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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Wednesday 19 January 2022 – Morning

Level 3 Cambridge Technical in Engineering

05873

Unit 24: Project management for engineers

Time allowed: 2 hours plus your additional time allowance

Resource Booklet

TEXT 1

Dynamic Defence plc, established in 1940, is a UK–based manufacturer of military–grade radar equipment. This equipment is primarily installed in ships and aircraft for national defence.

Company sales break down as follows:

45% to GZ Aircraft plc, a leading manufacturer of fighter jets

18% to Maritime Transport plc, a manufacturer of submarines

12% to Wayfaring plc, a company that specialises in border security.

The remainder are purchased by a range of different organisations for use in commercial air traffic control, weather forecasting, biological research and wildlife tracking.

Dynamic Defence plc prides itself on the quality of its engineering and its ability to work with its customers to create the best systems for their needs. The technology behind its 'Mark 2' radar equipment has been the industrial standard since the late 1970s and continues to be extremely profitable for the company. However, company directors are aware that the future success of the company depends upon the development of new radar systems, such as 'over-the-horizon' radar, and enhanced radar equipment for mapping, weather forecasting and other applications. To this end, the directors have initiated a formal project to develop 'Mark 3', a new generation of radar, to help ensure a profitable future for the business.

Oliver Porteous, Dynamic Defence plc's Senior Manager for Research and Development, has been assigned as Project Manager. Oliver is new to the company, but has managed several major projects for his previous employer.

The project team has 35 members:

Oliver as Project Manager.

Two project team leaders. Both of these are long-serving employees of the company who have been project managers before.

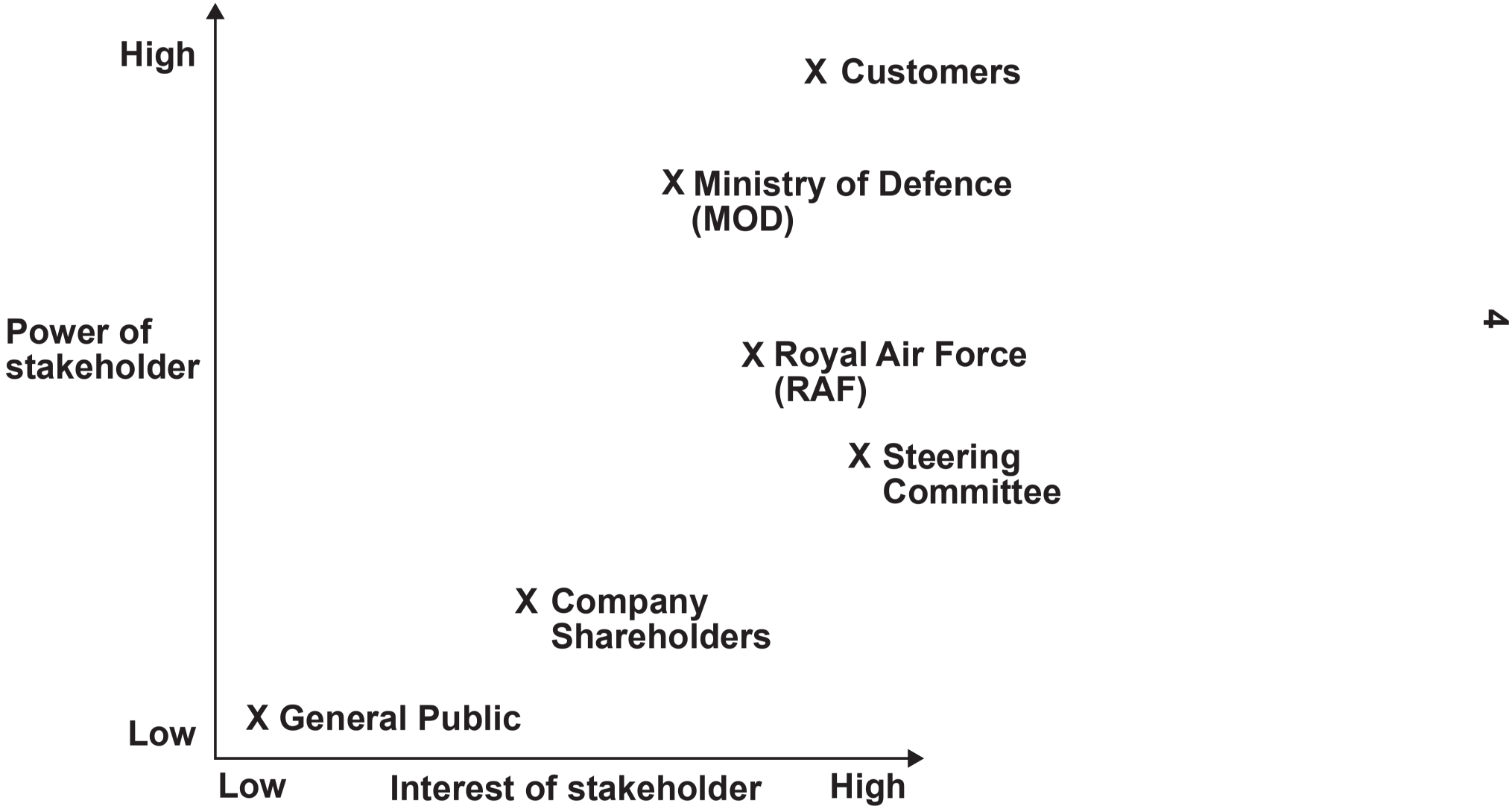
Two external consultants. One of these is from the Ministry of Defence (MOD) - a government department responsible for national security, specifying standards for quality and performance of security equipment; and one is from the Royal Air Force (RAF) - a branch of the armed services that uses the company's 'Mark 2' radar equipment on a daily basis.

30 project team members. All are well-respected company employees, including 20 senior engineers and 10 support staff.

The Steering Committee for the project comprises all six of the company's Directors; the Project Sponsor is Managing Director, James Fast. The critical control for the project is 'quality'.

Fig. 1

Graph showing project stakeholders according to their levels of power and interest



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TEXT 2

Developing the ‘Mark 3’ radar equipment will be a significant challenge. The task will be made more difficult by the size and onboard weight constraints for combat aircraft.

Research will need to be undertaken to find out what electrical, mechanical and technological improvements could be made. In addition, research will be needed to find out what the market demands. Market demands may conflict, and some improvements in radar capability may not be possible. The project team will need to decide which improvements are most likely to lead to commercial success.

To turn any proposed improvements into reality, the engineers will need to overcome many difficulties; not least how to improve the way the antenna, the transmit and receive modules and the visual display unit communicate with each other. The ‘Mark 3’ central processing unit (CPU) is likely to have an updated specification with advanced capabilities. In addition, new programs and utilities will be required, possibly run by a new computer operating system.

Oliver realises that the project will be complex: lots of activities will need to take place at the same time, some activities will need to carefully synchronised, and all activities will require effective communication from the project team.

Whilst ‘quality’ is the critical control, ‘time’ and ‘cost’ are also important. The development of the ‘Mark 3’ radar equipment is a commercial venture. The company needs to release its ‘Mark 3’ radar equipment ahead of international competitors, and at a cost which can achieve enough profit for the company and its shareholders.

TEXT 3

The development of the prototype of the ‘Mark 3’ radar equipment is now well underway.

Project spend is currently in the region of £40 million, with the total budget spend expected to exceed £1 billion. To fund this project, Dynamic Defence plc is using equity finance.

The prototype will use solid state technology (no moving parts), electronic scanning, digital processing and other advancing technologies.

All activities appear to be on schedule, with one exception: Oliver has received an issue log which indicates that the first batch of transmit and receive modules are not working to the required degree of accuracy.

There appears to be a problem with some of the gold bars within the transmit and receive modules. These gold bars need to be produced within tight control limits for length and thickness in order to function accurately.

A quality control report shows that the probability of a gold bar being out of the control limit for length is 0.25 and the probability of it being out of the control limit for thickness is 0.3.

TEXT 4

The prototype of the ‘Mark 3’ radar equipment has now been built and is undergoing testing.

Oliver needs to provide the Steering Committee for the project with performance data for the ‘Mark 3’ radar equipment.

This includes how it performs in aerial target range detection tests, which measure the maximum distance from which the equipment can detect an airborne target.

To be commercially successful the ‘Mark 3’ radar equipment needs to significantly outperform competitors, and also outperform the old ‘Mark 2’ equipment.

Sales of the ‘Mark 3’ are dependent on the publication of detailed technical data, supported by statistical measures of its performance. The statistical measures need to include the results of range testing across target sizes 1 m^2 to 100 m^2, together with graphical representation of these results and interpretation of any data skew.

The results of the 5 m^2 aerial target range detection test are shown in TABLE 1 opposite.

TABLE 1

Maximum range detection of 5 m^2 aerial target (n kilometres)	Frequency (f)
$97.5 < n \leq 102.5$	0
$102.5 < n \leq 107.5$	8
$107.5 < n \leq 112.5$	20
$112.5 < n \leq 117.5$	22
$117.5 < n \leq 122.5$	26
$122.5 < n \leq 127.5$	4
Total	80

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Version 2