Ireland and a small company in the textile industry, all reduced commercial viability. Despite very strenuous efforts by the McCleery L'Amie Group, it became apparent in 1979 that the losses at Saintfield could not be stemmed.

A general view of the textile industries' role in Northern Ireland is that they should concentrate on fringe applications and special uses, requiring special skills and techniques, using special fibres (linen, for example, which while grown and woven in N. Ireland is spun in France). On this philosophy a small ATOZ processing plant could possibly find a niche but it would be essential to research the market and the product and match the two.

19 LUCAS AEROSPACE: BRUSHLESS GENERATORS FOR AIRCRAFT

English Electric's Aircraft Equipment Division (AED) won the Queen's Award in 1966 for work which had led to lighter and more reliable electrical generating systems for aircraft. From the point of view of subsequent technological change, this achievement may be seen in the context of a long-term trend towards improved power-to-weight ratios in aircraft generating systems and the evolution of a technologically mature product. In assessing this strand of technological development the present case-study provides an interesting insight into the process of capitalisation of the benefits of success in the face of substantial changes in the structure of the UK aircraft equipment supply industry. The study also gives some indication of how an innovating organisation's performance has been influenced by wider aspects of its operating environment, and specifically the role played by technology licence agreements.

Aircraft equipment manufacture at English Electric

Early generating systems for use in aircraft were of the direct current (dc) type. The path of technological change in these systems was directed towards achieving higher power outputs by increasing the operating voltage from 12 to 24, and then in some cases, 112 volts. Further increases in voltage were however checked by problems in the design of effective switchgear. By the 1940s the state-of-the-art in dc
communicator-type generators was such that larger aircraft which had four engines, and hence four generators, had a maximum installed capacity of 50 kW. Nevertheless, the advent of the jet engine led to increases in airframe size and improved performance which pushed the power requirement still higher, to around 100 kW.

After the Second World War, military expenditure remained high and English Electric, who had begun aircraft production during the war, opted to enter the new jet age with its own plane. This policy led to the Canberra (B3–45), a second-generation jet-bomber, which entered squadron service in 1951 and remained front-line equipment for two decades. The development work for the Canberra was supported by the formation of the Aircraft Equipment Department (later the Aircraft Equipment Division) which made aircraft actuators and power-supply systems. These systems were of the dc type, in line with the prevailing technological trend. The success of the Canberra enabled the new Department to expand rapidly during the late 1940s and early 1950s. Further impetus for growth came from English Electric's decision to develop the P1–49, a third-generation jet-fighter (later called the Lightning). Against the background of this growth in English Electric's in-house aircraft production programme, the head of the Aircraft Equipment Division, Mr P. Daglish, adopted an innovative approach to technological development.

In the case of dc generators, innovation along the established path of improved performance through increased voltage had been blocked by switchgear and high-altitude brush-wear problems. These problems could be diminished by switching to alternating current (ac) which would permit an increase in voltage to 200 volts. However, in order to gain the full benefit of an ac system (achieved by running the generators in parallel) it was necessary to produce a constant-frequency alternating current.

One solution to the problem of producing a constant frequency output was a device known as the 'hydromechanical constant speed drive' (CSD), which had been pioneered in America by the Sundstrand organisation. Although this device was initially developed for the hydraulic control of machine tools, its potential for application in constant-frequency aircraft generators had been recognised during the 1940s by the US government, who sponsored the adaptation of the CSD for use in military aircraft. Daglish had himself been involved in the investigation of constant-speed drives in his previous position of Chief Development Engineer at English Electric's Stafford Research Centre. When in 1951 the UK Air Ministry began to show an interest