

ARTICLE

The British Government, Nuclear Testing, and the Arms Race, 1961–1962

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Abstract

In 1961–2, when a three-year international moratorium on nuclear testing was broken by the Soviet Union, Britain and the United States agreed to resume testing in partnership: Britain would test underground at the American site in Nevada and the US would use the British site at Christmas Island for a new series of atmospheric tests. This article uses archival evidence to examine the British government's position, showing that there was a great reluctance to resume testing and that, contrary to stereotypes, there was no strong lobbying for tests from the military or atomic scientists. While it was convenient to express the need for nuclear testing as a technical necessity, the requirement was fundamentally political: to support the United States. Meanwhile, Britain's atomic scientists were working hard not only to test nuclear weapons but to ban testing, and the article also introduces the extensive scientific work done in support of nuclear test detection and arms-control verification. Although histories today emphasize the health and environmental impacts of nuclear testing, at the height of the Berlin crisis it was the nuclear arms race that worried politicians and scientists above all.

Testing nuclear weapons in the earth's atmosphere was perhaps the most visible and alarming expression of the East–West arms race in the early years of the cold war. The mushroom cloud of the test became a powerful symbol of a new and fearful age. Although nuclear-weapons scientists began to consider contained testing deep underground as a safer and less visible alternative, most United States and all Soviet and British nuclear tests in the 1950s – nearly three hundred in all – were above ground.¹ The risks were not just local: fallout carried into the stratosphere was detectable worldwide and provoked serious controversy. Partly as a result, science and scientists gained a new prominence in domestic and international politics, their views eagerly sought on the arms race, the technical elaboration of nuclear weapons, and the health and environmental impact of fallout.²

¹A total of 291 tests between 1950 and 1959, including about twenty-five underground: quoted in www.atomicarchive.com/almanac/test-sites/testing-chronology.html, accessed 1 June 2026.

²Robert Gilpin, *American scientists and nuclear weapons policy* (Princeton, NJ, 1962); Robert A. Divine, *Blowing on the wind: the nuclear test ban debate, 1954–1960* (Oxford, 1978); Sarah Bridger, *Scientists at war: the ethics of cold war weapons research* (Cambridge MA, 2015), especially ch. 2.

In October 1958 an international moratorium on testing was agreed, lasting until the end of August 1961, when, at the height of the Berlin crisis, the Soviet Union announced a resumption of tests. Two weeks after the building of the Berlin wall, and two months before the notorious sixteen-hour face-off between American and Soviet tanks at Checkpoint Charlie, this was a new ratchet step in cold-war tension. In response, and despite the unpopularity of testing, Britain and the US agreed to resume also, and in partnership. Britain would test underground at the American site in Nevada, and the US would use the British site at Christmas Island, in what is now Kiribati in the Pacific, for a new series of atmospheric tests.

The breakdown of the test moratorium, at the intersection of cold-war politics and hard science, is the focus of this article, which uses archival evidence to examine the British government's position. Why did Britain resume testing, and allow British territory to be used for tests above ground? How did politicians, scientists, and military advisers come together, and what was most on their minds? Was there a distinctly British debate, or merely a rehearsal of themes from the US? Which was more important and to whom: running the arms race or reining it in?

I

The importance of nuclear testing at the time is reflected in its prominent place in histories of cold-war diplomacy, science, and protest. Many historians, for example, have studied the personal diplomacy of Western leaders on nuclear testing and the interactions of politicians and scientists, especially in the US.³ According to most of these accounts, presidents Eisenhower and Kennedy favoured a test ban but found it near-impossible to overcome opposition from scientists within government. Edward Teller in particular – physicist, weapons enthusiast, and the villain of many histories – put forward requirements for new nuclear weapons and suggestions of Soviet test-ban cheating which others found fanciful. Isidore Rabi, a Nobel prize-winner and moderate critic, commented that: ‘Teller was brilliant in inventing excuses and ways [a ban] could be circumvented, far beyond any reaches of common sense. We spent enormous fortunes trying to meet his objections.’⁴

Scientists outside government, notably Linus Pauling, a molecular chemist who was to win the Nobel prize for peace for 1962, put the case against testing with equal passion. His claims about the impact of testing on human health, however – for example, that ‘the lives of 100,000 people now living are sacrificed by each

³ Glenn Seaborg with Benjamin Loeb, *Kennedy, Khrushchev, and the test ban* (Berkeley, CA, 1981); John Freeman, *Britain's nuclear arms control policy in the context of Anglo-American relations, 1957–1968* (Basingstoke, 1986); Kendrick Oliver, *Kennedy, Macmillan and the nuclear test ban debate, 1961–1963* (Basingstoke, 1998); Donette Murray, *Kennedy, Macmillan and nuclear weapons* (Basingstoke, 2000); Nigel Ashton, *Kennedy, Macmillan and the cold war: the irony of interdependence* (Basingstoke, 2002); Bruce Geelhoed and Anthony Edmonds, *Eisenhower, Macmillan and allied unity, 1957–1961* (Basingstoke, 2003); Nigel Ashton, ‘Harold Macmillan and the “golden days” of Anglo-American relations revisited, 1957–63’, *Diplomatic History*, 29 (2005), pp. 691–723; Benjamin P Greene, *Eisenhower, science advice, and the nuclear test-ban debate, 1945–1963* (Stanford, CA, 2007); Paul Robinson, ‘“Crucified on a cross of atoms”: scientists, politics and the test ban treaty’, *Diplomatic History*, 35 (2011), pp. 283–319.

⁴ Quoted in Peter Goodchild, *Edward Teller: the real Dr Strangelove* (London, 2004), p. 282.

bomb test' – were as polarizing as some of Teller's contributions.⁵ Efforts by Western governments to quantify the dangers of fallout failed to satisfy either extreme of opinion and today tend to be seen as a chapter in the history of 'cover-up' and the suppression of dissent.⁶

Scientists, especially atomic scientists, felt a special responsibility to engage in these debates, but US politicians in particular found their claims and counter-claims disappointing; they had hoped science could offer objective answers.⁷ Eventually the testing debate took some of the shine off the public perception of scientists more widely. In histories of cold-war science, science itself is no longer an objective truth but a social construction; and the government scientist in particular is an ambiguous figure: powerful, well funded, and self-interested.⁸

Few of these accounts focus on British scientists, although David Edgerton in particular has emphasized the political and economic importance of defence science and scientists in Britain's 'warfare state', and Sir Solly Zuckerman, the chief scientist of the British Ministry of Defence (MoD) in the 1960s, developed a view that nuclear testing and the development of advanced nuclear weapons were driven by over-enthusiastic atomic scientists.⁹ I shall consider Zuckerman's personal involvement in the nuclear-testing story, the origins of the 'Zuckerman thesis', and the real political influence of government scientists below.

Many recent histories focus attention on the public political opposition to nuclear testing, catalysed originally by the American Castle Bravo test in March 1954, which contaminated a Japanese fishing boat and required the evacuation of several hundred Marshall Islanders.¹⁰ In response, the Indian prime minister, Jawaharlal Nehru,

⁵Quoted in Divine, *Blowing in the wind*, p. 186; see also Pauling's Nobel prize lecture, 11 Dec. 1963, www.nobelprize.org/prizes/peace/1962/pauling/lecture/, accessed 1 June 2026.

⁶Robert Divine's view, based on contemporary public and media commentary, of the cautious reports on fallout by the US National Academy of Sciences (NAS) and the UK Medical Research Council (MRC) in 1956, and of the United Nations scientific committee on the effects of atomic radiation in 1958, is much more forgiving than later accounts, which present the NAS and MRC reports in particular as desperate and doomed government attempts to remain in control of the debate: compare Divine, *Blowing in the wind*, pp. 78–80 and 221–3, with Christoph Laucht, 'Scientists, the public, the state, and the debate over the environmental and human health effects of nuclear testing in Britain, 1950–1958', *Historical Journal*, 59 (2016), pp. 221–51, and Toshihiro Higuchi, *Political fallout: nuclear weapons testing and the making of a global environmental crisis* (Stanford, CA, 2020), ch. 4.

⁷Michael Wright, *Disarm and verify: an explanation of the central difficulties of national policies* (London, 1964); Gilpin, *American scientists*; Greene, *Eisenhower*.

⁸Thomas Söderqvist, ed., *The historiography of contemporary science and technology* (Amsterdam, 1997); Bridger, *Scientists at war*; Audra Wolfe, *Freedom's laboratory: the cold war struggle for the soul of science* (Baltimore, MD, 2018).

⁹David Edgerton, *England and the aeroplane: an essay on a militant and technological nation* (London, 1991); David Edgerton, *Warfare state: Britain, 1920–1970* (Cambridge, 2006); Graham Spinardi, 'Aldermaston and British nuclear weapons development: testing the Zuckerman thesis', *Social Studies of Science*, 27 (1997), pp. 547–82; Richard Maguire, 'Scientific dissent amid the United Kingdom government's nuclear weapons programme', *History Workshop Journal*, 63 (2007), pp. 113–35.

¹⁰Milton S. Katz, *Ban the bomb: a history of SANE, the committee for a sane nuclear policy* (New York, NY, 1987); Richard Taylor, *Against the bomb: the British peace movement, 1958–1965* (Oxford, 1988); Lawrence S. Wittner, *Resisting the bomb: a history of the world nuclear disarmament movement, 1954–1970* (Stanford, CA, 1997); Tom Kunkle and Byron Ristvet, *Castle Bravo: fifty years of legend and lore. A guide to off-site radiation exposures* (Albuquerque, NM, 2013).

made testing a focus of international political concern and was the first to call for a 'standstill' agreement. Pope Pius XII added his voice: 'if in the heavens all is peace and joy, on earth the reality is quite otherwise ... new destructive arms ... are now capable, with artificially radioactive isotopes of extended average life, of polluting in a lasting manner the atmosphere, the land and also the oceans'.¹¹ A new generation of historians has emphasized the impact of testing on the environment and human health, constructing a narrative of global crisis and victimhood.¹² If these histories of protest, of health and environmental consciousness, and of testing as a 'new imperialism' of the nuclear-weapons states have a weakness, it is that they explore the long-term effects and not the motivations behind testing, which can appear one-dimensional: a moral choice between evil and good.

Excellent accounts of British nuclear testing and testing policy from insiders, including Lorna Arnold's official histories and an authoritative book by John Walker, former head of the Foreign Office's arms control and disarmament unit, share this tendency to assume, rather than question, the reasons for testing. They present the British story as a breathless rush to test and test again before a ban could come into force, as one day it surely would.¹³ A similar ruthless cold-war logic is presented in political histories: *first* Britain successfully tested hydrogen bombs ('H-bombs') and secured a new, close atomic relationship with the US, enshrined in the mutual defence agreement (MDA) of July 1958; *then* it could afford the luxury of arms control. In May 1957, Prime Minister Harold Macmillan told parliament that he was 'determined that this country should be and remain a nuclear power'.¹⁴ Only later, 'fortified by the bomb', did he 'put all his weight behind a test ban agreement'.¹⁵

¹¹Jawaharlal Nehru's statement in the Lok Sabha, 2 Apr. 1954, www.pmindiaun.gov.in/public_files/assets/pdf/Agreement_6sep.pdf, accessed 1 June 2026; Easter allocation of Pope Pius XII, quoted in *The Tablet*, 24 Apr. 1954, p. 404.

¹²*The report of the Royal Commission into British Nuclear Tests in Australia* (2 vols. plus summary of conclusions and recommendations, Canberra, 1985); Richard L. Miller, *Under the cloud: the decades of nuclear testing* (New York, NY, 1986); Greta Jones, 'The mushroom-shaped cloud: British scientists' opposition to nuclear weapons policy 1945–1957', *Annals of Science*, 43 (1986), pp. 1–26; Tilman Ruff, 'The humanitarian impact and implications of nuclear test explosions in the Pacific area', *International Review of the Red Cross*, 97 (2015), pp. 775–813; Colin N. Waters et al., 'Can nuclear weapons fallout mark the beginning of the Anthropocene epoch?', *Bulletin of the Atomic Scientists*, 71 (2015), pp. 46–57; Laucht, 'Scientists'; Nic Maclellan, *Grappling with the bomb: Britain's Pacific H-bomb tests* (Canberra, 2017); Christopher Hill, 'Britain, West Africa and "the new nuclear imperialism": decolonisation and development during French tests', *Contemporary British History*, 33 (2019), pp. 274–89; Higuchi, *Political fallout*; Matthew Bolton and Elizabeth Minor, 'Addressing the humanitarian and environmental consequences of nuclear weapons: an introductory review', *Global Policy*, 12 (2021), pp. 81–99, and other papers in the same issue; Robert A. Jacobs, *Nuclear bodies: the global hibakusha* (New Haven, CT, 2022).

¹³Lorna Arnold, *Britain and the H-bomb* (Basingstoke, 2001); Lorna Arnold and Mark Smith, *Britain, Australia and the bomb: the nuclear tests and their aftermath* (Basingstoke, 2006); John Walker, *British nuclear weapons and the test ban, 1954–1973: Britain, the United States, weapons policies and nuclear testing: tensions and contradictions* (Farnham, 2010); also Wilfrid Oulton, *Christmas Island cracker: an account of the planning and execution of the British thermonuclear bomb tests, 1957* (London, 1987).

¹⁴House of Commons debates (HOC debs.), 15 May 1957, vol. 570, col. 437. Macmillan's own account underlines the party-political motivation behind this statement: Peter Catterall, ed., *The Macmillan diaries* (2 vols., Basingstoke, 2011), II, p. 36, entry for 16 May 1957.

¹⁵Anthony Sampson, *Macmillan: a study in ambiguity* (London, 1967), pp. 226–7, 233.

In summary, the literature on nuclear testing, although it approaches the subject from diverse viewpoints, presents a broadly consistent picture. A coalition of independent scientists, pressure groups, and sometimes enlightened Western politicians opposed nuclear testing because of its effects. Government scientists, backed by the military, pressed for more tests. If their reasons are explored at all, those reasons add up to a determination not to have their expertise challenged, to fall behind in the arms race, or to be fooled by the Soviet Union into accepting an inadequate arms-control regime.

Detailed analysis of British archive material at several levels, however – including records from the Atomic Weapons Research Establishment (AWRE), which remain closed for reasons of security classification – suggests a different picture. The British government's military and scientific advice consistently belied stereotypes, and AWRE was, perhaps surprisingly, working as a high priority to make a test ban possible. Arms control was no afterthought but pursued in parallel with testing. A six-month-long series of meetings of a United Nations disarmament commission sub-committee took place in London in 1957, for example, so that, even as Macmillan spoke in parliament of his determination to remain a nuclear power, diplomats were considering a specific UK proposal, diligently submitted a week ahead of Britain's first H-bomb test, 'to consider possible methods of limiting nuclear test explosions'.¹⁶ Many histories present the British position at these meetings, which continued the interwar search for 'general and complete disarmament', as entirely disingenuous, but significant effort and political capital were spent in hosting and agenda-setting.¹⁷

Macmillan was an elusive character but his feelings on testing seem clear and genuine: quite simply, the bomb was less important to him personally than the ban.¹⁸ Some historians identify the close Anglo-American atomic relationship as Macmillan's 'great prize'.¹⁹ He used those words much more often, however, to describe the test ban. He told parliament in July 1959 that 'a comprehensive agreement ... signed by the three great powers who now operate in this field is a great prize indeed'.²⁰ His election manifesto, ahead of his landslide win in October, announced that:

¹⁶Cmnd.333, 'Report on the proceedings of the sub-committee of the United Nations Disarmament Commission held at Lancaster House, London, March 18–September 6, 1957', esp. p. 50.

¹⁷Compare Wittner, *Resisting the bomb*, e.g. pp. 163–4, with the accounts of diplomats involved in disarmament talks: Wright, *Disarm and verify*; Freeman, *Britain's nuclear arms control policy*.

¹⁸Sampson, *Macmillan*; Alistair Horne, *Macmillan, 1957–1986* (London, 1989); Charles Williams, *Harold Macmillan* (London, 2009); Richard Thorpe, *Supermac: the life of Harold Macmillan* (London, 2010). As head of the family publishing firm, Macmillan was able to avoid the overzealous attention of editors, but his memoirs, if heavy going, are useful because they quote extensively from original papers: see the relevant volumes, *Pointing the way, 1959–1961* and *At the end of the day, 1961–1963* (London, 1972–3), and published diaries: Catterall, ed., *Macmillan diaries*, II.

¹⁹John Baylis, 'Exchanging nuclear secrets: laying the foundations of the Anglo-American nuclear relationship', *Diplomatic History*, 25 (2001), pp. 33–61, at p. 33; Matthew Jones, *The official history of the British strategic nuclear deterrent* (2 vols., London, 2017), I, pp. 114–18. Macmillan also used 'great prize' in a closely related context in his diary: Catterall, ed., *Macmillan diaries*, II, p. 68, entry for 24 Oct. 1957.

²⁰HOC debs., 8 July 1959, vol. 608, col. 1490 (and Macmillan, *Pointing the way*, p. 86).

We have three objectives, achievement of each of which would be a great prize:

- (i) The end of atmospheric tests ...
- (ii) The establishment of the first experiment in a system of international control ...
- (iii) The abolition under effective control of tests of all kinds.²¹

Macmillan brought the test-ban issue to full cabinet meetings at least sixteen times between September 1961 and April 1962, when ministers were told ‘a great prize’ could be won.²² In 1963 he defined ‘the banning of all tests in all environments’ as ‘the great prize’ and, when agreement was finally reached in Moscow on the Partial Test Ban Treaty (PTBT), he ‘went to tell D[orothy, his wife] and burst into tears’, saying ‘I have prayed too hard for this, night after night.’²³

But if the prime minister was praying for a ban, then our question is all the more intriguing: why had Britain agreed in 1961–2 to resume testing? I shall look in turn at positions taken during the test moratorium of 1958–61; immediate reactions to the Soviet Union’s resumption of testing; political decision-making thereafter and the part played by scientists; and AWRE’s extensive work on test-ban verification. Finally, I shall attempt to draw some conclusions of more general historical interest.

II

When the test moratorium started in October 1958, Britain’s nuclear-weapons programme was in full swing. Ambitious requirements were being drawn up for new bombs and missiles with yields in the megatons, or millions of tons of high-explosive equivalent; smaller bombs, surface-to-air missiles, and artillery shells; and even anti-ballistic missiles (ABMs) to defend against incoming missile attack.²⁴ AWRE now faced the challenge of meeting these requirements without further nuclear testing, although it had the benefit of past test results and now also exchanges with its US counterparts under the new MDA. ‘Minor trials’ for safety and technical development of warhead components, involving no nuclear yield, also continued at Maralinga in Australia.²⁵ Meanwhile, planned full-scale test series were shelved, and facilities at Christmas Island were put on a care-and-maintenance basis, notionally at eighteen months’ notice to test.

In July 1959 Macmillan personally ruled that nuclear testing was now unnecessary and that an indefinite suspension of British tests, in any environment, should

²¹Conservative party general election manifesto, ‘The next five years’, <https://web.archive.org/web/2024072321315/https://www.conservativemanifesto.com/1959/1959-conservative-manifesto.shtml>, emphasis in original, accessed 1 June 2026.

²²CC(62)26th, 5 Apr. 1962, London, The National Archives (TNA), CAB 128/36. Strictly, neither the minutes nor the cabinet secretary’s notebook in CAB 195/20 make clear which minister said this, but the phrase is characteristically Macmillan’s. See also the minutes of the 49th, 58th, 59th, 62nd, and 63rd cabinet meetings of 1961 in CAB 128/35, and the 1st, 2nd, 6th, 10th, 12th, 18th, 23rd, 25th, 27th, and 28th meetings of 1962 in CAB 128/36.

²³HOC debs., 3 July 1963, vol. 680, cols. 514–15; Catterall, ed., *Macmillan diaries*, II, p. 582, entry for 27 July 1963.

²⁴Richard Moore, *Nuclear illusion, nuclear reality: Britain, the United States and nuclear weapons, 1958–1964* (Basingstoke, 2010), pp. 81–2.

²⁵Arnold and Smith, *Britain, Australia and the bomb*, ch. 11.

be assumed. This was evidently on the specific advice of Sir William Penney, a veteran of the wartime Manhattan project at Los Alamos, later the director of AWRE and then the board member for research of the UK Atomic Energy Authority (UKAEA).²⁶ Given his background, we might expect Penney to have pressed for more testing but he also had a personal stake in arms control. For long periods in 1958–60 he had been involved, at Macmillan's personal insistence, in test-ban talks in Geneva.²⁷ These talks focused on the detection of underground tests, and with this in mind AWRE began to establish an international reputation in forensic seismology.²⁸ After some work at an existing site at Foulness in Essex, in 1961 Penney set up a new dedicated seismic research centre in a country house at Blacknest, near his old headquarters at Aldermaston in Berkshire.

One focus of research was 'decoupling' – the idea that the Soviet Union could cheat a verification regime by testing in huge underground caves, muffling the seismic signatures of the tests. Experiments with chemical explosives underground and underwater around the UK helped build a corpus of data. Blacknest scientists, many with an electronics background, focused on developing arrays of seismic instruments and the signal processing to 'steer' them. Their work began to suggest that test-ban verification might be easier than anticipated, and need fewer monitoring stations.²⁹ Some Aldermaston scientists became strongly committed to work in support of banning tests, including AWRE's head of nuclear testing, Ieuan Maddock.³⁰ According to his boss, the UKAEA chairman, Sir Roger Makins, Penney himself was 'deeply disappointed at the failure to progress beyond a partial [test-ban] treaty'.³¹ Victor Macklen, a long-standing senior MoD official, recalled similarly that Penney was 'a patriot with a strong sense of duty, but ambivalent about nuclear weapons; his heart was more in disarmament than in weapon development and he worked very hard for the Test Ban Treaty'.³²

Zuckerman, Macmillan's other key nuclear adviser, had long experience of defence work during the Second World War and re-established his reputation as a serious thinker as MoD chief scientist after January 1960. He opposed, in particular, any idea that nuclear weapons might have a military value in war-fighting and his

²⁶NT(59)1st, 10 June 1959, and NT(59)2, 12 June 1959, TNA, CAB 134/2275; Duncan Sandys to Harold Macmillan, 23 June, and reply of 9 July 1959, TNA, DEFE 7/2361.

²⁷Walker, *British nuclear weapons and the test ban, 1954–1973*, pp. 45–6, 112–13, 122–3, 133–4.

²⁸Alan Douglas, *Forensic seismology and nuclear test bans* (Cambridge, 2013).

²⁹E. W. Carpenter, 'An historical review of seismometer array development', *Proceedings of the IEEE*, 53 (1965), pp. 1816–21; Charles C. Bates, Thomas F. Gaskell, and Robert B. Rice, *Geophysics in the affairs of man: a personalized history of exploration geophysics and its allied sciences of seismology and oceanography* (Oxford, 1982), esp. pp. 187–99.

³⁰Douglas, *Forensic seismology*, p. xxxiii.

³¹Roger Mellor Makins, 'William George Penney, O.M. K.B.E., Baron Penney of East Hendred, 1909–1991', *Biographical Memoirs of Fellows of the Royal Society*, 39 (1994), pp. 281–302, at p. 293. Lorna Arnold always underlined Penney's commitment to banning tests, recalling Glenn Seaborg's inscription in Penney's copy of *Kennedy, Khrushchev and the test ban*, along the lines 'Dear Bill, we nearly made it': John Walker, pers. comm., 29 and 30 Nov. 2022.

³²Lorna Arnold, 'Note of a meeting with Mr Macklen and Mr Fakley at the MoD on Wed 18 Aug 1982 at 1030', AWE archive, Aldermaston. References in this article to 'AWE archive' are to records held by AWRE's successor organization, AWE. These records cannot yet be declassified but I have been able to examine them fully and have permission to cite them.

view on nuclear testing, by extension, was that it was unlikely to provide any new information of military or strategic, as opposed to scientific, value – an important distinction.³³

British scientists were well connected in the US: Zuckerman, for example, with Jerry Wiesner, the head of Kennedy's Presidential Science Advisory Committee, whose views were very similar to his own; and Penney with Glenn Seaborg, the US Atomic Energy Commission (USAEC) chairman. Zuckerman's contacts, in particular, tended to reinforce his cynicism about the arms race. In early 1960, visiting the two US nuclear-weapons laboratories at Los Alamos, New Mexico, and Livermore, California, Zuckerman recalled having to listen to 'a lot of "hard-line" talk, particularly at Livermore', although he conceded that 'no-one in Los Alamos tried to persuade me about the merits of some exotic new weapons ... or to urge on me the need to break the moratorium'.³⁴ In fact, Zuckerman found a greater diversity of views at the laboratories than most histories have recognized. Livermore's position can partly be explained by organizational insecurity and partly by its culture of innovation. As the newer of the two laboratories, it felt more vulnerable to cutbacks during the moratorium; more positively, it prided itself on pushing the boundaries, designing smaller, lighter, and 'clean' warheads. Such innovative designs would more obviously need testing than the conservative designs of Los Alamos, where scientists were more relaxed about the moratorium.³⁵ Indeed, Norris Bradbury, the Los Alamos director, gave moderate advice to Washington: 'the current test-ban negotiations ... represent the first real attempt to alter the course of history with respect to the nuclear arms race ... I would personally prefer that the United States not be the first to resume this activity'.³⁶

III

At the end of August 1961, as we have already seen, it was the Soviet Union that announced a new test series, ending the moratorium. The move was related, in its timing, to events in Berlin:

The building of the wall did not end the Berlin crisis ... for the remainder of the month of August the Soviet government continued its campaign of psychological pressure ... No effort at military posturing was more impressive than the announcement at the end of the month that the USSR planned to break its self-imposed moratorium on nuclear testing.³⁷

³³Solly Zuckerman, *Monkeys, men and missiles: an autobiography, 1946–1988* (London, 1988); Zuckerman to Macmillan, 6 Sept. 1961, TNA, DEFE 19/92.

³⁴Zuckerman, *Monkeys, men and missiles*, pp. 311–12.

³⁵Sybil Francis, 'Warhead politics: Livermore and the competitive system of nuclear weapon design' (PhD thesis, MIT, 1995), esp. ch. 8; Tom Ramos, *From Berkeley to Berlin: how the Rad Lab helped avert nuclear war* (Annapolis, MD, 2022).

³⁶On 17 July 1961, quoted in Bridger, *Scientists at war*, p. 40.

³⁷Aleksandr Fursenko and Timothy Naftali, *Khrushchev's cold war* (New York, NY, 2006), p. 385; also Vladislav Zubok and Constantine Pleshakov, *Inside the Kremlin's cold war: from Stalin to Khrushchev* (Cambridge, MA, 1996), p. 253; Jonathan Haslam, *Russia's cold war* (New Haven, CT, 2011), p. 190. The Soviet

One of Aldermaston's local newspapers, the *Berkshire Chronicle*, asked plaintively: 'is nature deliberately mocking human folly and human misery? Why otherwise must the loveliest holiday weather of the year be spoiled by the news that Russia is resuming nuclear tests?'³⁸ Officials faced a more practical question: should the UK also now test again, whether to develop new weapons, to improve knowledge of existing types, to advance scientific knowledge on test detection, or for all three reasons?³⁹

At AWRE, testing and what could and could not be achieved without testing had been discussed from time to time during the moratorium.⁴⁰ The cancellation of the British strategic nuclear missile Blue Streak in April 1960 had affected these discussions profoundly because no current warhead design was suitable for its intended replacement, the much smaller American missile Skybolt. Would a new Skybolt warhead design need testing, or was there enough knowledge, including from the US, to make a test unnecessary? The cautious line was that a test would at least provide important evidence. An end to the moratorium was considered a distinct possibility by June 1961, but discussed in depth only in September.⁴¹ Lists of potential British test devices, including a warhead for Skybolt, were drawn up on two occasions but only shared outside AWRE in July 1961, when retired Air Chief Marshal Sir Claude Pelly, the UKAEA's board member for weapons, sent a short list for background reading to his wartime colleague Zuckerman. Pelly suggested that, if US testing resumed but Britain failed to share the 'burden', the Anglo-American atomic relationship might suffer.⁴² Sir Harold Caccia, Britain's outgoing ambassador in Washington, echoed this view. Britain, as an atomic ally, should 'share the odium' of testing with the US; otherwise, Congress would suspect British weakness.⁴³ Zuckerman sounded out his contacts at the US laboratories, and again they offered diverse views: Johnny Foster at Livermore was 'very much pro-tests', but Bradbury at Los Alamos took 'a far less extreme view'.⁴⁴

The head of the British joint services mission at the Washington embassy, Air Marshal Sir George Mills, relayed a 'strong feeling' from his US counterparts that 'we ought to show ourselves in support [of testing] ... future cooperation might be somewhat prejudiced if we were thought to be "hanging back"'.⁴⁵ Interestingly, although the joint chiefs of staff were closely involved in the US debate on nuclear testing, Mills's letter is almost the only archival evidence of any interest in the question

weapons scientist Andrey Sakharov recalled Khrushchev's personally making the link to Berlin when he first ordered the resumption of testing on 10 July 1961: Higuchi, *Political fallout*, p. 166.

³⁸*Berkshire Chronicle*, 1 Sept. 1961.

³⁹The MoD permanent secretary, Sir Richard Scott, asked Makins for a paper for ministers: Scott to Makins, 8 Sept. 1961, TNA, DEFE 19/92.

⁴⁰Weapon Development Policy Committee (WDPC) minutes, 29 Oct. 1958, 11 Mar. 1959; SSPD (senior superintendent, physics division) newsletter, 13 Nov. 1959; WDPC minutes, 16 and 30 Nov. 1959, 1 and 15 June 1961, all in AWE archive.

⁴¹WDPC minutes, 1 June and 7 Sept. 1961, AWE archive.

⁴²Claude Pelly to Zuckerman, 17 July 1961, AWE archive.

⁴³Harold Caccia to Foreign Office, 13 Sept. 1961, TNA, DEFE 19/92.

⁴⁴Zuckerman to Harold Watkinson, 20 July 1961, TNA, DEFE 19/92.

⁴⁵Secretary of state for air, Julian Amery, to defence minister, Harold Watkinson, 28 Sept. 1961; Watkinson to Macmillan, 29 Sept. 1961, TNA, DEFE 19/92.

from the British armed forces.⁴⁶ The Royal Navy and Royal Air Force were more interested at the time in debating which submarines or aircraft might be required to carry nuclear weapons than in the development or testing of warheads themselves.⁴⁷ The navy and army had also, for some years, been pressing the case for more non-nuclear weapons, believing that 'nuclear sufficiency' at the strategic level made planning for conventional war more important.⁴⁸

Macmillan's advisers were hardly enthusiastic about testing at the end of the moratorium, and the prime minister clearly still wished to avoid British testing: 'must we do a test ourselves?'⁴⁹ He also now selected Sir David Ormsby-Gore to go to Washington as the new ambassador directly from Geneva, where, as a junior Foreign Office minister, he had been leading the British delegation at the test-ban talks. But scientists and politicians alike recognized that the US would welcome British involvement, and Britain gave its support in a low-key Foreign Office statement when the US resumed testing underground in Nevada on 15 September 1961.⁵⁰ Of those questioned for a British opinion poll, 64 per cent echoed this support for American testing.⁵¹

IV

Also on 15 September, an internal paper from AWRE's field experiments division summarized the available facts on the feasibility and cost of testing in Nevada, now considered the only realistic site for a British test, which would necessarily therefore also be underground.⁵² In early October, a firm proposal duly surfaced in London. Pelly's shortlist, sent to Zuckerman in July, formed the basis of an annex to the proposal but, in line with subsequent discussion at AWRE's senior technical decision-making body, the Weapon Development Policy Committee, only one test was actually recommended, of a small device relevant to the design of a Skybolt warhead and thought to be interesting to US scientists.⁵³ This device was referred to loosely in Whitehall as Super Octopus. Far from toning down a red-blooded paper from AWRE on the urgent importance of testing, senior Whitehall officials felt the need to strengthen this document in drafting: the words 'the absence of any British tests for the time being would be unlikely to affect cooperation in the nuclear field' were removed, and the words 'a technical need to undertake one test' became 'a

⁴⁶One other much later note from the AWRE deputy director Ted Newley refers to a letter on the subject from the chief of the air staff, Air Chief Marshal Sir Thomas Pike, following a visit to AWRE. Pike had talked about his 'conviction that we should join the Americans in atmospheric [sic] testing'. Newley's tone was of surprise at this reference to atmospheric testing, which, he pointed out, was against government policy: Newley to Pelly, 7 Mar. 1962, AWE archive.

⁴⁷Ian Clark, *Nuclear diplomacy and the special relationship: Britain's deterrent and America, 1957–1962* (Oxford, 1994); Jones, *Official history of the UK deterrent*, 1.

⁴⁸Richard Moore, *The Royal Navy and nuclear weapons* (London, 2001), ch. 4.

⁴⁹Private secretary's note, 30 Sept. 1961, reporting Macmillan's comments, TNA, DEFE 19/92.

⁵⁰'US resumes H-tests: small underground explosion', *Guardian*, 16 Sept. 1961, p. 1. It seems that the British government had not been consulted specifically about this US move.

⁵¹George H. Gallup, gen. ed., *The Gallup international public opinion polls: Great Britain, 1937–1975* (2 vols., New York, NY, 1976), 1, pp. 588, 600.

⁵²'A possible nuclear shot at NTS', 15 Sept. 1961, AWE archive.

⁵³WDPC minutes, 7 Sept. 1961, AWE archive.

strong technical need to test'. The paper still made clear, however, that there was no need for any further British nuclear test in the atmosphere, for example a full-yield test of the Skybolt warhead.⁵⁴

The US, on the other hand, was certainly now considering testing above ground, mostly because underground testing, as a discipline, was in its infancy. Instrumentation was difficult, only low-yield devices could be tested underground, and practical problems included serious contamination from the earliest tests in tunnels in Nevada.⁵⁵ Previous US atmospheric tests had been conducted at Bikini and Enewetak in the Marshall Islands, but facilities there were in disrepair and the US had become sensitive to international criticism of the use of the islands, a United Nations trust territory. Hence, as an alternative, the idea arose of using Britain's mothballed facilities at Christmas Island.⁵⁶

Zuckerman and Penney found another opportunity to sound out their many American friends at the September 1961 Pugwash conference in Stowe, Vermont. The Pugwash events started in 1957 as an international forum for independent scientists opposed to nuclear testing, but their relaxed and constructive atmosphere now also made them an opportunity for government scientists too to engage in arms-control discussions. Pugwash and its guiding light, Sir Joseph Rotblat, were to share the Nobel prize for peace in 1995.⁵⁷ Following these discussions, Zuckerman reported, like others, that his US contacts wanted to see Britain resume testing alongside them, whereas an 'attitude of moral superiority' would risk the close atomic relationship of the MDA.⁵⁸

Glenn Seaborg, visiting London on 21 September, carefully and separately, and without any commitment or explicit linkage, discussed possible requests for British testing in Nevada and US testing at Christmas Island.⁵⁹ In the following weeks, Alvin Graves, head of testing at Los Alamos, also met the AWRE director, Nyman Levin, at Aldermaston, and Ieuan Maddock visited both Los Alamos and the USAEC headquarters in Germantown, Maryland. The records of these AWRE meetings show that discussion was limited to logistics, feasibility, and cost: they did not involve, or result

⁵⁴Compare ND(61)1, 4 Oct. 1961, AWE archive, with ND(61)1(Final), 16 Oct. 1961, TNA, CAB 134/2238. Makins, Scott, and a then-junior cabinet office official, William Geraghty, appear to have been responsible for the redrafting. An AWRE internal paper had also concluded that 'underground testing is adequate for our needs': 'Technical aspects of nuclear test policy', 17 July 1961, AWE archive.

⁵⁵William E. Ogle, *An account of the return to nuclear weapons testing by the United States after the test moratorium, 1958–1961* (Las Vegas, NV, 1985), ch. 3, declassified version at www.osti.gov/opennet/servlets/purl/16156584.pdf, accessed 1 June 2026.

⁵⁶This possibility had been mentioned earlier: NT(57)4th meeting, 18 Nov. 1959; NT(58)6th meeting, 11 Sept. 1958, TNA, CAB 134/2274.

⁵⁷Wittner emphasizes the views of some officials that Pugwash was a 'communist front gathering' (*Resisting the bomb*, pp. 113–14), but there were many milder views and Macmillan was 'an assiduous reader of Pugwash conference memos': Andrew Brown, *Keeper of the nuclear conscience: the life and work of Joseph Rotblat* (Oxford, 2012), chs. 8–10, esp. pp. 187–8; also papers in the special issue of *Journal of Cold War Studies*, 20 (Winter 2018).

⁵⁸Zuckerman to Macmillan, 19 Sept. 1961, TNA, DEFE 19/92; also a second letter of the same date, preserved in the AWE archive.

⁵⁹Seaborg met separately with Makins, Pelly, and Nyman Levin and Ted Newley, the director and deputy director of AWRE; and with Makins, Pelly, and Watkinson: records of both meetings, 21 Sept. 1961, AWE archive.

in, any political pressure for testing. If anything they emphasized the difficulties of conducting a British test, for which Los Alamos, facing logistical problems of its own, had 'no great enthusiasm'.⁶⁰

Macmillan was still optimistic that atmospheric tests, at least, could be avoided, although, in the House of Commons on 31 October, he conceded that he might support testing even above ground: 'We should be wrong to shrink from it because if we did we should be handing ourselves and the whole free world ... to be trampled on by the Russians.'⁶¹ On 3 November, he formally asked Kennedy's permission to stage an underground test in Nevada, and on 7 November the US ambassador, David Bruce, formally asked the foreign secretary, Lord Home, for permission to use Christmas Island, if atmospheric testing should become necessary. Rather than make a direct trade, Kennedy quickly agreed to the test in Nevada, increasing the political pressure on Macmillan only subtly.⁶² Britain would test again, but whether British territory would be used for above-ground testing was still up for debate.

V

At two meetings in November 1961, Macmillan's cabinet discussed hosting between twenty and thirty US tests at Christmas Island. This was a large number: Britain's biggest-ever test series had been four, and Macmillan described the American request as 'awkward' and the number of tests as 'alarming'. Noting that 'the Americans are in a real difficulty ... and we are in a position to give or withhold something that they badly need', Home suggested agreeing to the US request but under strict conditions: in particular, the military necessity of each test should be beyond doubt. Macmillan agreed: 'it was of the highest importance to avoid prejudicing the moral predominance of the West by indulging in nuclear tests which were not absolutely essential'.⁶³ A small group of ministers and senior officials were told, in between cabinet discussions, that the US proposed testing ABM warheads, warhead safety improvements, nuclear effects on electronics, hardening against those effects, and above all lighter warheads, partly to make additional payload available for 'penetration aids' to overcome missile defences.⁶⁴

The codename Brigadoon was now given to a practical study of bringing Christmas Island back to readiness, and a US-UK reconnaissance team visited the island in December.⁶⁵ In Whitehall, a committee was established to consider logistical and administrative details.⁶⁶ Penney and Zuckerman made a fact-finding visit to Washington on 7-8 December, suggesting a set of technical criteria against which the

⁶⁰Records of meetings in previous note; also Nyman Levin to Makins and William Penney, 20 Oct. 1961, AWE archive.

⁶¹HOC debs., 31 Oct. 1961, vol. 648, col. 37.

⁶²Macmillan to Kennedy, 3 Nov. 1961, and reply, 11 Nov. 1961, TNA, PREM 11/3706; record of Home-Bruce meeting at the House of Lords, 7 Nov. 1961, DEFE 19/92. Oliver describes Kennedy's diplomacy as 'subtly coercive': *Kennedy, Macmillan and the nuclear test ban debate*, p. 47.

⁶³C(61)179, 10 Nov. 1961, TNA, CAB 129/107; CC(61)62nd, 14 Nov. 1961, and 63rd, 16 Nov. 1961, CAB 128/35. Macmillan also referred in parliament to 'good military or scientific reasons' for any test: HOC debs., 31 Oct. 1961, vol. 648, col. 32.

⁶⁴Record of meeting, 15 Nov. 1961, TNA, PREM 11/3246.

⁶⁵Brigadoon reconnaissance reports, 20 Dec. 1961 and 3 Jan. 1962, AWE archive.

⁶⁶The copious records of the nuclear coordinating committee (A) are in TNA, CAB 134/2235 and 2236.

prime minister might approve (or not) individual US tests. No American was interested in a complicated British veto but Zuckerman was equally unimpressed by what he considered vague as well as unnecessary US plans.⁶⁷

Kennedy and Macmillan now met for a scheduled summit in Bermuda on 21–22 December, to which Penney was specifically invited by Britain's most senior civil servant, the cabinet secretary, Sir Norman Brook. Penney highlighted, for the president's benefit, the importance of testing for ABM research.⁶⁸ This apparently new line would certainly have annoyed Zuckerman, if Brook had invited him too. Like many of his American contacts, Zuckerman thought ABM a waste of time, money, and political capital. Macmillan, however, praised Penney's contribution: 'Sir William Penney was a match for them all ... It was the first time the President had met this remarkable man ... and he was deeply impressed by his humour and his sense of proportion as well as by his profound knowledge.'⁶⁹

What are we to make of Penney's advice, previously relaxed, but now emphasizing the importance of ABM? There is some evidence that Penney had been impressed by the Soviet test in October of a device yielding over 50 megatons. Later known as the 'tsar bomb', this was the largest-ever test by any country and 'an impressive technical advance'.⁷⁰ Several of the new Soviet tests had also been at high altitude, directly in support of ABM research.⁷¹ But it seems unlikely that any technical argument about massive nuclear yields or ABM truly swayed Kennedy or Macmillan. Rather, to allow the Americans to use Christmas Island was a political decision – one for which Brook, as Macmillan's grey eminence, arranged a suitable technical briefing in justification. Penney duly gave the best account he could of Soviet and American testing, correctly identifying ABM as an important theme. In so doing, he was not transmitting an Aldermaston view: no evidence has emerged of contact between Penney and AWRE ahead of the summit.

Finding Kennedy under domestic pressure to resume atmospheric testing, the prime minister had little room to manoeuvre. In return for 'a public announcement of some new initiative on disarmament', Macmillan conceded that he was 'prepared to consider a private arrangement ... about the resumption of nuclear tests and the use of Christmas Island'.⁷² In the margins of the meeting, Penney secured an important agreement from Seaborg: there would be no surface bursts in the proposed US test series, reducing dramatically the risk of contamination.⁷³

⁶⁷Zuckerman to Watkinson by signal, 6 Dec. 1961, and by letter, 10 Dec. 1961; Bob Press (on Zuckerman's staff) to Scott, 9 Dec. 1961, all in TNA, DEFE 19/92; Zuckerman to Macmillan, 15 Dec. 1961, TNA, PREM 11/3782. Penney appears to have drafted the list of criteria, suggesting he was almost as keen as Zuckerman: Penney to Makins, 1 Dec. 1961, AWE archive.

⁶⁸Record of meeting in Government House, Bermuda, 21 Dec. 1961 at 5.15 p.m., TNA, PREM 11/3782 and CAB 21/5557.

⁶⁹Macmillan, *At the end of the day*, p. 146.

⁷⁰Penney to Norman Brook, 21 Nov. 1961, TNA, PREM 11/3246; ND(61)2nd meeting, 21 Nov. 1961, CAB 134/2238. Penney had expressed an interest, months before the actual test, in Khrushchev's boast of a 100-megaton device: Penney to Pelly, 14 Aug. 1961, AWE archive.

⁷¹Anatoly Zak, 'The "K" project: Soviet nuclear tests in space', *Nonproliferation Review*, 13 (2006), pp. 143–50.

⁷²Record of meeting in Government House, Bermuda, 22 Dec. 1961 at 10.30 a.m., TNA, PREM 11/3782 and CAB 21/5557.

⁷³NCCA(61)8, 29 Dec. 1961, TNA, CAB 134/2235.

VI

The British cabinet discussed the matter twice more, on the morning of 3 January 1962 and again in the afternoon, when Penney was invited to explain the proposed US tests and again focused on ABM. British experts, notably Zuckerman, had 'concluded that the chances of effective anti-missile defence were extremely remote. Nevertheless the stakes were so high and the resources available to the Soviet Union and to the United States ... so great that it was impossible entirely to discount the possibility.' This was why the US now proposed several high-altitude tests and tests of missile warheads designed 'conservatively' during the moratorium which, with further testing, might be improved. 'If he had the responsibility of advising President Kennedy,' Penney explained, 'he would feel obliged to recommend that tests should be resumed.'⁷⁴ John Walker's assessment is that 'Penney's intervention had ... been decisive' and Macmillan was certainly impressed: 'Sir William Penney came to cabinet and in a quarter of an hour gave a simple, but brilliant exposition of the problem.'⁷⁵ It still seems most unlikely, however, that the technical issue of ABM defence was the deciding factor for ministers. A little later in 1962, following a report by Penney's near-namesake Bill Penley, director of the Royal Radar Establishment at Malvern, Britain essentially abandoned its own research on ABM radars and missiles, a decision taken without a hint of an objection from Penney, AWRE, or any politician.⁷⁶ Zuckerman discovered that Penney had briefed the cabinet, and took him to task privately on 17 January, but Penney fell back on a political argument, not on the need for ABM research: the Soviets would respect a 'strong arm'.⁷⁷

It is interesting that, once again, Brook had invited Penney and not Zuckerman to speak. Scientists' access to politicians, although close, was mediated in the UK by senior civil servants, whose skill was to organize timely and politically suitable advice. Penney was asked, not for his views on nuclear testing in general, but for a specific, factual account of the proposed US tests. Zuckerman, for one, concluded correctly that Macmillan's decision to support Kennedy was political and not technical: as he later recalled Macmillan's telling him, 'There are reasons which make it impossible for me to say "no" to the President.'⁷⁸

And yet Macmillan was also reluctant, even now, to give a plain 'yes'. Instead, over the new year, he wrote a philosophical, nine-page letter to Kennedy:

If we do what we are now contemplating, we shall be entering upon a new phase in this endless struggle, with all that this implies ... humanity is setting out on a path at once so fantastic and so retrograde, so sophisticated and so barbarous, as to be almost incredible.⁷⁹

⁷⁴C(62)1, 1 Jan. 1962, TNA, CAB 129/108; CC(62)2nd, 3 Jan. 1962, CAB 128/36.

⁷⁵Walker, *British nuclear weapons and the test ban, 1954–1973*, p. 215; Macmillan, *At the end of the day*, p. 152. The cabinet secretary's notebook does suggest that one previously unsupportive minister, the leader of the house, Iain Macleod, claimed to have been convinced by Penney's briefing: CC(62)2nd, 3 Jan. 1962, CAB 195/20.

⁷⁶Moore, *Nuclear illusion, nuclear reality*, pp. 223–4; Jones, *Official history of the UK deterrent*, 1, pp. 267–9.

⁷⁷Zuckerman's record of the meeting, 17 Jan. 1962, TNA, DEFE 19/115; also Zuckerman to Watkinson, 12 and 18 Jan. 1962, DEFE 7/2287.

⁷⁸Zuckerman, *Monkeys, men and missiles*, p. 320.

⁷⁹Macmillan to Kennedy, 5 Jan. 1962, TNA, PREM 11/3782.

Drafted personally and with time for reflection, the letter is an interesting one, for it surely gives a clearer insight than most diplomatic correspondence into what mattered to the prime minister. Macmillan discoursed over several pages on the arms race and international politics, mentioning Berlin seven times and East Germany twice more. He had fought on the Somme and had contested elections between the wars on disarmament and rearmament, and he expanded on the lessons for the present day: 'I greatly fear the end may be what has nearly always been the end in these armament races – one side or the other, when it thinks it has the moment of superiority, will be tempted to put the issue to the test.' His elegant phrase about sophistication and barbarism was another specific reference to the arms race. For Macmillan, at least, the debate on nuclear testing in 1961–2 was about war and peace, and not the distant prospect of health or environmental damage. Reading the letter, one State Department official asked dismissively: 'Why are we taking so much trouble over this hysterical document?'⁸⁰

A curious and almost comically time-consuming series of practical problems over the use of Christmas Island had meanwhile been resolved. For much of 1961, officials had stalled desperately in correspondence with Philip Ashmole of the Edward Grey Institute of Field Ornithology at Oxford, who wanted permission to spend a year on Christmas with his wife studying the breeding cycle of the sooty tern.⁸¹ Early in 1962, Queen Salote of Tonga had to be found in New Zealand and consulted over the establishment of US test-monitoring facilities.⁸² There was also the matter of a sovereignty dispute over Christmas Island itself. Christmas had been named by the British explorer James Cook in 1777 but had been claimed in 1859 under the somewhat obscure provisions of the US Guano Islands Act. No guano was ever mined on Christmas by any American and so, as far as the British government was concerned, that claim lapsed; in 1888 British sovereignty was asserted.⁸³ A memorandum of understanding on the proposed US tests, formalized by exchange of notes on 16 February 1962, recognized 'the administration of Christmas Island by the [British] Gilbert and Ellice Islands Colony' but made clear that 'nothing in this memorandum will be held to prejudice the question of sovereignty'.⁸⁴

Macmillan linked the use of Christmas Island to disarmament in another Commons statement on 8 February 1962. This was taken as the definitively final go-ahead by General 'Dodd' Starbird, task force commander for the American tests.⁸⁵ Even at the end of March, however, Macmillan was looking for some glimmer

⁸⁰ Arthur Schlesinger, *A thousand days: John F. Kennedy in the White House* (New York, NY, 1965), p. 433.

⁸¹ Correspondence in TNA, DEFE 7/2287.

⁸² NCCA(62)11, 16, 26, and 33, variously 12 Feb.–8 May 1962, TNA, CAB 134/2236; Deputy Prime Minister Tu'i'pelehake's letters to HM consul and Capt. Huntzinger, 28 Mar. 1962, TNA, DO 164/21.

⁸³ Harry Maude, 'Report on the Phoenix and Line Islands with special reference to the question of British sovereignty' (Suva, 1940), available at https://digital.library.adelaide.edu.au/dspace/bitstream/2440/88870/1/Maude_Report%20of%20the%20Phoenix%20and%20Line%20Islands_1940.pdf, accessed 1 June 2026.

⁸⁴ NCCA(62)18, 23 Nov. 1962, TNA, CAB 134/2236.

⁸⁵ HOC debs., 8 Feb. 1962, vol. 653, cols. 626–44. In the absence of explicit UK agreement, Starbird had a plan B to test, not at Christmas, but in the open ocean 300 miles south of Hawaii: NCCA(62)14, 20 Feb. 1962, TNA, CAB 134/2236.

of diplomatic progress to forestall the need for the tests.⁸⁶ He also continued to quibble over specifics, including the proposal to mount full launch-to-target tests of American missiles, and he sent Penney and Zuckerman again to Washington to explore, in vain, the prospects for agreement on underground test verification.⁸⁷

These seemingly endless difficulties must have looked like deliberate time-wasting to American observers, especially as planning for Britain's first underground nuclear test, given the codename Pampas, proceeded without fuss. Maddock led a team which observed the test of a Los Alamos device on 3 December 1961 and made detailed plans for the British test.⁸⁸ AWRE now operated at speed, with extensive support from Los Alamos and local staff in Nevada, where experience of mounting and instrumenting underground tests was accumulating rapidly. The Pampas test, originally planned for 15 March 1962, was even brought forward because of a politically unfortunate clash with new talks in Geneva. It went ahead successfully on 1 March.

VII

As the practical obstacles to a resumption of testing were steadily overcome, AWRE was coincidentally demonstrating, in the Medicine Bow National Forest at Pole Mountain, Wyoming, the equal or greater lengths to which it was prepared to go to support a test ban. Walker's is the only one of the existing histories to consider this important aspect of AWRE's work.⁸⁹

Quite suddenly, in late October 1961, Aldermaston scientists were invited to exercise their seismic detection capabilities by observing a US underground test on 10 December at Carlsbad, New Mexico. AWRE had been looking at sites with suitable geology for a seismic array around 1,000 km from Nevada and one such site, Pole Mountain, was a similar distance from Carlsbad. With winter coming, the site had little else to recommend it, but an advance party set out within days. Seismometers, recording vans, and 65,000 yards of cable were made ready, and the bold assumption was made that everything else would be available locally. To this end, the party carried a letter of credit for \$25,000, a princely sum. Within twenty-four hours the British had engaged a surveyor, a local builder, and a transport firm, the reassuringly named Cowboy Moving and Storage Inc. of Laramie, Wyoming. By 26 November, a recording trailer, generators, and a 'comfort caravan' were set up, and the next day the instrumentation team arrived.

Life on Pole Mountain was difficult:

Temperatures in nearby Laramie (some 1,000 ft lower in altitude) went down to -51° F during early January ... Strong winds and heavy snowfalls with considerable drifting made life extremely difficult ... digging snow, wrestling with

⁸⁶CC(62)25th–28th meetings, Mar.–Apr. 1962, TNA, CAB 128/36.

⁸⁷Walker, *British nuclear weapons and the test ban, 1954–1973*, pp. 226–32; Oliver, *Kennedy, Macmillan and the nuclear test ban debate*, pp. 80–8; Catterall, ed., *Macmillan diaries*, II, pp. 458–9, entry for 24 Mar. 1962; correspondence in TNA, CAB 21/4755.

⁸⁸AWRE Report T9/62, Mar. 1962, and report of AVIS 134, 12 Feb. 1962, AWE archive.

⁸⁹Walker, *British nuclear weapons and the test ban, 1954–1973*, ch. 6.

the truck, trying to keep it from heading down the nearest canyon, and lug-ging heavy things about, even just trudging ... any distance in the snow, [were] peculiarly exhausting in the thin atmosphere ...

Spring brought no respite: 'rodents ... were hungry after their hibernation ... Nothing applicable externally to the [PVC-coated] cables seemed to be effective.' AWRE's stiff upper lip had been tested and its report concluded proudly, but ruefully:

This was the first practical test of the British contention that simple tuned arrays would greatly increase detection capability ... [However] the station was installed against ... expert advice ... and despite ... five months of continuous and successful recording, it should be admitted that this advice was basically sound.⁹⁰

Meanwhile AWRE was also exploring detection of tests in the atmosphere and outer space.⁹¹ Measuring radio-flash (now better known as electro-magnetic pulse) and acoustic signatures and collecting radioactive debris from atmospheric tests were already familiar techniques. From 1960, in addition, French tests in the Sahara were observed using high-frequency backscatter radar at AWRE's Orford Ness site on the Suffolk coast. This work eventually led to a monitoring system manned 24/7 for several years in the later 1960s.⁹² Tests in the higher atmosphere required mostly indirect observations. X-rays from a high-altitude explosion, for example, would affect the ionosphere, causing fluorescence at visible frequencies and disturbances detectable over intercontinental distances through phase changes in very low frequency (VLF) radio. Geomagnetic disturbances would propagate after nuclear tests, even underground, although these 'earth current' or 'telluric' effects were very poorly understood and detection and identification were seen as long-term questions. These were intriguing problems in IT and electronics as well as geophysics: data needed processing to reduce volumes and distinguish events of possible interest from natural phenomena. Setting up a reliable monitoring system meant additional, organizational challenges. Test-detection work was discussed at meetings, starting in September 1960, of a working group of AWRE and its US counterparts, chaired jointly by Maddock and Carlton Beyer of the Defense Department's Advanced Research Projects Agency.⁹³ This was not a low-priority, second-class concern: by 1963 over forty professional scientists were employed at AWRE on detection of atmospheric, high-altitude, and outer-space nuclear tests, and another thirty on seismology. One of Penney's complaints for many years had been that recruiting talented scientists was difficult and that the ability to publish work openly would increase motivation. This may help to explain why work on test-ban verification

⁹⁰AWRE Report T9/63, 'Report on the construction and operation of the Pole Mountain seismic array, November 1961 to January 1963', TNA, ES 5/328.

⁹¹Ieuan Maddock, 'Detection of nuclear explosions in space and underground', *Journal of the British Institution of Radio Engineers* (June 1962), pp. 415–27.

⁹²See the accounts and reconstructions on the Independent Research Group on Orford Ness (IRGON) website, www.irgon.org, accessed 1 June 2026. France had not joined the test moratorium.

⁹³Papers of the joint working group on nuclear test detection, TNA, ES 16/47–53.

was approached with such energy and enthusiasm.⁹⁴ AWRE's spirit of inquiry was underlined in a letter to Maddock from one of his staff: 'Our early knowledge stated that it looked impossible. To me this is the very reason why we should tackle it.'⁹⁵

VIII

At Christmas Island, the US atmospheric test series, codenamed Dominic, finally began on 25 April and ended on 11 July 1962. Further tests followed in the high atmosphere over Johnston Island. British participation included radio-flash measurements on Christmas, Fanning, Palmyra, and Penhryn; optical measurements on Christmas and Fanning; observations on Christmas and Hawaii of electrical and magnetic field, air fluorescence, and VLF radio effects of the Johnston Island tests; thermal measurements on Johnston itself; and debris sampling. Palmyra, Hawaii, and Johnston were US territory, and British observations were supported by the US in many practical ways. About thirty British scientific and headquarters staff were involved.⁹⁶

These US tests were of great interest to AWRE not simply because of the warheads being tested but for test detection and test-ban verification purposes. In a published article in 1963, AWRE's Stan Abercrombie detailed three of the techniques described above – air fluorescence, VLF radio, and earth currents – with specific reference to the Johnston Island tests.⁹⁷ For Maddock, successful observations unlocked the possibility of a comprehensive worldwide network of test-monitoring stations, proposals for which he put forward in 1964. The high-altitude tests had confirmed that 'a very effective detection system can be produced by ground-based instruments', and Maddock suggested a cost of £1 million to set up the network, and 180 people and £1.25 million a year to run it, taking care to include a significant ongoing basic research programme at AWRE.⁹⁸

On 10 June 1963, Kennedy made his 'peace speech' at the American University in Washington, announcing a unilateral commitment to end atmospheric testing, and the PTBT was agreed in Moscow on 25 July, outlawing tests in the atmosphere, under water, and in outer space.⁹⁹ The treaty did not provide for an international monitoring system but Maddock's proposed UK network was agreed by ministers in July 1965 and set up in partnership with the US; it was a forerunner of the network now run by the Comprehensive Test Ban Treaty Organization. There was no question of any future British atmospheric test, although British underground testing in

⁹⁴'Manpower utilisation 1st April 1963–22nd June 1963', AWE archive. For Penney's recruitment issue, see Geoffrey Chapman, 'Knowledge management and institutional development within the British nuclear weapons programme, 1947–1993' (PhD thesis, King's College London, 2020), *passim*.

⁹⁵Stan Abercrombie to Ieuan Maddock, 8 Nov. 1961, AWE archive.

⁹⁶Operation Brigadoon plan, Apr. 1962, AWE archive.

⁹⁷Stan Abercrombie, 'Ground-based detection of atomic weapons', *IEEE Transactions in Nuclear Science*, 10 (1963), pp. 254–72.

⁹⁸'Detection of nuclear explosions in space and underground: a technical appraisal of the UK programme', AWRE Applied Physics Department Note (APDN) S/27, Mar. 1964; also 'Detection of nuclear explosions in space and underground: proposed UK detection system', APDN S/29, Dec. 1964, AWE archive.

⁹⁹John F. Kennedy, 'American University commencement address', 10 June 1963, JFK Library, www.jfklibrary.org/learn/about-jfk/historic-speeches/american-university-commencement-address, accessed 1 June 2026.

Nevada continued until 1991, when, paradoxically, following the end of the cold war and a huge relaxation of international tension, there was a good deal more pressure from within government to continue testing than during the period covered here.¹⁰⁰

IX

It is clear that the British government was reluctant in 1961–2 to resume nuclear testing and instead ‘strove mightily for a test ban’.¹⁰¹ There was no strong lobbying for tests from scientists or from the military within the British government. AWRE’s proposal for a single underground test was put forward in response to prompting from above, not from below, and the most influential government scientists on the issue, Penney and Zuckerman, were enthusiasts for a ban. Detailed analysis of Zuckerman’s observations at the time suggests that his later ‘thesis’ of pressure from atomic scientists was based narrowly on his conversations in the US and specifically at Livermore, the newer of the nuclear-weapons laboratories.

The debate among and between scientists and politicians in Britain was understated, informal, and mediated by senior civil servants, who called upon individual advisers to provide verbal briefings behind the scenes. Government scientists did not debate nuclear testing before parliamentarians or the press, as their US counterparts often did. Although scientific advice was ultimately subordinated to politics, the prestige of science within the British government remained high. Penney and Zuckerman both later became peers, and Zuckerman remained an active government arms-control adviser into the 1980s.

It was convenient to express the need for testing, as Penney and his briefings allowed Kennedy, Macmillan, and the British cabinet to do, as a technical need, relating specifically to the ABM problem. Neither politicians nor scientists, however, were committed to ABM, British work on which essentially stopped at precisely the time testing resumed. The military were far more interested in conventional defence, and during 1962 almost all of the nuclear-weapons requirements that had driven the British programme at the start of the moratorium were dropped.¹⁰² Instead, the need for testing was fundamentally political. For the Soviet leader, Nikita Khrushchev, testing underlined a point about Berlin. For Kennedy, it was a way to stand up to the Soviet Union. For Macmillan, it was a practical way to express friendship and support for the US president. The reason repeatedly given for Britain’s ending the moratorium – at political, military, and scientific levels – was to show solidarity with the US. Even then, as we have seen, there was considerable foot-dragging. An eventual end to testing was the real ‘great prize’ for Macmillan, and even for the scientists at AWRE who championed work on detection and verification, a neglected part of the nuclear-testing story.

We have also seen that the cold-war arms race was Macmillan’s key motivation in pursuing this prize. The Edwardian battleship-building race and the competitive rearmament of the late 1930s had led to war, and it was imperative that the nuclear

¹⁰⁰Some of the later history of the debate is explored by John Walker, *British nuclear weapons and the test ban: squaring the circle of defence and arms control, 1974–1982* (London, 2023); also papers in TNA, PREM 19/4054, DEFE 25/1015, and CAB 148/362.

¹⁰¹Walker, *British nuclear weapons and the test ban, 1954–1973*, p. 166.

¹⁰²Moore, *Nuclear illusion, nuclear reality*, ch. 4.

arms race should not. For Zuckerman, too, the ‘whole purpose’ of a test ban had been ‘to help to stop the arms race’.¹⁰³ Zuckerman’s memoirs, like Macmillan’s nine-page letter of January 1962 discussed above, barely touch on the question of fallout. If health and the environment had been the main concern, agreement to end testing in the atmosphere – an idea current as early as 1957 – would surely have come sooner, and there would have been no disappointment at the ‘partial’ nature of the PTBT.

One reason why today’s histories downplay the significance of the arms race to the nuclear-testing story is the waning over time of cold-war nuclear fear; another is an excess of hindsight and an urge to look for beginnings, rather than endings. Today’s historians see the resumption of nuclear testing in terms of fallout, the dissent and protest it inspired, the difficulties faced by ‘experts’ in controlling the production of knowledge, and the health and environmental crises that are our twenty-first-century Armageddons. In so doing, they neglect the issues that worried politicians and scientists most at the time: Berlin, the arms race, the ruinous wars of the twentieth century, the movement for general and complete disarmament they inspired, and the fear, especially in 1961, the year of Yuri Gagarin, that the arms race would spiral into space and out of control. We cannot escape using the past to explain the present, but in seeking to understand the action of history we must remind ourselves that the players were more aware of their past than their future. The resumption of testing was first and foremost a scene from the drama of cold-war international politics, not the prologue to any later performance.

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¹⁰³Zuckerman, *Monkeys, men and missiles*, p. 340.