Competence Profiles – Guidance for applicants and Assessors

PART 2 – INDUSTRY CLASSIFICATION (E) – AEROSPACE

Introduction

The civil aerospace business is global and its direction is dictated by air-framers like Boeing and Airbus. It is a cyclical business and is mainly controlled by World demand for passenger travel or freight transportation in the most thriving and dynamic economies. Rolls Royce is a global business and its civil aerospace activities are based in the UK with other branches in Germany, Canada, and USA etc. As a consequence of the increasing cost of new engine design and development, partnership deals are being set-up with Companies throughout Europe and the rest of the World.

The Engineering challenges facing the professional engineer in this Industry are many including the main requirements to improve engine efficiency, reduce weight, reduce emissions of nitrogen oxides and noise, improve reliability and safety, initial manufacturing cost and maintenance costs. At this point in time aerospace engineering is evolutionary rather than revolutionary and as a result of globalisation much engineering effort is directed towards cost reduction in manufacturing and reducing the design and development time of new engines.

The management structure of the Industry has been changed dramatically over the past five years to reduce costs and time to market. The principal change has been to place every aspect of design and make under one accountable board so that the economies of design for manufacture are driven into new designs. These new operating units or business units as they are called include manufacturing facilities, design, and procurement. As a result engineers are expected to work more closely with other professionals and the distinctions between the professions become blurred. Generally this has benefited mechanical engineers by giving them a wider exposure to broader engineering issues. (Not all may see it this way)

Engineers within the civil aerospace business take on a variety of roles from the specialist functions such as noise, aerodynamics or blade vibration to the more generalist roles of whole engine design, manufacturing engineering or project management. Accompanying the main new product design and development there are also engineers involved in rig design, manufacture and testing, and the series production and testing of engines.

It has been acknowledged that in the past engineers in the aerospace industry have lacked breadth of knowledge but this was countered by the depth of their expertise. Recently engineers have been encouraged to broaden their interests and expertise. Opportunities for career development through movement within the Company has been encouraged and engineers have moved sideways, or into other disciplines such as Programme Management, Business, or Information Technology to open up new possibilities for the future.

Management of engineers in this industry is changing from a rigid functional departmental structure to matrix management and more recently engineers are required to work in project or programme teams. The teams driving each engine development are generally formal structures but within the organisation there are many other teams, set up on an ad-hoc basis within a virtual structure, to deal with specific problems. Matrix management means that each individual has a line manager who will look after the usual aspects of work allocation, hiring, firing, employee development, training, reviews etc. The engineer will also be accountable for the technical result to a senior engineer, often a Chief Engineer. He would generally spend more time working with the technical manager rather than the line manager.

Although there is scope for each engineer to seek creative solutions to engineering problems these must be contained within a rigid Company process framework of stage gates, product data management (PDM) and enterprise resource planning (ERP). The “no blame” culture encouraged in aerospace to reduce safety related errors does mean that a great deal of the design information is contained within IT systems such as lessons learned logs and standard risk analysis cases. This can be a source of frustration to the most creative individuals.

There is a formal structure for Management and Professional growth. Initially there is a single path for early growth (The Technologist Structure) with five levels of seniority commencing with technician and building through technologist, advanced technologist, principal and staff technologist. The entry level grade for a graduate trainee is technologist. Engineers in the staff grade have two career progression routes open to them. This dual route allows them to progress by further developing their technical and engineering skills through a "Professional Structure" or to move into general management within a "Management Structure". Each route has three career steps. Most engineers fit into these grades but they are not exclusive. Some engineers will be found on the Business Structure (similar in principle to the technologist structure but more relevant to admin related positions)

Progression through the structure is by invitation from the line Manager (may also be called the resource manager) to attend a review board. These are formal meetings where the candidate can present their progress, achievements and aspirations to a selected board of senior engineers. The structure of the Board and its operation is regulated closely by a set of operational instructions. The Institution of Mechanical Engineers has agreed that when a candidate is appointed to the grade of Principal, the requirements of the Institution for membership and Chartered Engineer will also have been satisfied. (A similar agreement has been reached with RAeS). It is intended that eventually the review board for principal will also include IMechE representatives so that the board becomes dual purpose. However this is proving difficult to organise because of the logistics of locating sufficient IMechE representatives during the working day.

Each candidate is reviewed against a set of standard requirements. These are well documented and include technical and management accountability, continued professional development, training, size and complexity of projects being handled, number of people supervised and presentation of technical papers at internal and external conferences. The standard requirement fits well with the five competencies within SARTOR 3. However in the past there has been less emphasis on assessing professional conduct (Competence statement E) and this competence should be confirmed in any formal Institution membership interview.

For most engineers their annual performance review is based on an agreed set of requirements set by each line manager. These requirements have been passed down from the business objectives agreed at board level. The requirements are normally very specific and measurable and include innovation objectives and personal objectives.

It should be mentioned that technological developments mean that the traditional engineering roles are changing. The sophistication and complexity of software driven design and manufacture applications means more professionals are involved. Drawings for example have less importance as more components move directly to casting or machining by electronic transfer of data.

Requirements for election or transfer to member

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Assessment of Competencies

Competence statements A and B - Knowledge and understanding, application to practice

In the aerospace industry applicants will generally be able to demonstrate their understanding and use of specialised engineering knowledge. This would include specialist topics such as aerothermal, noise, vibration, computational fluid dynamics, finite element analysis, risk assessment and risk management, rig design, experimental design, combustion, combustor emissions, and the use and properties of specialised materials such as titanium based alloys.

These engineers may have concentrated on the development of specific engine components such as fans, compressors, combustors, turbines, controls, casings or transmissions. Others may be involved in the overall engine design, its installation and associated problems, safety, reliability, procurement of parts, manufacturing, engine configuration control or rig design, development and testing of new or production engines. Within these activities aerospace has a wide range of jobs. Increasingly with team working, role based activities are taking precedence over jobs with the consequence that job titles become less definitive.

Aerospace projects are becoming so large and costly that many smaller global partnerships are being formed to handle all aspects of engineering design and manufacture. This creates more specialist companies and a host of engineers to ensure that specifications and interfaces between subsystems are correct. These partnerships also include sharing the associated risks.
The very specialised engineering in aerospace does not always give engineers the opportunity to demonstrate their competence in practical engineering application or the breadth of their skills. However most employers now ensure that internal and external job secondments and opportunities are made available to assist.

Competence statement C - Leadership / Management / Supervision

With matrix management, virtual teams, and project based working becoming standard in the aerospace industry most applicants do not become line managers with a number of staff accountable to them. They do from time to time have significant managerial responsibility either within their team or project which will give them a wider and more varied exposure to engineering management. Competency could be tested by examining their membership of teams or projects and the degree of accountability for delivering specific targets by using the skills of the other team or project members.

Competence statement D - Interpersonal Skills

Communication and interpersonal skills should be assessed by consideration of both the Professional Review Report and interview performance. Assessors should look out for a report which has a logical structure, clearly aimed at presenting a portfolio of evidence against each of the five competence statements, while providing a qualitative description of activities and achievements.

Assessment of verbal communication skills should analyse the ability to give clear, concise and relevant answers that address the question without undue digression and provide sufficient, but not superfluous detail.

Additional evidence of competence in this area may be sought by investigating:

- Whether the applicant routinely makes presentations to in-house management at various levels, outside clients and contractors; subjects could include project plans, business plans, etc.

- Whether the applicant is involved in contract liaison and negotiations - systems, procedures, method statements, safety, etc.

Competence statement E - Commitment and Professional Conduct

The observance of safe working procedures, including compliance with internal and national codes of practice, is inherent in virtually all engineering activities in the aerospace industry. Applicants should be able to demonstrate their commitment to observing and promoting the use of any such codes that are relevant.

Evidence of professional integrity and commitment should include a Self-Development Action Plan, in any convenient format, outlining how the applicant intends to maintain and enhance competence through personal development. The Plan should include short, medium and long term goals and explain how these are likely to be achieved. Assessors should be aware that SARTOR 3 interprets Continuing Professional Development (CPD) as commencing at the point where Chartered status is attained; therefore applicants are not required to provide a record of courses attended, etc., when applying for corporate membership.

Examples of CPD activities recognised by the Institution as acceptable include:

- extra qualifications such as an MBA, Diploma in Engineering Management
- any relevant technical or business courses
- conducting or attending workshops
- attending, presenting or participating in seminars and conferences
- presenting or attending lectures
- writing technical papers
- reading technical articles and journals
- distance or open learning
- secondments and job rotation
- updating in own and other fields of work
- Institution meetings or events
- active IMechE committee work
- learning a foreign language
- involvement in government activities
- community and charity work

Requirements for election or transfer to Fellow

The following senior engineering jobs within Aerospace are likely to meet the requirements for the class of fellow

Engineering Director

Professional or Senior Professional

Senior Manager

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