matrix operations.

### **4.3.3 Strategic Change Programs**

*Executive Director: Craig Roy*

Total Budget 2008-09: \$19.5m

#### ***Business Process and Enabling Technology Replacement Stage 1 and Stage 2***

*Roze Frost (until August 2008)*

Business Process and Enabling Technology Replacement (BETR) is responsible for the design and implementation of an enterprise systems platform and standardised business process improvements, for the effective management of core CSIRO processes. BETR Stage 1 is scheduled to go-live on 1 July 2008 and transition to business as usual will be completed by 30 November 2008. Stage 2 will provide enhancements (including additional processes) and will be approached as business process improvement.

#### ***Health Safety and Environment***

*Gerard Kennedy*

Health Safety and Environment (HSE) provides effective leadership, strategy and coordination to drive the delivery of the HSE 2007-11 Strategic Plan and to ensure the health, safety and environmental performance across the enterprise.

#### ***Research Support Services Relationship Management***

*Simon Lynch*

Effective enterprise delivery of Research Support Services through client engagements and surveying to ensure continuous improvement opportunities are identified and realised, and ongoing customer satisfaction. Provide ongoing management of the Service Centre.

#### ***Program Office***

*Craig Roy*

The Program Office provides coordination and leadership to the enterprise-wide change activities through initiatives such as Strategy in Action (SIA), Organisational Design Principles (ODP) workshops and the Change Partners Network. The Program Office also oversees and provides sponsorship for specific change initiatives, including the Intellectual Property Improvement Program and other organisation-wide initiatives.

## **4.4 Finance**

*Chief Financial Officer: Allan Gaukroger*

Total Budget 2008-09: \$15.7m

CSIRO Finance is a large scale enterprise-wide team that provides financial and procurement services to support the organisation. Finance work in a mix of settings including within business units, regional processing centres and centralized specialist services.

## **4.5 Business Services**

*Executive Director: Nigel Poole*

*Total Budget 2008-09: \$185.9m*

### ***Client and Partner Relationships***

*Nigel Johnson*

Client and Partner Relationships are responsible for building organisational capability leading to an improvement in major client and partner relationships and the impact and resources derived from these; delivery of client and partner relationship and revenue performance & improvement metrics; entry point internally and externally for major government collaborative research funding schemes, including Cooperative Research Centres, and for engagement with SMEs.

### ***Commercialisation and Investment Portfolio Services***

*Jan Bingley*

Commercialisation and Investment Portfolio Services deliver impact and Intellectual Property (IP) revenue from CSIRO's commercialisable technologies by licensing IP to new or existing commercialisation entities. This group is also responsible for the management of CSIRO's investments in incorporated and unincorporated entities.

### ***Contract Administration***

*Kathy Heinze*

Contract Administration are responsible for the operational aspects of CSIRO's research contracting process including delivering para-legal services, capture and reporting of contracts data and records, and CSIRO's contracts systems.

### ***Information Management and Technology Services***

*David Toll*

Information Management and Technology (IM&T) supports CSIRO's research by providing a range of essential enterprise-wide functions such as IT security, records, library, eResearch, networks, data storage, email, desktop support and specialised services.

### ***Intellectual Property Management***

*Gordon Meijis*

Intellectual Property Management is responsible for improving organisational capability in capturing, protecting and managing intellectual property.

### ***Legal Services***

*Adam Liberman*

CSIRO Legal provides services to CSIRO across a broad range of legal areas with a clear focus on achieving CSIRO's objectives and protecting CSIRO's best interests. Specifically, CSIRO Legal provides services in relation to: Commercial transactions; Corporate law; Governance and regulatory matters; Dispute resolution and management; and training in relation to all the above matters. CSIRO Legal also manages the provision of services by external legal firms and facilitates the engagement of patent attorney firms.

## **Major Transactions**

*Jack Steele*

Major Transactions manage large/complex business development transactions including new, and restructured, significant joint ventures, through to closure, working closely with line management, CSIRO Legal and CSIRO Finance, and including passage through approvals processes.

## **Property Services**

*Trevor Moody*

CSIRO Property Services (CPS) supports CSIRO's science and business objectives by managing the planning, provision, maintenance and operation of all CSIRO's scientific and research facilities. CPS delivers its services through enterprise functions which incorporate strategic, capital and estate activities; while CPS teams within each zone deliver operational property services.

## 5 RESOURCES

### 5.1 Financial Summary for the Period Ended 30 June 2009

	<u>2006/07</u> <u>Actuals</u> M's A	<u>2007/08</u> <u>Strat. Plan</u> M's B	<u>2007/08</u> <u>PBS</u> M's C	<u>2007/08</u> <u>Op. Plan</u> M's D	<u>2007/08</u> <u>Actuals</u> M's E	<u>2008/09</u> <u>Strat. Plan</u> M's F	<u>2008/09</u> <u>PBS</u> M's G	<u>2008/09</u> <u>Op. Plan</u> M's H	<u>07/08 - 08/09</u> <u>Change</u> M's I = H - E	<u>07/08 - 08/09</u> <u>Change</u> %
<b>REVENUE</b>										
Appropriation	610	665	663	664	663	681	668	668	5	0.7%
Research Services (Co-Investment/Consulting)	286	310	308	328	290	325	319	319	29	10.0%
Intellectual Property	31	37	39	36	82	38	38	38	(44)	(53.4%)
Other (e.g. Interest, Asset Sales, Donations)	46	21	15	58	57	22	16	57	1	0.9%
<b>TOTAL REVENUE</b>	<b>973</b>	<b>1,033</b>	<b>1,025</b>	<b>1,087</b>	<b>1,092</b>	<b>1,066</b>	<b>1,041</b>	<b>1,083</b>	<b>(9)</b>	<b>(0.8%)</b>
<b>EXPENSES</b>										
Staffing	563	610	611	629	600	645	613	618	18	3.1%
Operating	333	330	334	379	368	335	348	381	14	3.7%
Other (e.g. Depreciation)	76	93	80	80	77	86	80	93	16	21.1%
<b>TOTAL EXPENSES</b>	<b>972</b>	<b>1,033</b>	<b>1,025</b>	<b>1,087</b>	<b>1,044</b>	<b>1,066</b>	<b>1,041</b>	<b>1,093</b>	<b>48</b>	<b>4.6%</b>
<b>OPERATING RESULT</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>48 (1)</b>	<b>0</b>	<b>0</b>	<b>(10) (2)</b>	<b>(58)</b>	<b>0.0%</b>

#### Explanatory Notes:

(1) The reported operating surplus in 2007/08 reflects the required accounting standards for property valuations plus the requirement to record the "paper" value of some shares acquired in 2008:

- A \$10.5m increase in the value of two investment properties at Lindfield and the North Ryde (The Village). Under the accounting standards, revaluation of these investment properties is required to be reflected in the income statement as a book entry in 2007/08.
- CSIRO received 91.35m Metex shares as part of the proceeds from the sale of the CSIRO's interests in Carbon Energy. The book value of these shares was equivalent to \$65m as at 23 June 2008m. An escrow period of 12 months applies before any parcels of shares can be sold and any cash realised. CSIRO will use the shares as and when required to ensure a balanced cash budget in future years.
- The investment properties revaluations and receipt of Metex shares were partially offset by approximately \$12.5m in restructuring provisions, including mergers and site closures, and \$11.3m in asset impairment expenses.

(2) The operating loss comprises \$10m in increased depreciation charges due to the revaluation of CSIRO properties in 2007/08.

## 5.2 Budgeted Income Statement for the Period Ended 30 June 2009

	<u>2007/08</u> <u>Actuals</u> <u>000's</u>	<u>2008/09</u> <u>Budget</u> <u>000's</u>	<u>07/08 - 08/09</u> <u>Change</u> <u>%</u>
<b>REVENUE</b>			
<b>EXTERNAL REVENUE</b>			
Co-Investment	231,704	250,018	8%
Consulting & Services	58,365	68,982	18%
<b>Co-Investment, Consulting &amp; Services</b>	<b>290,069</b>	<b>319,000</b>	<b>10%</b>
IP, Royalties, etc	81,672	38,082	(53%)
Research & Services	371,741	357,082	(4%)
Other External	34,085	33,065	(3%)
Interest	7,280	7,200	(1%)
<b>TOTAL EXTERNAL</b>	<b>413,106</b>	<b>397,347</b>	<b>(4%)</b>
<b>APPROPRIATION REVENUE</b>			
	663,160	668,121	1%
<b>REVENUE FROM THE SALE OF ASSETS</b>			
	15,565	17,170	10%
<b>TOTAL REVENUE</b>	<b>1,091,831</b>	<b>1,082,638</b>	<b>(1%)</b>
<b>EXPENSES</b>			
Salaries & Related Expenses	599,738	618,177	3%
Travel	42,827	43,209	1%
Other Operating	324,788	338,148	4%
Depreciation & Amortisation	76,794	93,103	21%
<b>TOTAL EXPENSES</b>	<b>1,044,147</b>	<b>1,092,638</b>	<b>5%</b>
<b>OPERATING RESULT</b>	<b>47,684</b>	<b>(10,000)</b>	<b>0%</b>

## Analysis of other operating expenses

	<u>2007/08 Actuals 000's</u>	<u>2008/09 Budget 000's</u>	<u>07/08 - 08/09 Change %</u>
Advertising & Promotion	1,613	1,711	6%
Bad Debts	207	0	(100%)
Cleaning	6,522	6,897	6%
Computing/IT Costs	25,711	26,566	3%
Contracted Consulting Services	704	766	9%
Contracted Research & Development	50,127	55,429	11%
Doubtful Debt Expense	(116)	0	(100%)
Entertainment	1,223	1,313	7%
Grants & Contributions	7,041	6,937	(1%)
Insurance	1,996	2,330	17%
Joint Venture Contributions	22,207	19,177	(14%)
Laboratory & Workshop Supplies	43,587	47,230	8%
Legal	11,926	13,699	15%
Library	10,238	10,596	4%
Motor Vehicles	6,328	6,618	5%
Office Supplies & Printing	9,095	10,168	12%
Operating Leases	469	454	(3%)
Patents	5,656	5,762	2%
Postage & Freight	3,158	3,246	3%
Property	27,653	28,588	3%
Recruitment & Relocation	4,943	5,086	3%
Repairs & Maintenance	17,254	17,609	2%
Security	1,663	1,649	(1%)
Telecommunications	11,217	12,455	11%
Training	10,110	11,307	12%
Utilities	16,180	17,188	6%
Other	28,077	25,365	(10%)
<b>TOTAL OTHER OPERATING</b>	<b>324,788</b>	<b>338,148</b>	<b>4%</b>

## 5.3 Budgeted Balance Sheet as at 30 June 2009

	<u>2007/08 Actuals 000's</u>	<u>2008/09 Budget 000's</u>	<u>07/08 - 08/09 Change %</u>
<b>ASSETS</b>			
<b>FINANCIAL ASSETS</b>			
Cash and cash equivalents	98,536	77,035	(22%)
Trade and other receivables	70,911	70,911	0%
Investments accounted for using the equity method	614	614	0%
Other investments	118,615	104,715	(12%)
<b>TOTAL FINANCIAL ASSETS</b>	<b>288,676</b>	<b>253,275</b>	<b>(12%)</b>
<b>NON - FINANCIAL ASSETS</b>			
Land and buildings	1,324,262	1,332,053	1%
Plant and equipment	260,688	288,913	11%
Investment properties	48,540	48,540	0%
Intangibles	26,752	32,033	20%
Properties held for sale	69,126	53,671	(22%)
Inventories held for sale	1,093	1,093	0%
Other non-financial assets	32,697	32,697	0%
<b>TOTAL NON FINANCIAL ASSETS</b>	<b>1,763,158</b>	<b>1,789,000</b>	<b>1%</b>
<b>TOTAL ASSETS</b>	<b>2,051,834</b>	<b>2,042,275</b>	<b>(0%)</b>
<b>LIABILITIES</b>			
<b>PAYABLES</b>			
Suppliers	81,915	81,219	(1%)
Other Payables	87,818	87,818	0%
<b>TOTAL PAYABLES</b>	<b>169,733</b>	<b>169,037</b>	<b>(0%)</b>
<b>INTEREST BEARING LIABILITIES</b>			
Leases	67,799	64,541	(5%)
Deposits	11,950	11,950	0%
<b>TOTAL INTEREST BEARING LIABILITIES</b>	<b>79,749</b>	<b>76,491</b>	<b>(4%)</b>
<b>PROVISIONS</b>			
Employee Provisions	192,768	189,493	(2%)
<b>TOTAL PROVISIONS</b>	<b>192,768</b>	<b>189,493</b>	<b>(2%)</b>
<b>TOTAL LIABILITIES</b>	<b>442,250</b>	<b>435,021</b>	<b>(2%)</b>
<b>NET ASSETS</b>	<b>1,609,584</b>	<b>1,607,254</b>	<b>(0%)</b>
<b>EQUITY</b>			
Capital	0	7,670	-
Accumulated Results - Operations	499,591	489,591	(2%)
Reserves	1,109,993	1,109,993	0%
<b>TOTAL EQUITY</b>	<b>1,609,584</b>	<b>1,607,254</b>	<b>(0%)</b>

## 5.4 Statement of Cashflow - Budget for Period Ended 30 June 2009

	<u>2007/08</u> <u>Actuals</u> <u>000's</u>	<u>2008/09</u> <u>Budget</u> <u>000's</u>	<u>07/08 - 08/09</u> <u>Change</u> <u>%</u>
<b>OPERATING ACTIVITIES</b>			
<b>Cash received</b>			
Appropriations	663,160	668,120	1%
Goods and services	343,663	398,170	16%
Interest	6,897	7,200	4%
Net GST received	10,306	11,977	16%
Deposits	0	0	-
<b>Total cash received</b>	<b>1,024,026</b>	<b>1,085,467</b>	<b>6%</b>
<b>Cash used</b>			
Employees	590,445	621,452	5%
Suppliers	360,478	397,898	10%
Finance costs	3,038	2,985	(2%)
Other	4,916	1,170	(76%)
<b>Total cash used</b>	<b>958,877</b>	<b>1,023,505</b>	<b>7%</b>
<b>Net cash from or (used by) operating activities</b>	<b>65,149</b>	<b>61,962</b>	<b>(5%)</b>
<b>INVESTING ACTIVITIES</b>			
<b>Cash received</b>			
Proceeds from sale of property, plant and equipment	11,779	69,725	492%
Proceeds from sale of equity investments and intellectual property	7,605	13,900	83%
<b>Total cash received</b>	<b>19,384</b>	<b>83,625</b>	<b>331%</b>
<b>Cash used</b>			
Purchase of property, plant and equipment	110,763	171,500	55%
Purchase of equity investments	1,489	0	(100%)
Selling cost of investments	588	0	(100%)
<b>Total cash used</b>	<b>112,840</b>	<b>171,500</b>	<b>52%</b>
<b>Net cash from or (used by) investing activities</b>	<b>(93,456)</b>	<b>(87,875)</b>	<b>6%</b>
<b>FINANCING ACTIVITIES</b>			
<b>Cash received</b>			
Appropriations - contributed equity	0	7,670	-
<b>Total cash received</b>	<b>0</b>	<b>7,670</b>	<b>-</b>
<b>Cash used</b>			
Cash used for other financing activities	4,205	3,258	(23%)
<b>Total cash used</b>	<b>4,205</b>	<b>3,258</b>	<b>(23%)</b>
<b>Net cash from or (used by) financing activities</b>	<b>(4,205)</b>	<b>4,412</b>	<b>205%</b>
<b>Net increase or (decrease) in cash held</b>	<b>(32,512)</b>	<b>(21,501)</b>	<b>34%</b>
Cash at beginning of the reporting period	131,048	98,536	(25%)
<b>Cash at end of the reporting period</b>	<b>98,536</b>	<b>77,035</b>	<b>(22%)</b>

## 5.5 Capital Investment - Budget for the Period Ended 30 June 2009

	<u>2007/08</u>	<u>2008/09</u>	<u>07/08 - 08/09</u>
	<u>Actuals</u>	<u>Budget</u>	<u>Change</u>
	<u>000's</u>	<u>000's</u>	<u>%</u>

### SOURCES OF CAPITAL FUNDING

Baseline Depreciation	85,000	85,000	0%
External Contributions to Capital <sup>(1)</sup>	0	9,685	0%
Proceeds from the Sale of Property and other assets <sup>(2)</sup>	10,966	69,725	536%
Capital Injections from Government <sup>(3)</sup>	0	7,670	0%
	<b>95,966</b>	<b>172,080</b>	<b>79%</b>

### APPLICATIONS OF CAPITAL FUNDING

Property <sup>(4)</sup>	52,226	99,700	91%
Scientific Equipment/IT/Other Plant & Equipment <sup>(5)</sup>	56,411	63,800	13%
Intangibles <sup>(6)</sup>	2,500	8,000	220%
	<b>111,136</b>	<b>171,500</b>	<b>54%</b>

#### Explanatory Notes:

(1) External contributions to capital include \$8.4m in NCRIS funding from Government. These contributions are represented as a surplus against Business Units.

(2) Proceeds on sale of assets primarily consist of the proceeds on properties *held for sale* of \$79.1m.

(3) The capital injection relates to the development of the Square Kilometre Array Pathfinder.

(4) Property investment in 08/09 includes \$1.3m associated with the Environmental Sustainability Initiative (ESI).

(5) Investment in this category includes \$12.1m in IT equipment and infrastructure.

(6) The \$8.0m investment in Intangibles consists of \$7.0m for access rights to Nanofabrication facilities and \$1.0m for enhanced capability in the BETR project.

## 5.6 Enterprise Support Services - Budget for the Period Ended 30 June 2009

	<u>2007/08 Actuals 000's</u>	<u>2008/09 Budget 000's</u>	<u>2008/09 Change %</u>
Chief Executive Office	8,265	7,997	(3%)
DCE Operations	8,631	11,946	38%
DCE Science Strategy & Investment	3,074	2,844	(7%)
Finance	14,843	15,659	5%
People & Culture	16,281	16,796	3%
Strategic Change Programs	23,606	19,535	(17%)
Group Executives	2,488	2,631	6%
Information Management & Technology	60,521	66,810	10%
Property Services	90,542	100,848	11%
Business Services	18,595	18,246	(2%)
Flagship Support	8,919	10,863	22%
<b>TOTAL ENTERPRISE SUPPORT SERVICES</b>	<b>255,767</b>	<b>274,174</b>	<b>7%</b>
		(1)	

### Explanatory Note

(1) Includes \$8.3m in increased depreciation. Excluding depreciation the net increase is 4% on 07-08.

## 5.7 Output Portfolio View 2008-09

Group/Portfolio	Internal	Revenue (\$M)	External	Total Revenue	Research Labour	FTE's	Expenditure (\$M)	
							Research	Operating
<b>AGRICULTURE GROUP</b>								
Livestock Industries	47,616	22,614	71,232		20,000	251	6,448	
Health & Nutrition	2,620	1,368	3,988		1,558	21	565	
Plant Industry	30,181	31,685	67,866		21,542	394	6,566	
Food Source Australia	6,595	10,357	16,943		0	0	8,831	
Forest Biocare	12,077	10,532	23,409		9,690	87	3,830	
Entomology	12,276	10,180	22,456		9,929	105	3,618	
Food Safety Flagship	40,751	7,559	48,310		15,173	157	17,428	
Pest & Disease Flagship	20,271	7,782	37,053		15,655	143	7,121	
Collections	9,836	6,320	16,156		6,632	65	3,143	
Agricultural Sustainability Initiative	26,579	17,268	43,947		18,623	172	6,653	
Transformational Biology	6,833	208	9,041		3,121	26	2,664	
<b>AGRICULTURE GROUP TOTAL</b>	<b>233,529</b>	<b>127,003</b>	<b>360,512</b>		<b>129,512</b>	<b>1,427</b>	<b>67,346</b>	
<b>ENERGY GROUP</b>								
Energy Technology	7,205	3,400	10,705		4,570	42	2,015	
Petroleum Resources	7,362	5,100	12,432		5,263	46	2,151	
Health from Oceans Flagship	51,594	21,711	73,305		30,912	277	12,795	
Energy Transformation Flagship	30,356	16,703	55,051		21,866	210	11,453	
<b>ENERGY GROUP TOTAL</b>	<b>104,629</b>	<b>46,914</b>	<b>151,523</b>		<b>62,711</b>	<b>575</b>	<b>28,615</b>	
<b>ENVIRONMENT GROUP</b>								
Climate Adaptation Flagship	18,957	8,264	27,221		12,575	106	2,724	
Marine Ecosystems Research	24,540	9,791	34,371		13,447	113	4,655	
Land & Water	6,784	4,623	10,427		4,190	42	2,453	
Sustainable Ecosystems	15,204	7,711	24,515		10,522	101	3,907	
Water for a Healthy Country Flagship	54,013	34,621	88,634		38,796	354	14,692	
<b>ENVIRONMENT GROUP TOTAL</b>	<b>120,191</b>	<b>65,150</b>	<b>185,341</b>		<b>79,621</b>	<b>718</b>	<b>32,472</b>	
<b>INFORMATION &amp; COMMUNICATION SCIENCE &amp; TECHNOLOGY GROUP</b>								
Astro & Telescopes National Facility	31,020	1,479	32,991		12,377	145	9,421	
Mathematical & Information Sciences	15,485	6,252	21,717		15,729	145	1,271	
ICT Centres	21,158	6,236	27,394		13,220	121	3,544	
Sensors & Sensor Networks	250	0	250		0	0	250	
Computational Simulation Science	250	0	250		0	0	250	
<b>INFORMATION &amp; COMMUNICATION SCIENCE &amp; TECHNOLOGY TOTAL</b>	<b>68,625</b>	<b>13,967</b>	<b>82,892</b>		<b>37,326</b>	<b>411</b>	<b>14,736</b>	
<b>MANUFACTURING, MATERIALS, &amp; MINERALS GROUP</b>								
Mining Down Under Flagship	33,420	19,833	53,253		24,055	203	8,710	
Metals & Minerals Flagship	14,241	4,269	18,179		7,544	58	2,774	
Molecular & Health Technologies	20,819	13,256	44,077		19,540	194	3,410	
Minerals	13,420	11,810	25,330		15,133	96	4,038	
Exploration & Mining	6,680	9,340	15,020		6,172	52	4,008	
Textiles & Fibre Technology	7,203	5,362	12,565		4,493	46	2,927	
Manufacturing & Engineering	27,064	22,271	49,335		19,931	173	8,779	
Light Metals Flagship	26,945	9,626	36,510		14,972	120	7,571	
Advanced Materials	2,139	0	2,139		973	6	526	
<b>MANUFACTURING, MATERIALS, &amp; MINERALS GROUP TOTAL</b>	<b>161,677</b>	<b>95,955</b>	<b>257,634</b>		<b>107,392</b>	<b>957</b>	<b>35,643</b>	
<b>ENTERPRISE OUTPUTS GROUP</b>								
Discovery Centres	1,846	330	2,176		407	3	405	
High Performance Computing Centre	7,810	0	8,260		1,557	16	5,149	
Education Programs	3,005	5,070	8,075		3,857	37	2,429	
Publications	284	10,650	10,934		3,350	34	2,333	
Reports	6,000	0	5,000		0	0	5,000	
Group Exec Science Networks & Research	450	0	450		0	0	450	
<b>ENTERPRISE OUTPUTS GROUP TOTAL</b>	<b>10,330</b>	<b>16,250</b>	<b>35,580</b>		<b>9,181</b>	<b>90</b>	<b>15,815</b>	
<b>UNALLOCATED RESOURCES</b>								
Science Development/Source Resources	8,008	0	8,008		4,985	0	3,043	
Net Advancement	14,519	(20,765)	(6,247)		(8,159)	0	(2,410)	
Smart SMEs	1,903	0	1,903		0	0	1,900	
Flagship Collaboration Fund	1,463	0	1,463		0	0	1,463	
Frontier Science Seed Funding	1,003	0	1,003		620	0	380	
International Societies	100	0	100		0	0	100	
Science Communication	725	400	1,125		0	0	1,125	
Coupling System Capability	200	0	200		0	0	200	
<b>UNALLOCATED RESOURCES TOTAL</b>	<b>27,915</b>	<b>(20,356)</b>	<b>7,549</b>		<b>(2,574)</b>	<b>0</b>	<b>5,801</b>	
<b>ENTERPRISE OUTPUTS GROUP TOTAL</b>	<b>736,156</b>	<b>344,977</b>	<b>1,081,033</b>		<b>423,169</b>	<b>4,179</b>	<b>204,827</b>	
<b>TOTAL OUTPUT PORTFOLIO INVESTMENT</b>	<b>736,156</b>	<b>344,977</b>	<b>1,081,033</b>		<b>423,169</b>	<b>4,179</b>	<b>204,827</b>	
<b>RECONCILIATION OF OUTPUT VIEW TO THE OPERATING STATEMENT</b>								
CAPABILITY BUDGET (NET OF RECOVERIES TO OUTPUTS)	(68,035)	68,540	1,605		195,000	1,813	268,633	
OPERATING STATEMENT POSITION	668,121	414,517	1,082,637		618,177	5,992	474,460	

## 5.8 Capability/Business Unit View 2008-09

Group/Business Unit	Expenses											000's Capital
	Revenue			Expenses								
	Appropriation	External	000's Revenue	Research	Labour	FTE's	000's Business Unit O/Hd's	Enterprise O/Hd's	Total ESC's	000's Planned Recoveries from Output Themes	000's Profit/(Loss) on Sale of Assets	000's Surplus/(Deficit)
AGRICULTURE GROUP												
Livestock Industries - AAHL	0	208	208	11,412	138	18,780	12,511	32,291	(43,703)	0	0	2,717
Livestock Industries	0	622	622	16,501	193	9,215	12,101	20,405	(32,507)	0	0	2,454
Human Nutrition	0	0	0	7,295	60	1,942	4,556	6,369	(13,794)	0	0	719
Plant Industry	0	4,125	4,125	20,208	501	13,634	31,344	45,177	(84,355)	0	2,900	6,001
Entomology	0	267	267	17,449	181	4,542	10,749	15,300	(32,840)	0	0	786
Forest Sciences	0	0	0	13,380	125	6,004	8,193	14,197	(2b 177)	0	0	467
Food Science Australia	0	0	0	0	0	727	9,630	10,367	(10,357)	0	0	604
Terrestrial and Biological	0	0	0	0	0	0	0	0	0	0	0	226
AGRICULTURE TOTAL	0	5,222	5,222	105,945	1,218	55,044	89,174	144,218	(250,163)	0	2,957	14,275
ENERGY GROUP												
Energy Technology	0	575	575	16,114	146	4,634	9,744	14,378	(30,452)	0	575	2,169
Petroleum Resources	0	0	0	13,379	117	5,755	6,707	12,461	(25,841)	0	0	3,003
ENERGY TOTAL	0	575	575	29,493	263	10,389	16,451	26,839	(56,333)	0	575	5,172
ENVIRONMENT GROUP												
Sustainable Ecosystems	0	0	0	27,500	247	10,444	15,118	25,562	(51,061)	0	0	1,731
Marine & Atmospheric Research	0	0	0	41,095	363	15,354	22,696	38,061	(79,156)	0	0	4,392
Land & Water	0	150	150	38,639	361	13,446	21,552	34,996	(73,637)	0	150	2,539
Oceanographic Research Vessel	0	0	0	1,052	10	1,053	380	1,433	(2,484)	0	0	405
ENVIRONMENT TOTAL	0	150	150	108,285	981	40,307	59,746	100,053	(208,338)	0	150	9,067
INFORMATION & COMMUNICATION SCIENCE & TECHNOLOGY GROUP												
Australia Telescope National Facility	0	3,600	3,600	13,902	131	3,305	6,667	10,963	(23,965)	0	3,120	9,841
Mathematical & Information Sciences	0	0	0	18,525	200	4,831	8,978	13,908	(32,434)	0	0	43
ICT Centre	0	174	174	29,563	259	9,455	12,437	21,892	(51,455)	0	174	1,054
INFORMATION & COMMUNICATION SCIENCE & TECHNOLOGY TOTAL	0	3,774	3,774	61,990	590	17,782	28,081	45,864	(107,854)	0	3,294	10,938
MANUFACTURING, MATERIALS, & MINERALS GROUP												
Textile & Fibre Technology	0	0	0	8,594	81	6,671	6,399	13,269	(22,263)	0	0	1,221
Minerals	0	15	15	22,380	208	9,957	14,905	24,891	(47,271)	0	0	2,320
Materials Science & Engineering	0	580	580	35,511	310	13,417	26,635	40,053	(75,564)	0	80	9,215
Exploration & Mining	0	75	75	21,732	181	6,559	10,484	17,043	(38,775)	0	75	1,440
Molecular & Health Technologies	0	2,554	2,554	26,164	258	12,141	18,082	30,223	(56,386)	0	2,554	6,180
MANUFACTURING, MATERIALS, & MINERALS GROUP TOTAL	0	3,224	3,224	114,780	1,036	48,945	76,534	125,479	(240,259)	0	2,709	20,355
ENTERPRISE OUTPUTS GROUP												
Discovery Centre	0	0	0	280	3	1,059	255	1,364	(1,644)	0	0	0
High Performance Computing Centres	0	0	0	1,567	16	931	613	1,544	(3,112)	0	0	0
CSIRO Publishing	0	0	0	3,305	34	3,578	1,478	5,066	(8,361)	0	0	0
Education Programs	0	0	0	3,856	37	788	1,832	2,620	(6,476)	0	0	0
ENTERPRISE OUTPUTS GROUP TOTAL	0	0	0	9,009	90	6,396	4,188	10,584	(19,593)	0	0	0
UNPLANNED RESOURCES TOTAL	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL BUSINESS UNIT CAPABILITY BUDGET	0	12,945	12,945	429,504	4,179	178,652	274,174	453,036	(882,540)	0	9,685	59,807
ENTERPRISE SUPPORT SERVICES												
Adjustments	(68,035)	33,616	(34,523)	(6,335)	0	0	0	6,335				(1,148)
Enterprise Support Services	0	6,010	6,010	0	1,813	178,862	260,185	(459,047)	17,170	17,170	0	112,841
Recoveries from Business Units	0	0	0	0	0	(178,862)	(274,174)	453,037			0	0
(68,035)	39,525	(28,510)		(6,335)	1,813	0	6,010	325		17,170	17,170	111,693
TOTAL CAPABILITY BUDGET	(68,035)	52,470	(15,565)	423,169	5,992	178,862	280,184	(882,216)		17,170	26,855	171,500

## APPENDICES

### Appendix 1. Science Investment Process Criteria

Relevance and Impact criteria were developed to assist the Executive Team in making decisions through both the Broad Direction Setting and Theme Review phases of the Science Investment Process. The criteria are applied slightly differently in each of the phases, as outlined in the following tables.

#### Broad Direction Setting

The BDS criteria provide a basis for asking critical questions about CSIRO's remit, roles and future direction. For example: should CSIRO be engaged in the area of research (relevance), what is the likelihood of adoption (impact), how competitive is CSIRO's research? (impact)

<b>Relevance</b>	<ul style="list-style-type: none"> <li>- Value from R&amp;D</li> <li>- Size of the area (industry / market size, growth rate, employment, exports etc)</li> <li>- Addressable benefit to Australia (social, economic, environmental)</li> <li>- CSIRO should be engaged</li> <li>- Fit with CSIRO role vs other members of NIS</li> <li>- Responsive to National Research Priorities</li> <li>- Relevance of R&amp;D (science and technology is a key component)</li> </ul>
<b>Impact</b>	<ul style="list-style-type: none"> <li>- Likelihood of adoption</li> <li>- State of "receptor" system</li> <li>- Willingness of partners / receivers of technology</li> <li>- R&amp;D productivity / potential</li> <li>- CSIRO research competitiveness (now and future networks)</li> </ul>

#### Theme Review Phase

The criteria for the Theme review have been split into two groups, or lenses, distinguishing between those indicators or measures that are objective in nature and those that are more subjective (requiring greater judgment). All criteria are important, but it is important to acknowledge the different natures.

	<b>Prioritisation</b>	<b>Judgment / Balance</b>
<b>Relevance</b>	<ul style="list-style-type: none"> <li>- Significant potential capturable benefit for Australia (industry / community)</li> <li>- Aligned with National Research Priorities or stated government or industry priority area</li> <li>- Delivery of science and technology is key to achieving outcomes</li> </ul>	<ul style="list-style-type: none"> <li>- Builds important capability in CSIRO with broad applicability (including intellectual assets / intellectual property)</li> <li>- Results in valuable additional benefits (eg reputation enhancement, Australian global positioning)</li> <li>- Top leadership commitment</li> <li>- Aligned with CSIRO strategy (CSIRO role in the national innovation system)</li> </ul>
<b>Impact</b>	<ul style="list-style-type: none"> <li>- Distinctive (and differentiated) science (science quality)</li> <li>- Theme researchers' track record of delivery (last five years including delivery of scientific outcomes)</li> <li>- Clear community / industry delivery pathway (including intellectual property / knowledge diffusion pathway)</li> </ul>	<ul style="list-style-type: none"> <li>- Science "hotspot"</li> <li>- Appropriate leadership capacity (Divisional performance and competencies)</li> <li>- Staff "achievability" (recruitment / refocussing)</li> <li>- Appropriate investment level</li> <li>- Level of technical uncertainty</li> <li>- Level of other risks: political, legal, cultural, reputation</li> </ul>

## Appendix 2. List of Research Themes

Theme No.	Name	Leader	2008-09			
			Total Revenue (\$m)	Planned Research FTEs		
<b>NATIONAL RESEARCH FLAGSHIPS</b>						
1155	Climate Adaptation	Andrew Ash				
1156	Pathways to Adaption	Bryson Bates	6.526	25		
1156	Liveable Cities, Coasts and Regions	Allan Kearns	9.687	39		
1157	Protecting Ecosystems and Natural Resources	Trevor Booth	5.498	22		
1158	Adaptive Enterprises, Industries and Communities	Mark Howden	5.679	22		
1016	Energy Transformed	John Wright				
1016	Energy Futures	Paul Graham	3.245	14		
1017	Low Emissions Electricity	Jim Smitham	27.925	95		
1018	Low Emission Transport	Mick Wilson	14.269	63		
1019	Low Emissions Distributed Energy	Terry Jones	9.621	39		
1020	Food Futures	Bruce Lee				
1020	Futur Grains, Grain-based Food and Feed	Matthew Morell	18.181	74		
1021	Breed Engineering	Nigel Preston	12.633	53		
1022	Designed Food and Biomaterials	Ingrid Applequist	14.491	58		
1023	Quality Biosensors	Stephen Trowell	7.205	29		
1000	Light Metals	Raj Rajakumar				
1000	Aluminium and Magnesium Manufacturing	Kevin Rogers	8.115	25		
1001	Alumina	Chris Vernon	8.904	36		
1002	Aluminum	Richard Bean	7.741	27		
1003	Magnesium	Richard Bean	1.396	5		
1004	Titanium	Raj Rajakumar	10.454	28		
1160	Minerals Down Under	Peter Lilly				
1160	Discovering Australia's Mineral Resources	David Gray (Acting)	22.157	83		
1161	Transforming the Future Mines	Jock Cunningham	13.558	54		
1162	Securing Australia's Future Ore Reserves	Jonathon Law	9.826	39		
1163	Driving Sustainability Processing Through Systems Innovation	Sharif Jahanshahi	7.712	27		
1090	Niche Manufacturing	Greg Simpson (Acting)				
1090	Electroactive Materials	Gerry Wilson	8.975	32		
1166	Nanomaterials for Medical Delivery	John Tsanakisidis	2.555	9		
1167	Analysis at Point of Sampling	Tim Davis	3.284	11		
1168	Carbon Nanotube Yarn	Shaun Smith	1.839	6		
1169	Nanosafety	Maxine McCall	1.817	8		
1025	Preventative Health	Richard Head				
1025	Colorectal Cancer and Gut Health	Trevor Lockett	14.342	58		
1026	Neurodegenerative disease, mental disorders and brain health	Jose Varghese (Acting)	9.846	32		
1027	Health Data & Information	Christine O'Keefe	7.621	36		
1146	Obesity and Health	Peter Clifton	5.944	35		
1006	Water for a Healthy Country	Tom Hatton				
1006	Urban Water	Alan Gregory	27.271	109		
1010	Water Resources Observation Network (WRON)	Ross Ackland	15.049	61		
1136	Healthy Water Ecosystems	Bill Young	18.334	72		
1137	Better Basin Futures	Glen Walker	27.979	112		
1064	Wealth from Oceans	Kate Wilson				
1064	The Dynamic Ocean	Andreas Schiller	12.411	46		
1065	Ocean Based Industry Development and Growth	Edson Nakagawa (Acting)	22.990	81		
1066	Ocean Based Regional Development and Growth	Bill de la Mare	15.982	64		
1133	Ocean Based Regional Development and Growth	David Smith	16.023	64		
1134	Sustainable Australian Fisheries and Ecosystems	Nic Bax	5.898	22		
	sub-total national research flagships		442.983	1,712		
<b>CORE RESEARCH</b>						
<b>AGRIBUSINESS GROUP</b>						
1077	Entomology	Joanne Daly				
1077	Biosecurity and Invasive Species	Mark Lonsdale				
1080	Building Bioindustries with Synthetic Biology	Andy Sheppard	11.990	57		
1080	Food Science Australia	Peter East	10.466	48		
1030	Processing Innovation	Anthos Yannakou				
1030	Food Safety and Quality	Lyndon Kurth	7.050	31		
1032	Obesity and Health	Gary Dykes	9.386	39		
1033	Livestock Industries	Michael Fenech	4.500	25		
1044	Transforming Animal Biosecurity	Alan Bell				
1044	Transforming the Animal and its Products	Deborah Middleton	25.335	92		
1045	Plant Industry	Ian Purvis	17.677	87		
1038	New Horizons in Plant Science	Jeremy Burdon				
1038	Delivering Quality Crops for Health and Consumer Choice	Frank Gubler	10.959	61		
1039	Plant Fibre and Biofactories for New Agricultural and Industrial Products	Mark Peoples	9.748	54		
1040	Designing Crops for Australian Environmental Challenges	TJ Higgins	21.949	126		
1041	Biodiversity and Conservation	John Manners	22.577	135		
1042	Agricultural Sustainability Initiative	Andrew Young	2.632	18		
1129	Australian Agriculture Transformed	Brian Keating				
1129	vacant		8.373	31		
1130	Economic and Environmental Performance of Australian Agriculture	Pete Carberry	16.181	64		
1131	Agroecosystem Function and Prediction	Pete Thrall	14.339	56		
1139	Managing Australia's Soil and Landscape Assets	Mike Grundy	5.054	21		
1171	Sustaining Australia's Forest Ecosystems Resources	Michael Battaglia	8.189	31		

Theme No.	Name	Leader	2008-09	
			Total Revenue (\$m)	Planned Research FTEs
<b>CORE RESEARCH con't</b>				
	<b>ENERGY GROUP</b>	Beverly Ronalds		
	Energy Technology	David Brockway		
1140	Secure and Sustainable Energy Technologies	John Carras	10,705	42
	<b>Petroleum Resources</b>	Beverly Ronalds		
1092	Maximising Australia's Petroleum Self Sufficiency	Pewter McCabe	12,452	46
	<b>ENVIRONMENT GROUP</b>	Andrew Johnson		
	Land and Water	Neil McKenzie		
1119	Centre for Environmental Contaminants Research	Simon Apte	9,763	40
	<b>Marine and Atmospheric Research</b>	Greg Ayers		
1132	Climate and Atmosphere	Tony Hirst	22,369	86
	<b>Sustainable Ecosystems</b>	Dan Walker (Acting)		
1012	Sustainable Regional Development	Dan Walker	13,530	58
1014	Healthy Ecosystems	Iain Gordon	8,187	36
	<b>INFORMATION AND COMMUNICATIONS &amp; T GROUP</b>	Alex Zelinsky		
	Australia Telescope National Facility	Brian Boyle		
1068	Technologies for Radio Astronomy	Graeme Carrad	3,031	8
1069	Astrophysics	Robert Braun	5,958	23
1070	ASKAP: The Australian SKA Pathfinder	David DeBoer	9,180	63
	<b>ICT Centre</b>	Alex Zelinsky		
1057	eHealth	Bruce Baracough	4,071	17
1058	Service Science, Technologies and Architectures	Dimitrios Georgakopoulos	5,251	21
1059	Broadband Wireless for Connecting Australia	Jay Guo	5,538	21
1062	Sensor Networks	Peter Corke	10,996	47
1083	Facility Management / Canberra Deep Space Communications Complex	Miriam Baltuck	4,709	4
	<b>Mathematical and Information Sciences</b>	Bronwyn Harch (Acting)		
1084	Discovery Bioinformatics and Imaging	David Lovell	0,277	1
1085	Decision Technologies	Andrew Dinigan	9,329	37
1086	Environmental Monitoring and Modelling	TBA	5,424	25
1087	Terabyte Science	John A Taylor	5,501	22
	<b>MANUFACTURING, MATERIALS AND MINERALS GROUP</b>	Steve Morton		
	<b>Exploration and Mining</b>	Mike McWilliams		
1115	Maximising the Value of Mining	Hua Guo	15,020	53
	<b>Materials Science and Engineering</b>	Calum Drummond		
1103	Advanced Engineering Technologies	Barrie Finnin	7,311	23
1104	Sustainable Polymeric Materials	Stuart Bateman	11,788	44
1106	Industrial Research Services	Mark Burgess	5,495	30
1142	Manufactured Devices: Growing Globally Competitive	Scott Martin	11,810	41
1145	Nano-Additives for the Fine Chemicals Industry	Tony Hughes	8,324	31
1034	Protein Biofibres	Anthony Pierlot	4,147	14
1036	Advanced Fibrous Materials	Niall Finn	7,701	26
1172	Transformed Forest Industries	Jamie Hague	15,221	56
1174	Advancing Human Performance	Richard Helmer	1,450	6
	<b>Minerals</b>	Bart Folink		
1053	Iron ore - Maximising Export Marketability	Ralph Holmes	4,561	21
1054	High-performance Mineral Processes for Australia	John Farrow	11,511	40
1055	Instrument Systems for On-Line Analysis	Nick Cutmore	6,854	26
	<b>Molecular Health Technologies</b>	Megan Fisher (Acting)		
1048	National Security Technology Partnerships	Peter Osvath	9,786	42
1088	Australian Biotech Growth Partnerships	Tim O'Meara	9,642	41
1089	Biomedical Materials and Regenerative Medicine	Keith McLean	12,596	59
1144	Imaging for Early Disease Detection	Peggy Stasinos	6,689	34
	<b>sub-total core research</b>		<b>502,582</b>	<b>2,161</b>
<b>OUTREACH AND EDUCATION</b>				
1151	Discovery Centre	Jim Peacock	2,176	3
1153	Education Programs	Ross Kingsland	8,906	37
1154	CSIRO Publishing	Paul Reeke	10,400	34
	<b>sub-total outreach and education</b>		<b>21,482</b>	<b>75</b>
<b>NATIONAL RESEARCH FACILITIES AND COLLECTIONS</b>				
1047	Diagnosis Surveillance and Response (Australian Animal Health Laboratory)	Peter Daniels	28,220	72
1067	Australia Telescope National Facility Operations	Dave McConnell	15,312	52
1099	Marine National Facility Operations	Fred Stein	9,590	18
1173	National Biological Collections	Mark Lonsdale	16,156	66
	<b>sub-total facilities and collections</b>		<b>53,122</b>	<b>142</b>
	<b>TOTAL</b>		<b>1,020,169</b>	<b>4,090</b>

### Appendix 3. Science Assessment Review Criteria

This is a "double ladder" encompassing

- leadership and recognition in the international research community, as well as
- the ability to provide scientific/technical means for leadership to those organisations adopting and using CSIRO's research results.

It has been constructed this way to reflect CSIRO's role.

#### Research Community Position

✓ Benchmark	Sustained scientific leader – well recognised in the international research community for this.
/ Strong	Able to set and sustain new scientific/technical directions within the international research community.
/ Favourable	Able to maintain a good position in the international research community "pack"; not a scientific leader except in developing niches (not mainstream areas).
Tenable	Not able to set or sustain independent scientific/technical directions – a sense of being continually a follower.
Weak	Declining quality of scientific/technical output compared with other research groups. Often a short term "fire-fighting" focus.

#### Industry / Community Impact Position

✓ Benchmark	Research results used to set the pace and direction of technically-based commercial, environmental, community or policy development – recognised in industry or community for this.
/ Strong	Research results able to be used by organisations to distinguish themselves from peers or competitors.
Favourable	Research results able to be used by organisations to improve their position relative to peers or competitors.
Tenable	Research results able to be used by organisations to maintain, but not improve, their position relative to peers or competitors. Research results not able to be used to differentiate organisations from their peers or competition.
Weak	Research results not able to be used by organisations to even maintain their position relative to peers or competitors.

*Cecile Paris*

## Appendix 4. CSIRO Executive Management Council

CSIRO Executive Management Council

July 2008

Enquiries: 1300 363 400 Email: [enquiries@csiro.au](mailto:enquiries@csiro.au)  
Web: [www.csiro.au](http://www.csiro.au)

To email any of these executives: [firstname.lastname@csiro.au](mailto:firstname.lastname@csiro.au)

### Executive Team

<b>Dr Geoff Garrett</b>	Chief Executive	02 6276 6621
<b>Dr Alastair Robertson</b>	Deputy Chief Executive: Science Strategy & Investment	02 9490 8468
<b>Mr Mike Whelan</b>	Deputy Chief Executive: Operations	02 6276 6598
<b>Dr Joanne Daly</b>	Group Executive: Agribusiness	02 6276 6805
<b>Dr Andrew Johnson</b>	Group Executive: Environment	07 3214 2383
<b>Dr Steve Morton</b>	Group Executive: Manufacturing, Materials & Minerals	03 9545 8303
<b>Dr Bev Ronalds</b>	Group Executive: Energy	08 6436 8700
<b>Dr Alex Zelinsky</b>	Group Executive: Information & Communications S&T	02 9372 4202
<b>Dr Michael Eyles</b>	Executive Director: Leadership & Organisation Development	02 9490 8341
<b>Mr Craig Roy</b>	Executive Director: Strategic Change Programs	02 9490 8564
<b>Mr Nigel Poole</b>	Executive Director: Business Services	02 9490 8504
<b>Mr Allan Gaukroger</b>	Chief Finance Officer	02 6276 6633

### Divisions, Flagships & Joint Ventures

#### Agribusiness Group

Entomology	<b>Dr Mark Lonsdale</b>	02 6246 4360
Food Futures Flagship	<b>Dr Bruce Lee</b>	02 9490 8490
Livestock Industries	<b>Dr Alan Bell</b>	07 3214 2999
Plant Industry	<b>Dr Jeremy Burdon</b>	02 6246 5546
Preventative Health Flagship	<b>Dr Richard Head</b>	08 8303 8819
Food Science Australia (JV)	<b>Dr Anthos Yannakou</b>	03 9731 3530

#### Energy Group

Energy Technology	<b>Dr David Brockway</b>	02 4960 6046
Energy Transformed Flagship	<b>Dr John Wright</b>	02 4960 6080
Petroleum Resources	<b>Dr Bev Ronalds</b>	08 6436 8700
Wealth from Oceans Flagship	<b>Dr Kate Wilson</b>	03 6232 5375

#### Environment Group

Climate Adaptation Flagship	<b>Dr Andrew Ash</b>	07 3214 2346
Land & Water	<b>Dr Neil McKenzie</b>	02 6246 5922
Marine & Atmospheric Research	<b>Dr Greg Ayers</b>	03 9239 4687
Sustainable Ecosystems	<b>Dr Dan Walker (Acting)</b>	07 3214 2373
Water for a Healthy Country Flagship	<b>Dr Tom Hatton</b>	02 6246 5745

### **Information & Communications S&T Group**

Australia Telescope National Facility	<b>Dr Brian Boyle</b>	02 9372 4300
ICT Centre	<b>Dr Alex Zelinsky</b>	02 9372 4200
Mathematical & Information Sciences	<b>Dr Bronwyn Harch (Acting)</b>	02 9325 3203

### **Manufacturing, Materials & Minerals Group**

Exploration & Mining	<b>Dr Mike McWilliams</b>	08 6346 8610
Light Metals Flagship	<b>Dr Raj Rajakumar</b>	03 9545 8625
Materials Science & Engineering	<b>Dr Calum Drummond</b>	02 9413 7800
Minerals	<b>Dr Bart Follink</b>	03 9545 8605
Minerals Down Under Flagship	<b>Dr Peter Lilly</b>	08 6436 8613
Molecular & Health Technologies	<b>Dr Graeme Woodrow</b>	03 9662 7135
Niche Manufacturing Flagship	<b>Dr Greg Simpson (Acting)</b>	03 9545 2049

### **Other EMC members**

<b>Dr Attila Brungs</b>	General Manager: Science Investment	02 9490 8572
<b>Dr John Curran</b>	General Manager: Communications	02 6276 6438
<b>Ms Roze Frost</b>	Project Director: BETR	02 6276 6601
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