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Simon Lavington

Moving Targets

Elliott-Automation and the Dawn of the
Computer Age in Britain, 1947 – 67

 Springer

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Moving Targets – Elliott-Automation and the Dawn of the Computer Age in Britain, 1947–67

Introduction

In 1957 the Elliott-Automation company was formed from Elliott Brothers (London) Ltd., which itself had its origins in the Elliott Instrument Company founded in 1804. One way or another, Elliotts had been involved in the design of analogue computers since about 1916 and digital computers since about 1946. Elliott-Automation was thus an active participant in the birth of the *information age* in Britain. By 1961 the company, via its laboratories at Borehamwood a few miles north of London, was supplying 50% of the digital computers delivered to UK customers in that year. The company boss, Sir Leon Bagrit, was known as *Mr Automation* when he gave the BBC Reith Lectures in 1964. Yet by 1968 Elliott-Automation had effectively disappeared in a flurry of takeovers, leaving little apparent trace of the technical excellence that had once characterised the name *Elliott*.

Moving Targets charts the gradual take-up of information technology in Britain, as seen through the eyes of one innovative company and remembered by those who worked for that company. The electronic excellence, developed in the Borehamwood Laboratories of the Elliott company during the 1950s, forms the underlying theme of the story. This excellence grew out of government-sponsored work on secret defence projects. In this sense, the large numbers of Elliott computers that had permeated the market-place by 1961 represented the transfer of technology from military to civil applications, from swords to plough-shears.

The hopes and fears of ordinary citizens during the post-war period are now past history. It is as well to be reminded of these hopes and fears because they determined the priorities not only of those who designed the earliest digital computers but also of those who had to decide if, when and where such machines could be put to use. A quick review of the 1950s will serve to set the scene for much of this book.

Life in the 1950s

Two factors characterised the 1950s in Britain: economic austerity and the Cold War. The latter is the easier to comprehend. Churchill ominously remarked in 1946 that ‘an Iron Curtain has descended on Europe’ – an image first given meaning to

most people in Britain by the Berlin Airlift, a tense confrontation with the Soviet Union which lasted from June 1948 to May 1949. The Cold War between the armed forces of *the west* and the communists of *the east* continued in varying degrees until the Soviet Union and its military manifestation, the Warsaw Pact, collapsed in 1991. The Berlin Wall which epitomised the separation of east and west Germany had effectively fallen in November 1989.

During the Cold War period, Britain had its own end-of-empire conflicts. From 1945 to the end of the 1960s and beyond, British troops were in action at various times in places such as India, Malaya, Cyprus, Kenya and Aden [1]. Britain also contributed forces to larger wars, particularly the Korean War (1950–1953) and the Vietnam War (1962–1975). Conscription, known as *National Service*, was introduced in 1947. This meant that most young men had some degree of military training right up until the end of the 1950s. In the immediate post-war years, science was assumed to be the servant of defence, operating through the mysteriously named Ministry of Supply, MOS. The surviving Visitors Books of Elliott's Borehamwood Laboratories show evidence of the frequent interchange between the company and the Ministry of Supply.

The resources available to the military were reflected in the country's annual defence budget. Since military applications provided the spur for many technologies, and in particular to Elliott's digital electronics, it is instructive to see how defence spending varied over the years covered by this book. This is shown in Table 1, taken from [2].

Table 1 The UK's annual defence budget, £m

	Budget (£m)	% change, adjusted for inflation
1945/46	4,410	...
1946/47	1,653	−62.8
1947/48	854	−50
1948/49	753	−16.3
1949/50	741	−3.5
1950/51	777	+2.5
1951/52	1,110	+31.3
1952/53	1,404	+18.6
1953/54	1,364	−5.7
1954/55	1,436	+3.3
1955/56	1,405	−6.1
1956/57	1,525	+2.6
1957/58	1,430	−9.7
1958/59	1,468	−0.7
1959/60	1,476	−0.7
1960/61	1,596	+6.3
1961/62	1,689	+2.2
1962/63	1,767	+1.6
1963/64	1,792	−1.0
1964/65	1,909	+2.0
1965/66	2,056	+3.0

Table 2 Approximate retail price index, UK

Year	Price index, 1974 = 100
1945	26.4
1955	40.9
1965	54.7
1975	124.2
1985	344.0
1995	542.1

The massive decreases in defence spending between 1946 and 1950 had consequences for companies such as Elliott Brothers (London) Ltd., whose activities in those years were still largely dependent upon contracts from the Admiralty. Likewise, the increased defence budgets between 1951 and 1953 helped to revive Elliott’s fortunes. After 1960, the year-on-year changes in the UK’s total defence budget were not dramatic so that any sudden impact upon Elliott’s activities was due to the initiation or cancellation of individual major projects rather than on overall defence spending. One particular event that loomed large in the fortunes of the UK’s aerospace industry was the cancellation of the TSR 2 fighter aircraft contract in 1965 – an event that certainly shook Elliott-Automation.

Translating contemporary expenditure into present-day equivalents is not an exact science. At various points in this book, prices are quoted and it is interesting to guess at the corresponding modern values. Table 2, which comes from [3], will help.

On a personal level, the emotional consequences of the Second World War persisted well into the 1950s. Ordinary people were used to making sacrifices. Economic austerity meant that war-time rationing of commodities such as food, clothes and petrol was only gradually phased out between 1948 and 1954, though coal rationing continued until 1958 [4]. People had to make the best of what was available: *make-do and mend* was a catch-phrase of the time. For those scientists and engineers whose contribution to the war effort had been an intellectual one, there was an unspoken assumption that post-war challenges could be met, difficult problems solved and that Britain was still at the forefront of scientific and industrial achievement. On a practical level, this spirit of confidence permeated most of the post-war digital computing projects and helps to explain group loyalties and the willingness to work hard for modest financial return. Resources were scarce, so great ingenuity was required.

The Arrival of the Modern Computer

To the general public, the stored-program digital computer first appeared in the late 1940s, heralded by newspaper headlines such as: ‘A marvel of our time: the “memory machine” which can solve the most complex mathematical problems’ [5]. Neither the computer nor its applications were understood by the journalists but both were somehow assumed to be important. The machines and their applications were taken to be products of the boffins who had come up with scientific wonders during the dark days of war.

Of course, not all pioneering digital computer projects had their origins in defence-related activities. Nevertheless, the great majority of projects were initially targeted at science and engineering calculations and the application of general-purpose computers to business and commerce was seldom considered at the outset. Certainly, it was not until the mid-1950s that Elliott's Borehamwood Laboratories investigated the possibilities for *electronic data processing (EDP)* and the needs of the business community. Marketing arrangements were established in 1956 with the National Cash Register Co. Ltd. (NCR).

In Table 3 we give a broad summary of the Elliott digital computers that emerged from Borehamwood. Of the 11 designs shown, six had their origins in classified defence contracts. Only one, the Elliott 405, was specifically aimed at the commercial data-processing market from the outset. The design of the Elliott 800 series and the 900 series were strongly influenced by the emerging requirements for industrial process control and factory-floor automation – areas in which Elliott-Automation excelled. If the numbers of each machine in Table 3 seem ridiculously small by modern standards, recall that by the end of 1949 there were probably only four prototype electronic stored-program computers that had come into hesitant operation anywhere in the world. Even by the start of 1955, there were still only about 17 operational digital computers in the whole of the UK and several of these were one-off research prototypes.

Besides stored-program digital computers, the Elliott company also designed analogue computers. Amongst the many analogue systems built by Elliotts was the huge TRIDAC machine, installed for missile research at the Royal Aircraft

Table 3 Elliott digital computers designed and delivered between 1947 and 1967. Accurate company records cease after 1967. Further details of costs, deliveries and applications are given in Appendix 8

Computer	Dates first working	No. built to 1967	Relative size	Initial application
152	1950	1	Medium	Defence
153	1954	1	Large	Defence
Nicholas	1952	1	Small	Defence
401, 402	1953, 1955	11	Small	General
403	1955	1	Large	Defence
311	1954	1	Medium/large	Defence
405	1956	33	Large	EDP
800 series and 503	1957–1962	219 + 32	Small, medium and large	Automation and general
ARCH101, 1000, etc.	1962–1966	Many embedded	Small	Automation
502	1963	3	Large	Defence
900 series	1963–1970 and later	391+	Small	Defence and automation
4120, 4130	1965, 1966	160+	Medium	General

Table 4 Charting the gradual take-up of stored-program digital computers in Britain

Application area	Typical computing methods, before the move to stored-program digital computers	Approx. period during which the switch to digital computers took place
General science and engineering	Electromechanical numerical desktop calculators	1949–1954
Commercial data processing	Electromechanical numerical desktop calculators; electromechanical punched card accounting equipment	1953–1963
Special scientific simulations e.g. missile design; nuclear power stations	Electromechanical and electronic analogue computers; electromechanical differential analysers, etc. (see Chap. 4)	1958–1966
Automation and industrial process control	Electromechanical analogue instrumentation (see Chaps. 6 and 7)	1959–1966
Ship-borne naval weapons systems	Electromechanical and electronic analogue computers e.g. fire control tables (see Chap. 4)	1959–1969
Airborne flight control and weapons systems	Electromechanical and hydraulic analogue air data computers (see Chap. 12)	1965–1980

Establishment at Farnborough and costing £750,000 in 1954 – equivalent to about £15 million at the time of writing this book.

For some applications, notably airborne defence, the relative capabilities and cost-effectiveness of analogue versus digital computing was keenly debated for many years. In other areas such as commercial data processing, digital in the sense of numerical calculation had always been the natural choice. Generally speaking, the move to electronic stored-program digital computers occurred at different times in different application areas and depended upon a number of factors, of which technological considerations loomed large. Thus, the dawn of the *digital computer* age in Britain took place at various times between about 1949 and 1975, depending upon applications. Table 4 gives the flavour of the transitions for average users.

To describe all these interwoven computing threads and the resulting applications in a single book has been an interesting challenge. The challenge to the uninitiated reader is undoubtedly greater! In Fig. 1 we give a diagram of the book's chapters, arranged in three general themes. To the left of the diagram the growing importance of software and business applications is charted. The centre of the diagram highlights industrial process control, in which Elliott-Automation was a pioneer. To the right of the diagram, hardware considerations dominate the military arena. As an aside, the right-hand thread of Elliott's defence applications continues today, inherited via GEC and Marconi and now embedded in the multinational company BAE Systems. Amongst BAE Systems' many research and development sites is the former Elliott-Automation factory at Rochester.

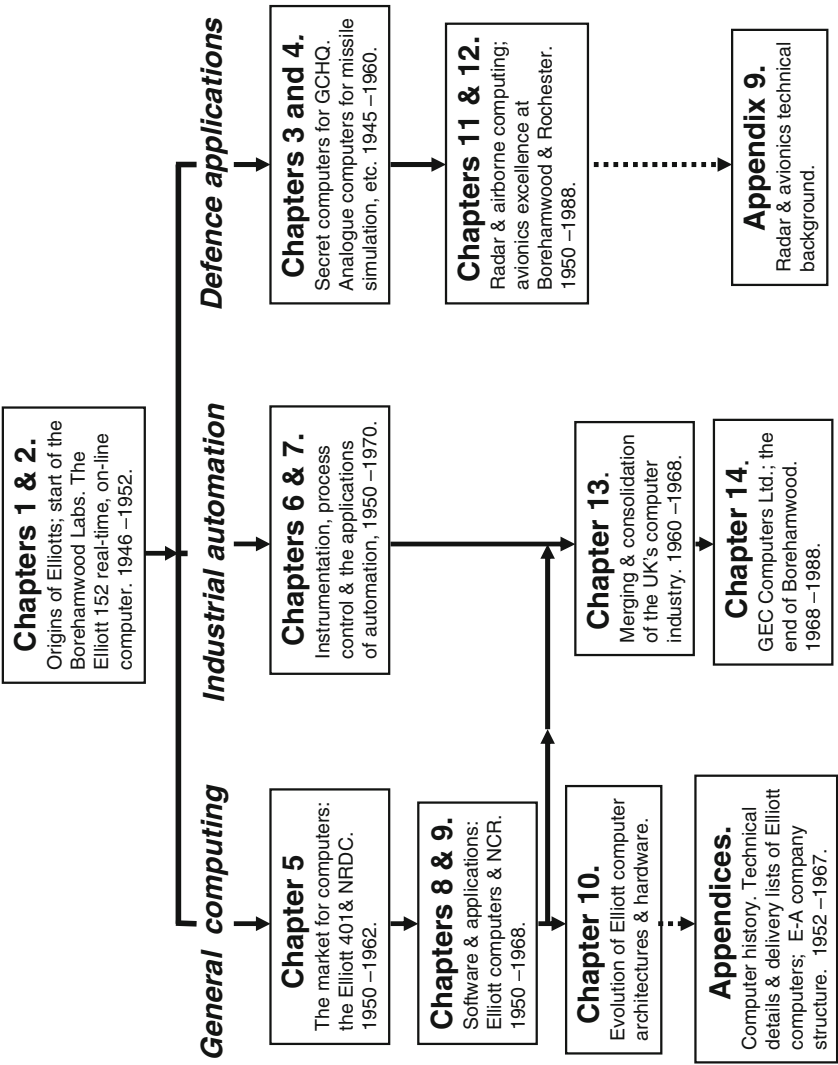


Fig. 1 A guide to the subject matter covered in the book

Sources and Acknowledgements

Researching a book about Elliott-Automation, a company that effectively ceased to exist as a trading entity in 1968, has not been straightforward. In 1985, a survey of the historical records of British computer manufacturers [6] highlighted ‘above all a widespread disregard for the value of archives. Of the twelve companies still in operation, only one (STC) has employed a qualified archivist and only four others make any effort at all to retain significant documents.’ ICL and Ferranti Ltd. were fortunately amongst the four, and authoritative histories of these two important British computer manufacturers now exist (see [7, 8]).

Ferranti Ltd. and Elliott Brothers (London) Ltd. had together produced 75% of the British commercially available computers that had been delivered to customers by 1955 – indeed, the two companies became market rivals. Some of the computer endeavours of Ferranti and Elliott were in due course incorporated into ICL (respectively, in 1963 and 1968). ICL itself had had a long involvement in electromechanical punched card office equipment through its ancestor companies British Tabulating Machine Co. Ltd. (BTM) and International Computers and Tabulators (ICT).

More generally, the post-1967 successor companies to Elliott-Automation’s activities have included at various times English Electric, GEC, ICL, Marconi, BAE Systems and Telent Ltd. Only the last two organisations have survived at the time of writing. M G D (Mike) Williams, who worked in Elliott-Automation’s Head Office from 1956 to 1964 and then indirectly until the GEC takeover in 1968, has said: ‘It is no surprise that company documents (both external and internal) for the period up to 1967 are hard to come by: reorganisations (frequently acrimonious) and repeated “new broom” exercises will have ensured that most if not all interesting papers held inside the company will have been disposed of’ [9].

Whilst none of these successor companies appear to have made much official effort to preserve Elliott-specific historical material, enthusiastic employees have, from time to time, saved documents from oblivion. Thus, the Marconi Archive acquired some early Elliott papers in 2001, thanks to the efforts of H R (Ron) Bristow, a former Assistant General Manager [10]. These papers were passed with the rest of the Marconi Archives to the University of Oxford in 2005, upon the dissolution of the Marconi company.

Of more relevance to Elliott computers is the effort of SLH (Laurence) Clarke CBE, who retired in 1992 as Assistant Technical Director of GEC, to collect material for a history of Elliott’s Borehamwood Laboratory. Clarke was obliged to abandon his project in 1997 for personal reasons but had by then accumulated written anecdotal evidence from a number of key employees who have since died [11]. Laurence Clarke gallantly passed his material to the present author in 2001.

Lacking official company archives, the computer historian is obliged to cultivate a network of former employees and hopefully, through them, access to original company documents and reports that have been kept for many years in attics and garages. The National Archives contains many relevant defence-related documents that were formerly classified (i.e. secret). Contemporary secondary source material,

for example, Stock Exchange reports, National Research Development Corporation correspondence and trade journal articles, help to form a picture of the company's relative standing. Finally, personal histories and anecdotes, whilst often notoriously imprecise about dates and/or perceived rivals, do add colour to the picture and are sometimes invaluable in revealing the underlying causes of organisational changes.

Numerous former Elliott employees and related specialists have made original documents and notes available to the author. Besides Laurence Clarke and Ron Bristow, special mention should also be made of the following people who have been unsparing in their time spent in meeting with, and/or corresponding with, the author: Jonathan Ayles, Erik Baigar, John Barrett, Iann Barron, Tony Bartolome, Laurie Bental, John Blackburn, Gordon Brand, Allan Bromley, Heather Brown, John Brooks, John Bunt, Malcolm Burchall, Richard Burwood, Harry Carpenter, Mike Cochrane, Matthew Connell, Roger Cook, Doug Cornish, John Coulter, John Crawley, John Deane, Ninian Eadie, Dai Edwards, Marilyn Evans, Gerald Everitt, Ralph Erskine, Peter Excell, George Felton, Peter Fielding, Peter Freeman, Terry Froggatt, Andrew Gabriel, Steve Gilbey, Rob Gordon, Michael Healy, Peter Hearne, Ray Henville, Ed Hersom, Tony Hoare, Ron Howard, Roy Hynes, Michael Irish, Alex Kahan (grandson of Sir Leon Bagrit), Paul King, John Kinnear, Betty Laverick, Peter Lawrence, Jack Lonergan, Ian Merry, Colin Merton, Brian Millis, Gerry Mills, Rachel Monk, Frances Morley, Pierre-E. Mounier-Kuhn, Maurice Needham, Roger Newey, Peter Onion, Ian Ormerod, Richard Overill, Jack Pateman, David Pentecost, Paul Rayner, Lord William Rees-Mogg, Tony Ridlington, Dennis Rowland, Joseph Roth, Gavin Ross, Hugh Ross, Geoff Scammell, John Sinclair, Brian Spratt, Andrew St Johnston, Dina St Johnston (née Vaughan), Harriett St Johnston, Alison Steer (née Coales), Philip Tattersall, Colin Thurston, Nick Vince, Alan Wakefield, David Warman, Sally Whytehead (Charles Owen's daughter), Nigel Williams, Bruce Williamson, Ron Wilson, Linda Wolffe, Andrew Wylie and many others. Sadly, several of the aforementioned people have passed on since 2001 and others were in such frail health that they may not now be around to read these words of thanks. Nevertheless, the author is truly grateful to them all.

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1. Amongst the end-of-empire conflicts were: India, 1945–48; Palestine, 1945–48; Malaya, 1948–60; Suez Canal Zone, 1951–54; Kenya, 1952–60; Cyprus, 1955–59; the Suez incident, 1956; Borneo, 1962–66; Aden, 1955–67; Radfan (Federation of South Arabia), 1955–67; Oman & Dhofar, 1969–76. See for example: <http://www.britains-smallwars.com/>
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4. The main sequence was as follows. 1948: bread rationing ended; 1949: clothes rationing ended; 1950: the points rationing scheme for many basic foods ended and petrol rationing ended; 1953: sweet rationing and sugar rationing ended; 1954: all food rationing officially ended; 1958: coal rationing ended

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Volume 2: from family firm to multinational company, 1975–1987, published in 2007 by Crucible Books, Lancaster. ISBN: 978-1-905472-01-7
9. MG D (Mike) Williams, letter to Simon Lavington dated 14 July 2003
10. H R (Ron) Bristow joined Elliotts in Sept 1951 and, apart from a break between December 1952 and January 1955, stayed with the company until his retirement in 1992. His career with the company was predominantly within the Aviation sector, rising to the position of Assistant General Manager. He became interested in the company’s history and was in a position to prevent the loss or destruction of many archival papers, including the 30-page typed document entitled ‘*Elliott Flight Automation History*’. He eventually arranged for the documents to have a permanent home in the University of Oxford as part of the Marconi Archive. Since retiring in 1992, Ron Bristow has made a detailed study of Elliott’s nineteenth-century instrument-making activities
11. SLH (Laurence) Clarke joined Elliott’s Borehamwood Laboratory in 1951, having worked there the previous summer as a vacation student. Laurence’s career was entirely within the computing sector, retiring as Assistant Technical Director of GEC in 1992. In 1994, with the active encouragement of John Coales, Laurence started work on a history of the Borehamwood Laboratories. He began by contacting former employees, with an emphasis on the period from 1946 to the early 1950s. By the end of 1995, Laurence had collected the written and verbal anecdotes of about 30 people, some of whom had joined the Laboratory when it was first set up by John Coales in October 1946. Due to other commitments, Laurence had abandoned his history project by 1997

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