Contents
TERMS OF REFERENCE .................................................................3
MEMBERSHIP OF THE REVIEW COMMITTEE........................................5
EXECUTIVE SUMMARY OF COMMENDATIONS AND RECOMMENDATIONS ........6
  Commendations ...........................................................................6
  Recommendations .......................................................................7
ASSESSMENT, COMMENDATIONS AND RECOMMENDATIONS ......................9
  1. Governance and Administration ..............................................9
  2. Teaching .................................................................................10
  3. Research and Research Training .............................................12
  4. Alumni & Community ..............................................................14
  5. Internationalisation .................................................................15
  6. Industry Links .........................................................................15
  7. Diversity ..................................................................................16
  8. Physical Facilities and Resources ............................................18
Bibliography ..................................................................................19
APPENDIX 1 : SUBMISSIONS .............................................................20
APPENDIX 2 : INTERVIEWS .............................................................21
 TERMS OF REFERENCE
for the
REVIEW OF THE SCHOOL OF MECHANICAL AND MINING ENGINEERING

The terms of reference for reviews of schools and academic disciplines should be read in the context of The University of Queensland’s (UQ) mission, goals and objectives.

The review committee’s task is to provide an objective view of the School’s perceptions and plans developed through the self-assessment process, and either to confirm or to recommend changes to the plans. The majority of school reviews are expected to result in incremental changes in schools, however it is recognised that significant change might result from some reviews.

The review process is undertaken in the context of the Faculty of Engineering, Architecture and Information Technology and the University as a whole, and considers relationships within and between schools and where relevant, with centres and institutes. Reviews are conducted on a septennial basis to assist schools in understanding and planning for their future strategic development in relation to the University’s three broad planks of learning, discovery and engagement. Reviews have three key dimensions:

- an evaluation of past performance since the previous review, including especially, the School’s program of improvement in response to the recommendations of that review;
- benchmarking of current structures, activities and performance against appropriate comparable organisations to determine the School’s standing, nationally and internationally, in relation to its key strategic goals; and
- an evaluation of the School’s future prospects in the context of its strategic goals, resources, and internal and external opportunities.

Evaluation of past and benchmarking of current, performance nationally and internationally is undertaken primarily to develop an appropriate contextual understanding of future prospects. The focus of the review process is on the future prospects of the School in relation to key aspects of learning, discovery and engagement.

The terms of reference provide the framework in which the School, through its self-assessment, and the review panel, through its enquiries, can analyse the School’s performance (and that of its centres) and plans in relation to appropriate and attainable future objectives. The terms of reference are:

To review, within the context of the University’s strategic and operational plans, the School’s current performance and in particular its plans for enhancing performance in relation to:

1. The governance, leadership and inclusive decision-making structures in relation to promoting a clear and distinctive vision for the future development of the School;

2. The quality, scope, focus, direction and balance of the School’s curricula and teaching at the undergraduate and postgraduate levels in the light of enrolment trends, success rates, student and graduate satisfaction and the perception of key external stakeholders, the availability of alternative programs elsewhere in Queensland and Australia, and future developments in the discipline/s;

3. The research performance of the School including its research activity, research outcomes, including quality and impact, quality of research training, in light of future developments in the disciplines/s and other contextual matters;
4. The School’s strategies in relation to internationalisation of the undergraduate and postgraduate curriculum; increasing international student enrolments and support for international students; student and staff mobility internationally; and international research collaborations;

5. The role played by the School in relation to its relevant industries or other stakeholder communities and in service to the profession and the community;

6. The effectiveness of the School’s relationship with its alumni and the broader community and its ability to develop support for meeting its future goals;

7. The performance of the School in providing equity in access, employment and learning for staff and both domestic and international students, including the recruitment of students and staff from under-represented groups;

8. The effectiveness of the organisation and administrative support structures of the School (effective committees, strong academic and professional staff support, efficient and equitable staffing arrangements) in the context of its current functions and anticipated developments; and

9. The financial health of the School and the effectiveness of the School’s use of resources in relation to accommodation, facilities, allocation of teaching/research/equipment funds, internationalisation and potential to generate additional external resources.
MEMBERSHIP OF THE REVIEW COMMITTEE

External Members:

Professor Brian Launder FRS, FREng (Chair)
School of Mechanical, Aerospace and Civil Engineering
The University of Manchester

Emeritus Professor Malcolm Good
Melbourne School of Engineering
The University of Melbourne

Dr Anita Hill FTSE
Chief
CSIRO Process Science and Engineering

Professor Gustavo Lagos
Department of Engineering and Mining
Pontifical Catholic University of Chile

Internal Members:

Professor Justin Kenardy (Academic Board Standing Committee Representative)
School of Medicine
The University of Queensland

Professor Paulo Vasconcelos (Member of Cognate School)
Head
School of Earth Sciences
The University of Queensland

Secretary:

Ms Gillian Di Corleto
Executive Officer
Faculty of Engineering, Architecture and Information Technology
The University of Queensland
EXECUTIVE SUMMARY OF COMMENDATIONS AND RECOMMENDATIONS

Commendations

The Review Committee Commends the School for:

Governance and Administration
C1 The leadership provided by the Head of School which is seen as outstanding in drawing all levels of staff and students together. All round, this is a happy school.

C2 The School Manager and the administration who provide a highly regarded level of service to the School.

C3 The technical staff who are commended on their commitment to the educational and research activities of the School and other organisational units.

C4 The heads of Divisions who are commended for their collegiality and constructive engagement to bring the three disciplines together as a coherent group.

Teaching
C5 Maintaining a high level of satisfaction in the Faculty’s teaching evaluations under the difficult circumstances of an ever increasing student to staff ratio.

C6 Taking a careful approach in introducing the BE/ME program in 2014 within existing capabilities and resources.

C7 Embracing and leading the new teaching pedagogy for flipped classrooms and MOOCs.

C8 Maintaining both the depth and breadth of the curriculum in the face of an increasing student staff ratio within current budget constraints.

C9 Introducing active learning methods into tutorials and practicals and for obtaining funds for student activities, e.g. STC and Newcrest HVAC Lab.

Research and Research Training
C10 Achieving an outstanding performance in the ERA, with the highest rating of all schools in UQ in the weighted index.

C11 The research in Hypersonics, confirming its unique, world-class position in ultra-high-speed flow.

C12 The small and productive group of materials engineers who contributed 48% to the overall score of 5 in the University’s ERA rankings.

C13 The high profile of the Materials Engineering Division and its links with industry and government providing the seed funding enabling the Advanced Engineering Building to be built.

C14 The Mechanical and Mining Divisions’ strong engagement with the mining and energy sectors leading to extensive support of their activities and to the uptake of research outputs, with valuable national and international impacts.

Alumni and Community Links
C15 The wide contributions of the School’s high quality graduates to industry and the community.

Internationalisation
C16 Its active and enthusiastic participation in a diverse range of initiatives both for raising the international experience of its students and for bringing students from overseas to participate in its undergraduate and RHD programs.

C17 The strong international links underpinning the School’s research and research training activities that substantially contribute to the University’s reputation.

Industry Links
C18 The School’s strength in applied research which has been the foundation for extensive CRC engagement, the growth of its research impact and the attraction of industry-funded chairs.

C19 The School’s strong links with industry, evidenced by the latter’s demand for both its graduates and postgraduates and by the leadership provided through the Mining Education Australia (MEA) program.

Recommendations

The Review Committee recommends that:

Governance and Administration
R1 The Head of School should utilise the School’s pool of talent to develop ambitious and visionary strategic plans for the School.

R2 Portfolio responsibilities for driving the strategic goals should be defined and developed for senior staff.

R3 The School management should work with the senior management of the University to examine mechanisms to increase interactions between its divisions and cognate research institutes.

Teaching
R4 The School should explore further opportunities for rationalising undergraduate course offerings, not only across disciplines but also across schools (e.g. Civil and Chemical Engineering).

R5 Noting the benefits it has derived from the ResTeach funding program, the School should continue to apply for this funding and identify further opportunities to engage Research Only staff, including institute researchers, into its teaching program.

R6 The School should work with the Faculty and the University senior management in devising more rational and transparent ways of calculating student-staff ratios.

R7 The School should implement more robust mechanisms for incorporating student feedback into course content, planning and delivery.

R8 The School should develop better communication strategies with undergraduate students.

Research and Research Training
R9 While recognising the constraints imposed by industry and DSTO partnerships, and acknowledging its excellent ERA rankings, the School needs to increase its efforts to publish in high impact journals.

R10 The School should introduce internal mechanisms to encourage and support all academic staff, particularly early- and mid-career academics, to apply for more Category 1 funding.
R11 The School should monitor the effects of the milestone process on RHD completion rates.

R12 The School should encourage RO staff to supervise RHD students and projects within the BE/ME program.

R13 Steps should be taken to increase the currently modest level of research in low-speed flow and associated convective heat transfer which offer numerous, diverse areas of industrial application.

R14 The School should actively engage with the different components of the Hypersonics group to identify strategies best suited to maintain the group’s position as the leading university-based research group in the world.

R15 Because the initiative in Deep Mining proposed in the Mining Division’s strategic plan will only be successful through collaborative effort with CRC Mining and SMI, such collaborative engagement should begin forthwith.

Alumni and Community Links
R16 The School should lift its profile through more aggressive and targeted marketing strategies.

R17 The School should exploit its success in graduating high-profile industry and community leaders to secure endowed chairs and funding.

Industry Links
R18 The Mining Division should take advantage of its link to CRC Mining, its Industry Chairs and recently appointed staff to apply more actively for Category 1 funds.

R19 The School should engage with the senior management of the University to promote a higher public profile of the extensive mining research and existing teaching capabilities through the publication of a mining newsletter.

Diversity
R20 The School should immediately address the gender imbalance in the academic staff profile by assigning a Gender Balance portfolio to a senior academic staff member.

R21 The School should increase participation in the Summer Indigenous camp and other activities aimed at promoting engineering as an attractive career option among ATSI and Low SES groups.

Physical Facilities and Resources
R22 The School should engage in succession planning for technical laboratory staff.

R23 The School should work closely with the Faculty Workshop Group in establishing a more sustainable operational and funding model.
ASSESSMENT, COMMENDATIONS AND RECOMMENDATIONS

1. Governance and Administration

The overwhelming impression gained by the Review Committee is that this is a well-run, high-performing, and harmonious School. All categories of staff display an admirable dedication to their teaching, learning and engagement activities, in an environment of continually increasing work-load and performance expectations. The academic and professional staff exhibit a remarkable degree of mutual respect and regard. New staff and postgraduates are unanimous in praising the welcoming atmosphere and practical support they received when joining the School.

The Head of School is recognised as a highly effective manager of the School’s activities. He is advised by an appropriate suite of committees, and is widely respected for his consultative style. The School’s financial position is sound, and is managed in a professional manner. The T&R staff profile is heavily weighted to senior positions, but this reflects the School’s success in obtaining industry-funded and named chairs. The School has engaged in a number of planning exercises in which the challenges and opportunities for its future development have been addressed in a collegial manner.

The Review Committee commends the School for:

C1 The leadership provided by the Head of School which is seen as outstanding in drawing all levels of staff and students together. All round, this is a happy school.

C2 The School Manager and the administration who provide a highly regarded level of service to the School.

C3 The technical staff who are commended on their commitment to the educational and research activities of the School and other organisational units.

C4 The heads of Division who are commended for their collegiality and constructive engagement to bring the three disciplines together as a coherent group.

The Review Committee is concerned that the progressive and significant increase in student load without a commensurate increase in resources is putting the School under a level of stress which is unsustainable and threatens to compromise the on-going quality of teaching and research. The School has been a member of a number of CRCs and other centres which have, or are about to, come to the end of their funding periods. It is clear that significant and creative efforts will need to be made to decrease costs and/or increase revenues if the School is to maintain and aspire to enhance the quality of its operations. The Review Committee acknowledges that the School recognises and has articulated these challenges, but is of the view that a bolder and more energetic approach is required if they are to be successfully overcome. The talent, dedication, senior profile and industry/government connectedness of the School’s academic staff represent a powerful resource to drive change. The Review Committee suggests that the School utilise this resource to identify a number of strategic objectives with ambitious targets, and allocate corresponding portfolio responsibilities to senior staff. These objectives could encompass resource utilisation, pedagogical innovation, staff development, external profile, strategic and symbiotic relationships within and outside UQ, active and targeted recruitment, advancement, and the optimum balance of income streams.
The Review Committee recommends that:

R1 The Head of School should utilise the School’s pool of talent to develop ambitious and visionary strategic plans for the School.

R2 Portfolio responsibilities for driving the strategic goals should be defined and developed for senior staff.

R3 The School management should work with the senior management of the University to examine mechanisms to increase interactions between its divisions and cognate research institutes.

2. Teaching

The Review Committee was impressed with the large, comprehensive, and high-quality training program for Mechanical, Materials, and Mining Engineering students provided by the School. The program is successful in producing high-quality graduates who find ready employment in industry. The feedback from industry is that UQ graduates are well-trained problem solvers.

The pressure imposed by increasing student-staff ratios has been handled well by the School, and the students are satisfied with the education they receive, as reflected in positive outcomes in teaching and course evaluation surveys. The introduction of the BE/ME program in 2014 will enhance the depth and breadth of student training thereby producing a cohort of better trained engineers able to make a richer contribution to society. In addition, the program will allow the maintenance of an adequate level of research and hands-on laboratory training for UQ engineering students, helping to mitigate the pressures imposed by increasing student-staff ratios. It will also provide opportunities for showcasing research opportunities that may attract more students into the RHD program. In addition, it will provide opportunities for Research Only staff, particularly those on short-term contracts, to participate in student supervision, raising their profile and employability while at the same time contributing to lowering the demand on currently overburdened T&R staff.

The Review Committee was impressed with the School’s enthusiasm for embracing new pedagogical approaches based on high technology and problem-based learning activities. The School is one of the leaders in the introduction of MOOCs as part of UQ’s contribution to EdX. The MOOC on hypersonics will showcase the research-led education provided by the School to a global pool of talent. As a consequence it will increase the national and international profile of the School and the University, and will thus contribute to attracting top national and international graduates to UQ’s RHD program.

The successful links that the School maintains with industry and government agencies have also contributed to the quality of its teaching program by attracting external funds for the construction and maintenance of new laboratory facilities. This has ensured that UQ students continue to receive hands-on training on modern and OH&S-compliant laboratories (e.g., the Newcrest mine ventilation laboratory), reversing the trend seen in other institutions, where the laboratory and practical experience has diminished under the pressure of lower levels of education funding and higher demands for new OH&S compliance. The Review Committee was particularly impressed with the quality of the laboratory facilities in the Advanced Engineering Building, which will certainly contribute to increasing the quality of the student experience. That, combined with the competence and dedication of the teaching and technical staff, will lead to even better Mechanical, Materials, and Mining Engineering programs offered by The University of Queensland.
The Review Committee commends the School for:

C5 Maintaining a high level of satisfaction in the Faculty’s teaching evaluations under the difficult circumstances of an ever increasing student to staff ratio.

C6 Taking a careful approach in introducing the BE/ME program in 2014 within existing capabilities and resources.

C7 Embracing and leading the new teaching pedagogy for flipped classrooms and MOOCs.

C8 Maintaining both the depth and breadth of the curriculum in the face of an increasing student staff ratio within current budget constraints.

C9 Introducing active learning methods into tutorials and practicals and for obtaining funds for student activities, e.g. STC and Newcrest HVAC Lab.

The Review Committee was impressed with the breadth of the engineering program offered by the three disciplines in the School, but it was also concerned about the high demand on T&R staff imposed by the increase in student intake. To avoid further pressure on T&R staff, the Review Committee identified several opportunities for rationalising course offerings through the creation of joint courses between School disciplines (e.g., Structural Mechanics between Mechanical and Mining) or between this School and other Schools in the University (e.g., Rock Mechanics and Fluid Mechanics with Civil Engineering; Heat and Mass Transfer with Chemical Engineering). These opportunities should be seriously explored by the School management. The Review Committee questions the absence of a course in Electrical Systems in the Mining Engineering Program.

The School has successfully used the ResTeach program to ameliorate the pressures imposed by student-staff ratios. The University’s senior management has also identified the need for greater interaction between the School and cognate research institutes. The ResTeach program provides unique opportunities and incentives for this greater interaction, and the School is strongly encouraged to actively work with UQ senior management to increase the ResTeach program into the future. This would be a win-win situation for the University. For the School, it would help to decrease student-staff ratios; for the Institutes, it would provide direct access to a pool of top university graduates that could be attracted into its research activities. It would also engage Institute staff with the University’s principal activity and contribution to society: the production of new generations of professionals and talent.

The Review Committee noted the discrepancies in calculations of student-staff ratios provided by the University, the School, and the various Disciplines. The discrepancy seems to arise from a less-than-transparent mechanism for calculating student-staff ratios practiced at UQ. Although the Review Committee recognizes that some of the calculation methods are imposed by external government reporting agencies, it would, nevertheless, be desirable for the University, Schools and Disciplines to work together on a more widely understood and accepted method to accurately calculate student-staff ratios. Only then will the School have the necessary information to properly allocate duties and resources.

The School has a successful and high-quality educational program, but its ranking within the University shows room for improvement. A particularly sensitive issue is the view expressed by some undergraduate students that their opinions and feedback on their learning experiences are not taken into consideration in staffing of courses, academic promotion, or modification/improvement of course materials. This perceived disenfranchisement may arise from: the lack of a robust mechanism for incorporating student input into course offerings; overloaded members of staff who do not have the time to improve materials previously developed; and/or poor communication between the School and its undergraduate student cohort. To improve the student experience during their undergraduate years, it is desirable that the School introduces more transparent mechanisms for incorporating student input
into course content and devises new mechanisms for informing students on how their input is incorporated into the School’s offerings.

**The Review Committee recommends that:**

- **R4** The School should explore further opportunities for rationalising undergraduate course offerings, not only across disciplines but also across schools (e.g. Civil and Chemical Engineering).

- **R5** Noting the benefits it has derived from the ResTeach funding program, the School should continue to apply for this funding and identify further opportunities to engage Research Only staff, including institute researchers, into its teaching program.

- **R6** The School should work with the Faculty and the University senior management in devising more rational and transparent ways of calculating student-staff ratios.

- **R7** The School should implement more robust mechanisms for incorporating student feedback into course content, planning and delivery.

- **R8** The School should develop better communication strategies with undergraduate students.

### 3. Research and Research Training

**The Review Committee commends the School for:**

- **C10** Achieving an outstanding performance in the ERA, with the highest rating of all schools in UQ in the weighted index.

- **C11** The research in Hypersonics, confirming its unique, world-class position in ultra-high-speed flow.

- **C12** The small and productive group of materials engineers who contributed 48% to the overall score of 5 in the University’s ERA rankings.

- **C13** The high profile of the Materials Engineering Division and its links with industry and government providing the seed funding enabling the Advanced Engineering Building to be built.

- **C14** The Mechanical and Mining Divisions’ strong engagement with the mining and energy sectors leading to extensive support of their activities and to the uptake of research outputs, with valuable national and international impacts.

Division heads should interact individually with their academic staff to develop for each a publication strategy that balances the constraints of their research-funding sources with the School’s need to raise the proportion of its research output that appears in highly ranked academic journals.

As with publications, the School, working through its Head and Division heads, needs to develop a plan for each academic staff member to engage more extensively in the process of seeking research funding of Category 1 type. Internal incentives should be a component in this plan. The staff with a history of successful Category 1 funding applications can mentor, advise and help review applications for their colleagues.

While the introduction of the ‘milestone’ approach to the progress of research students towards their thesis submission is, in principle, a helpful and responsible measure, the School should monitor the impacts of this scheme on completion rates. The current incompletion rate of around 20% and time to
completion of 4.5 years for PhDs are higher than desirable. The steady increase of the proportion of students whose first language is other than English is likely to require further measures to prevent the time to completion increasing.

The greater involvement of Research-Only (RO) staff in the supervision of thesis research in the School is strongly recommended. Such an increased engagement has several benefits:

(i) It provides the RO academic with an extra, highly valuable dimension on his or her CV should (s)he ever apply for an academic post at another university;

(ii) If the thesis project is directed at the same problem as the RO staff member’s, it significantly raises the effort deployed on the problem for no extra cost to the project supervisor;

(iii) It increases the potential pool of supervisors and research projects available to the students.

Where the RO academic is employed on a short-term contract (and is thus ineligible to be the principal supervisor of PhD or MPhil theses), he or she will still be able to act as the principal supervisor of students within the BE/ME program since such theses are confined within one semester.

The Review Committee suspects that the School’s lack of a major research programme in low-speed flows may be linked to the outstanding success of the Hypersonics team. Over the period up to the next review, the School is thus encouraged to develop, within the Thermo-Fluids area, an ambitious programme of research on low-speed flows, including the corresponding areas of convective heat or mass transfer that would complement that of the QGECE and Combustion group. Such research should have applications from wind turbines to heat exchangers within both the mechanical and aeronautical sectors of industry. A still wider set of research opportunities is to be found in safety studies or the internal and external aerodynamics of buildings. Naturally, such a development has implications for recruitment of academic staff though some existing staff possess the requisite range of knowledge and experience. This step would also provide a cushion and route for diversification should the funding level for Hypersonics research be seriously reduced.

The Review Committee has concluded that Hypersonics research has entered a phase where careful, collective, strategy-forming interactions are needed among the contributors to this flagship effort within the University. These interactions should also necessarily involve inputs at Faculty and University levels to ensure that the future for this star element in the University’s portfolio is as bright as possible.

The Review Committee is concerned that the initiative in Deep Mining proposed in the Mining Division’s strategic plan, which also involves CRC Mining, could have a relevant overlap with the longstanding research conducted at the SMI on hard rock deep mining. It is recommended that the deep mining strategic plan of the Mining Division should be refocused in order to be complementary and collaborative rather than competitive with research already conducted at SMI. In the view of the Review Committee, there is ample space to achieve this given the research capabilities that exist in the Mining Division and in CRC Mining.
The Review Committee recommends that:

R9 While recognising the constraints imposed by industry and DSTO partnerships, and acknowledging its excellent ERA rankings, the School needs to increase its efforts to publish in high impact journals.

R10 The School should introduce internal mechanisms to encourage and support all academic staff, particularly early- and mid-career academics, to apply for more Category 1 funding.

R11 The School should monitor the effects of the milestone process on RHD completion rates.

R12 The School should encourage RO staff to supervise RHD students and projects within the BE/ME program.

R13 Steps should be taken to increase the currently modest level of research in low-speed flow and associated convective heat transfer which offer numerous, diverse areas of industrial application.

R14 The School should actively engage with the different components of the Hypersonics group to identify strategies best suited to maintain the group’s position as the leading university-based research group in the world.

R15 Because the initiative in Deep Mining proposed in the Mining Division’s strategic plan will only be successful through collaborative effort with CRC Mining and SMI, such collaborative engagement should begin forthwith.

4. Alumni & Community

The Review Committee was impressed by the quality of the School’s graduates. Recent graduates have included Young Queenslander of the Year (2011), Australian Young Mechanical Engineer of the Year (2012), Graduate of the Year (2011), International Alumnus of the Year (2007) and UQ Young Alumnus of the Year (2012). At the Industry Dinner the Review Committee also met with a number of School graduates placed in high-profile industry positions. Graduates are also leaders in contributions to the community including the Youth Without Borders program.

The Review Committee commends the School for:

C15 The wide contributions of the School’s high-quality graduates to industry and the community.

The Review Committee formed the opinion that although the School is performing very well, it could promote itself more effectively. The involvement with the MOOCs initiative will lead to greater profile and recognition in the broader community. However, the School should explore other opportunities to showcase its expertise and activities. It should draw on existing expertise within the School to develop marketing and promotion activities for the broader community. The strength of the School’s alumni community also provides a great opportunity for the School to promote itself in government, industry and the broader community. The ongoing and successful engagement with the alumni should be expanded in both national and international arenas.

The School should capitalise on the continued success in graduating international students by strengthening the alumni networks in China and Southeast Asia in particular. The School should continue to work with UQ International to develop events and activities for its international alumni such as the Global Leadership Program. Nationally many of the School’s alumni are placed in high profile industry positions. This provides an opportunity not only to promote the School’s activities but also to source industry funding for research chairs and funds.
The Review Committee recommends that:

R16 The School should lift its profile through more aggressive and targeted marketing strategies.

R17 The School should exploit its success in graduating high-profile industry and community leaders to secure endowed chairs and funding.

5. Internationalisation

The Review Committee was impressed by the extent of global engagement by the School, in particular within the School’s research, research training, and teaching. Specifically the School is engaged in teaching and research higher degree training with Institutions in China through its “3+1+1” exchange program which not only includes an international experience but also provides a structured pathway into a research high degree. The School plans to expand this program across other universities in China. The School also has a significant number of students from China and Southeast Asia with increasing numbers from India and the Middle East.

Through the University, the School was also the first member of the Top Industrial Managers Europe (TIME) which, along with its links with five Écoles Centrales in France and the Technical University of Munich, has facilitated exchange programs for its students and for European students coming to the School through the Internal Dual Degree programs. The University is also involved in a student visit program with Chilean undergraduates.

The School has strong international engagement internationally across most of its research activities. Of particular note are the CRC for Advanced Composite Structures which has a large number of international partners, and the relationship with École Centrale Paris, where there have been significant high-level collaborations with the Hypersonics Group as well as recognition of the outstanding nature of UQ’s research.

The Review Committee commends the School for:

C16 Its active and enthusiastic participation in a diverse range of initiatives both for raising the international experience of its students and for bringing students from overseas to participate in its undergraduate and RHD programs.

C17 The strong international links underpinning the School’s research and research training activities that substantially contribute to the University’s reputation.

6. Industry Links

The Review Committee was impressed by the high engagement of the School with Industry, resulting over the years in being headquarters for five Cooperative Research Centres. The outcome of such partnerships has been outstanding in terms of attracting a greater number of undergraduates and national and international masters and PhD students to the disciplines of Mechanical, Mining and Materials Engineering. The existence of scholarships from industry, but especially the promise of being part of an exciting profession into the future, has facilitated these outcomes.

The partnerships have resulted in a high output of PhD graduates, creation of a large capability for teaching at undergraduate and postgraduate levels, generation of endowed and non-endowed academic chairs, recruitment programs for indigenous students, patents, spin-off companies, licences
and royalties for the placement in the market of specific products and technologies, sponsoring of conferences, workshops, and generation of peer-reviewed publications.

The Review Committee commends the School for:

C18 The School’s strength in applied research which has been the foundation for extensive CRC engagement, the growth of its research impact and the attraction of industry-funded chairs.

C19 The School’s strong links with industry, evidenced by the latter’s demand for both its graduates and postgraduates and by the leadership provided through the Mining Education Australia (MEA) program.

In particular, industry partnerships have led UQ to possibly becoming the largest mining-focused research organization in the world, with in excess of four hundred mining-linked researchers distributed in four schools, two centres and one institute. The School, in conjunction with the University, should consolidate this achievement by making all possible efforts toward the continuation and growth of the existing Research Centres and Institutes, in close collaboration with involved schools. Given its position within the UQ mining cluster, and its several recent appointments, the Mining Division is well placed to pursue a more balanced portfolio of funding sources, and should actively seek more Category 1 funds.

The mere existence of this mining research cluster places UQ as a world leader in this field. The University and the School would benefit if the expertise, achievements and potential for future engagement of this powerful grouping were more actively promoted, perhaps through the publication of a mining newsletter.

The Review Committee recommends that:

R18 The Mining Division should take advantage of its link to CRC Mining, its Industry Chairs and recently appointed staff to apply more actively for Category 1 funds.

R19 The School should engage with the senior management of the University to promote a higher public profile of the extensive mining research and existing teaching capabilities through the publication of a mining newsletter.

7. Diversity

The School is already strong but it could become a powerhouse with the right recruitment strategy and by helping its staff members understand how to better develop their teams as high performing units. One characteristic of high performing teams is their diversity. Diversity brings innovation and greater returns on investment, because diversity leads to better decision making and solutions (Woolley, Chabris, Pentland, Hashmi, & Malone, 2010).

Numerous studies have highlighted the factors that allow a team to be smarter than their smartest individuals. MIT’s Center for Collective Intelligence found that teams with more women and teams where team members share “airtime” equally show higher group intelligence scores. The performance of the School is very good, but it could become even better, nationally and internationally, if it builds the right leadership that includes women.

The School cannot expect high performing women to come unsolicited; they must be actively recruited! The Gender Balance portfolio needs to be given to a staff member who will conduct the
research to understand the best methods of recruitment and support for female undergraduates, postgraduates and staff: someone who will examine best practice and strategies across Australia and worldwide.

As a committee we urge the School to:

(i) Support its Gender Balance Portfolio Leader with mentors;
(ii) Identify such mentors from the University Senate, other Schools, and industry leaders in Queensland in order to secure the services of someone external to the School that can help the School in this recruitment program;
(iii) Examine all advertisements for positions (including scholarships) and enlist a female engineer to review these advertisements once drafted;
(iv) Examine the short-listing process and the composition of the interview panel to ensure that these panels include people who have hired and successfully mentored high-performing females;
(v) Invite external high performing females to be on the interview panels.

Diversity on the writing team for the job advertisement, on the short-listing panel, and on the interview panel will help identify the best candidate for the job based on merit and the candidate that will help most in making the School a high performing team.

As biases are universal and influence our decisions (Shackelford, 2011), the Committee also suggest that the School should enlist a professional consultant to run an education program or role-playing activity for academic staff (indeed, any staff that have a role in hiring) to illustrate how a diverse team is stronger and how our inherent bias influences us in ways that reduce diversity. Staff should also continually ask themselves “What can I do to make the School the most attractive environment for female engineers”? Moreover, the School should consider how to promote itself both within the University and externally so that all promotional material includes features that are attractive to women.

With respect to Fellowships, the Committee suggests that the School consider whether its strategy to recruit DECRAs, Future Fellows, and Laureate Fellows needs adjustment specifically to attract female mechanical/materials/mining engineers. Moreover, as part of its research, the female Laureate positions across the nation should be examined to ascertain any common factors on which the School could capitalise.

The Review Committee recommends that:

R20 The School should immediately address the gender imbalance in the academic staff profile by assigning a Gender Balance portfolio to a senior academic staff member.

The Review Committee urges the School to develop a Diversity Portfolio position for attracting and supporting undergraduate students from ATSI and low SES backgrounds and to assign this to an enthusiastic staff member. It should consider how the School can support programs in local schools with ATSI and low SES profile. Programs like Engineers without Borders, STELR, UQ’s summer indigenous camp, etc. can be effective means to increase the diversity of undergraduates. STELR develops high school curricula that teach engineering-related, practical concepts to students in Year 10 and these work best when the teacher is supported by an external partner such as university staff or students. By reaching ATSI and low SES students in Year 10 the School may well achieve more diverse enrolments in the School. The Committee believes the School could engage the enthusiasm of its current undergraduates and postgraduates to undertake these activities.

The diversity of these programs should, naturally, be developed with the Pro Vice-Chancellor (Indigenous Education). Equally, Industry, DSTO, CSIRO and other external partners should be
enlisted to join with the School in these activities. Everyone in the nation wanting to employ bright engineers from diverse backgrounds should be eager to help in this effort.

**The Review Committee recommends that:**

R21The School should increase participation in the Summer Indigenous camp and other activities aimed at promoting engineering as an attractive career option among ATSI and Low SES groups.

8. **Physical Facilities and Resources**

The Review Committee was generally satisfied that the physical facilities devoted to teaching and research are appropriate and well maintained. The facilities in the new Advanced Engineering Building promise to be exceptional when equipment and services are bedded down. The laboratory managers who met with the Review Committee are clearly passionately dedicated to the welfare of the School and its students, and provide vital technical services. However, with the growth in student numbers and reduction in the technical staff complement, their work-load and the fragility of service levels to unplanned events, such as sickness, are not sustainable. Several of them who have extensive experience and knowledge are approaching retirement age.

**The Review Committee recommends that:**

R22 The School should engage in succession planning for technical laboratory staff.

The Faculty has invested heavily and appropriately in providing excellent facilities for the fabrication of research and teaching equipment. The workshop has quite a large number of staff, whose ability to make intricate and complex apparatus is readily acknowledged by School staff. The Review Committee is concerned, however, that a number of staff are bypassing the workshop to have items made by external providers, because of unacceptable lead times or uncompetitive pricing from the workshop. It is noted that only about 40-45% of the $1.5m overhead charge on the School is recovered from research funds. Hence there appears to be a substantial ‘flagfall’ cost to the School (of the order of $750k), just to sustain the presence of the workshop and have it perform work for teaching activities (typically less than $100k). The Review Committee is not in a position to comprehend the business model of the workshop, but believes that there may be significant opportunities for improvement which could benefit both the workshop and the School.

**The Review Committee recommends that:**

R23 The School should work closely with the Faculty Workshop Group in establishing a more sustainable operational and funding model.
Bibliography


APPENDIX 1 : SUBMISSIONS

Submissions to the Review were received from:

The School of Mechanical and Mining Engineering

Other University Staff:
Dr Tim McIntyre and Professor Halina Rubinsztein-Dunlop, School of Mathematics and Physics

Outside Individuals/Organisations:
Professor Peter Ireland, Donald Schultz Chair in Turbomachinery, The University of Oxford
Mr Gavin Lind, Director, Education and Training, Minerals Tertiary Education Council
1 Postgraduate Student
1 Undergraduate Student
APPENDIX 2 : INTERVIEWS

Interviews Held with:

University Staff

Senior Executive
  Professor Kaye Basford, President, Academic Board
  Dr Anna Ciccarelli, Deputy Vice-Chancellor (International)
  Professor Peter Høj, Vice-Chancellor
  Professor Max Lu, Deputy Vice-Chancellor (Research)
  Professor Graham Schaffer, Executive Dean, Faculty of Engineering, Architecture and
       Information Technology
  Professor Cindy Shannon, Pro Vice-Chancellor (Indigenous Education)
  Professor Deborah Terry, Senior Vice-Chancellor
  Professor Joanne Wright, Deputy Vice-Chancellor (Academic)

School Staff

Academic Staff
  Professor David Mee, Head
  Professor Andrej Atrens
  Professor Russell Boyce
  Professor Hal Gurgenci
  Professor Han Huang
  Professor Peter Knights
  Professor Paul Lever
  Professor Ross McAree
  Professor Richard Morgan
  Professor David StJohn
  Associate Professor Mehmet Kizil
  Associate Professor Martin Veidt
  Associate Professor Mingxing Zhang
  Dr Saiid Aminossadati
  Dr Aleks Atrens
  Dr Bianca Capra
  Dr Alex Chen
  Dr Zhongwei Chen
  Dr Bill Daniel
  Dr Bo Feng
  Dr Jeff Gates
  Dr Matthew Green
  Dr Yang Huang
  Dr Ingo Jahn
  Dr Mortez Khashehci
  Dr Christopher Leonardi
  Dr Sheng Liu
  Dr Zhiming Shi
  Dr Tonguc Uysal
  Dr Anand Veeraragavan
  Dr Qiang Wang
  Dr Vince Wheatley
  Dr Yuming Xiong
  Dr Ming Yan
  Dr Y Feng Yang
Administrative Staff

10 representatives, as a group

Technical Staff

4 representatives, as a group

Postgraduate Students

8 representatives as a group

Undergraduate & Masters Coursework Students

4 representatives, as a group

Other University Staff

Professor Stephen Riek, Deputy Dean, Graduate School
Professor Chris Moran, Director, Sustainable Minerals Institute

Outside Individuals/Organisations

Ms Yassmin Abdel-Magied, President, Youth Without Borders
Mr Allan Curtis, Principal Engineer – Thermal Generation, Parsons Brickenhoff
Mr Troy Hobson, Local Division Manager Process Automation, ABB Australia Pty Ltd
Dr Chris Meimaris, CEO, Engineering Analysis and Design
Mr Andrew Reid, Managing Director, Haald Engineering
Dr Scott Rowan, Senior Systems Engineer, Nova Systems Aerospace
Dr Darren Van Twest, Director of Brisbane Office, Vipac Engineers & Scientists
Mr Leslie Yeow, IMechE Chair of the Queensland Panel, Energex