

DRAFT – For Comments

1985 – The Year Procurement Died



Michael Pryce

LCxD Working Paper 1/18

September 2018

LCxD Working Papers

Low Cost by Design Working Papers aim to accelerate the public availability of the research undertaken by the LCxD network, and exceptionally, other research that is of considerable interest to the network. It presents research results that in whole or part are nearing submission to a refereed journal, to a sponsor, to a major conference or to the editor of a book.

Our intention is to provide access to early copies of LCxD research and to stimulate comments on the work ahead of its formal submission for publication.

Comments on this paper should be sent to the author, Michael Pryce - m.pryce@cranfield.ac.uk

Acknowledgements

Some of the work reported here was supported by the Higher Education Innovation Fund, the EPSRC and the Naval Postgraduate School and through a research fellowship funded by Manchester Business School. In addition, material that supported advice given as an Independent Scientific & Technical Advice (ISTA) register member in support of the [Combat Air Strategy](#) is incorporated.

Cover: European Fighter Aircraft and Hawk 200 mock-ups on the British Aerospace stand at the Paris Air Show, 1985
Credit: *Wikimedia Commons/Daniels Collection/SDASM Archives*

Introduction

2018 marks the centenary of the Royal Air Force (RAF). For a full third of its life the RAF has not had a procurement system that supports its needs. In 1985 a number of events meant that the technical needs of the RAF could no longer be met by British industry. This paper looks at how that came to happen and discusses its current and future implications.

Background

Since the 1950s there has been a perception of a decline in the British aviation industry¹. A belief has arisen that the industry would be stronger if it was not for the interference of politicians, ‘evil bloody Air Marshals’² and a general view that engineering is not accorded sufficient status in the United Kingdom³. This is all nonsense⁴, but has led to an ‘anti-history’ that dwells on the ‘what if’ projects and failures of the industry, treating them as lost opportunities, whose loss has had dire consequences⁵.

This view, although held by some in the 1960s, and expressed by engineers themselves in the 1970s when railing against perceived decline of both their status and the nation, has affected policy decisions. Perhaps the most notable example of the declinist thesis is found in Corelli Barnett’s ‘The Lost Victory’⁶ being handed around cabinet in the 1990s by Michael Heseltine⁷.

This focus on failures has masked the key role of the RAF, and the technical parts of the ‘warfare state’⁸ in working with, and sometime against, the aircraft industry in order to obtain what it needed. Cancellation was a key tool of technical control. The infamous Sandys White Paper of 1957 followed from the RAF’s developing view that changes in

¹ James Hamilton-Patterson’s ‘Empire of the Clouds: When Britain’s Aircraft Ruled the World’ is the best known recent (2011) example, with over 300,000 UK sales.

² Camm quote in Mason.

³ Finniston, Bore and Edgerton.

⁴ Edgerton, Rise and Fall of the British Nation

⁵ In both libraries at Shrivenham it is notable that there are more books about the cancelled TSR.2 of the 1960s than there are on the Tornado, which has served widely with the RAF for almost forty years.

⁶ Corelli Barnett, The Lost Victory

⁷ Heseltine, Life in the Jungle

⁸ Edgerton, Warfare State

warfare meant fighter aircraft were no longer essential⁹. The cancellation of the TSR.2 was brought about by explosive cost growth and poor technical performance, the causes and effects of both being well understood by the RAF.

The predominately military nature of Britain's aircraft industry¹⁰ meant that its development was dependent on the wishes and concerns of its main customer. For the RAF the ability to act independently meant that having aircraft designed specifically to meet its own needs was attractive¹¹. But this was not the comfortable monopoly/monopsonist relationship portrayed in some of the defence economics literature¹². The competence of the RAF in setting requirements¹³, and of the technical and supply branches of the various ministries charged with assessing designs and managing their development¹⁴, meant that the aircraft industry was constantly challenged by their main customer.

It was by rising to this challenge that it prospered. It was as a domestic supplier to the RAF, working with supply and technical branches, that the British aircraft industry could still, by the mid-1980s, be the second largest in the West. Despite cancellations, policy changes, governmental and industrial reorganisations, and even nationalization, the private British aircraft industry succeeded because of its links to the procurement system of the state, not in spite of them.

All that changed in 1985.

Five in '85

The most notable procurement decision made in 1985 was the agreement, with West Germany and Italy, to go ahead with the European Fighter Aircraft (EFA) programme. The

⁹ RAeS Sandys conference

¹⁰ Edgerton, England and the Aeroplane

¹¹ As it still is – see the recent Combat Air Strategy

¹² Hartley 1991

¹³ RAF Historical Society 2017

¹⁴ Various the Ministry of Aircraft Production, Ministry of Supply, Ministry of Aviation, Ministry of Technology and Ministry of Aviation Supply were separate ministries given the main tasks of procurement from 1940 until 1971. That they were separate from the defence ministries (there were four of those until 1964), and dominated by aircraft, indicates the scale and importance of their work to the state. Their role was taken over, along with other service functions, in the Ministry of Defence's Procurement Executive in 1971, following the Rayner Review, the first attempt at bringing in commercial thinking (Rayner came from Marks and Spencer) to tackle the perceived problems of procurement.

‘Turin Agreement’ in August was the culmination of many years of lobbying by industry for a new fighter aircraft that the RAF did not want¹⁵. Unable to have the supersonic ‘jump jet’ that it had decided in 1981 was the real future operational need¹⁶ the RAF agreed to take EFA as an interim type¹⁷. With it came an operational concept, beyond visual range (BVR) combat, that West German industry had come up with¹⁸, that had been accepted by British Aerospace (BAe) as the price for getting a joint programme with the Germans. The RAF adopted the BVR concept on advice from the technical parts of the Procurement Executive¹⁹, who themselves had obtained the model used to justify it from BAe and their German industrial partners²⁰. Using the same model-based analysis as the designers was akin to marking your own homework.

The adoption of BVR combat drove the design and concept of operations of EFA and the subsequent Typhoon, as well as dramatically increasing its development, operation and support costs. As an interim aircraft it was supposed to be easy and cheap, but the adoption of the BVR concept led to a very different outcome from that intended. In 1985 EFA was expected to go out of service by 2015.

The second significant change in 1985 also eroded the RAF’s ability to analyse the work of industry. The reorganisation of the central management of defence, announced by Michael Heseltine in 1984²¹, was implemented in January 1985. In the place of separate service Operational Requirements (OR) branches a centralised organization for concepts and requirements was created, reporting to a downgraded Chief Scientific Adviser, with much

¹⁵ TNA

¹⁶ TNA and P1216 book

¹⁷ They wanted 150, but collaborative workshare meant this was inflated to 250. Today they are completing the acquisition of 160. TNA

¹⁸ Herbst, AGARD

¹⁹ The Strathcona reforms of the MoD Research Establishments had reduced the numbers of people significantly in the early 1980s and their ability to develop new, in house assessments of technology. In their place the Conservative government sought to place more research with industry. Strathcona report, Hooper interview

²⁰ The model, SILKA, was questioned by the RAF in 1981, supported by design teams in BAe who were developing the preferred ASTOVL aircraft, and was actively opposed by the Operational Requirements branch in 1983 along with the entire concept of BVR combat. Their view was disregarded in light of political lobbying by industry and by an acceptance that the BVR EFA was just an interim, limited programme. MBB/BAe report, OR40b notes

²¹ Cmnd 9315

smaller Service OR groups. The separate Operational Requirements Committee was abolished – it was seen as having allowed early concept discussions and funding with industry that had generated too many projects. That was to be avoided in future. These changes were intended to ensure that single services did not promote their own interests, and equipment programmes, at the cost of wider defence capability²². The idea was to move away from ‘replacement thinking’ by removing policy planning from individual services. This would, “it was hoped, ..open the door to systems analysis; the ministry of defence simply states the operational requirement without insisting on any particular method of fulfilling it, and leaves the answer to those with sharp minds and technical expertise”²³. Inter-service rivalry was to be replaced by joint, centralised planning.

While an attractive idea, this centralization of requirements, and supporting analysis, both weakened the individual operational requirement sections and separated front-line experience on tactics, training and the other matters from the higher-level, and less detailed, analysis of options competing for scarce resources²⁴. It also stopped early, pre-project discussions with industry, preventing requirements being developed that were informed by an understanding of industrial abilities. There was no more money from the OR staffs for small scale design studies, reducing the amount of concept design work.

The third major change in 1985 was intended to further distance those who set requirements from those who could meet them. Since 1983 the industrialist Peter Levene had been advising Michael Heseltine on procurement matter. In 1985 he became Chief of Defence Procurement, in line with American attempts at turning a poacher into a gamekeeper²⁵. The Levene reforms built on the earlier policy of competition by putting in place a more contractual and adversarial relationship in defence procurement. In line with government policy, this sought to eliminate the worst excesses of the supposed cosy relationship with monopoly suppliers²⁶.

²² Macintosh and Broadbent

²³ Critchley, 1994, p.118

²⁴ This approach had been tried in the 1981 Nott Defence Review, with the Defence Operational Analysis Establishment used to look at issues in a service-neutral way, rather than taking individual services ideas. In 1985 it became the standard way of doing things. Malcolm Macintosh etc.

²⁵ David Packard for acquisition and, earlier Robert McNamara. Stealth technology and the Vietnam body count had resulted.

²⁶ TNA

With the onus now on industry to come up with their own ideas, theirs being the ‘sharp minds’ sought to meet the capabilities required by the MoD, it was hoped that a wider pool of competing firms would generate greater innovation and reduce waste. Government scientists or engineers were not seen as being capable of this, with the research establishments reduced to providing an ‘intelligent customer’ capability and assessing the work of industry²⁷.

A fourth area of change with a similar purpose was the conceptual separation of maintenance from procurement. A National Audit Office report in 1984 had illustrated that 48% of the RAF’s direct resources, rising to 60% when indirect ones were added in, was attributable to maintenance²⁸. By early 1985 a proposal for a ‘Maintenance Executive’²⁹ was being raised. This would have reorganised the RAF’s support functions, but industry were not involved in the discussion, as they had been in earlier ones. Maintenance was seen as a separate activity from development, rather than something of concern to the designer, which had been the case at least since the 1960s and as recently as 1983³⁰.

This separation of maintenance from design stifled attempts to design combat aircraft with significantly lowered maintenance targets than the previous generation³¹. The aim was to increase production numbers of aircraft by making them less expensive to support³². Failing to achieve this, with a focus on improving the way existing aircraft were maintained instead, could only mean the hoped for savings, and increased fleet sizes, could never be realised³³, while obsolete technology was also kept in service longer than hoped. The RAF has spent on spanners instead of new capability as a result.

²⁷ Edgerton 1984 outlines part of the long process of debate over whether the state had any part in creating its own designs.

²⁸ NAO report. The high cost of maintenance had been a concern since the 1960s (various 1970s/80s studies/seminars), compounded by an increase in the number of different types in service, partly caused by the 1960s cancellations. Savings in development and production led to increases in support costs. In 1965 only 10 years of running costs had been factored into decisions. AVIA

²⁹ AVM paper from RAF HS proceedings

³⁰ Reliability seminars in 1968 and 1983

³¹ EFA had the same targets as the Tornado, set in 1968. It has not been as unreliable as Tornado in service, although still higher than planned.

³² Faddey

³³ AVM Harcourt-Smith, 1988

The fifth area was the international one. A new MoD post for defence collaboration was created, to operate alongside Levene. Export sales were to take a near equal place to domestic requirements, with a view to limiting equipment costs through economies of scale. For Michael Heseltine the EFA project had been an early priority, one which he was involved in when at an early stage, unusual for a Secretary of State³⁴. His desire for large European projects was to prevent the UK and Europe from being 'like Toytown'³⁵ compared to the Americans. EFA was to be 'far and away the biggest industrial deal that Britain had ever done'. Similarly large was the Al-Yamamah arms deal, initiated by a Memorandum of Understanding signed in September 1985 'then the largest contract ever won by British industry'.³⁶

While earlier in the 1980s the accumulated experience of collaboration with Europe on earlier projects had led to a belief that a national, or joint US-UK, project might be preferable, with novel methods of payment looked at³⁷, the possibility of a large programme on EFA cemented UK policy in this direction³⁸. Even the attractions of the 'Star Wars' Strategic Defense Initiative³⁹ or US stealth technology was not enough to separate the UK from this⁴⁰, with suspicions about the cost/benefit ratio of such collaboration being very much in favour of the United States.⁴¹

Beyond EFA

The implications of these five changes became clear as soon as work started on the next major programme, an advanced 'jump jet' to succeed the Harrier and Tornado force. This was not attractive to European nations, and collaboration with the United States was

³⁴ Heseltine, Jungle, p.274

³⁵ Heseltine, interview

³⁶ Heseltine, Jungle, p.287

³⁷ TNA – 'cash on delivery' was seen as possible if projects were properly planned, and would incentivise industry to avoid the pitfalls of Tornado through lower risk technical solutions.

³⁸ All projects from UK industry were now to be offered to the Inter-European Programme Group from 1985, with the Verderling Report of 1986 cementing this. Missile meeting minutes, Verderling book.

³⁹ Not very great for Heseltine, Crick, Heseltine Interview

⁴⁰ The UK had a different operational concept for stealth technology, preferring to see it as part of a mix of countermeasures to increase survivability

⁴¹ Heseltine, Jungle, 256

assumed to be essential⁴². The loss of the small amounts of money for design work from the OR branch of the RAF meant that design studies were funded using research funds, not associated with an operational requirement. This led to a range of possible technical solutions being created, and an absence of any clear criteria against which to judge their utility. The lack of money also led to the closure of all but one design office within British Aerospace, and an associated lack of diversity and competition in design.

The replacement of Tornado and Harrier led to an ever increasing number of studies at a broad conceptual level. By 1988 these were termed the Next Combat Aircraft (NCA) by British Aerospace, and the Combat Aircraft Beyond EFA (CABE) by the Royal Aircraft Establishment (RAE). These studies were not part of a dialogue between those drafting a requirement and those developing designs for aircraft in response⁴³. Rather, they existed to explore the background technologies and their possible uses in the broadest sense. NCA looked at manned and unmanned aircraft, technologies like stealth and the benefits of mixes of systems across all of the RAF's roles and cost base. A 1988 study group explored how BAe might get more money by extending the life of aircraft and maintaining them in place of developing new aircraft as part of this⁴⁴.

CABE was “an RAE initiative concerned with total systems requirements for the future”⁴⁵. It too looked at a range of possible outcomes, with a view to identifying the type of area that requirements should focus on. What is striking is that BAe and the RAE did not share their work. The 1985 changes had led to a separation of those looking at possible future systems. Market mechanisms like competition and taut contracts, as well as the change in requirements generation to one of broad concept exploration rather than design of specific aircraft, changed what was being done.

Fit For the Future?

Since the late 1980s a whole series of studies, derived from, and often repeating, the CABE and NCA work have continued. Acronyms such as FOAS, DPOC and FCAS have been given for often widely differing studies, but the way they have been carried out has been in line with the changes of 1985. Such studies have produced very little hardware, and nothing for front-line RAF use. The EFA and Hawk models on the British Aerospace stand at the Paris Air Show

⁴² Economies of scale again being the justification.

⁴³ The start of this process is outlined by Williams, 1987 - IPLC

⁴⁴ 1988 Cost Study

⁴⁵ 1990 RAE CABE paper

in 1985 represent the most common aircraft in RAF service, and the ones still being built and sold by BAE Systems, most often for export.

That studies do not result in useable aircraft is due to a range of factors⁴⁶. Resources are part of this – the US can always spend more, and if the UK or other countries seek to emulate their technology they simply do not have the money. Stealth is a good illustration of this – up to 1985 there was a more nuanced understanding of how to deal with threats by a arrange of survivability measure in the UK, arrived at by the development of requirements and technology in tandem⁴⁷. After 1985 the ability to do this diminished, and by 1989 the UK was simply chasing US stealth requirements⁴⁸ and considering the direct purchase of such aircraft rather than developing their own⁴⁹. The current F-35B programme brings US doctrine and intellectual property controls along with it, unsurprising once the UK had stopped developing its own. The loss of UK design capability can be seen to have added \$100 billion to the programme.⁵⁰

Current attempts to revive the national ability to generate meaningful design capability⁵¹ seek to address these issues, but do so with the framework of 1985 still hanging around their neck. Changing the managerial approach to working with industry does not get back to a truly close working relationship, where requirements generation is informed by studies carried out by experienced design teams who have recently developed front-line aircraft. Team Tempest faces a formidable challenge if something more than mock-ups are not to be the result of current work.

While the way the MoD works has remained in the mould of 1985, the sorts of people who were attracted to the aerospace industry has changed radically since. Despite attempts at encouraging STEM graduates into the industry, the financialised world economy⁵², with vast amounts of debt, seeking collateral, funding many projects like those of Space X in the

⁴⁶ Descartes and Locke at the Drawing Board

⁴⁷ This despite the knowledge of what American stealth technology was. See TNA & RSRE 1982.

⁴⁸ 1989 ASTOL review/US-UK paper - Levine

⁴⁹ RAE CABE 1990

⁵⁰ Pryce, The \$100 billion equation: Designing cost into the Joint Strike Fighter, forthcoming, IPLC, November 2018

⁵¹ See Combat Air Strategy

⁵² Tooze, Crashed.

United States, means that good graduates will chase the well-funded, interesting work⁵³. A state that can borrow at low rates of interest was able to resource projects better than industry as long as industry could only borrow against assets⁵⁴. That is no longer strictly the case. Equally, an acceptance of huge financial losses while pursuing market share makes for a very different industry to one that must justify value for money, pursued through strict control of financial and contractual terms. The 1985 changes may have been convincing to those implementing them, but it is clear that they have not delivered much for the RAF since. How they can do so in future is unclear.

Conclusions

At the heart of the pre-1985 approach to procurement was close working between those developing detailed requirements and those designing aircraft to meet them. Taking front-line experience, threat analysis and other factors into account, they worked to generate realistic aircraft designs. Despite a mixed track record of delivery in time, cost and performance terms, at least delivery occurred. The changes in 1985 took away the ability for UK industry to deliver new capability to the RAF front line; only subcontracting on larger US programmes has achieved that since.

Reflecting on the effect of 1985's changes can show why, for a third of its life, the RAF has not been able to procure a combat aircraft that truly met its needs, rather than adopting a US one. As the UK seeks to move back to being able to do this, through the Combat Air Strategy, it will take a concerted effort to change the context within which it tries to acquire capability. For over 30 years procurement as it had worked has been dead. Whether it can rise, Lazarus-like, remains to be seen, despite claims to have learned the lessons of history⁵⁵.

⁵³ The last UK aircraft design team to be created have effectively moved to the United States. Their design is now owned, and made, by Russian and Chinese firms, some operating through US-based companies. Interview, Farnborough F1 team

⁵⁴ The BBC documentary, Billion Dollar Day, filmed in 1985 shows this world emerging in that year. <https://www.youtube.com/watch?v=TxlTHZ0GmxU>

⁵⁵ AVM Rochelle, in Jane's

Low Cost by Design (LCxD) is a network bringing together researchers who seek to explore how good design can lead to lower cost complex system acquisition.

LCxD addresses this challenge through a range of interdisciplinary work which crosses the traditional boundaries of engineering, management and the humanities.

Projects (and funding body) that LCxD members have worked on:

- Costing Future Complex & Novel Projects - Jul 2015-Feb 2017 (EPSRC & Dstl in kind)
- Air System Programme Data – Mar 2016-Nov 2016 (Dstl/CORDA)
- Studies in association with BAE Systems regarding Air Defence concepts and requirement drivers - Sept 2016-Nov 2016
- Policy for Aerospace Industrial Strategy - Feb-July 2018 (Higher Education Innovation Fund)

To discuss ways of working with us contact m.pryce@cranfield.ac.uk

About the author

Mike leads the Low Cost by Design (LCxD) research network, which has carried out a range of projects funded by the EPSRC, Dstl and BAE Systems, and is a member of the MOD's Independent Scientific & Technical Advice (ISTA) register. He has recently supported the Combat Air Strategy, announced by Prime Minister Theresa May at the Farnborough Airshow in July 2018.

Before coming to Cranfield Mike was a research fellow at the University of Manchester, in the business school (project management and innovation groups) and in engineering and physical sciences. His last role at Manchester was technology horizon scanning in the BP-funded International Centre for Advanced Materials (ICAM).

Mike studied for his DPhil at the Science Policy Research Unit (SPRU) at the University of Sussex. This involved in-depth access to BAE Systems' design teams, management and archives, as well as MOD staff. His undergraduate degree is in history, with an MSc in the History of Technology from Imperial College.