F-111K: Britain's *Lost* Lost Bomber

By Dr Richard Moore

For several years in the mid-1960s, the US-built F-111K strike/reconnaissance aircraft was the RAF's future "spearhead". It was to replace the TSR.2 and saw off the Navy's new generation of aircraft carriers in a bitter political battle. This article explores the technical, military and political history of the F-111K up to its dramatic cancellation in 1968. It also throws light on the Air Staff's view of the TSR.2.

Introduction

For three years between 1965 and 1968, the Royal Air Force's future plans were built around a "spearhead" force of 50 US-built F-111K strike-reconnaissance aircraft.[1] Although much has been written about Britain's defence policy and planning in these years, the F-111K tends to be mentioned sketchily or in passing, as a footnote to the better known stories of TSR.2, aircraft carriers *versus* island bases, and the withdrawal from east of Suez. Paddy Menaul's history of the British nuclear deterrent, for example, gives a short and partisan account of the TSR.2 cancellation before suggesting that Labour Defence Secretary Denis Healey "had no intention of buying the F-111 for the RAF" as a replacement.[2] In fact, as we shall see, Healey fought tooth and nail for the F-111K. Chris Bartlett's excellent history of postwar British defence policy notes that, after 1968, "no special capability for operations east of Suez would be preserved, which meant that the order for F-111s ... could be cancelled."[3] In fact the Air Staff had made strong arguments for a European role for the aircraft, in the context of NATO's flexible response strategy.

TSR.2 is described nostalgically as "Britain's lost bomber".[4] But so much has been written about TSR.2, and so little about the F-111K, that the description better fits the latter aircraft. Moreover the eventual cancellation of the F-111K was, I shall argue, more traumatic for the RAF.

As the RAF again looks forward to introducing an American-built frontline combat aircraft, this article introduces the technical and acquisition issues surrounding the F-111K, and its intended role in some of the never-to-be nuclear and conventional wars of the 1970s, before describing the political drama of cancellation.

Tactical Fighter Experimental

The F-111 story began in the late 1950s, when Tactical Air Command (TAC) of the US Air Force (USAF) was looking for a new flagship high-performance nuclear strike aircraft.[5] The US tactical nuclear arsenal was growing and TAC saw the need to replace its F-105 strike fighters. Originally, the replacement was to have vertical take-off and landing (VTOL) to aid dispersal, because only a dozen or so airfields in the whole of western Europe could support the heavy F-105. In the summer of 1959, however, TAC HQ staff were briefed by NASA researchers at Langley Field in Virginia on their research into variable geometry or "swing wings". The research had been stimulated, to some extent, by studies in late 1958 of the exotic and impractical Swallow aircraft conceived by British designer Sir Barnes Wallis.[6]

Variable geometry was of immediate interest to the new TAC commander-in-chief, General Frank F Everest USAF, because it offered the chance of excellent performance in different flight regimes – in particular short take-off and landing, high speed at high and low level, and long ferry range. Hence requirement number SOR.183 was issued by TAC in July 1960, calling for an advanced variable-sweep, turbofan-engined strike fighter with a two-man crew, capable of M2.5 at 60,000 ft, with an 800-mile combat radius at low level, including 400 miles terrain-following at M1.2, and a 3300-mile trans-Atlantic ferry range.

From December 1960 the aircraft was known as TFX, or Tactical Fighter Experimental. Famously Robert S McNamara, Kennedy's new Defense Secretary from January 1961, forced the USAF and US Navy to work together on the TFX programme to meet their nuclear strike and carrier air-defence requirements in one airframe, hoping for economies of scale in a long production run. Also famously, in 1962 he chose General Dynamics (GD) to build the aircraft, against the repeated strong recommendations of the services for the competitor design from Boeing. The Senate Permanent Subcommittee on Investigations, chaired by Democrat Senator John L McClellan of Arkansas, held a long series of hearings on this decision during 1963, requiring McNamara to testify in person but failing, ultimately, to establish any wrongdoing. In fact, the decision was perfectly justifiable on the basis of the competition rules set by McNamara: the GD design had more commonality between the Air Force and Navy versions, as required, and GD's Convair division had a great deal more supersonic fighter and bomber experience at this time than Boeing. GD's partner Grumman had even built a variable-geometry prototype for the Navy.[7]

From an early date, the British knew a fair bit about the plane that would come to compete directly with their own TSR.2. The operational requirements branch of the Air Ministry opened a file on TFX in April 1960, comparing in detail the UK and US requirements – three months before the latter was formally issued.[8] This and other comparisons issued over the following years highlighted the pros and cons of the two aircraft.[9] The TFX – known formally as the F-111 from December 1961 – would have better airfield performance, range, and speed at both high and low altitude. It would also be cheaper, mostly because the production run would be longer. But variable geometry was a big technological leap, and the Air Ministry was therefore sceptical about delivery timescales. It was also very worried about the navigation and attack avionics of the F-111, which were less advanced than the TSR.2's. TSR.2's nav/attack system was based on a relatively simple inertial guidance platform but with frequent fixes from forward and sideways-looking radar and doppler, and calculations made in a digital computer. F-111's guidance fixes, from external radio navigation aids and forward-looking radar only, would be less frequent and useful, and its computer was analogue. F-111 was also less suitable for quick-reaction alert (QRA) scramble, because its better inertial platform needed longer warm-up on the ground for gyro alignment. As a result, 200ft weapons accuracy and blind attack, as in the TSR.2 requirement, were judged impossible for the F-111.[10]

In October 1963, to the consternation of many in the UK, the Royal Australian Air Force (RAAF) chose the F-111 over the TSR.2 to meet its own requirement for a tactical strike/reconnaissance aircraft.[11] By the start of 1964, the UK Air Ministry was also seriously questioning the TSR.2 and especially its rising cost – perhaps £5M per unit, compared to £2M for the F-111.[12] On 9 January Hugh Fraser, the Secretary of State for Air, wrote to Defence Minister Peter Thorneycroft. Fraser was "appalled", he said: "to put it brutally, the British aircraft industry is destroying our military air power ... unless the new cost figures for the TSR.2 can be drastically reduced, we should, I believe, seriously consider looking elsewhere ... the only alternative I see to the TSR.2 is the American TFX". This appears to have been bluster on Fraser's part, in advance

of taking a "tough line" with BAC, the makers of the TSR.2, at a meeting two days later.[13] Still, these were strong words for a minister in a Conservative government, traditionally very supportive of the domestic aircraft industry.

The Air Staff knew its concerns about TSR.2 were unlikely to be resolved politically at this stage. Frank Cooper, at the time a senior Air Ministry official, recalled that the Chief of the Air Staff (CAS), Air Chief Marshal (ACM) Sir Charles 'Sam' Elworthy, "after discussion with a very limited circle, took a note from himself to ... Fraser, who showed it to Thorneycroft expressing doubts about the project. The paper was torn up and CAS told that this was not a matter to be discussed before an election."[14] The Air Ministry was anyway in the process of being reorganised out of existence, as the central Ministry of Defence (MOD) took over the functions of the single-service ministries on 1 April.

Nevertheless in September, just before the election, a long paper appeared on the "Short Comings of the TSR.2". This seems to have been written by Joe Croshaw, the Wing Commander in the Air Staff responsible for the TSR.2 requirement, with the encouragement of his boss Air Commodore (Air Cdre) Alan Frank. In this hard-hitting assessment, the "outstanding and all-pervading short-coming of the TSR.2" was "its high cost ... which results mainly from inept management and an almost total lack of value engineering. The country will be able to afford only a small force which, at best, will hardly meet our commitments in NW Europe, the environment to which the TSR.2 is best suited, and will be numerically, and to some extent operationally, incapable of being effective elsewhere at the same time". Other listed weaknesses included conventional strike capability at night and in bad weather, reconnaissance, navigation outside accurately mapped areas mainly in Europe, weight, ferry range, and engine tunnel and wing design.[15] Air Cdre Frank had previously written despairingly that "virtually no attempt has been made to keep down costs ... this can only complete our loss of faith not only in BAC's word but in that of MoA [the Ministry of Aviation], who are supposed to see that we get value for money ... The fact is that MoA have no interest in getting production costs down".[16] It is abundantly clear that at least some RAF officers were prepared during 1963 and 1964 to think the unthinkable about TSR.2.[17]

Labour in Power: TSR.2 *versus* F-111

Prime Minister Harold Wilson, newly elected in October 1964, had three overriding objectives in defence: first, to cap the annual defence budget at £2bn/year by 1969/70, down from the projected £2.4bn (the target was reduced further to £1.85bn after the sterling crisis of July 1966); second, to reduce commitments overseas; and third, to reform Britain's aircraft industry. Labour firmly believed the industry was tying up too much R&D money – over £250M each year, mostly on military projects – and too many people who should have been working instead in the civilian export economy.[18] The industrialist and former UK Atomic Energy Authority Chairman, Lord Plowden, was appointed to conduct a long study into the future of the aircraft industry but meanwhile Sir William Cook, Deputy Chief Scientific Advisor for Projects in the MOD, also wrote a more specific report in March 1965 on military aircraft

procurement and the pros and cons of a "buy American" policy. In a clear-sighted report, he recommended a balanced approach, with some American purchases, some home production and some European collaboration. An all-American approach, as he noted with considerable foresight, "would put vital areas of our defence policy at the mercy of balance-of-payments crises".[19]

One of Healey's first actions as the incoming Secretary of State for Defence, well in advance of seeing these conclusions, was to call for specific studies of US alternatives to the three big UK military aircraft projects then current: the P.1154 VTOL fighter and the HS681 tactical transport were to compete with two of the most successful military aircraft of the late 20th Century, the McDonnell-Douglas F-4 Phantom and Lockheed C-130 Hercules; and TSR.2 was pitted against the F-111.[20] Wilson and Healey were in Washington when McNamara told them he thought TSR.2 was "an expensive and nearly worthless project". On 9 December, Healey explicitly asked him for a price quote for the F-111.[21]

A blow-by-blow account of the politics of the TSR.2 cancellation would be out of place here.[22] I should like, however, to draw attention to the position on TSR.2 of the RAF and Air Staff, which many previous writers have neglected. The junior service mounted no determined last-ditch defence of TSR.2, as the aircraft's supporters in industry and the MoA certainly did. Nor however did the RAF whole-heartedly change horses; rather, the Air Staff diligently researched the options. They desperately wanted a high-quality, supersonic strike aircraft, but they were concerned about the F-111's avionics and its lack of reconnaissance capability. Air Marshal (AM) Sir Christopher Hartley, responsible as Deputy Chief of the Air Staff (DCAS) for RAF equipment, took a team to the US in December 1964, and his report explored these issues in detail, with a front line force of 74 F-111s in mind and a total buy of 110.[23]

Anticipating controversy, the Air Staff began to prepare defensive lines on their own part in the TSR.2 story. By 30 December, Air Cdre Frank had finished a paper on what went wrong, blaming the MoA for dismal cost and time estimation and failure to consider design trade-offs early enough. A further paper addressed the charge that the RAF's requirements had doomed the TSR.2. The conclusion – that there had been no 'requirements creep' over time – avoided the more basic question of over-ambition in the original specification.[24] Elworthy certainly felt defensive about press and public criticism in this regard, writing on 19 January that "the services should not be allowed to absorb the unjust impression that professional advice to Her Majesty's Government in the air force field is provided by a bunch of short-sighted and vacillating spend-thrifts".[25]

On 15 January 1965, aircraft industry workers marched in London in support of TSR.2 and to protect their jobs. The previous day, however, at a Defence Council meeting of ministers and officials, Elworthy had already spoken in favour of a version of F-111, needing both improved Mk.2 avionics, known to be under consideration in the US, and a UK reconnaissance pallet. At a meeting of the ministerial Defence and Overseas Policy Committee on the day of the

march, Healey recommended an order for 10 F-111s and an option on 100 more.[26] Roy Jenkins, as Minister of Aviation, loyally defended TSR.2 and opposed the F-111.[27] Political compromises were suggested between Healey and Jenkins – a mixed TSR.2/F-111 force, perhaps, or F-111 with Rolls Royce Spey engines, or with British avionics. The Air Staff tended to oppose these ideas on practical grounds. For example Michael Quinlan, Elworthy's Private Secretary, described British avionics as "an absolutely rotten idea".[28] Ministers, at this time, were keen to emphasise east-of-Suez roles for a strike/reconnaissance aircraft, and this had the effect of undermining the technical advantages of TSR.2, which had been optimised for long-range low-level penetration against targets deep in east European and Soviet airspace.

Labour minister Dick Crossman, observing the politics of the cancellation, claimed in his diary that the Chiefs of Staff "hate[d] TSR.2".[29] This is an overstatement, at least of Elworthy's views. Surviving correspondence between Quinlan, Elworthy and other senior officials shows that the CAS agonised over expressing an opinion against the British aircraft. Eventually, however, as the air chief himself recorded on 30 March, the balance of opinion within the Air Staff was indeed in favour of the F-111. Quinlan had told Elworthy that Healey wanted to hear a clear military preference for the F-111, also that "on present evidence you yourself slightly favour the TFX Mk.2". But the CAS would endorse only a more neutral formula, listing many pros and cons of the two aircraft and favouring the F-111 "simply on grounds of cost".[30] TSR.2s would probably cost £5.8M each, and F-111s £2.1M. The Cabinet finally decided on 1 April to cancel TSR.2 and explore an option to purchase the F-111. On 6 April this decision was announced in Parliament.

Operational Roles

The RAF now had the opportunity, therefore, to acquire the F-111. What operational roles were envisaged for the aircraft worldwide? Many misleading maps were produced in the years 1965-68 showing the range and capability of the F-111. Large parts of the world were graphically threatened in these maps by means of circles, drawn around current or proposed RAF bases. In one example, appended to a February 1966 paper for the Defence and Overseas Policy Committee, the world was coloured air force blue from Brazil and the Azores through southern European Russia and Tibet to the Solomon Islands, these areas being within range of an F-111 flying a High-Low-Low-High attack profile with 2000lb of nuclear or conventional bombs. The inferiority of the Royal Navy's subsonic carrier-borne aircraft, the Buccaneer – which the Air Staff was *determined* not to have – was shown by means of smaller, inner concentric circles.[31] But there were no plans to strike so widely, least of all with nuclear weapons. Such maps were a product of the staffs battling over carriers and island bases, not of operational planners.

Far more interesting in this regard is the March 1965 report of a group chaired by the Vice Chief of the Air Staff (VCAS), AM Sir Brian Burnett.[32] Burnett had been asked to set out the requirement for a strike/reconnaissance aircraft of the TSR.2/TFX type. He envisaged the front line of 74 aircraft deployed as follows: 24 for strike and 12 for reconnaissance in the UK,

earmarked for NATO in war but otherwise available to reinforce overseas theatres; 16 and eight based permanently in the middle east; and eight and six in the far east.

The main role of the overseas-based aircraft would have been conventional non-nuclear strike. Addington, for example, was the name given to the C-in-C Far East's plan to destroy the Indonesian air force on the ground, in the event of air attacks on Malaysia, in a strike against 40 airfields and air defence targets.[33] Similar plans were drawn up to defend Libya and Kuwait against Egypt and Iraq. This was a very Trenchardian concept of strategic air power: first wipe out the enemy's air force, then ask questions. Sir Solly Zuckerman, the government's powerful Chief Scientist, was unimpressed with such plans, noting that US destruction of the North Vietnamese air force, and much else besides, was having little effect on the war in Indo-China.[34] Sir Burke Trend, the Cabinet Secretary, was also sceptical: "Against whom are we likely to be carrying out deep (and pre-emptive) strikes of the kind which this aircraft will make possible?"[35]

Burnett's report, however, went further, arguing that:

> It is unlikely that non-nuclear potential enemies would believe that we would employ nuclear weapons against them. However it is a factor that they must take into account, particularly if our vital interests are threatened or if they envisage relying on overt support from third parties. Furthermore, we cannot at this stage be certain that world pressure for some form of non-dissemination agreement will be strong enough to prevent nations such as Egypt and Indonesia from obtaining nuclear weapons ... nuclear deterrence is necessary. This capability can be provided by tactical strike aircraft equipped with kiloton weapons (which we already possess).[36]

Very few other documents are known which express an interest in nuclear deterrence of Indonesia, and there was no wider official or political approval for such a concept.[37] However, there *was* also a specific plan to use nuclear weapons in south-east Asia, as a part of South-East Asia Treaty Organisation (SEATO) Plan 4. This plan was the reason 48 Red Beard nuclear bombs were stored by the UK in Singapore between 1963 and 1970, for potential use by RAF Canberras based locally and V-bombers reinforcing from the UK. Small numbers of Red Beards were also held aboard Royal Navy carriers deployed to the far east. Plan 4 envisaged a Chinese and North Vietnamese invasion of the SEATO countries, directly and through Burma and Indo-China, with over 30 divisions. British nuclear strikes would have been mounted, in this unlikely scenario, against airfields and other military and communications targets in southern China including Hainan Island, also in North Vietnam and, it seems, neutral Burma.[38] Up to the entire UK-based force of 36 F-111s might have had to reinforce the far east for either Addington or SEATO Plan 4 to be carried out.

Burnett's report also had F-111s replacing the four Canberra squadrons (32 aircraft) then based at RAF Akrotiri on Cyprus. As well as their conventional role, these aircraft too had Red Beards

stored locally. They were the only nuclear forces of any nation declared to the Central Treaty Organisation (CENTO). A map in the report showed that the targets for these aircraft in "general war" were in the USSR. In case of unilateral British action there were "national" targets – probably cities – in Ukraine and southern Russia; there were also CENTO targets – probably military – in Soviet central Asia.[39] Twelve of the Canberras would attack from Akrotiri itself, ten others would disperse to Muharraq on Bahrain, four to Sharjah in the then Trucial States and six to Masirah in Oman. The aircraft would recover to Sharjah, Peshawar in Pakistan or Mehrabad in Iran.

Technical and Cost History

F-111 was a complex aircraft, still under development in these years and incorporating a great deal of new and ambitious technology – most obviously variable geometry and turbofan engines, but also some new materials, to which we shall return later. As we have seen, the Air Staff always knew the basic USAF version, the F-111A, would fail to meet the UK requirement for nav/attack accuracy. As the US and UK both explored modifications and new versions over the years between 1965 and 1968, the Air Staff had constantly to revise its ideas, and therefore also its cost estimates. Industry and the MoA, meanwhile, pressed for the incorporation of various items of British equipment including Spey engines, a Ferranti nav/attack system and various British weapons. The Air Staff, and indeed GD, resisted these ideas.

The Air Staff's operational requirement for TSR.2, number OR.343, was redrafted several times with the F-111 in mind before being reissued formally at Issue 3 in October 1965.[40] In almost all cases, US equipment was eventually preferred over British but there remained a number of important differences between the USAF's standard aircraft and the UK variant, formally designated F-111K in June 1966. The second aircrew member would be a navigator, not a co-pilot. There would be British nuclear weapons – not US weapons under a "dual-key arrangement" – and with British nuclear wiring. This meant, specifically, one or two high-yield WE177B bombs for UK-based aircraft; or the same number of low-yield WE177As for aircraft east of Suez.[41] The Anglo-French Martel, a conventional air-to-surface missile, would also be carried.[42] A UK reconnaissance pallet would be fitted to some aircraft, and all would have British flight-refuelling and communications equipment.

By the start of 1966, negotiations with the US for a firm price for the F-111 were no longer complicated by the possibility of Spey engines, but there remained questions over the final avionics fit required on both sides of the Atlantic. The US Mk.2 avionics would include a digital nav/attack computer and other improvements to the inertial guidance platform, now with astro and doppler fixes, and to the forward-looking radar and terrain-following. Even in 1967 and 1968, the British Mk.2K avionics fit was still to be finalised and tested.[43]

In addition to uncertainty over detailed specification, the F-111 was plagued during flight testing in 1965 and 1966 by engine compressor stalls – interruptions in the flow of air through the engines. As a result the engine air intakes were in a constant flux of redesign.

The afterburners were also problematic. These problems, however, mostly affected high-Mach, high-altitude and high-manoeuvring flight, and therefore the US Navy's F-111B fighter version. The F-111A was clear by November 1965 for flight at low level in the penetration role in which the RAF was most interested. Hartley himself flew the fifth aircraft in the US in May 1967, and managed to create and recover from a compressor stall in a 3G turn at 22,000ft without incident.[44]

Specification changes and technical setbacks naturally affected the cost of the F-111K. The Air Ministry's earliest guess, in March 1963, had been a unit price of £1.15M ($3.22M) plus a contribution to the overall US research and development (R&D) programme.[45] When a letter of offer was first received from the US in September 1965, £2.125M ($5.95M) was the unit price given, plus an estimated £470k ($1.316M) for UK modifications, although no contribution to R&D was required.[46] By September 1967, with no certainty still about the final avionics fit, unit price had crept up to £2.95M.[47] Despite this cost escalation, F-111K was still far, far less expensive than the cancelled TSR.2, and the overall deal with the US was seen as an excellent one, with a fixed price including R&D, eventually a ceiling price for UK modifications, long-term credit repayments and – a recent innovation, relating also to the purchase of Phantoms and Hercules – provision for 'offset' deals. The US agreed, for example, to buy salvage tugs from Brooke Marine of Lowestoft, UK catapults and arrester gear for aircraft carriers, Jetstream passenger aircraft from Handley Page and even $1.3M worth of barbed wire from Tinsley Wire of Sheffield.[48]

Despite the difficulties of finalising a specification – and, as we shall see, the background of an ongoing defence review and the related temptation to put off any and every specific decision – Healey was able to use the provisions and deadlines of his agreement with McNamara to turn options into firm orders for F-111K. Twisting the arms of his ministerial colleagues, he placed ten orders in February 1966 and 40 more in March 1967.[49]

Politics and Changing Roles

Harold Wilson presided over an almost non-stop process of defence review upon review for the first four years of his premiership, and the political story of the F-111K project weaves together debates on dollar cost, the future of the British aircraft industry, the east of Suez role, and bitter interservice battles with the Navy.

Industry and the Ministry of Aviation – later of Technology – fought a continuing rearguard action against American procurement. Thus the F-111 found itself, throughout these years, battling in a continuing series of studies against other aircraft: a developed Buccaneer known as the 2* or "Two-Star", a Spey-engined French Mirage IV, a version of the Phantom, etc. In one ministerial discussion these alternatives to the F-111 were described, revealingly, as representing "a dying generation of fixed-wing subsonic aircraft". Industry and its supporters in government were far keener to preserve and encourage work on supersonics, VTOL and variable geometry.[50]

Although none of the alternative aircraft was attractive in the short term, especially to the RAF, concerns about the dollar cost of F-111 and the determination in some quarters to promote home-grown alternatives did lead to a rapid erosion of planned F-111 numbers. Of the 110 originally envisaged, and the 20 more wanted by Elworthy as a bonus to replace the Fleet Air Arm, by October 1965 only 50 could be agreed, for a front line force of 36: 14 based in the far east, and 22 at RAF Honington in Suffolk.[51] These were the 50, as we have seen, that Healey was able to order by the spring of 1967. The 1966 Defence White Paper, because of dollar cost and industrial policy concerns, described the F-111 essentially as a niche, interim aircraft, now required in small numbers alongside existing V-bombers, and moreover only until the mid-1970s when almost 200 of a new strike aircraft would enter service. This was the smaller, shorter-range Anglo-French Variable Geometry plane (AFVG), intended to be built by BAC, Rolls-Royce and their French counterparts.[52]

Meanwhile the Navy's aircraft carrier programme CVA-01 was cancelled in 1966, which was good news for F-111K; and Britain's east of Suez role gradually eroded, which was not.[53] Healey steadily undermined the case for the new carrier by throwing doubt upon the need for any truly independent UK intervention east of Suez, without allied support and basing. From at least June 1965, he also talked specifically about withdrawal from the far east at some future point when the Confrontation with Indonesia was over. This idea gained ground after Sukarno's anti-communist coup in October 1965 and the formal end of Confrontation the following August.

In parliament and the press, the F-111K attracted controversy. As *Flight International* put it in February 1966, "it is doubtful whether any previous aircraft in history has created such a furore ... In Britain in recent months it has been a divisive subject in the MOD (and anathema to those who wear the darker blue, for reasons not connected strictly with the aircraft's virtues); a contentious topic during frequent references in parliament, a never-failing story for the press and as much of a household word as any aircraft can become".[54] Conservative MPs tabled regular questions about cost, performance, delivery timescales and details of weapons and other equipment.[55] On 1 March 1967, the *Financial Times* asked sceptically: "Do we need the F-111s?" A full-scale debate on the aircraft followed in the Commons on 1 May. Enoch Powell, opening for the opposition, went over a great deal of ground, challenging the government on rising prices before moving on: "So much for cost. I now come to performance. Here there has been the opposite of an escalation". Healey and his junior minister John Stonehouse defended stoutly.[56]

Originally firmly committed to east of Suez, Labour ministers had been stung by a significant back-bench revolt after the defence debate in the Commons in February 1967. Two months later, the Cabinet agreed to end the east of Suez role some time in the mid-1970s. Suddenly therefore, with the publication of a new Defence White Paper in July 1967, the F-111K became an aircraft with a European rationale.[57] All 36 in the front line would now be assigned fully to SACEUR and based in the UK at Honington and perhaps, for the reconnaissance version, Wyton. Interestingly, as we have seen, the F-111 had originally been

judged somewhat less suitable than TSR.2 for a European role, although the USAF certainly planned to use the aircraft in Europe.

These were the years when NATO's flexible response doctrine was being developed in detail, and so the F-111K was focused on conventional deep strike and reconnaissance which, it was thought, could be especially important either to help crisis management in a time of tension or for escalation control in a conventional, pre-nuclear war. In addition, as the new CAS, ACM Sir John Grandy, noted in December 1967, the F-111K "could broadly cover SACEUR's nuclear target zone" as far east as Moscow.[58]

In January 1968, VCAS, AM Sir Peter Fletcher, described this European role in more detail. The F-111K, he emphasised, was "in an entirely different class from the Phantom and other lesser brethren" – and it had a nuclear capability. Advanced F-111Ks fitted with electronic counter-measures could make a conventional or nuclear first strike against bomber airfields in the Eastern bloc, with V-bombers and other less capable aircraft following up.[59] For the Air Staff, the recent Arab-Israeli conflict had reinforced once again the value of strategic air superiority and therefore of attacking the other side's airfields. In the minds of some ministers, however, the F-111K had become closely associated with east of Suez, and the shift in emphasis towards Europe seemed a little too politically convenient.[60]

Crisis and Cancellation

In autumn 1967, there was a further sterling crisis and finally, on 18 November, the shame of devaluation. Wilson famously claimed on television that devaluation didn't affect "the pound in your pocket". It did, however, affect the pound in Denis Healey's pocket, because overnight the F-111K became 14% more expensive (around £50M over its lifetime). Also the Chancellor, Jim Callaghan, lost his job and Roy Jenkins – the chief opponent of F-111 back in 1964-5 – was appointed on 30 November to replace him and push through a deep new round of spending cuts.[61] Some of the most uncomfortable ministerial meetings of the late 20th Century followed. Wilson had been weakened personally by devaluation and, for a time, most unusually, the British Cabinet started voting on decisions – including the future of the F-111K.[62]

By the end of December Jenkins was pushing for, amongst other things, an early and complete withdrawal from east of Suez and the cancellation of the F-111K. His opponents were divided: the Foreign Office and Commonwealth Office were the most recalcitrant on east of Suez, raising fears of communist subversion and disorder in which "British subjects ... may be killed".[63] Healey prepared instead to defend the F-111K. On 3 January 1968, he lost his temper at a meeting with Tony Benn, the Minister for Technology; it was "f... this and f... that", as Benn primly recalled.[64]

The Crossman, Benn and Castle diaries beautifully capture the mood in Cabinet as left-wingers spotted an opportunity for – as Crossman put it, with typical generosity of spirit – "a vote of

no confidence in the four pygmies on the other side of the table – Michael Stewart, George Brown, James Callaghan and Denis Healey – who had been running our foreign policy for the last three years".[65]

Cabinet met "in an icy atmosphere" on 4 January, the first of a gruelling series of eight meetings on Jenkins' cuts, totalling 32 hours over eleven days. Healey "made the most formidable case in favour" of the F-111 – "the last thing we should cancel if we paid due regard to defence needs".[66] Cancellation charges would amount to $140M, mostly up-front in the next financial year.[67] In the end, however, it was ten votes to nine *against* the aircraft, on Wilson's casting vote, although with the decision so close Healey was given leave to regroup. Various ministers also went away to consult overseas partners. Hence on 12 January, Cabinet discussion resumed and Foreign Secretary George Brown reported on what he called "bloody unpleasant" meetings in the US on east of Suez and the F-111: "the most awful experience of his life".[68] Barbara Castle recalled that "we listened in silence as he thundered on for half an hour, merely raising an eyebrow at his more purple passages ... 'They want us to keep the bird'. 'The what?' we chorused. 'The bird – the F-111'".[69] Wilson's annoyance with the US, however, in particular with President Lyndon Johnson's implied threat to use financial pressure to get his way, was clear. His response showed, for a postwar British prime minister, a surprising belligerence:

> It was important to our future relations that both we and the United States should recognise, especially now that we were both seeking to eliminate our external deficits, that we must each look after our own interests. They might be able to damage us economically if they wished; but it should not be thought that we were not in a position to reply in kind by, for example, withdrawing our investments from the United States.[70]

As Jenkins spoke, Brown passed a note to Healey: "I am fed up with this Jesuitical bastard".[71] After "an interminably long speech" on the F-111K from the Defence Secretary, who promised to find alternative cuts to the same value as cancellation, one vote went over to him: the 7th Earl of Longford, the Lord Privy Seal, was now pro-F-111.[72] But there was a further twist. As Crossman recounted gleefully to his diary, Jenkins had got at Cledwyn Hughes, the Welsh Secretary, and Patrick Gordon Walker, the Education Secretary, behind the scenes. Both therefore now voted against the F-111. Healey had been "no match for Roy ... we tottered out of Cabinet".[73]

Still, however, the Defence Secretary wasn't finished. One last time, on 15 January, Healey argued for (now just 35) F-111s, and even appeared to be winning the argument. As the minutes record, "it was argued that, in view of the new information which the Cabinet had been given on the F-111 situation, it would be right to consider the matter further. It was clear that the governments of the United States and Australia in particular attached the very greatest importance to our having this aircraft".[74] Crossman almost despaired: "if the future of the plane had been reconsidered on its merits, we couldn't possibly have won". But Wilson

refused to reopen any aspect of the cuts package without reopening the whole, an exercise for which ministers had no remaining strength. By this prime-ministerial tactic, therefore, the F-111K was finally cancelled.[75] Later that day David Bruce, the US Ambassador in London, melodramatically described the whole episode, in a telegram to Washington, as demonstrating "the most deplorable resolve, except for Munich, that any British [government] had taken during the last 150 years".[76]

The RAF and Cancellation

The protests of the RAF in general, and Grandy in particular, were shrill, and the contrast with Elworthy's careful treading of the line over TSR.2 three years earlier is clear. Grandy had been conspiring very closely with Healey in the run-up to these Cabinet meetings.[77] On 15 January, he presumed to write that he "deplore[d] the Cabinet decision" and that "the military consequences are of an altogether different order from other recent major and painful decisions on capabilities such as Skybolt ... and the carrier replacement programme ... we find ourselves with a void". He made a final plea: "in the knowledge that there are only hours to go before the PM's statement tomorrow ... *any* F-111s would be vastly better than none at all, in that even 16 aircraft would at least give a steel tip to our strike and recce forces for the 1970s".[78]

A very gloomy paper followed a week later: "There is no need for me to emphasise the effect of the void left in our defence policy by the loss of the advanced strike reconnaissance capability represented by the F-111, a void which reduces the effectiveness of our remaining land, sea and air forces to an extent out of all proportion to its size ... we have begun to think how to respond to the situation created by the disastrous decision to cancel the F-111".[79] DCAS, now AM Sir Peter Wykeham, wrote a sombre note of thanks to his own staff: "With the cancellation of the F-111K project the service has suffered, in the words of CAS, a severe blow ... Except that this was no fault of anyone in the Royal Air Force I have no comfort to offer".[80]

The first two F-111Ks had been nearing completion at Fort Worth, with the first flight planned for 28 March 1968 – a date which had caused problems with protocol because most very senior RAF officers would have been unable to attend, being otherwise occupied at a dinner with the Queen to mark the 50th birthday of their service.[81] With the unexpected resolution of this dilemma, the two F-111Ks were dismantled, and components used in testing and production of USAF aircraft.[82]

A letter exists from John T 'Bing' Cosby, a Vice President of GD, to Merlyn Rees, junior minister for the RAF, dated 21 February 1968 and highlighting ways in which the British might still get their F-111s. The aircraft might be completed as F-111As or as Australian F-111Cs and then loaned or leased to the RAF, or RAF crews might fly USAF aircraft, or "fly now pay later" terms might be agreed.[83] No such deals were politically realistic. Instead the RAF had finally to face the unwelcome prospect of introducing more of its least favourite strike aircraft, the Buccaneer, into front line service, as well as prolonging the life of the now outdated Vulcan. A paper from Grandy on plans for life "After the F-111" complained again that "the decisions of last month

made matters very much worse. Not only was the spearhead force excised, but as a result of the change ... we now find ourselves having to depend on Vulcans for conventional operations in the much tougher operational environment of Europe ... [meanwhile] no amount of investment in the Buccaneer would give us the options, in terms of both operational viability and reliability that a more modern aircraft [would] offer".[84]

It is curious that, given their recent success in seeing off the Royal Navy's carriers, the Air Staff seems to have made no attempt, even in the final months, to set its cherished nuclear-capable strike aircraft against another naval project, and major dollar expenditure, the Polaris submarine. The likely strategic role of the TSR.2 had repeatedly been mentioned by the Air Ministry in Whitehall debates on nuclear deterrence, especially in 1960 and again in 1963, either as a supplement or an alternative to other delivery systems, including Polaris.[85] In 1968, a choice between Polaris and the F-111K was certainly real in the minds of some ministers, and on 4 January at least one of these ministers argued in Cabinet that "we could not afford to provide both Polaris and the F-111 for NATO when our partners were providing neither".[86] Treasury officials also made the link.[87] Cancelling Polaris, however, was a step neither Wilson nor Jenkins was prepared to take. The Air Staff perhaps accepted, by this time, that its days in charge of the nuclear deterrent were over: a "child's guide" [*sic*] intended for use in briefing MPs on the F-111K stated that "the age of the strategic bomber as the hard core of the RAF's thinking and the big club in its offensive power has passed. The V-force is converting to the tactical role". Even if these words were a little disingenuous, the Polaris programme was now almost complete and the Air Staff must have calculated that a final grab for the strategic nuclear deterrent role would have been doomed.

Perhaps, with hindsight, 1968 was a good year to cancel. The F-111 was eventually to enjoy a long and successful career in US and Australian service. Its early years, however, continued to be dogged by technical and political problems. McClellan remained an inveterate opponent, and parts of the US media continued to run the 'costly failure' story. The US Navy cancelled its F-111B variant as soon as McNamara left office in 1968. Operational deliveries of the F-111A to the USAF began in July 1967 and in March 1968 the plane was deployed to Vietnam, only to be withdrawn soon after following a controversial series of losses. Serious fatigue problems then emerged, especially in the crucial parts of the aircraft structure which attached the wings to the fuselage: the wing carry-through box and wing pivot fittings, both made of a new steel which turned out not to be as high-tensile as intended. The Australian F-111C first flew in July 1968 and was formally accepted by the RAAF at a ceremony in September, but at this point the wing carry-through box had already failed in testing and *all* F-111Cs were grounded for most of the next *five years* – Australia didn't get its "F-trouble-one" until 1973.[89] Meanwhile the Mk.2 avionics intended for the F-111K and other variants did not become fully operational, on the USAF's F-111D, until 1974.[90]

We have seen that the F-111K was no footnote but a serious programme, and its loss a bitter blow for the RAF. Denis Healey's support for the aircraft had been strong, and he used it to

defeat the Royal Navy over carriers. In the aftermath of cancellation, he briefly considered resignation.[91] A combination of political factors had conspired against him: support for the British aircraft industry, wounded only superficially by the TSR.2 affair; anti-Americanism and opposition to post-imperial commitments within the Labour party; Cabinet tactics; and sheer economics. As Roy Jenkins sought to cut education and health in the aftermath of devaluation, defence had to bear a proportionate burden. During the 1970s and 80s, in common with the other services, the RAF refocused its attention on Europe and eventually, in the Tornado, it got a supersonic aircraft with low-level strike capability. Meanwhile the USAF, as so often, filled the gap, successfully basing F-111Es and Fs for over 20 years at Upper Heyford and Lakenheath, in just the roles previously envisaged by the RAF.

Notes

[1] The RAF variant of the F-111 was known officially as the F-111K from June 1966, although contemporary documents and sources did not use this designation consistently. Despite extensive correspondence on possible names including Richmond, Merlin, Taipan and even Thanggamau (see e.g. papers in UK National Archives (formerly Public Record Office) (PRO), AIR 20/11751), no name for the aircraft was adopted at the time and the US Air Force did not use the name Aardvark until many years later.

[2] AVM Stewart Menaul, *Countdown: Britain's strategic nuclear forces* (Robert Hale, London 1980), p. 152.

[3] C J Bartlett, *The long retreat: a short history of British defence policy 1945-70* (Macmillan, London 1972), pp. 224-5.

[4] See e.g., Damien Burke, *TSR2: Britain's Lost Bomber* (Crowood Press, Marlborough 2010).

[5] The best overall history of the F-111 development is the Masters thesis by Maj Brian L Reece USAF, *Development of the TFX F-111 in the Department of Defence's search for multi-mission, joint-service aerial platforms* (US Army Command and General Staff College, Ft Leavenworth KA 2011). Mark Lax, *From controversy to cutting edge: a history of the F-111 in Australian service* (Air Power Development Centre, Canberra 2010) focuses on the RAAF story but also has excellent general background, and there are useful accounts online by Joe Baugher and Peter Grant: respectively www.f-111.net/JoeBaugher.htm (accessed 21 Oct 2014); www.bayourenaissanceman.blogspot.co.uk/2010/11/weekend-wings-37-f-111-aardvark-part-1.html (accessed 21 Oct 2014). Enthusiasts will enjoy Don Logan, *General Dynamics F-111 Aardvark* (Schiffer, Atglen PA 1998).

[6] NASA Langley Research Center, 'Summary of NACA/NASA variable-sweep research and development leading to the F-111 (TFX)', Langley Working Paper LWP-285, Dec 1966, pp. 12-13; Reece, *Development of the TFX F-111*, pp. 16-17.

[7] Robert J Art, *The TFX decision: McNamara and the military* (Little Brown, Boston 1968).

[8] PRO, OR24 to ACAS(OR), 8 Apr 1960 and DOR(A) to OR17b, Apr 1960, AIR 2/18112. I am grateful to Lorraine Yeamans at the MOD for reviewing and declassifying this file.

[9] PRO, PS/VCAS to ACAS(OR), 13 Mar 1963 and DOR(A) to PS/VCAS, Mar 1963, AIR 2/16555; DDOR1 paper, Sep 1963, AIR 2/18112; ACAS(OR) to PS/SofS, 12 Nov 1963, AIR 19/1055; DOR3 to ACAS(OR), 27 Jul 1964, AIR 2/17776.

[10] PRO, OR24b note, 4 Feb 1964, AIR 2/18112; DAP(RAF) report on avionics, May 1965 and DOR3 note, 2 Jun 1965, AIR 2/17309.
[11] Richard Moore, 'A proliferation of Royal Air Forces: bombers and bombs down under, 1956-63', *Nonproliferation Review* 21/2 (June 2014), pp. 169-87.
[12] PRO, anon draft of 24 Jan 1964, AIR 2/17776; note of meeting in PUS MOD's office, 28 Jan 1964, DEFE 19/80.
[13] PRO, Fraser to Thorneycroft, 29 Jan 1964, DEFE 25/50.
[14] Sir Frank Cooper, 'TSR.2 and Whitehall', *RAF Historical Society Journal 17B: TSR.2 with hindsight* (1998), pp. 43-64.
[15] PRO, OR29 paper, 7 Oct 1964, AIR 2/17210. This must be the "devil's advocate paper" referred to by Frank in DOR3 to ACAS(OR), 14 Oct 1964, AIR 2/17776.
[16] PRO, DOR3 note, 17 June 1964, AIR 2/17210.
[17] Further evidence is provided by Wg Cdr George Wilson, 'A system study of TSR.2', *RAF Historical Society Journal 17B: TSR.2 with hindsight* (1998), pp. 16-26.
[18] Harold Wilson, *The Labour government 1964-70: a personal record* (Weidenfeld and Nicolson, London 1971), pp. 39-44; Bartlett, *The long retreat*, pp. 197-9; Andrew Pierre, 'Britain's defense dilemmas', *Proceedings of the Academy of Political Science* 29/2 (Nov 1968), pp.64-79; David Edgerton, 'The "White Heat" revisited: the British government and technology in the 1960s', *Twentieth Century British History* 7/1 (1996), pp. 53-82; Sean Straw and John W Young, 'The Wilson government and the demise of TSR.2, October 1964-April 1965', *Journal of Strategic Studies* 20/4 (Dec 1997), pp. 18-44; Saki Dockrill, *Britain's retreat from east of Suez: the choice between Europe and the world* (Palgrave, Basingstoke 2002), pp. 56-7.
[19] Cmnd. 2853, *Report of the committee of inquiry into the aircraft industry appointed by the Minister of Aviation under the chairmanship of Lord Plowden* (HMSO, London Dec 1965); PRO, DRE(65)15, 4 March 1965, AVIA 65/1768.
[20] Anthony Bennell, *Defence Policy and the Royal Air Force 1964-70*, p.1.2 (I am grateful to Sebastian Cox for arranging access to this MOD Air Historical Branch narrative); PRO, Private Office letter, 19 Oct 1964 and AUS(AS) to CAS, 21 Oct 1964, AIR 8/2428.
[21] Bennell, *Defence Policy*, p.1.9.
[22] See e.g. Straw and Young, 'The Wilson government and the demise of TSR.2'; Dockrill, *Britain's retreat*, ch. 4.
[23] A report of Hartley's visit on 15-17 Dec 1964 is the third appendix to a sheaf of working papers in PRO, AIR 20/11438; see also ACAS(OR)'s commentary, 29 Dec 1964, AIR 20/11510.
[24] PRO, DOR3 to PS/DCAS and DTSR2 to DCAS, both 30 Dec 1964, AIR 2/17777.
[25] PRO, CAS to MinRAF, 19 Jan 1965, AIR 20/11510.
[26] Bennell, *Defence Policy*, pp. 2.4-5.
[27] Jenkins was not a particular enthusiast for TSR.2 himself. In his memoirs, he describes it incorrectly as a swing-wing aircraft and recalls that "TSR.2, good plane though it was, had few friends outside the aircraft industry and the military chauvinist political lobby. I did not think that we should keep it going, although I was not convinced that the automatic alternative was to buy the F-111": Roy Jenkins, *A life in the centre* (Macmillan, London 1991), pp. 171-2.
[28] PRO, marginal note on DCAS to CAS, 6 Jan 1965, CAS to DCAS, 7 Jan 1965, both AIR 8/2429.

[29] Richard Crossman, *The diaries of a cabinet minister, vol. 1: Minister of Housing* (Hamilton and Cape, London 1975), p. 191.
[30] PRO, Quinlan to CAS, 24 March 1965 with Elworthy's manuscript notes, AIR 8/2413; ACAS(OR) to PS/CAS, redrafted note for CAS signature, and Healey's reply to CAS, all 31 March 1964, AIR 8/2414. Bennell seems to have had access to a further 30 March 1964 draft of CAS's note (*Defence Policy*, p. 2.13-14).
[31] PRO, Appendix 3 to Annex A, OPD(66)30, 8 Feb 1966, CAB 148/27.
[32] PRO, Burnett report, 19 March 1965, AIR 20/11779.
[33] Plan Addington had been drawn up in 1964; another plan, Althorpe, envisaged similar air strikes against a wider target set including naval forces, ports and oil installations: see National Archives of Australia, Canberra (NAA), file A1838 TS687/9/1 PART 2: Plans – Cannon, Spillikin, Mason, Addington, 1964.
[34] PRO, Zuckerman to SofS, 22 Nov 1965, AIR 8/2417.
[35] From a brief to Wilson, 8 Feb 1966, quoted in Hampshire, *From east of Suez*, p. 131.
[36] PRO, Burnett report, 19 March 1965, AIR 20/11779, p. 3.
[37] For one other example, see PRO, note of a meeting in Healey's room to discuss Polaris, 8 Jun 1967, DEFE 11/437.
[38] NAA, A1838 TS688/27/8 PART 1: SEATO Plan for defence of south-east Asia including East Pakistan and Philippines against attack by Communist forces and Democratic Republic of Vietnam, 1959-1960. One PRO document suggests 41 SEATO nuclear targets were assigned to the UK: note on range requirement for AFVG, 1 Apr 1966, AIR 2/17962.
[39] PRO, Burnett report Appendix 5 to Annex G, 19 March 1965, AIR 20/11779.
[40] PRO, Air Staff requirement OR.343 Issue 3, drafts of 10 and 30 June and 6 July 1965, AIR 2/17309 and 25 Aug 1965, AIR 2/17310; formal issue, 26 Oct 1965, AIR 2/17312.
[41] PRO, Air Plans 1 note, 10 Jun 1965, AIR 2/17309; RAE note on OR, 4 Aug 1965, AIR 2/17310.
[42] PRO, DCSA(P) to SofS, 28 Jan 1966, AIR 2/17861.
[43] PRO, OR29 to DOR1, 22 Feb 1966 and DDOR6 note, 18 Mar 1966, AIR 2/17861; D Air Projects note, 24 May 1967, AIR 2/18053.
[44] PRO, draft paper for Weapons Development Committee, 18 Nov 1965, AIR 3/17313; notes of visit, circulated 10 May 1967, AIR 2/18053.
[45] PRO, table dated Mar 1963, AIR 2/18112.
[46] PRO, letter of offer, 30 Nov 1965, AIR 2/17313.
[47] PRO, paper on F-111K programme costs, undated (6 Dec 1967), AIR 2/18054; also Quinlan (MOD) to France (Treasury), 15 Dec 1967, T 225/2951.
[48] PRO, C(68)10, 3 Jan 1968, CAB 129/135.
[49] PRO, C(66)35, 11 Feb 1966, CAB 129/124 and CC(66)9th, 14 Feb 1966, CAB 128/41; implementing sales order signed 22 March 1966, AIR 2/17862; OPD(67)12th, 15 March 1967, CAB 148/30, Healey to McNamara, 16 March 1967, DEFE 13/552.
[50] PRO, OPD(66)5th, 21 Jan 1966, CAB 148/25; MoA paper DC/P(65)2, 13 Jan 1965 and COS.3rd/65, 17 Jan 1965 both, AIR 20/11510; Bennell, *Defence Policy*, p. 7.6.
[51] PRO, papers of the RAF Programme Working Group, Oct-Nov 1965, DEFE 13/745.
[52] Cmnd.2901, *Statement on the Defence Estimates Part I: the Defence Review* (HMSO, London Feb

1966). The AFVG had a troubled existence until the French cancelled it in 1967; conceptually it was a fore-runner of the Tornado.

[53] Gjert Lage Dyndal, *Land based air power or aircraft carriers? A case study of the British debate about maritime air power in the 1960s* (Ashgate, Farnham 2012); Edward Hampshire, *From east of Suez to the eastern Atlantic: British naval policy 1964-70* (Ashgate, Farnham 2013); P L Pham, *Ending 'East of Suez': the British decision to withdraw from Malaysia and Singapore 1964-8* (OUP, Oxford 2010); Matthew Jones, 'A decision delayed: Britain's withdrawal from South East Asia reconsidered 1961-8', *English Historical Review* 117 (Jun 2002), pp. 569-95; David M McCourt, 'What was Britain's "East of Suez Role"? Reassessing the withdrawal 1964-8', *Diplomacy and Statecraft* 20/3 (2009), pp. 453-72.

[54] 'F-111: the big swing-winger from Texas', *Flight International,* 24 Feb 1966, p.301.

[55] For example House of Commons debates (HoC debs.), 22 Dec 1965, vol. 722, cols. 2096-7; 3 Aug 1966, vol. 733, cols. 451-2; 16 Nov 1966, vol. 736, cols. 416-7; and others too numerous to list.

[56] HoC debs., 1 May 1967, vol. 746, cols. 99-227. The quote from Powell is at col. 107.

[57] Cmnd. 3357, *Supplementary Statement on Defence Policy* (HMSO, London July 1967); PRO, paper of 9 Aug 1967, AIR 2/17350.

[58] PRO, CAS to SofS, 15 Dec 1967, AIR 20/11920; Bennell, *Defence Policy*, pp. 12.10-13.

[59] PRO, VCAS to CAS, 8 Jan 1968, AIR 20/11920.

[60] Jeffrey Pickering, 'Politics and "Black Tuesday": shifting power in the Cabinet and the decision to withdraw from east of Suez, November 1967-January 1968', *Twentieth Century British History* 13/2 (2002), pp. 144-70, esp. p. 159; Barbara Castle, *The Castle diaries 1964-70* (Weidenfeld and Nicolson, London 1984), pp. 106-7, 350.

[61] Pickering, 'Politics and "Black Tuesday"', pp. 151-7.

[62] Wilson, *The Labour government*, p. 481.

[63] Pickering, 'Politics and "Black Tuesday"', p. 160.

[64] Tony Benn, *Office without power: diaries 1968-72* (Hutchinson, London 1988), p. 1.

[65] Richard Crossman, *The diaries of a cabinet minister, vol. 2: Lord President of the Council and Leader of the House of Commons, 1966-1968* (Hamilton and Cape, London 1976), p. 635.

[66] Benn, *Office without power*, p. 2; Castle, *The Castle diaries 1964-70*, p.350; PRO, CC(68)1st, 3pm 4 Jan 1968, CAB 128/43.

[67] PRO, C(68)10, 3 Jan 1968, CAB 129/135.

[68] Benn, *Office without power*, p. 12. Brown used the same phrase "bloody unpleasant" in a telegram to Wilson from New York: PRO, 11 Jan 1968, PREM 13/1999.

[69] Castle, *The Castle diaries 1964-70*, p. 354.

[70] PRO, CC(68)6th, 2.30pm 12 Jan 1968, CAB 128/43.

[71] Dominic Sandbrook, *White heat: a history of Britain in the swinging sixties* (Little Brown, London 2006), p. 482.

[72] Benn, *Office without power*, p. 12.

[73] Crossman, *Diaries, vol. 2*, pp. 647-8; Benn, *Office without power*, p. 15. Jenkins's memoirs suggest that Wilson had been the one to conspire with Hughes (*A life at the centre*, p. 227).

[74] PRO, CC(68)7th, 10am 15 Jan 1968, CAB 128/43.

[75] Crossman, *Diaries, vol. 2*, p. 650.
[76] Quoted in Pham, *Ending East of Suez*, p.231.
[77] PRO, numerous papers, AIR 20/11920.
[78] PRO, undated paper (with others of 15 Jan 1968), AIR 20/11920. The file copy is marked "draft only" in manuscript, and Grandy may not have had the courage to send it.
[79] PRO, CAS to SofS, 22 Jan 1968, AIR 2/18054.
[80] PRO, DCAS to ACAS(OR) and others, 18 Jan 1968, AIR 2/18054.
[81] PRO, correspondence, AIR 2/18054.
[82] Logan, *General Dynamics F-111*, p. 279.
[83] PRO, Cosby to Rees, 21 Feb 1968, AIR 19/1146.
[84] PRO, draft for CAS to SofS, 26 Feb 1968, AIR 20/11758.
[85] Humphrey Wynn, *The RAF strategic nuclear deterrent forces: their origins, roles and deployment 1945-64* (HMSO, London 1994), pp. 520-9; Burke, TSR2, pp. 302-10.
[86] PRO, CC(68)1st, 3pm 4 Jan 1968, CAB 128/43. The night before, left-wing ministers had discussed F-111 and Polaris over dinner (Castle, *The Castle diaries 1964-70*, p. 348). The Chiefs told Healey the two were not comparable (Annex A to CDS to SofS, 8 Jan 1968, DEFE 13/511) but there were several further references to Polaris in Cabinet: CC(68)6th, 2.30pm 12 Jan 1968, CAB 128/43.
[87] PRO, Ian Bancroft to Peter Baldwin, 3 Jan 1968, T 225/3067.
[88] PRO, Annex C to VCAS note of 19 Dec 1967, DEFE 13/511.
[89] Lax, *From controversy to cutting edge*, ch. 4.
[90] www.f-111.net/JoeBaugher.htm (accessed 21 Oct 2014).
[91] Denis Healey, *The time of my life* (Penguin, London 1990), p. 273.