INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN
ICED 03 STOCKHOLM, AUGUST 19-21, 2003

# MAINTAINING DESIGN PROFESSIONALISM IN LARGE ORGANISATIONS

Author: G E Kirk

## Abstract

Large international organisations that operate in a number of market sectors can lose core professionalism due to a lack of focus. Rolls-Royce has introduced a series of management procedures where the professionalism of a group of engineers is the concern of an individual. Twenty-one professionalisms have been identified, design is one of the largest. This paper describes the rationale for professionalism management and some of the initiatives that have been taken in the design community.
*Keywords: professional management, design professionalism, professional development*

## 1 Introduction

A large international company that depends on being at the forefront of technology for its business has to consider carefully the professionalism of its employees.

There are advantages for having common processes, sharing best practice and applying core technology across a company's product portfolio. This becomes challenging when the company operates on a number of sites, in different countries and market sectors.

Organisations change to accommodate varying market pressures. This has led to various types of matrix organisation, which are project or product focus, replacing the older, functionally based structures. It is very easy to rely on knowledge and skills, which has been built up over the years, which is then incapable of adapting to the new challenges.

The management of engineering professionalism to maintain and develop this capability is therefore extremely important. The design process is key to many engineering activities and so design professionalism is particularly important.

This paper is a case study describing how Rolls-Royce has addressed these important issues and hopefully provides a basis that may guide the choice on the areas for future academic research. Being a case study, the material is based upon a participant observer collecting ethnographic data.

## 2 Rolls-Royce - A Global Company

Rolls-Royce is a global company providing power for land, sea and air. The company is made up of four customer-facing businesses Civil Aerospace, Defence Aerospace, Marine and Energy. These are supported by a number of specialist operations businesses, see figure 1. The operations of all these businesses have extended significantly over recent years.

The company has about 30,000 employees in the UK in 21 locations. The UK based

operations develop, manufacture and support power systems for civil and defence aerospace, naval and commercial marine and power generation.

There are close to 8,000 employees in 65 sites across North America developing manufacturing and supporting power systems for civil, corporate and defence aircraft, helicopters, power generation, oil and gas, pumping and marine industries.

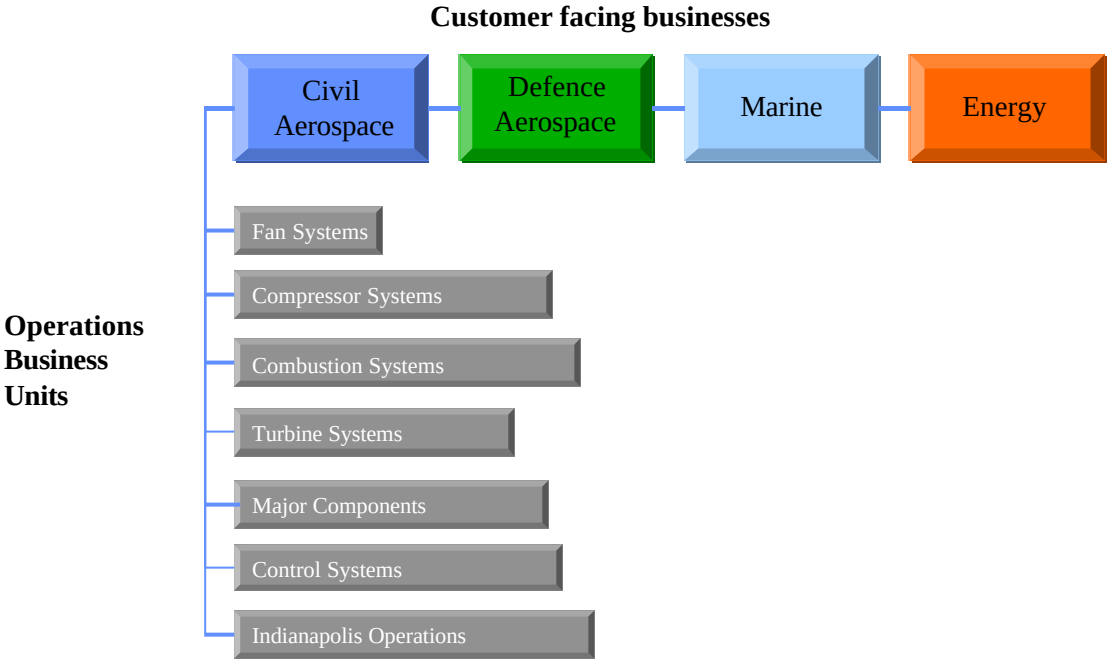


**Figure 1 The Company Organisation**

In Germany the Company employs 2,000 people in manufacturing and service operations located close to Berlin and Frankfurt. The German operation designs, builds and supplies engines for the latest long range executive jets and is a sole supplier on a number of aircraft.

Most of the commercial marine business is based in Norway, Finland and Sweden. Here 3,000 people are engaged in the design and manufacture of marine propulsion and manoeuvring systems for applications ranging from tugs to cruise liners.

There is also a network of offices and service facilities supporting the needs of customers in 130 countries around the world.

Total sales are $10bn annually with an order book of $23bn. There are engines in service with 500 airlines, 2,400 corporate and utility operators and more than 100 armed forces.

In summary Rolls-Royce is a successful company that operates in a fiercely competitive global market with diverse market sectors and employing an international work force in many countries. The importance of a well-trained and motivated staff is crucially important

# 3 Developing and Maintaining Engineering Talent

There are approximately 7000 engineers employed in Rolls-Royce, most are graduates qualified to first degree and some at PhD level.

In the UK, following completion of an apprenticeship, about eighteen months for a graduate and thirty-six for a non-graduate, the newly qualified engineer will be appointed to a substantive position.

The Company operates a professional development process comprising performance appraisals and development cells. Each individual is appraised annually where their progress and achievement of pre-set objectives is measured. This identifies any necessary changes to attitudes or work practices as well as training needs. They are then considered at a development cell, run by their manager. Here their career is discussed, and taking into account the individual's aspirations expressed in their appraisal, opportunities for advancement are identified.

There are three routes along which an engineer may progress.

- A technical role embracing all aspects of engineering rising to the supervision of technical groups and ultimately to be directors of large engineering teams.
- A project management role that requires project management and integration skills where engineers are required to manage the output of many groups not necessarily working for them. These may then become the Chief Engineers of large major projects.
- A specialist role in a particular discipline, providing the fundamental knowledge base of the Company, methods, expert advice, and liasing with academia. The pinnacle of this route is to become a Rolls-Royce Fellow or Associate Fellow.

In practice there is a great deal of interchange of personnel between the three routes and an individual may spend time in each, especially in the early years of their career.

Advancement to senior appointments as a professional is achieved by a series independent professional reviews where the individual's performance and capability has to be demonstrated.

High potential engineers are being sought such that they may be placed on an accelerated leadership programmes, which exposes them to the experiences and knowledge required for senior positions.

The company encourages individual membership of professional bodies and is a corporate member of a number of them, such as in the UK, the Royal Aeronautical Society, The Institution of Mechanical Engineers and the Institution of Engineering Designers. Membership of an appropriate institution is an indication of an individual's commitment to professional growth and is taken into consideration during promotion boards.

It can be seen that there is a well-established basis for professional development within the company but it was considered that even more had to be done as the company extended its operations and markets.

## 4 Professionalism Ownership

There is a need to transfer personnel between the businesses, for their professional growth and to promote the application of best practice. It is advantageous to have common processes, professional development and training throughout the Company. Maintaining specific professionalisms in such an environment is challenging.

To address this issue the concept of professional ownership was developed in 1997 and 21 professional groups with engineering roles were identified. Most of these are now well established and have a strong sense of community.

A professional owner leads each group. The owners are key people usually considered to be world-class experts in their field, being recognised both within the Company and externally. The professional owner's role is to:

- assess the health of the professional group
- define a recruitment and training policy
- be active in the development of the individuals within their group
- provide specific tools and processes

Each professional group has its own culture and practices but best practice is shared between the groups.

Design is a key process in engineering and is one of the largest professional groups.

# 5 Design Professionalism

## Assessing the health of the group

### Identifying the roles

The first task was to identify those individuals who performed a design role and equally important those who did not. In a large organisation the job title is not always a good indicator of the role performed. For example the title Work Package Owner does not convey the extent to which the individual is concerned with design.

There were 650 people throughout the company who were considered to have design as a total or major part of their role.

Four generic roles were identified

**Chief Design Engineer.** The Chief Design Engineers are responsible for the delivery of verified design solutions, ensuring they are both functionally and reliably fit for purpose. They are likely to be involved in strategic development and the delivery of a complete product.

**Design Team Leader.** The Design Team Leaders are responsible for specific packages of design as part of a greater whole. It is necessary to be technically proficient in the area of design for which they are responsible and capable of managing a group of people to achieve their objectives.

**Designer.** Designers are responsible for the generation of system or component definitions, this may be part of a team or as an individual.

**Design Methods Specialist.** Design Methods Specialists are responsible for the development of new methods, processes and systems to support the continuous improvement in design engineering capability and efficiency.

### The Role Profile

Four key attributes were used as a means of defining the ideal person for a particular role,

personal characteristics, knowledge, skills, and experience. For each attribute the necessary qualities were defined, for example a Chief Design Engineer would need to have 'action orientated' as a personal characteristic and relevant experiences. By considering each role a profile of the ideal person could be generated, see figure 2. This could then be used to:

- measure a candidates' suitability for a particular role
- identify training for individuals aspiring to a role
- demonstrate career progression needs
- identify additions or deletions from the whole training portfolio

| **Attributes** | | | | | |
|---|---|---|---|---|---|
| Personal Characteristics | PC1 | PC2 | …. | …. | PCn |
| Knowledge | K1 | K2 | ….. | …. | Kn |
| Skill | S1 | …. | …. | …. | Sn |
| Experience | E1 | …. | ….. | ….. | En |

**Figure 2 An Example of a Profile**

Personal characteristics

Personal characteristics were identified using *Career Architect* © in an exercise with the current practitioners. These characteristics were ordered into those that could be easily trained, and those that were more difficult to train. The more difficult then became a key part of the selection criteria.

Knowledge

Knowledge can be described in two ways; generic knowledge for the design role, which all designers would be expected to have, e.g. materials processing, theory of stressing etc and domain knowledge specific to the position, e.g. compressors, turbines, combustion etc.

Skills

Skills were defined that are required to perform the role in a competent and efficient manner. There are core skills, for design such as capture requirements or define product. There are other skills needed by a design professional but which are core to other professional groups, such as engine performance.

Experience

Experience is similar to knowledge in that it is generic and domain specific. Time served in a position is not necessarily an indication of the value of the experience gained. Here career profiles of ‘successful’ individuals were used to gain an insight into the most useful experiences. These were not just technical, exposure to different interpersonal relationships and cultures was considered very important.

This provided a means for assessing the health of the organisation in an objective manner.

## Training

There has been a well-founded training programme in the company for many years. With an understanding of the personal characteristics, knowledge and skills required for the various design roles, it was possible to identify areas where the training portfolio could be modified and strengthened. Recommendations for graduate intake selection and training were also made.

The need for a Product Definition Course was an example where there had been disparate training packages and new material that needed to be brought together. This was made into an Early Engineering Professional Development Scheme (EEPDS) module in conjunction with Bristol University and the University of the West of England, leading to an MSc. Lectures were then shared between academia and the company.

## Professional Development of Designers

In addition to the normal development cells an international cell for the design population has been initiated. There are a number of key positions in the company that require succession planning. Potential candidates for these positions are identified who are 'ready now', 'ready in two years' or 'ready in five years'. Career planning for these individuals can then ensure that there is a robust succession plan.

In addition with representatives from all areas of the company career opportunities are made more visible and so ensure that there is a good group of candidates available for vacancies.

## Provision of Design Tools

The management of design capability acquisition is conducted through a series of working groups headed by the Design Practices Committee (DPC) chaired by the professionalism owner and attended by representatives of the major design groups throughout the company. The terms of reference are

- to ensure that the skills, knowledge and facilities of designers are continually developed so that they are well equipped to meet future challenges and be world class
- to be the authority for the generic design procedures and working practices
- to define and approve the design process capability acquisition programme
- to provide a forum for discussion of issues relating to company design practices
- to communicate design innovation and experience across all engineering groups

It is extremely important that knowledge and improvements in working practices are communicated around the organisation. Progress has been made towards this by the use of the Company Intranet where there is an Engineering Design website, available on all sites.

Information on the website includes

- Design Rules and Aids
- information on careers and training courses
- lists of acknowledged company experts
- progress on design technology research
- notes on the design process
- Information on the latest design tools

In short all the information to help the designer perform their task.

In 1998 Rolls-Royce in conjunction with BAE Systems set up a University Technology Partnership to carry out research into the design process, formulate tools, which could be incorporated into the company procedures.

This was established with the Universities of Cambridge, Sheffield and Southampton. Cambridge concentrated on knowledge capture sharing and reuse, Sheffield on team working and creativity, and Southampton on optimisation techniques. The three Universities have between them over 40 research topics and in recent years have provided significant benefit to the design population.

Some examples of the output from the UTP are studies into selection and retention of designers, factors affecting creativity and design rationale capture tools.

The work of the universities is co-ordinated on behalf of the company by key topic holders. Their role is to convey the policy of the DPC to the researchers, monitor progress and plan for the implementation of the research into company procedures and working practices.

There has been some interchange of people between the company and academia for short periods and this is an area that has more potential.

# 6 Summary and Conclusions

Despite having a sound professional development process, the global nature of the business demanded further improvements and this was achieved by the use of professional ownership.

The benefits of professional ownership are:

- it provides focussed understanding of current capabilities and areas which need to be developed or enhanced
- the professional growth structures are strengthened
- it supports effective succession planning even in the midst of significant organisational change
- it provides improved global resource planning leading to the transfer of work around the globe
- there is a clear interface and involvement with academia which facilitates the transfer of knowledge and people

- it is possible to identify, train and retain key groups and individuals
- a number of projects have been successfully completed where the engineers have been in different countries
- there is a significant transfer of good working practices and procedures between sites

The conclusions are based on practical experience and evolutionary developments without the benefit of a fundamental academic study so only represent one solution albeit one that works well within the context described.

For correspondence:
Geoff E Kirk RDI
Chief Design Engineer - Civil Aerospace
Rolls-Royce plc
P.O.Box 31 (ML-60)
Derby,
UK
DE24 8BJ
geoff.kirk@Rolls-Royce.com