THE AUSTRALIAN NATIONAL UNIVERSITY

ANU College of Physical Sciences – Research Strategic Plan

Executive Summary

Principal Goals for College in 2010

1. Supporting Excellence
2. Sustaining Performance
3. Optimising Staffing Profile
4. Linking Research and Education
5. Supporting Infrastructure

Our strategic imperatives for new and redistributed resources are, in following order of priority:

1. Funding allocation models (3.2B & D Sustaining Performance pg 9)
2. Diversifying the staff profile (3.3C Optimising Staffing Profile pg 10)
3. Supporting infrastructure (3.5 Supporting Infrastructure pg11)
4. Career development & staff movements (3.3A Optimising Staffing Profile pg 10)
5. Discipline review program (3.2C Sustaining Performance pg 9)
6. Recruitment incentives (3.3B Optimising Staffing Profile pg 10)
7. Centre of Excellence support (3.1B Supporting Excellence pg 8)
8. College linking activities (3.1A Supporting Excellence pg 8)
9. Granting income initiatives (3.1A Supporting Excellence pg 8, 3.2A Sustaining Performance pg 9)
10. Linking research and education (3.4 Linking Research and Education pg10)

Professor Aidan Byrne
Director, College of Physical Sciences

7th September, 2009

ANU College of Physical Sciences – Research Strategic Plan

Vision

The College of Physical Sciences will maintain research excellence at the highest international levels across the full discipline spread in the enabling sciences, linked to our educational mission.

The College will strive to maintain a good balance between fundamental, strategic and applied research and education.

The discipline components should be regarded as the best in their field in Australia and among the best in the world for their size.

Mission

To conduct world class fundamental, strategic and applied research across all College disciplines, by providing outstanding research infrastructure to sustain research at the highest international levels. Through research leadership the College will sustain strong national and international engagement in collaborative research.

Implementation

The implementation of the College Research Plan will be the responsibility of the Director of the College and the College Executive (which also acts as the College Research Committee). The Executive will collectively set the budget priorities. The individual Schools will generate and pursue detailed implementation plans to achieve the College objectives.

1. Background

1.1. *Strategic Environment*

The College of Physical & Mathematical Sciences comprises five strong disciplinary strands[1]

- Mathematical Science Institute (MSI)
- Research School of Astronomy & Astrophysics (RSAA)
- Research School of Chemistry (RSC)
- Research School of Earth Sciences (RSES)
- Research School of Physics & Engineering (RSPE)

These disciplinary areas have combined the research and education functions assembled from former Institute of Advanced Studies and Faculty of Science components. The fusion is of long standing in the Mathematical Sciences Institute. The merger of the former Research School of Earth Sciences with the Department of Earth and Marine Sciences was formalised from 2008 January 1, and was followed in 2009 by reorganisation in Physics and Chemistry. While not having a single Faculty partner, RSAA is nonetheless committed to the teaching programs in Mathematics and Physics.

Each of the disciplinary units is a major player in its chosen field. RSPE, MSI and RSES are the largest entities of their type in Australia and their size gives them enhanced international profiles. However, ensuring the research undertaken is of national and international importance is critical to all disciplines. The strength of the College discipline structure provides an excellent platform for interdisciplinary collaboration with colleagues from across the ANU, nationally and internationally.

❖Each School has a Discipline Future Directions Statement and Research and Education Plan

The internal organisation of each College constituent varies significantly. This reflects the differing nature of the fields of endeavour as well as the unit's scale. Configurations include few formal subunits, a broad range of disciplines with significant cross-discipline interactions brought to bear on a single system or formal departmental structures with a number of distinct sub-discipline groupings. Each of the structures enables the units to successfully market their research and education capabilities in a discipline specific manner.

Many of our competitors have been very active in promoting themselves, through strong branding in particular fields of research coupled to significant infrastructure investments and formidable enticements. However despite the growth in research activity in other Australian universities, and a spike in the number of research-only appointments, the College of Physical Sciences continues to have a distinctive capability to launch focussed research efforts in important areas of national significance due to outstanding staff. Looking forward, the College must focus not just on attracting outstanding researchers but on building a vibrant community, on driving individual productivity and on promoting the strong connections of our disciplines to global issues. The College will need to consider how the research outcomes from its constituent units are presented to the outside world and in doing so it can maximise the resulting external resources.

Our work spans the research spectrum from basic/theoretical through to pre-commercial activities. This foundation enables the explicit exploitation of locally developed intellectual property. However the globalisation of industrial activity has impacted on the breadth of potential industry partners and the sustainability of industry engagement in research projects. The major players have adapted their business strategies, driving profit margins through efficiency in production, rather than directing attention, and funding, to developmental research.

Many of our components are big enough to exploit the recent trends of national competitive grant funding. The College success in competing for larger centre and program grants has diverted focus away from the small investigator/project schemes. The funding environment for research however can change quickly and the College must be able to respond to "earmarked" funding and societal agendas. In the engagement of larger scale activities the College will need to balance the eminence of the "lead institution" against the advantages arising from supporting the involvement CPS researchers in the funding bids of other organisations.

A distinctive feature of the College of Physical Sciences is its role in the provision of national research infrastructure, through significant long term investment by the ANU and in attracting major investment from the Commonwealth. More recent infrastructure additions, funded through the National Collaborative Research Infrastructure Strategy (NCRIS) and SuperScience include Plasma and Accelerator Science in RSPE, Earth Imaging and Geodetic Studies (AuScope) in RSES and with new funding into RSAA, the development of a Giant Magellan Telescope. This concentration of major infrastructure is a significant strength for the College however infrastructure operating costs (particularly the attraction, retainment and the development of human capital) must be considered against the national benefit. To manage this, the College is committed to regular deliberation and implementation of infrastructure management strategies.

1.2. *Research Strengths*

The disciplinary strengths of the College, and the current collaborations both intra and inter College are summarised in the figure below. The topics marked with a star are identified new activities in which further interactions will be encouraged. New linking activities will be

focussed through research nuclei, hosted in one of the Schools of the College, noted by the position of the star symbol. The identification of linking activities by College staff brings together those with cognate interests from within the College and across the University. College Linking Initiatives will be facilitated with a small budget, but will depend on the development of real linkages for their success.

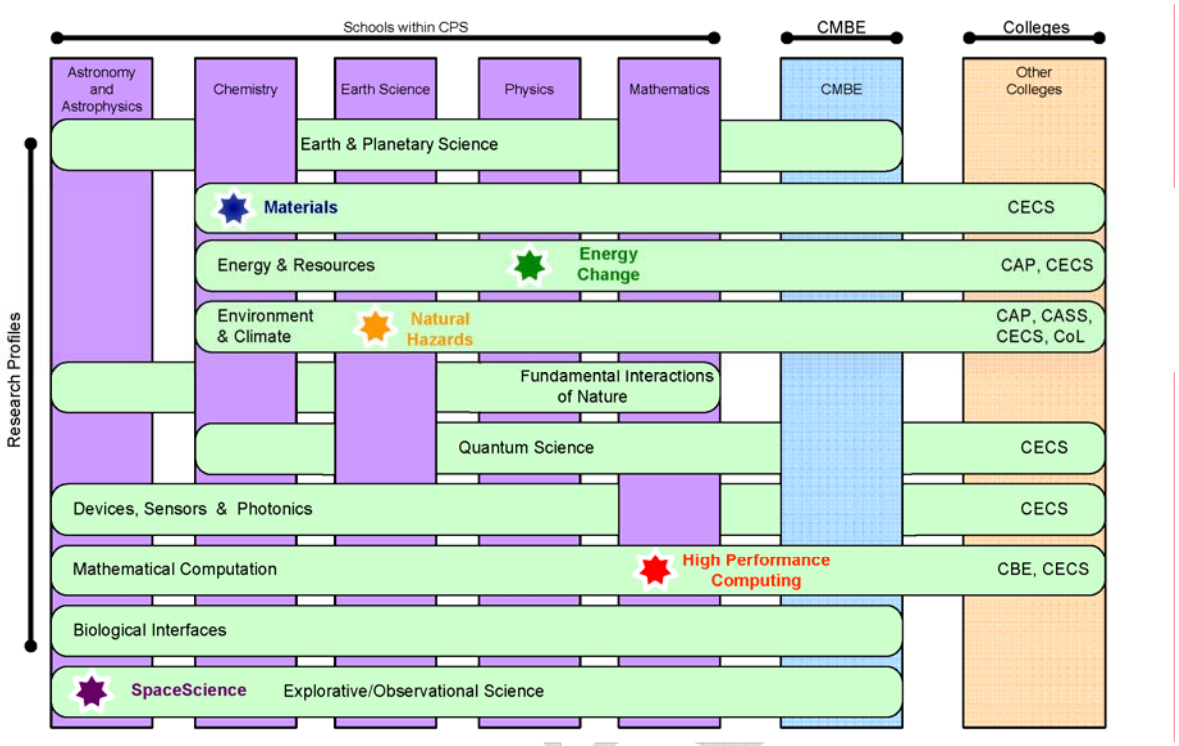

Figure 1: The ANU College of Physical Sciences Research Profile and Future College Linking Activities

The various components of the College have very high international profiles as recognised, e.g., through Thomson Essential Science indicators that place RSES & RSAA (2008-space science) in the top 25 institutions worldwide in the 10 year period to 2009.

The College makes a very substantial contribution to the research profile of the ANU. The principle goals described below are designed to address the College's challenges such as the recruitment/ retainment of high performing staff and students, exploiting the available external funding sources to maximise research income and an infrastructure management strategy (including research infrastructure and capital works).

1.3. *Planning Process*

The research planning process in the College of Physical Sciences is one that draws on the development of discipline plans from within the Schools, with the plans discussed and amalgamated by the College Research Committee.

There are two important components of the planning process

(a) College Profile

This represents an up to date portrait of the College which includes information and descriptions of the disciplines and their capabilities, staffing profiles and infrastructure status. This is a dynamic profile updated annually.

(b) Discipline Future Directions Statements
There is an expectation these statements will be updated biennially. Their purpose is to communicate a clear statement of research themes and/or major questions, and the way in which the research agenda is expected to evolve. Statements are accompanied by a description of the needs that arise in fulfilling the goals and the way in which the School anticipates handling the necessary responses.
Statements will not only reflect future aspirations, but also the practical steps to be taken, particularly around the release of resources to achieve progress.

The present research plan has also drawn on material prepared for the 2008 Research and Education Master Plan, which was updated in 2009.

The CPS Research Plan is a dynamic document that reflects the changes in the research environment, such as, government policy changes, shifting external funding opportunities, staff turnover, changing social needs, and the competitive environment nationally and internationally. It is anticipated that the basic framework can be regarded as a 3-5 year forward projection with annual review to ensure relevance.

2. Principal Goals

The College recognises a number of key elements to sustain and enhance the current high level of research:

2.1. Supporting Excellence

Aim: to sustain and enhance the excellence of research to the highest international standards.

Main challenges:
The component Schools of the College of Physical Sciences have established an enviable reputation for their research strengths. Our challenge will be to sustain this against a background of enhanced external competition. The College will continue to maintain a high level of investment to sustain our high quality human capital resources. Although there has been a national decline in research and teaching positions in most physical science disciplines, our major competitors have increased the percentage of research-only positions within their organisations.

Main opportunities:
- Breadth of Research Capability and Strong Discipline Foundations
- Unique Assets and Infrastructure
- National and International Significance of Activities
- Expand Relationships with Organisations such as Geoscience Australia, CSIRO and Australian Nuclear Science and Technology Organisation

Centres of Excellence – The College has immediate priority to ensure its Centres of Research Excellence are enhanced. This will be achieved by the supply of strong budget support to high flying ANU researchers. The scale of matching funds for ARC or similar Centres of Excellence bids will be an important aspect to achieving this goal.

Inter/Intra-College Planning – The College is committed to attracting increased external funding through integrated research/collaborative projects. Strong opportunities for linked research activities have been identified through this strategic planning process, especially by researchers working in the areas of Materials, Natural Hazards, Energy, Quantum Science, High Performance Computing and Space Science (refer to Figure 1).

2.2. Sustaining Performance

Aim: to manage resources so to ensure exceptionally high standards of research performance, both by individual researchers and by groups of researchers.

Main Challenges:
External fund-raising has become an essential aspect of research and must be used to build on the base provided by the block grants to ensure salary security, the provision of infrastructure and technical support and the availability of strategic/development funds for new ventures. The College shall align its limited discretionary resources against merit. As such the highest standards will apply to recruitment, continual review and assessment of staff and disciplines and the delivery of career development.

Main Opportunities:

- Utilise external funding schemes with the expectation of improving the income at the College level.
- Revise the resource distribution model to enable clear transparent mechanisms for the allocation of discretionary funds, moving from historical to performance/strategy based funding allocation.
- Improved performance management and reporting systems enabling workload assessments including the implementation of research and education assessment models.

Ongoing Reviews – The College will establish a review program of major research areas within Schools, to complement University commissioned discipline reviews, and other assessment processes. The College will use review outcomes to inform planning processes, including the development (or redevelopment) of research strengths, and the consequent withdrawal of support from areas that are under-performing.

2.3. Optimising Staffing Profile

Aim: to ensure that, in its areas of discipline depth, the College continues to be an internationally and nationally recognised destination of choice in which to undertake research.

Main Challenges:
The issues of securing ongoing research strength and succession planning confront all areas of the College in different ways:

- The demographic profile of the College shows limited diversity in age at senior academic levels, gender is also a core concern here. While our overall cultural diversity is strong our indigenous profile is also lacking. A core element of this challenge is to make progress at a time of constrained funding.
- Previous success in the national competitive fellowship schemes has amplified the imbalance in mid career academics on fixed term appointments. To address this profile, effective (financially sustainable) processes need to be implemented for renewing high flying fixed term mid-career staff to continuing appointments.
- Serendipity of externally funded fellowship schemes.

Main Opportunities:

- Focused renewal.
- Potential for success in competitive grant schemes such as Laureate and Future Fellows
- New Australian Government initiatives e.g. SuperScience Fellowships
- Ability, although recognisably limited, to provide support for high quality new staff, to compete internationally, through mechanisms such as the Ringwood Fellowship in RSES and the Oliphant Endowment in RSPE.

- Potential of the Supporting Research Excellence (SRE) process to provide additional resources.

2.4. Linking Research and Education

Aim: to achieve coherence between teaching and research activities where appropriate and achieve an acknowledgment from staff of the College's commitment to education as a key academic activity. An outcome will be visible growth in HDR loads in targeted areas of the College.

Main challenges:

- The College has the potential for enhanced training of HDR students however:
  a) In many discipline areas there is a small student population (national) from which to draw;
  b) There is a relatively small population base in Canberra from which we can develop/grow our own HDR students. This is compounded by the relatively small set of students able to pursue advanced study in the physical sciences;
  c) There is a decrease in domestic students interested in pursuing doctorates (across all disciplines) and low unemployment levels;
  d) The inter-institutional mobility among Australian graduate students is not high;
  e) High competition from entry level employment with excellent starting salaries.
- There are tensions in managing funding and demand across domestic and international cohorts. While federal funding is largely driven by domestic student numbers, in many areas there is strong demand from high-quality international students. Regardless, the College must strive to increase HDR in its areas of strength, recognising the wide variations in cost patterns associated with different types of research.

Main opportunities:

- There has been recent growth in federal funding provision for research students that provides opportunities for enhanced HDR recruitment.
- The mergers of the previous institutional entities to produce five Schools creates the potential for enhanced involvement in postgraduate course work, and the overall enhancement of the educational experience for undergraduates and honours students with the potential to flow on to HDR programs. All academic staff, no matter how their salaries are funded, will be expected to engage with teaching – whether at the undergraduate, postgraduate or HDR level.
- The potential of expanding Postgraduate Coursework programs will enable us to offer study opportunities in niche areas of critical importance to the nation.
- Promotion of coordinated educational activity both within the College and across College boundaries, particularly with CECS and CMBE.

2.5. Supporting Infrastructure

Aim: to maintain, develop and enhance the College's significant infrastructure resources.

Main challenges:

- Sustenance and renewal of the high level of existing infrastructure – particularly with regard to operational costs and technical support and maintaining a high skill base.
- The funding discrepancy, present in major infrastructure grants, between set up costs and the support required for continued operations (particularly human capital).
- Poor phasing of external infrastructure support leading to clumping of acquisitions and similar timescales for infrastructure replacements.

- The limited life-cycles of equipment in areas such as high-performance computing, microscopes and NMR facilities.
- Building infrastructure (or refurbishment) required to house major investments.
- The failure of funding schemes to recognise the full life-cycle costs of infrastructure.

Main opportunities:

- The College has a significant infrastructure base including major pieces of national infrastructure that can be used by the College to leverage further investment.
- New funding opportunities in e.g. SuperScience
- Potential for renewed and new national collaborations attractive to the ARC LIEF scheme.
- Other significant renewal programs funded by the Australian Government such as the significant works in RSC through the Education Investment Fund (EIF) or the National Collaborative Research Infrastructure Strategy (NCRIS).

3. Research Strategies

3.1. Supporting Excellence - *To sustain & enhance the excellence of research to the highest international levels.*

A. Each School has identified focus areas within its discipline in which research excellence will be further developed or newly created. The associated strategies are detailed in the plans of the individual Schools. In addition, the College has identified the five areas of potential for cross College linkages. Each Linking Initiative will be hosted in a School and a coordinator identified. The indentified fields and coordinators are:

- Materials Science (Tim White)
- High Performance Computing (Richard Brent)
- Space Science (Harvey Butcher)
- Renewable Energy (Ken Baldwin)
- Natural Hazards (Paul Tregoning)

The Schools will take on the responsibility to develop the initiatives and some modest start up funds will be provided. School Directors will provide progress reports to the College Executive biannually. This low cost strategy will inform staff of our collaborative opportunities and encourage them to exploit existing relationships. It is expected School networks will expand quickly across the College, improving the dissemination of research ideas, collaboration and overtime the emergence of new networks. Such activities will support current School efforts to grow and maintain strategic international linkages.

B. The College will support existing Centres of Excellence (and similar programs) that address questions aligned to our nominated areas of strategic strength. In addition, the College is committed to developing external partnerships with other universities supporting centre proposals in discipline areas of strategic importance to our Schools. Further, research proposals for new ANU (hosted) Centres must align their research questions closely to those of the College and the future directions statement of the host School in order for a commitment of resources to be considered.

C. The College will continue to grow its national and international partnerships by:

- Entering into formal Memorandums of Understanding (MoU) with leading international institutions, preferably at the institution level.
- Expanding existing relationships with organisations such as the Australian Nuclear Science and Technology Organisation (ANSTO), Geoscience Australia (GA), Defence Science and Technology Organisation (DSTO) and CSIRO.

- Facilitating the engagement of our staff in leadership roles in national collaborative ventures.
- Coordinating proactive marketing strategies, communicating research capabilities and the future directions of the College to key audiences such as the international research community; the national research community, prospective PhD students, international foundations and funding bodies, Australian funding councils, federal policy-makers, and the general public.

D. The College will introduce initiatives that promote:

- Greater scrutiny over research funding proposals, optimising the competitiveness of appropriately resourced and coordinated bids to produce better outcomes and returns for the ANU.
- Securing sufficient financial resources to foster and sustain world-scale, collaborative research efforts.
- Utilising existing areas of support to expand our financial base through coordinated bids in defined areas.
- The allocation of new and redistributed resources, to ensure critical mass in key areas thus sustaining national and international competitiveness.

The College will monitor the overall engagement of Schools, research groups and individuals with these strategies through the individual School plans and associated progress reports.

A distinctive feature of the College of Physical Sciences is the depth and breadth of disciplines in which it excels. This enables an unchallengeable delivery of education programs in a research intensive environment. Our ability to deliver research led education exceeds all of our Australian competitors. The College provides the country with a unique scientific compact and continues to provide the research leadership that it is renowned for. As a consequence the College ought to be resourced appropriately.

3.2. Sustaining Performance – *To manage resources so to ensure exceptionally high standards of research performance, both by individual researchers and by groups of researchers.*

To sustain performance the College will:

A. Initiate greater scrutiny in the development of funding proposals, optimising coordinated and resourced bids to produce better success rates and financial returns to the ANU.

B. Introduce clear and transparent mechanisms for the allocation of discretionary funds, moving away from historical funding to merit and strategy based funding.

C. The College will establish a review program of our major research areas to complement the major discipline reviews commissioned by the University. Following the 2009 ANU staff (IAS) review and the pilot ERA exercise the College will undertake a review of Physics, Engineering and Mathematical Sciences in the broadest sense. This exercise is expected to include activities undertake, in these fields, in other Colleges. This follows on from reviews already been undertaken in Chemistry and in parts of Earth Sciences.

D. The College will use the outcomes to inform the planning process, including the development (or redevelopment) of research strengths, and consequent withdrawal of support from areas of under-performance. The Schools will use the outputs from the ANU review, the ERA process, sub-discipline reviews and the external review of Physics, Engineering and Mathematical Science to redirect resources, including vacant posts, to areas of strength.

E. The College recognises the tension between the breadth of capabilities that has established our reputation and the need to focus resources due to the funding environment.

The College will scrutinise internally and externally funded activities to maintain an appropriate balance between breadth and depth. As such, five College linking activities have been identified, in key thematic areas in which the College will maintain and develop research leadership.

3.3. Optimising Staffing Profile - *To ensure that, in its areas of discipline depth, the College continues to be an internationally and nationally recognised destination of choice in which to undertake research.*

A. Our greatest attribute is our staff. The College of Physical Sciences is committed to career development and supporting our staff, to improve individual performance, the delivery of outcomes and to build a working environment conducive to a culture of collaboration and pre-eminence. To do this we are engaging in specific human resource planning such as:

- Talking with staff, particularly those nearing the end of their careers, about their role, their discipline and how they will engage with the Universty into the future.
- Proactively creating opportunities for salary conversions, between external sources to recurrent and vice versa, for early and mid-career researchers.
- Clearly communicate a merit-based process available to fixed term outstanding early career researchers aiming to move them onto onto continuing posts within our Schools.
- Provide career mentoring to all staff wishing to engage in such activities, through facilitating interactions with key peers within the international scientific community, stimulate engagement in conference activity, provide assistance in creating competitive publication records and encourage staff to undertake national leadership roles.

B. The College is committed to maintaining its profile as an internationally recognised destination of choice for staff. However, the recruitment of high flying staff has its challenges. The College's major research infrastructure is enticing to incoming staff, to maximise our advantage Schools will continue to offer start-up support to high quality new staff though the Ringwood Fellowship and the Oliphant Endowment. Such strategies enable our Schools to meet the expectations of international researchers.

C. Staff diversity is a growing concern for the College and we address these issues through the following strategies:

- The College will be proactive in encouraging staff from minority areas (race, religion, gender etc.) to apply for new positions and promotion, though the mentoring strategies described above.
- Engage in discussions with indigenous persons in an attempt to honour the University's Reconciliation Action Plan.
- The College will investigate the underlying causes that impede diversity balances in our workforce so to inform new strategies; for example, the drop off rate of early career females in our science disciplines.

3.4. Linking Research and Education - *To achieve coherence between teaching and research activities, achieving an acknowledgment from staff of a commitment to education and a visible growth in HDR loads in all areas of the College.*

The College will build on the opportunities generated by the mergers of the Faculty of Science departments with the associated Research Schools. Each School in the College is responsible for promoting the College educational goals, in particular by exposing students to the research environment. The College education strategies will be detailed in the College

Education Plan. The following are some examples of research linked strategies that may be considered by the education planning committee.

- Increasing Postgraduate Coursework – identifying areas and markets that will benefit from expanding coursework offers in niche areas of critical importance to the nation.
- HDR Students – The College will utilise arrangements such as A*STAR to enhance the PhD experience. The College has identified the need for a more integrated approach to progressing students through our undergraduate degrees to PhD programs. The PhB program is one example that has proved successful, but the BSc (Advanced) Hons is another that is yet to be fully exploited.
- The College aims to develop initiatives that provide students with the opportunity to better engage with the ANU research experience.
- The College will move towards harmonising the expectations of our Honours programs.
- For our students to succeed in the higher stages of our disciplines and/or succeed in employment it is important that we offer a comprehensive education in the discipline we teach. This requires the College, in collaboration with other ANU Colleges, to teach a breadth of courses beyond that which can be maintained from the current student income.

To address this, an initial strategy includes the development of education programs that link (greater coordination) the discipline areas, for example, statistical mechanics between Chemistry and Physics, Earth Sciences into Physics, and Physics into Engineering.

3.5. Supporting Infrastructure - *To maintain, develop and enhance the College's significant infrastructure resources.*

The College must be able to underpin the physical infrastructure capability in strategic areas. The Schools will focus efforts to secure resources for:

- Support and renewal of existing infrastructure; and
- Development of new infrastructure in strategic areas.

In the broader sense the College has committed to the following strategies:

- Proactive creation of technical apprenticeships.
- Coordination of workshops (including, mechanical, electronics, experimental support and timber) across CPS and CMBE, and then the University as a whole.
- A coordinated Science building plan including a planned cycle of building developments will be put in place. This will continue on from the current Science Building Project (Biology, followed by Chemistry). We currently have an EIF under development for Physics, a proposal identified for Mathematics and plans for works within Research School of Earth Sciences. In parallel, the Research School of Astronomy and Astrophysics has new funding to assist in the development of the Giant Magellan Telescope. The specific infrastructure plans are detailed in the individual School components.
- To sustain our research activities the College needs to explore different ways of acquiring support for infrastructure.
- In addition to a capital building plan the College is developing a building maintenance strategy for works funded by the Q94 fund.

The College has a significant fraction of the nation's infrastructure in the physical sciences. To deliver on our compact with the nation, a Hubs and Spokes arrangement will be implemented to support infrastructure maintenance and renewal.