Section 3: Criteria and working methods

Main Panel G
Covers the following UOAs:

- 24 Electrical and Electronic Engineering
- 25 General Engineering and Mineral & Mining Engineering
- 26 Chemical Engineering
- 27 Civil Engineering
- 28 Mechanical, Aeronautical and Manufacturing Engineering
- 29 Metallurgy and Materials

Absences of chair and declaration of interests
1. Main panel members will leave the room when discussion takes place regarding any institution in which they have declared a major interest. This interest includes an individual's employing institution, any institutions at which an individual has been employed since January 2001, any institution at which the individual has been engaged in significant teaching or research since January 2001, and any institution at which the individual's partner and/or immediate family member is employed. The panel has identified a deputy chair, who will chair the panel when the main panel chair has to leave the room, and who will act on their behalf when the chair is unavailable.

2. The members of the main panel will declare minor interests to the secretariat, in line with Annex 4, and the chair will determine appropriate methods for handling any conflicts of interest arising. Members will not necessarily withdraw from the meetings in such cases.

How the main panel will work with its sub-panels
3. Sub-panels are responsible for:
   - preparing draft statements of relevant criteria and working methods
   - making recommendations to main panels on the quality profiles to be awarded for each submission.

4. Main panels are responsible for:
   - reviewing and endorsing the criteria and working methods to be used by the sub-panels
   - deciding on the quality profile to be awarded to each submission, following recommendations from the sub-panels
   - maintaining a good level of communication and joint working with the other main panels.
5. In view of this, Main Panel G will:

a. Provide coordination of its sub-panels on their approach to the assessment process and establishment of their criteria and working methods.

b. Work closely with sub-panels throughout the assessment period to ensure consistency in application of quality standards, and adherence to common procedures and equal opportunities guidance.

c. Ensure that sub-panels complete assessments in accordance with their published criteria and working methods.

d. Facilitate the provision of external specialist advice to sub-panels where appropriate.

e. Based on the work of the sub-panels, decide on quality profiles for all submissions.

6. The main panel chair will have access to all sub-panel papers and minutes. All sub-panel chairs will have access to minutes of all full meetings of the sub-panels of Main Panel G. During the criteria-setting phase, the secretariat ensured that the key issues discussed and decided on by each sub-panel were circulated to other sub-panel chairs and the main panel chair for consideration.

7. Where a sub-panel does not have sufficient specialist expertise to assess a research output or part of a submission, the main panel will facilitate cross-referral to other sub-panels of Main Panel G or to sub-panels outside engineering; input from additional specialist advisers will be sought where necessary.

8. In such cases the secretariat will liaise with the main panel chair and the RAE team to ensure such input is provided on the quality of the research, which the sub-panel will then use to inform its assessment of the quality of the output.

9. Any research outputs which are focused on the pedagogy of engineering will normally be cross-referred to one of the engineering sub-panels with an expert on engineering pedagogy, or if required to specialist advisers.

Range of indicators of excellence

10. Each sub-panel expects that four research outputs will be submitted by each member of staff named as research active and in post on 31 October 2007; four is also the maximum. However the sub-panels recognise that individual staff circumstances might preclude this level of return for reasons that are discussed in detail in the sub-panels’ working methods.

11. These outputs might take the form of research monographs, in whole or part; authored articles in professional journals; conference contributions; conference reports; descriptions of new devices and instrumentation; descriptions of new processes and materials; patents awarded; published papers in peer-reviewed journals; software; and technical reports.

12. In the context of the definitions of quality levels, the sub-panel will base its assessment of the quality of an output on its judgement of the extent to which the research exhibits the following characteristics (though the weightings of these to each other may vary for any particular output):

a. The advancement of knowledge and understanding.

b. Originality and innovation.

c. Impact on theory, analytical techniques, products and processes, including design, production and management, policy and practice at national and international levels.

d. Influence and reach.

e. User take-up in academe and/or industry.

13. In making submissions to the sub-panels of Main Panel G, departments must make use of the ‘Other relevant details’ field in RA2 to inform the sub-panel’s assessment of research outputs. This information should explain why the submitted output has been chosen. Such information might include independent recognition of the quality of the output (as indicated by prizes awarded); the impact that the research had on industrial practice, or on other areas of research, by invigorating established or initiating new areas of science and engineering; or the value or
importance of the output. However, departments are instructed to ensure that such evidence is succinct and externally referenced as appropriate (eg, details of colleagues in industry who benefited from the work, details of additional research income, or of new or invigorated areas of research). This information should not be a synopsis of the submitted paper, nor a volunteered opinion on the quality of the output. Reference to the citation frequency of an output will not be considered as evidence of quality. There is a limit of 100 words, and it is expected that for most outputs sufficient information would be provided in significantly fewer words.

14. As with all information submitted to the RAE, it is expected that the validity of these statements could be subjected to dipstick verification by the RAE team.

Consistency of quality levels

15. All sub-panels will build quality profiles for each submission by assigning 50% of the weighted profile to research outputs, 30% to esteem indicators and 20% to research environment. Research grant and contract income will be used as an esteem indicator, whilst the number of research doctorates awarded will be used as a measure of the research environment, along with the way resources (either internally or externally funded) are used to sustain infrastructure or equipment. Half the quality profile for research environment (ie, 10% of the total quality profile) will be derived from quantitative data on research doctorates awarded per submitted staff FTE, with the rest of the profile being derived from other submitted evidence on the research environment. For UOAs 24-28 half the quality profile for esteem (ie, 15% of the total quality profile) and for UOA 29 two-thirds of the quality profile for esteem (ie, 20% of the total quality profile) will be based on quantitative data on research grant and contract income per submitted staff FTE, with the rest of the profile being derived from other submitted evidence on esteem.

16. During the assessment phase in 2008 the main panel will act as a forum for discussing issues related to the assessment, as identified by sub-panel chairs, so that difficulties can be swiftly addressed and good practice easily disseminated. Early in the assessment phase Main Panel G will consider a small number of submissions to the 2008 RAE to generate draft quality profiles. The sub-panels will use these draft profiles to inform calibration and consistency of assessment across sub-panels and between individual members.

17. Each sub-panel collectively will examine in detail, across the range of media and the full range of anticipated quality levels, a proportion of the submitted outputs sufficient to develop a realistic view of the quality profile. In no case will the proportion of outputs examined in detail be less than 10%. To ensure consistency in assessing research outputs, comparative reviews will be carried out between sub-panels of Main Panel G and where possible with other sub-panels with overlapping fields. In the assessment of outputs, world-leading quality will be taken to include outputs which are among the leading in the world for their discipline.

Research environment and esteem

18. Information relating to the research environment and esteem indicators will be taken from RA5a, with supporting information for individual researchers taken from RA5b. Information on income will be aggregated across the entire department and will be drawn from RA4. Departments are invited to structure their responses to RA5a under the two headings of research environment and research esteem.

19. In assessing this information, the sub-panels may take cognisance of the findings of the International Review of UK Engineering Research 2004, organised by the Engineering and Physical Sciences Research Council and the Royal Academy of Engineering, which lists the characteristics of highly regarded groups as follows:

- ‘Basic technical core competency underlying field of work
- Excellent people, resources, high quality infrastructure
• Strong leadership, shared vision, good
    strategic plan (leading to both academic
    excellence and good management)
• Strong interaction with external stakeholders
    (industry, medicine and Government, as
    appropriate) that influences practice and
    commercialisation
• Well attuned to needs of stakeholders and
    ability to adapt to market changes
• Strengths in both engineering analysis and
    creative synthesis
• Ability to draw excellent postgraduate
    students and postdoctoral researchers from
    home and abroad, through a fine world-wide
    reputation
• Strong supportive university environment’.

20. In providing details of their research
    environment and esteem, departments will be
    expected, where possible, to include in their
    submission evidence which demonstrates the
    characteristics of highly regarded groups within
    their department.

Research environment

21. The research environment will include such
    issues as the department’s vision, strategy,
    approach to managing staff new to academe (eg,
    training and mentoring schemes), as well as
    details of the physical environment in which the
    research takes place (ie, research infrastructure and
    equipment).

22. Assessment of the research environment will
    also include the number of research assistants and
    postdoctoral researchers (data from RA1), the
    number of research students (regardless of
    funding source – data from RA3), and the
    number of doctoral degrees awarded.

23. Details of arrangements for supporting
    interdisciplinary research and subject
    collaborations, both within and outside the
    institution, and with overseas bodies, will also be
    considered under this section, as will details of the
    environment within the department for
    promoting international activity in general.
    Departments will be invited to clearly identify
    exemplars of such activity, providing examples of
    national and international collaborations
    separately.

24. Departments will be asked to detail their
    institution’s technology transfer practices and
    arrangements for encouraging and supporting
    relationships with research users (including
    industry and commerce) and the
    commercialisation of research ideas.

Esteem indicators

25. All external funding for research will be
    considered to have equal importance as a measure
    of esteem. External funding will include grant
    income from Research Councils, and funding
    from other external sources to undertake research.
    Indicators that provide evidence of esteem are
    listed in the sub-panel criteria statements and
    include fellowships awarded by funding bodies or
    learned societies, prizes and awards, and other
    evidence of esteem in which researchers are held
    by practitioners in their field. Exemplars of
    collaborations with industry or other end-users of
    research, of knowledge transfer, of
    commercialisation of research outputs, and/or of
    the impact of departmental research activity on
    engineering practice, wealth creation and/or
    quality of life should be given.

26. Esteem indicators will be assessed at either
    the research group or overall departmental level,
    as each sub-panel deems appropriate for the
    specific discipline. In reviewing the overall spread
    of esteem indicators, details should be provided
    for all categories of submitted staff at different
    career stages. When making any assessment,
    panels will give a weighting to account for the
    length of time the individual has been active in
    academe, commensurate with their experience as a
    Category A member of academe.

Methods for ensuring consistency

27. Each sub-panel will be expected to assign
    profiles for research outputs, esteem indicators
    and research environment, as set out in
    paragraphs 15-17 above. To ensure these three
    measures are applied consistently across the sub-
    panels, an initial consideration of a limited
number of submissions will be carried out by the main panel early in the assessment phase. The resulting draft profiles will be used by each sub-panel to inform the production and calibration of quality profiles in advance of the formal assessment phase of each sub-panel.

**Elements of variation in the criteria statements**

28. The criteria statements will be consistent between the sub-panels. The balance between the research outputs (50%), research environment (20%) and esteem (30%) will be the same between all sub-panels of Main Panel G. These weightings have been determined through careful consideration of the breadth of activity undertaken within the engineering UOAs, and although the importance of research outputs is acknowledged, the main panel wishes to ensure that due weight is given to the human, physical and financial sustainability of the discipline. The balance also includes Main Panel G’s commitment to treat all forms of research outputs equally, regardless of whether the research is of a pure or applied nature. To encourage departments to submit such a range of research outputs, Main Panel G expects all departments to use the ‘Other relevant details’ field in RA2 (maximum 100 words) to provide additional evidence of the impact, importance and value of a particular research output.

29. As stated in paragraph 25 above, assessment of esteem includes research grant income. The main panel has agreed to award 30% of the quality profile to esteem in view of the importance of obtaining income to carry out significant amounts of engineering research, the intense competition to obtain such resources, and the perceived value of demonstrating peer and end-user esteem.

30. To acknowledge the importance of the physical and human infrastructure in engineering research, 20% of the quality profile is allocated to the research environment. The number of doctoral research students and the number of doctoral research degrees awarded will be included in the assessment of the research environment.

31. In view of the cohesion and overlap of engineering disciplines, the criteria of the six engineering sub-panels follow a common form, with minor differences according to discipline-specific issues, eg, emphasis on research groups in the research structure of departments. To emphasise the similarity, the sub-panel documents have been drafted with common wording where possible.

**Applied research and practice-based research**

32. All types of research will be given equal weighting by the panel. The following definition for applied research will be used:

Applied research involves a process of systematic investigation within a specific context in order to solve an identified problem in that context. It aims to create new or improved systems (of thought or production), products, processes, materials, devices, or services which have an impact on society through enhanced wealth-creation and quality of life.

33. Some characteristics of applied research are that:

a. It is informed by an intellectual infrastructure of scholarly research in the field.

b. It applies and/or transfers enhanced knowledge, methods, tools and resources from pure research and developmental research.

c. It contributes to scholarship in the field through systematic dissemination of the results.

d. The outcomes of applied research may be specific to the situation in which the research has been applied, although the methods/tools evolved are often transferable.

34. The possible outputs of applied research in engineering include: research monographs, in whole or part; authored articles in professional journals; conference contributions; conference reports; descriptions of new devices and instrumentation, descriptions of new processes...
and materials; evidence of design artefacts, patents awarded, published papers in journals; software; and technical reports.

35. Any research outputs which are focused on the pedagogy of engineering will be cross-referred to one of the engineering sub-panels with expertise in engineering pedagogy or to specialist advisers.

**Individual staff circumstances**

36. The main and sub-panels encourage departments to include in their submissions those staff whose quantity of output may have been affected by absences from research, including circumstances addressed by equality and diversity legislation. RA5b must be completed for each individual staff member (either Category A or C) who is submitting fewer than four outputs, to describe the mitigating factors which explain the impact of such circumstances on their work. This will enable the sub-panels to take full account of such mitigating circumstances.

37. In assessing submissions, all sub-panels will take account of the circumstances described in paragraph 39 of the generic statement. The sub-panels in Main Panel G will take account of staff who have spent significant periods of time away from research, eg, while establishing a spin-out company, or who are new to academe, regardless of whether they are young people at the start of their academic career, or individuals who have moved across from outside academe, eg, from industry.

**Panel observers**

38. Panel observers from the Research Councils will be expected to confirm and, if necessary, comment on specific schemes or grants issued by their funding body, which are identified in the submission.

**Discipline-specific matters**

39. Any discipline-specific matters are detailed in the criteria and working methods statements of the appropriate sub-panel.