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Turchetti, Simone (2003) Atomic secrets and governmental lies : nuclear science, politics and security in the Pontecorvo case. British Journal for the History of Science, 36 (4). pp. 389-415. ISSN 1474-001X

https://doi.org/10.1017/S0007087403005120

BJHS **36**(4): 389–415, December 2003.
DOI: 10.1017/S0007087403005120

Atomic secrets and governmental lies: nuclear science, politics and security in the Pontecorvo case†

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Abstract. This paper focuses on the defection of nuclear physicist Bruno Pontecorvo from Britain to the USSR in 1950 in an attempt to understand how government and intelligence services assess threats deriving from the unwanted spread of secret scientific information. It questions whether contingent agendas play a role in these assessments, as new evidence suggests that this is exactly what happened in the Pontecorvo case. British diplomatic personnel involved in negotiations with their US counterparts considered playing down the case. Meanwhile, the press decided to play it up, claiming that Pontecorvo was an atom spy. Finally, the British secret services had evidence showing that this was a fabrication, but they did not disclose it. If all these manipulations served various purposes, then they certainly were not aimed at assessing if there was a threat and what this threat really was.

Mr. George Strauss, Minister of Supply, stated in the House of Commons yesterday that he had no information about the present whereabouts of Professor Bruno Pontecorvo, the atomic scientist, apart from what had appeared in the press. Questioned about the professor's 'loyalty', he said: 'We would like to wait for a few days.' He could not say that the professor had not been able to gather valuable information, but for some time he had had only 'limited' access to secrets.

The Manchester Guardian, 24 October 1950

Since the beginning of the nuclear age the fear that nuclear knowledge may fall into the wrong hands has run in parallel with the development of nuclear science. Those states, like Britain, that possess atomic knowledge feel obliged to control it in order to prevent nations eager to harness weapons of mass destruction (WMD) from doing so. During the Cold War and after, government agencies have regularly investigated whether atomic secrets crossed Britain's borders to reach 'enemy' countries. Praising the work of intelligence agencies, governments have often claimed that evidence on possible threats is quickly gathered and used to make precise assessments on risks deriving from

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the spread of nuclear information.[1] Those assessments are very important tools not only in the resolution of international controversies, but also in the establishment of atomic security in Britain, where activities carried out in universities and research centres are monitored and regulated by laws.[2]

Many issues related to nuclear science and technology are not as easy to assess as one may believe. In recent years, historians and sociologists of science have pointed out that in nuclear physics similar means can be used for peaceful purposes or to harness WMD. Nuclear science and technology is multifaceted in several ways. First, the nuclear materials can be used as fuel in nuclear reactors to produce energy or in nuclear devices as an explosive.[3] Second, instrumentation for the measurement of radioactivity has a variety of applications within pure and applied nuclear research.[4] Finally, nuclear experts know how to shift nuclear knowledge from the domain of pure research or energy research to weapons research. Their tacit knowledge plays a crucial role in this transfer.[5] So the multifaceted character of nuclear science and technology may represent an obstacle to assessments put forward. Moreover, it is disputable whether government and intelligence agencies make their assessments solely with reference to gathered scientific evidence, as political or diplomatic agendas may drive their actions. Thus defining what represents a threat in relation to atomic issues may be negotiated within the 'corridors of power' before becoming a subject of public discussion.

These issues, which are certainly at the heart of contemporary British home and foreign policy, also have a historical resonance with the well-known 'atom spy cases' of the 1950s. In the post-war years, the fear that the Soviet Union was harnessing WMD prompted intelligence work. The investigations led to the discovery that the Soviet Union had used Western scientists to gain access to atomic secrets. In 1946 this led to the incrimination of British physicist Allan Nunn May. In January 1950 further investigation led to the arrest of German émigré physicist Klaus Fuchs. In July 1950 American chemist Harry Gold and army sergeant David Greenglass confessed their

1 For example the recent 'Iraq's WMD. The assessment of the British Government', 24–7, at www.pm.gov.uk, accessed 10 October 2002. This essay was written before the conflict in Iraq, thus it does not take into account later criticism of the assessment of the British government put forward by MPs, media or other academics.

2 The Export Control Bill (2002) gives the government the power to veto the transfer of ideas abroad, license foreign researchers working in Britain and stop the publication of research findings. This was approved following the Scott report on the 1996 Iraq arms scandal that considered British security measures over science too lax. P. Curtis, 'Export Bill changes secure academic freedom', *The Guardian*, 23 July 2002.

3 M. Walker, 'Legends surrounding the German atomic bomb', in *Science, Medicine and Cultural Imperialism* (ed. T. Meade and M. Walker), London, 1991, 181. In nuclear technology, raw materials such as uranium (U^{238}) and thorium (Th^{232}) are used in the production of fissile materials. U^{238} is used to produce enriched uranium (U^{235}) or plutonium (Pu^{239}), while thorium is used to produce another fissile isotope of uranium (U^{233}). The fissile materials U^{235} and Pu^{239} can be used (and have been used in the past) as fuels in nuclear reactors or explosives in nuclear weapons. See I. Ursu, *Physics and Technology of Nuclear Materials*, Oxford, 1985, Chapter 3.

4 For example, Peter Galison argues that in the post-war years 'instruments like [the counters] were among the bonds connecting weapons work with post-war basic research'. P. Galison, *Image & Logic: A Material Culture of Microphysics*, Chicago, 1997, 296.

5 D. MacKenzie and G. Spinardi, 'Tacit knowledge and the uninvention of nuclear weapons', *American Journal of Sociology* (1995), **101**, 44–99.

espionage activity in the US. This led to the indictment of Ethel and Julius Rosenberg, both condemned to death and executed. On the whole, the witch-hunts prompted accusations of scientific treachery, while the cases were used to foster anti-communist propaganda.[6]

Ironically, this was not the case for Bruno Pontecorvo, whose probable defection to the USSR was announced on 21 October 1950. British newspapers reported that Pontecorvo had mysteriously disappeared in Finland while returning to Britain from a holiday resort in the Mediterranean. Born in Italy but now having British citizenship, Pontecorvo was a scientist at the UK's Atomic Energy Research Establishment (AERE) based in Harwell (Berkshire). A former pupil of Nobel Prize-winner Enrico Fermi, he had previously worked at the Chalk River nuclear research station in Canada as part of the Manhattan Project. Yet the British government's reaction to Pontecorvo's disappearance was extraordinarily understated. In two parliamentary briefings, the Minister of Supply George Strauss claimed that Pontecorvo's contact with secret work was very limited because in recent years he had been mainly involved in cosmic ray research. But was Strauss telling the whole story?

The questions 'what is really secret in the atomic secrets?' and 'how do governments assess the threats deriving from the spread of nuclear information?' are the focus of this paper, which explores Bruno Pontecorvo's career and the episode of his defection to the USSR. Exploiting archival material recently made available to the public, I reconsider these issues in the light of the Pontecorvo case.[7] The episode turns out to be much more interesting than the existing literature suggests. Pontecorvo made crucial contributions to the British nuclear programme. His expertise was used in the design of nuclear piles and the manufacture of instrumentation for the detection of natural radioactive deposits. Both these research areas were considered secret because the success of any nuclear weapons programme depended upon harnessing natural uranium and transforming it into fissile material within nuclear piles.

Following Pontecorvo's defection, the Deputy Director of the UK Atomic Energy Department, Michael Perrin, assessed the case on behalf of the British government. He was advised to minimize its impact in relation to negotiations on nuclear matters between Britain, Canada and the US. Thus he claimed that Pontecorvo had had very limited access to secret research.[8] By contrast, Pontecorvo was depicted as an atom spy by the press. The British security service MI5 knew that the allegation was not supported by evidence, but in view of agreements with the FBI, the British intelligence

6 On Klaus Fuchs see R. C. Williams, *Klaus Fuchs: Atom Spy*, Cambridge, MA, 1987. On the Rosenbergs see M. Garber and R. L. Walkowitz (eds.), *Secret Agents: The Rosenberg Case, McCarthysm, and Fifties America*, New York, 1995.

7 These include 1. Pontecorvo's scientific reports in the AB series at the Public Records Office (PRO), London; 2. Diplomatic correspondence on the *Pontecorvo Case* in the series FO, CAB, at the PRO; 3. B. Pontecorvo and J. Chadwick correspondence in the collections PNVO and CHAD at Churchill College Archive, Cambridge.

8 If Perrin's action was due to a contingent agenda, it was also shaped in the context of a 'culture of secrecy'. As shown by historian David Vincent, this culture was a very important aspect of British policy in the post-war years. D. Vincent, *The Culture of Secrecy: Britain, 1832–1998*, Oxford, 1998, 186–247.

agency did not dismiss the claim.[9] In turn the media campaign that followed Pontecorvo's defection promoted the reformation of atomic security and fostered the introduction of tighter measures of control at government laboratories, including the infamous 'positive vetting'. The construction of Pontecorvo's image as an 'atom spy' therefore served various political, security and media agendas.

In the last fifty years, public opinion and the 'received' version of events have been shaped by accounts manipulated both by diplomatic and intelligence agencies. The 'gap' between what the public knew about Pontecorvo and what was known by just a few has led also to two contradictory historical accounts – one claiming that Pontecorvo never passed relevant atomic secrets to the Soviets,[10] the other claiming that Pontecorvo was an atom spy.[11] Historians have not so far challenged the emergence of this contradiction. And the existence of disciplinary boundaries between history of science and diplomatic history has tended to thwart attempts to understand the Pontecorvo case in terms of construction of scientific knowledge in the context of national politics and the agenda of government agencies. In this paper I cross these boundaries and seek to resolve this contradiction.

The Pontecorvo case offers important lessons to historians of science and policy-makers.[12] It demonstrates that in nuclear physics, the notion of atomic secrecy did not always correspond to the practice of scientists, in which similar principles and instrumentation were used in both secret and open research. It also demonstrates that during the nuclear age secret national political agendas were prioritized in respect to the actual intelligence gathered about the spread of nuclear information. And it questions whether, entering a new age in which international controversies and security policies require similar assessments, these covert agendas should continue to play a major role.

An Italian Jew making physics 'on the move'

The Italian-born nuclear physicist Bruno Pontecorvo was known by many as a flamboyant character who liked travelling more than anything else. By 1950 he and his Swedish wife had three children and an equal number of passports (including Canadian and British). In 1936 the young *Cucciolo* Pontecorvo left the Institute of Physics in

9 These details are in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837 and 'Disappearance of Dr. Bruno Pontecorvo in Finland', FO 371/86437. The Foreign and Commonwealth Office (FCO) originally retained those files under Section 3(4) of the Public Records Act (1958). In March 2002 I asked the FCO Records Manager to review the files to establish whether the secrecy conditions still applied. In May 2002 the papers were released.

10 M. Mafai, *Il Lungo Freddo. Storia di Bruno Pontecorvo, lo scienziato che scelse l'URSS*, Milan, 1992; S. M. Bilenky, T. D. Blokhintseva, I. G. Pokrovskaya and M. G. Sapozhnikov (eds.), *B. Pontecorvo Selected Scientific Works*, Bologna, 1997.

11 C. Pincher, *Too Secret Too Long*, London, 1984; H. Montgomery Hyde, *The Atom Bomb Spies*, London, 1980; J. Costello, *Mask of Treachery*, London, 1988.

12 A similar criticism on consolidated historical accounts and their limits is in L. Scott and S. Smith, 'Lessons of October: historians, political scientists, policy-makers and the Cuban Missile Crisis', *International Affairs* (1994), **70**, 659–84.

Rome to conduct research in the Laboratoire de chimie nucléaire in Paris.[13] The research position at the French institute was supposed to be temporary and it was initially funded through the Italian Ministry of National Education. But in 1938 the promulgation of the racial laws in Italy forced Pontecorvo, as an academic of Jewish origins, to make the leave permanent to avoid returning to Italy.[14] However, Pontecorvo could not settle in Paris because in 1940 the invasion of France by German troops forced him to flee to the USA. Before 1940 Pontecorvo's travels had been forced mainly by contingencies, but from that year onwards they continued for research reasons (conferences and visits to research laboratories) and personal pleasure. Between 1941 and 1943 he worked for Wells Surveys in Oklahoma, travelling frequently to Chicago and New York. In 1943 Pontecorvo settled in Canada and became a member of the British mission involved in the Anglo-Canadian project to harness nuclear energy. But he continued travelling to major US cities and to Europe, visiting England and Italy. From 1949 Pontecorvo worked at the AERE based in Harwell. Though he always kept his position within the British nuclear programme, from 1943 to 1950 he was tempted to leave many times following offers of positions by several universities in America and Europe.[15] Pontecorvo's life up to 1950 was characterized by many travels, uncertainty with respect to the future and resistance to settling in a permanent position either in a university or in a national laboratory.

It is sensible to assume that this way of living influenced Pontecorvo's nuclear research. Considered by science historians as a pioneer of neutrino physics, an experienced cosmic ray researcher and a master of particle physics, he had a far wider range of interests. If moving from place to place is a way of interpreting his life, shifting constantly from the domain of 'knowing new particles' to that of 'using them in practice' is a way of interpreting his physics. This included solving applied problems with the experimental practices of particle physics and gaining new knowledge in particle physics with instrumentation devised for applied problems. Very often Pontecorvo's study of new nuclear phenomena was followed by expectations over their possible application.[16] This 'flexibility' in the use of techniques for the study of nuclear physics

13 *Cucciolo*, meaning 'puppy', was Pontecorvo's nickname among Fermi's group. G. Holton, 'Fermi's group and the recapture of Italy's place in physics', in *The Scientific Imagination* (ed. G. Holton), New York, 1978, 155–98.

14 On the Fascist racial laws in Italy and their impact on the national academic community see G. Israel and P. Nastasi, *Scienza e Razza nell'Italia Fascista*, Bologna, 1998. The racial laws allowed Pontecorvo to go back to Italy, but they forced him to renounce further employment in Italian universities. Between 1937 and 1940 Pontecorvo's research was funded through the French National Research Council (CNRS) and the Carnegie Foundation ('University Documents', PNVO 1/2).

15 Pontecorvo was offered a position by the Universities of Michigan, Rochester and California and by General Electric in 1946; by Cornell University in 1947; and by the Universities of Rome, Pisa and Cagliari between 1948 and 1950.

16 For example, in 1940 the recent research conducted by French physicist André Lazard and Pontecorvo on 'atomic phosphorescence' prompted expectations of possible applications in medicine. Interviewed by the French newspaper *L'Oeuvre*, Pontecorvo claimed that his research would have had a major impact in medicine, as ionizing radiation was going to have beneficial effects on organisms ('Ici, l'on fabrique des atomes!,' *L'Oeuvre*, 6 April 1939, copy in 'Assorted Papers', PNVO 4/2). In 1949, Pontecorvo's research on mesons had prompted expectation of their possible use as 'atom-busting' rays. Pontecorvo was hopeful that he would be

raises the question of Pontecorvo and his relation with secret research. At the time of his defection (and still many years later), it was claimed that Pontecorvo, being mainly interested in cosmic ray research and particle physics, had limited access to secret research. But I want to show that it was exactly Pontecorvo's expertise in these research areas that led him into secret research. In order to do so, I reconsider here two major aspects of Pontecorvo's research: the manufacture of instrumentation for geophysical prospecting and pile physics.

In 1941 Pontecorvo was employed by the Wells Surveys research laboratory in Tulsa thanks to Emilio Segrè, one of his former colleagues at the Physics Institute in Rome. In May 1940 Segrè, who had been doing research at the Radiation Laboratory of Berkeley since 1938, turned down the proposal for a job at Wells Surveys. He eventually recommended Pontecorvo to Wells Surveys engineer Serge Scherbatskoy, who helped the Italian physicist to find a place in the company.[17] Wells Surveys was a company mainly involved in well-logging in relation to oil surveys, but it was expanding quickly into the development of instrumentation to locate radioactive deposits. As a Wells Surveys researcher, Pontecorvo filed four patent applications for geophysical prospecting instrumentation.[18] Three of the detectors that he designed were based on the technique of radioactive well-logging. This consists of irradiating geological strata with a neutron source to produce a return radiation, which is detected electrically and plotted. The log so obtained shows the well characteristics (such as, for example, its depth).[19] The fourth detector was not designed for well-logging, but to detect radioactive deposits. Pontecorvo used the 'coincidence technique' to distinguish between ores of the uranium family and those of the thorium family (Figure 1).[20] This technique was developed in the early 1930s in the context of cosmic ray research and greatly enhanced by the Italian physicist Bruno Rossi with the coincidence-counting circuit.[21] Pontecorvo

able to set up a 'meson-ray production plant' ('University of British Columbia lecturer probing new atom-busting ray', undated press cutting from a Canadian newspaper in 'Scientific Correspondence', PNVO 4/1/1).

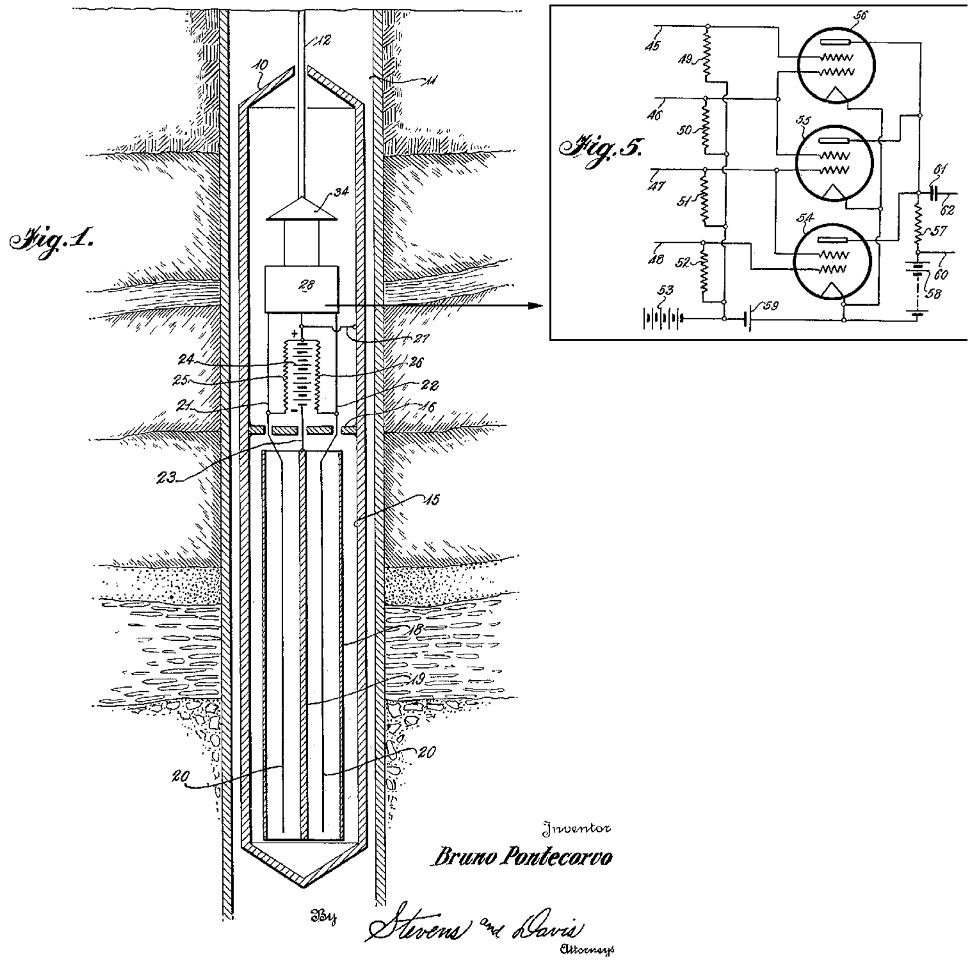
17 E. Segrè, *A Mind always in Motion*, Berkeley, 1993, 159–60.

18 Using radioactivity in prospecting was a significant innovation. Between 1920 and 1940 this was carried out using electricity, magnetism and seismography in surface and subsurface techniques. Radioactive prospecting derived from the electrical subsurface method consisting of introducing cables in the well and plotting the difference in potential between the surface and the geological strata. A historical study of this method (and others) is in G. C. Bowker, *Science on the Run: Information Management and Industrial Geophysics at Schlumberger, 1920–1940*, Cambridge, MA, 1994.

19 B. Pontecorvo and G. Swift, 'Geophysical prospecting', P.N. US 2353619, 11 July 1944 (filed 18 September 1941); *idem*, 'Method of geophysical prospecting', P.N. US 2508772, 23 May 1950 (filed 31 October 1942); *idem*, 'Well surveying', P.N. US 2398324, 9 April 1946 (filed 10 August 1943). Also on the same issue see *idem*, 'Neutron well logging: a new geological method based on nuclear physics', *Oil and Gas Journal* (1941), **40**, 32–3.

20 B. Pontecorvo, 'Method and apparatus for geophysical exploration', P.N. US 2349753, 23 May 1950 (filed 31 October 1942). Natural uranium is rarer and more precious than thorium. Within the context of atomic projects, fissile material obtained from uranium was used in weaponry. By contrast the fissile material U^{233}, obtained from thorium, proved to be of lower fissile quality and its use in weaponry was ruled out. I. Ursu, op. cit. (3), 123.

21 The technique consisted of separating Geiger–Müller counters with metallic plates absorbing low-energy particles. The Rossi circuit applied to each counter a valve-condenser-resistor system as switch for the counters. Bruno Rossi, *Cosmic Rays*, New York, 1964, 46–53.



Figures 1A and B. The geophysical prospecting detector with the Rossi circuit. From Bruno Pontecorvo, 'Method and apparatus for geophysical prospecting', P.N. US 2349753.

shifted the technique from cosmic ray research to geophysical prospecting. Geophysical specimens containing thorium emit radiation in the form of quanta of gamma rays at an energy of about 2.6 million electron volts, while similar specimens containing radium or uranium emit radiation of the same type but at an energy of about 2.2 million electron volts. A detector provided with a coincidence apparatus can distinguish different radioactive elements in the ores by detecting the degree of penetration of their radiation. This application of the coincidence technique indicates the 'proximity' between two research areas that would eventually be classified very differently in atomic security regulation. Cosmic ray research was open research, while geophysical prospecting would become secret applied science in relation to the mapping of radioactive deposits.

But Pontecorvo's first contact with secret research was not in direct relation to geophysical prospecting. In 1943 Pontecorvo moved to Canada and participated in the secret Anglo-Canadian project code-named 'Tube Alloys'. This was funded through the British Department for Scientific and Industrial Research (DSIR) and the Canadian National Research Council to explore the potentialities of harnessing nuclear energy. Directed by British physicist John Cockcroft from 1944, the project focused on the design of a heterogeneous nuclear pile deploying enriched uranium and moderated with heavy water.[22] Pontecorvo joined the project and provided vital help on several issues related to the design of the Nuclear Reactor X (NRX). According to official historian Margaret Gowing, the DSIR secretary Edward Appleton was initially against Pontecorvo's employment:

> When it was urged that the brilliant physicist Pontecorvo should be engaged for the British section of the team, the secretary of DSIR protested. He did not want to add to the number of non-British nationals, but he was pressed hard in view of Pontecorvo's reputation and the shortage of physicists.[23]

This decision was certainly fruitful for the nuclear programme. At first, the NRX project employed mathematical calculations on lattice dimensions (the exponential experiment). Eventually, other engineering problems such as 'experimental features, hazards, suitability of materials, and necessity for cooling' were analysed.[24] The calculations on the lattice dimension depended upon experimental data on the behaviour of neutrons in the pile. In order to obtain these data, Pontecorvo was sent to the Argonne Laboratory, just outside Chicago, where Fermi and his co-workers were running the CP-2 pile.[25] Back in Canada, Pontecorvo also made studies on the properties of fissile nuclear materials, their products in nuclear reactions and finally their interaction in the pile.[26] He contributed also to the analysis of materials used in the pile shielding.[27] His role in the context of NRX planning and research was indeed of great importance.

But when Pontecorvo moved to Canada in 1943 he also continued working on geophysical prospecting. In September 1944 he met with his former Wells Surveys colleague Serge Scherbatskoy to carry out some fieldwork. They explored an area within the Northwest Territories of Canada and a secret report was sent to Cockcroft on

22 Heterogeneous means using a solid fuel and a liquid moderator. On the Anglo-Canadian project, see M. Gowing, *Britain and Atomic Energy 1939–1945*, London, 1964. On its contribution to the post-war Canadian nuclear programme, see R. Bothwell, *Nucleus: The History of Atomic Energy of Canada Limited,* Toronto, 1988; D. G. Hurst, 'Overview of nuclear research and development', in *Canada Enters the Nuclear Age* (ed. D. G. Hurst), Montreal and Kingston, 1997, 1–32.

23 M. Gowing, op. cit. (22), 191. The Czech physicist George Placzek and his French colleague Pierre Auger, both already in the Tube Alloys project, were influential in Pontecorvo's employment. M. Mafai, op. cit. (10), 125.

24 J. Dunworth to H. Skinner, 26 April 1946, in 'Harwell pile discussion group, 1946,' AB 12/19.

25 B. Pontecorvo, 'Some information on physical data obtained on a recent trip to Chicago (Blue Print)', 24 June 1944, AB 2/643. CP-2 stands for Chicago Pile 2. Pontecorvo had visited Chicago already in the summer of 1942, when the project on Fermi's first pile, CP-1, had just started.

26 For example, the experimental study of fission properties of by-products of nuclear reactions. B. Pontecorvo and D. West, 'The fission properties of radium 226 and protactinium 233', 1 December 1945, AB 2/318.

27 B. Pontecorvo, 'Some data useful in shielding problems', 8 August 1944, AB 2/655 and *idem*, 'The side shield of the polymer plant', 8 August 1944, AB 2/656.

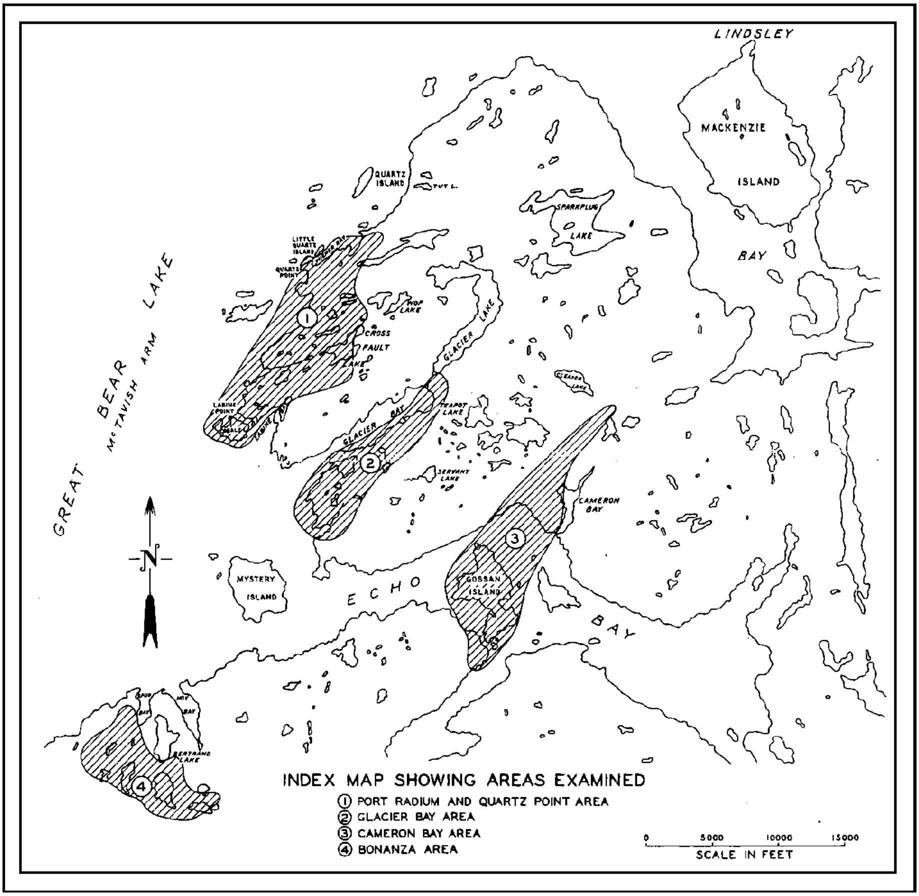


Figure 2. Map showing areas with uranium deposits in the Northwest Territories. From B. Pontecorvo, 'Report on trip to Port Radium (secret)', AB 1/648.

the radioactive deposits found there (Figure 2).[28] In October a meeting was held in Washington by the US Army as part of the Manhattan Project in order to compare different instruments for geophysical prospecting manufactured by British, Canadian and American scientists. Pontecorvo attended the meeting on behalf of the British group and learned about detectors of several kinds. The meeting's chairman, US Army Colonel Paul Guarin, stressed that all the research on prospecting instrumentation ought to be considered secret.[29] In view of prospecting high-grade ores, Pontecorvo suggested to Cockcroft that a combined effort joining aerial surveys with large ionization chambers and land surveys with portable counters would represent a better way to carry out

28 B. Pontecorvo, 'Report on trip to Port Radium, September 1944 (secret)', AB 1/648.

29 It was also argued that Wells Surveys produced the most innovative instrumentation. Appendix 1, 'Dr Pontecorvo's notes', 31 October 1944, in F. H. Burstall, H. Carmichael, A. H. Gillieson and J. Hardwick, 'Report on a technical conference on prospecting problems held in Washington, 24–26 January 1946', AB 2/67.

uranium prospecting.[30] Pontecorvo's participation in vital aspects of the Manhattan Project in the context of allied war research programmes demonstrates that he was considered a valuable and trusted expert by senior members of the British and American nuclear establishment. Indeed, he had a role of paramount importance in the production and exchange of information on nuclear knowledge and techniques for the detection of uranium deposits and the production of fissile material in view of their military use.[31]

The bombing of Hiroshima and Nagasaki marked the accomplishment of war research in nuclear physics, but it also signalled the beginning of national projects aimed at exploiting nuclear energy for military purposes. According to plans for the post-war British nuclear programme, Pontecorvo was intended as the pile physics expert of a new nuclear establishment based at Harwell in Britain.[32] Just before Christmas 1945, Pontecorvo was offered a position as Principal Scientific Officer (PSO).[33] But Pontecorvo did not accept the offer immediately. He was tempted to leave the British mission because the physicist James Chadwick, who directed British nuclear policy from Washington, DC, prohibited him from travelling to Europe. Pontecorvo wanted to visit his parents in Italy, but in this period investigations about spying activity on atomic matters in Canada had started following the defection of Lieutenant Igor Gouzenko from the Soviet Embassy in Ottawa.[34] In February 1946 Pontecorvo met Chadwick and stressed that if allowed to travel he would accept the British offer, otherwise he was ready to leave for a position in an American university or a private laboratory. Following the end of investigations on the Soviet spy-ring and the public disclosure of the case,[35] Chadwick raised no objections and Pontecorvo left Canada for Europe.[36]

But coming back from Europe, things changed once again. Pontecorvo wanted to stay in Canada to complete the NRX project, now running at full speed in the newly

30 B. Pontecorvo, 'Notes on prospecting for radioactive materials', 2 April 1945, AB 2/671.

31 Pontecorvo also possessed safe conducts to travel between different sites of the Manhattan Project in the US and Canada. 'In carrying out his official duties he has occasion to travel from one country to the other on official business and to carry with him confidential documents.' Office of the High Commissioner for the UK to Whom it May Concern, 12.2.1943 in 'Official letters', PNVO 1/5.

32 'Notes of meeting held on 13 February, 1945 to discuss increments and promotion of U.K. staff' in 'Staff recruiting', AB 6/171.

33 A. Sumner to B. Pontecorvo, 18 December 1945, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

34 In August 1945 Chadwick wrote to Cockcroft that 'it would be most indiscreet to allow Pontecorvo to visit Italy in the near future and he cannot be allowed to go until matters are much clearer than they are now. … It will take three or four months'. J. Chadwick to J. Cockcroft, 20 August 1945, 'Work in North America, Canadian Project', CHAD IV, 28.

35 The discovery of the Canadian spy-ring led to the arrest of physicist Alan Nunn May and further secret investigation of German émigré physicist Klaus Fuchs. On the Gouzenko case see A. Moorehead, *The Traitors: The Double Life of Fuchs, Pontecorvo and Nunn May*, London, 1952, 5–18; R. Aldrich, *The Hidden Hand: Britain, America and Cold War Secret Intelligence*, London, 2001, 103–9.

36 The Manhattan project director Leslie Groves was also informed about Pontecorvo's travel to Europe: 'Later on he will be employed by the British Government in the new Establishment. He will probably take steps to acquire British citizenship.' J. Chadwick to L. Groves, 10 April 1946, 'Work in North America, Canadian project', CHAD IV, 28.

built atomic research establishment of Chalk River. Cockcroft accepted this decision. On the other hand, he was aware that the NRX project was a crucial source of information for the British nuclear programme. Thus, to establish an effective mechanism to exchange information between the group working in Canada and those working on the new British Experimental Pile O (BEPO) at Harwell, he promoted the constitution of a 'Production Pile Discussion Group'. This acted 'as an advisory body of the UK design group and as committee for answering technical queries sent from the UK'.[37] Pontecorvo was a prominent member of the group, advising Harwell scientists on technical matters and providing solutions to important problems of design.

If pile physics and geophysical prospecting had kept the Italian scientist busy during the war, the post-war period was characterized by an intensification of pure research in particle physics. In 1946 Pontecorvo started planning experimental trials for the detection of neutrinos produced by nuclear reactors. Together with Canadian physicists G. C. Hanna and D. H. W. Kirkwood, Pontecorvo developed a new type of proportional counter very sensitive to low-range β-ray energies.[38] This was used to analyse the β-spectrum of tritium and the physical phenomenon known as *L*-capture, in which neutrinos are produced.[39] Moreover, Pontecorvo set up a cosmic ray laboratory in Chalk River. This was the starting point for two years of research conducted at Chalk River with the help of the Canadian physicist E. P. (Ted) Hincks on meson disintegration.[40] This 'shift' to problems of particle physics can be explained by Pontecorvo's desire to develop studies in which great advances had followed the end of the Second World War. The use of new particle accelerators and nuclear reactors had allowed the production by artificial means of physical reactions never possible before. Recent developments in cosmic ray research had also revealed many aspects of the interaction between particles

37 Minutes of meeting, 'Harwell Pile discussion group, 1946', AB 12/19. The engineer James Kendall, who was responsible for pile design at Harwell visited Canada in the early summer of 1946 and, according to Gowing, returned to Britain 'saying that the help of Bruno Pontecorvo…was worth that of all the others put together'. M. Gowing, *Independence and Deterrence: Britain and Atomic Energy, 1945–1952*, London, 1974, 380.

38 G. C. Hanna and D. H. Kirkwood, 'High multiplication proportional counters for energy measurements', *Physical Review* (1949), **75**, 985–6. The proportional counting technique differs from the coincidence counting technique because it is based upon the detection of the initial ionizing event that gives formation to secondary electrons. These in turn affect the gas filling the counter and give rise to a phenomenon called 'gas amplification' in which an 'avalanche' of electrons is produced. In the proportional counter technique, the experimenter focuses on the electric pulse due to the initial avalanche, while in the coincidence counting technique the experimenter focuses on the regular pulses that take place afterwards and are independent from the initial gas amplification. For details see S. Korff, *Electron and Nuclear Counters*, New York, 1946, 6–14 and B. Rossi and H. H. Staub, *Ionization Chambers and Counters: Experimental Techniques*, New York, 1949, 72.

39 But their proportional counters were not sensitive enough to detect neutrinos. In 1956 physicists F. Reines and C. Cowan detected for the first time neutrinos using the Savannah River nuclear pile in the US.

40 Pontecorvo assumed that the meson decay could be interpreted as an inverse β-process involving the production of an electron and two neutrinos. B. Pontecorvo, 'Nuclear capture of mesons and the meson decay', *Physical Review* (1947), **72**, 246–7. To validate this assumption, Pontecorvo and Hincks developed a new coincidence counter arrangement to detect the meson decay. An account of their experimental results was given in B. Pontecorvo and E. P. Hincks, 'On the disintegration products of the 2.2-μsec. meson', *Physics Review* (1950), **77**, 102–20. In this paper evidence in support of the 'electron + 2 neutrino' process was also provided.

in nuclear processes. But even when involved in 'pure' scientific endeavours, Pontecorvo did not abandon areas of secret research. He used classified instrumentation to perform cosmic ray experiments. He continued advising British scientists on how to develop counters for geophysical prospecting. And finally he started consulting activities for European and American companies working in this field. Through his mastery of the dual-use detector technology, he was a key part of the developing British nuclear programme.

Although primarily focused on cosmic ray research, Pontecorvo used secret apparatus to perform coincidence experiments. These included instruments like the kicksorters (pulse analysers) used to assess the energy range of particles entering a counter. The publication of details concerning kicksorters had been allowed only recently.[41] Moreover, in 1947 Pontecorvo's early reports on geophysical prospecting were transferred to the Telecommunication Research Establishment (TRE) based in Malvern. The TRE had been prominent in radar research during the war years and was now involved in the manufacture of electronic detectors in view of their application in several areas of nuclear research. Indeed, counters were used for particle detection in nuclear piles, accelerators, cosmic ray research, and uranium prospecting. As far as the latter is concerned, since 1945, British intelligence had conducted investigations in several places around the world to map uranium ores, but more sensitive instrumentation was required.[42] TRE developed two research programmes: portable devices for field exploration and instrumentation for aerial surveys. In 1947 E. Franklin produced the first portable rate-meter, still based on coincidence circuitry (Figure 3).[43]

Security measures in this area of research were very strict. In 1948 the TRE physicist Dennis Taylor published the description of a new portable γ-ray detector in the establishment newsletter, causing an outburst among AERE managers. Electronic equipment for geological survey to determine the proportions of uranium and thorium in samples of ores was considered a vital secret.[44] C. F. Davidson was very upset by Taylor's publication:

> To publish reports in technical journals is surely to make a quite unnecessary free gift of information to certain countries particularly interested in what we are doing in this field. Perhaps it is salutary to remember that release of <u>any</u> information concerning prospecting of non-ferrous ores within the USSR is a capital offence.[45]

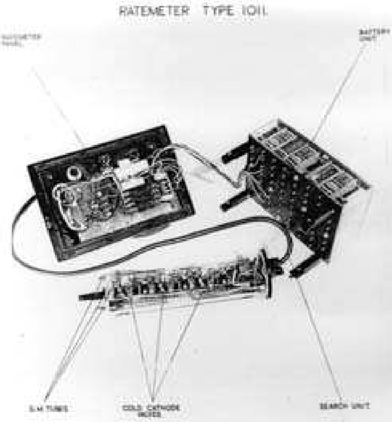
41 H. F. Freundlich, E. P. Hincks and W. J. Ozeroff, 'A pulse analyser for nuclear research', *Review of Scientific Instruments* (1947), **18**, 90–100. The issue of secrecy for this device is analysed in P. Galison, op. cit. (4), 296. Pontecorvo used this pulse analyser and also another one designed by C. H. Westcott and G. C. Hanna. Details were published in 'A pulse amplitude analyser for nuclear research using pre-treated pulses', *Review of Scientific Instruments* (1949), **20**, 181–8.

42 In 1943 geologist C. F. Davidson of the Geological Survey and the Museum of London set up a uranium committee on behalf of the Ministry of Supply. Intelligence-gathering provided the committee with an approximate list of uranium deposits worldwide. At the time most of the prospecting work was done with GM counters supplied by the Canadians. On 29 August 1945 a meeting took place in which it was stressed that 'the manufacture of counters in the UK must be regarded as urgent'. 'Uranium intelligence, Section 1', AB 1/507. See also M. Gowing, op. cit. (22), 180–2.

43 E. Franklin, 'GM tubes portable equipment for uranium prospecting, 1948', AB 15/9.

44 C. F. Davidson to J. Hardwick, 14 April 1948, in 'Security, general', AB 6/115.

45 C. F. Davidson to J. Hardwick, 14 April 1948 in 'Security, general', AB 6/115. Original emphasis.



Figures 3A and B. E. Franklin's rate-meter and detector still based on the Rossi circuit. From E. Franklin, 'GM tube portable equipment for uranium prospecting', in AB 15/350.

Davidson also asked a British envoy in Washington, DC to find out whether the Soviet Union might profit from the publication of details. The envoy replied that the open publication of equipment would allow Soviet agents to interpret the British radiometric maps.[46] During 1947 and 1948 Pontecorvo continued advising Cockcroft on detector technology and Cockcroft continued transmitting the specific data provided by Pontecorvo on counters to the TRE.[47] In July 1948, soon after the outburst caused by Taylor's publication, Pontecorvo visited the TRE and did some coincidence circuit work there with the reproached physicist.[48] Pontecorvo also acted as consultant for private companies involved in geophysical prospecting. In 1946 a Ministry of Supply officer had made concessions to Pontecorvo about his consulting, but at the same time stressed that he was prohibited from filing patents.[49] That was why Pontecorvo stopped doing so, leaving this task to Scherbatskoy, with whom he was still associated in a number of projects for commercial counters.[50] Moreover, from 1948 Pontecorvo's

46 'A comparable situation does, in fact, exist in reverse, in that our Intelligence has information of foreign counter readings which cannot be interpreted in terms of grades of ores because lack of data in the makeup of the counters', R. A. Thomson to C. F. Davidson, 1 June 1948, in 'Security, general', AB 6/115.

47 J. Cockcroft to B. Pontecorvo, 3 February 1947, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

48 B. Pontecorvo, 'Equipment required for experimental work, 1948', AB 1/648.

49 A. E. Fry to Dr Watson, 31 December 1946, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

50 S. Scherbatskoy to B. Pontecorvo, 14 March 1947, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

detectors in neutron well-logging had attracted the interest of European oil companies, especially the Italian Oil Agency (Agenzia Generale Italiana Petroli – AGIP) and the Anglo-Iranian Oil Company.[51]

In 1948 the British scientific journal *Nature* announced that Bruno Pontecorvo, 'who was responsible for pile development in Canada and is now conducting fundamental atomic energy research in nuclear physics', was now appointed as Senior Principal Scientific Officer (SPSO) at Harwell.[52] Pontecorvo wanted to move to Europe to stay closer to his family and at the same time Cockcroft wanted an experienced scientist to supervise several research projects developed in the British nuclear programme. Primarily, Pontecorvo was called to participate in the recent project of cooperation between several European countries for the completion of a cosmic ray research laboratory at the Pic du Midi in the Pyrenees. But he was also involved in other issues. For example, in May 1949 he was introduced to the Power Steering Committee (PSC) and eventually became a full PSC member.[53] From 1947 the PSC was the most important committee in Harwell, discussing issues related to reactor technology, fissile material, pile design and study of new materials to be deployed in nuclear reactors.[54] The PSC gathered the most important and influential AERE scientists, including their director, John Cockcroft. Even if Pontecorvo went to Harwell to further his studies in cosmic ray research and particle physics, his membership in the PSC reveals that more generally in the nuclear establishment pure and applied, open and secret, research were closely related. The web of relationships between research projects of a pure or applied nature was indeed represented in an AERE organization chart that demonstrates some of the links between secret and open research areas (Figure 4).[55] As the chart shows, pure research was supposed to provide knowledge eventually useful in the study of future reactors, as much as nuclear piles were supposed to be the experimental facilities for the achievement of new knowledge in particle physics. Thus, if a strict security regulation was enforced at Harwell for all scientific personnel, then it is sensible to assume that an SPSO involved in the supervision of so many aspects of nuclear research was not restricted from accessing secret areas as well as documents.

In Britain Pontecorvo continued research on new types of proportional counters for very low energy radiation.[56] The detection of new particles in cosmic rays, nuclear piles or accelerators was certainly one purpose of this research. But the other was the definition of new types of counter of greater accuracy in view of further explorations for the prospecting of radioactive material (as well as oil and gas). In 1950 Pontecorvo learnt that Scherbatskoy had left Wells Surveys and joined the Perforating Guns Atlas Corporation, 'a new company that has powerful financial backing and which is going into

51 G. Fidecaro, 'Bruno Pontecorvo: from Rome to Dubna', in S. M. Bilenky *et al.* (eds.), op. cit. (10), 474.

52 'Scientific Civil Service', *Nature* (1948), **161**, 195.

53 Minutes of meeting, 4 May 1949, 'Power Steering Committee, vol. 2, 1948–49', AB 12/74.

54 'Power Steering Committee, vol.1, 1947', AB 12/57.

55 Survey of Nuclear Physics Programme with other projects in 'Power Steering Committee, vol. 2, 1948–1949', AB 12/74.

56 B. Pontecorvo, 'Recent developments in proportional counter technique', *Helvetica Physica Acta* (1950), **23**, 97–118.

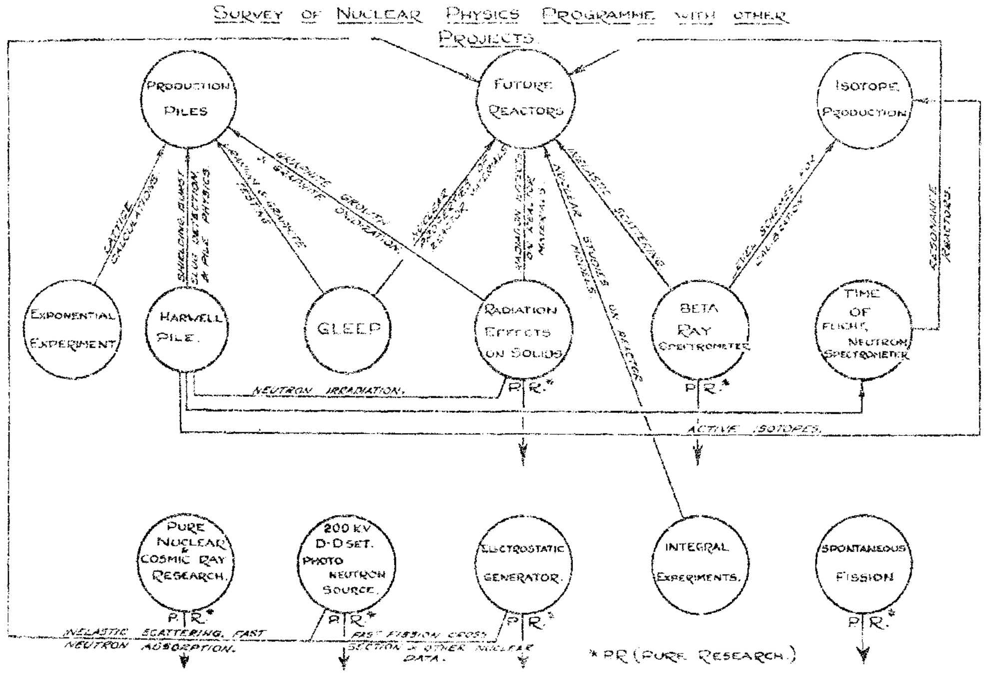


Figure 4. 'Survey on nuclear physics programme with other projects, 1948', in 'Power Steering Committee, Vol. 2, 1948–1949', AB 12/74.

competition with Wells Surveys'.[57] Both companies were conducting prospecting work in Canada for the Combined Development Trust (CDT), born in 1944 to optimize cooperation between the US, Britain and Canada and achieve a monopoly of uranium supplies worldwide. The prospecting corporations regarded the manufacture of detectors as an industrial secret because new detectors with increased sensitivity allowed prospecting for high-grade uranium ores and thus guaranteed domination of the commercial sector of this technology. Scherbatskoy asked for Pontecorvo's help. He wanted to devise a detector sensitive to both neutrons and γ-rays and stressed that his plan should be considered top secret by Pontecorvo and that 'we are especially anxious that nobody, especially nobody at Wells Surveys, should find out we are working on this problem'.[58] The request came at the end of a profitable cooperation, as from 1947 Scherbatskoy and Pontecorvo had continued exchanging secret information on new types of detector and exploring their possible application in the prospecting industry. As a matter of fact, in the context of prospecting research, commercial, industrial and national secrecy were intertwined.

In March 1950, following Fuchs's arrest and the witch-hunts in the US and Europe, a terrified Pontecorvo asked for a hearing with Henry Arnold, the AERE security officer.

57 S. Scherbatskoy to B. Pontecorvo, 19 January 1950, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

58 S. Scherbatskoy to B. Pontecorvo, 27 June 1949, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

He confessed that he had communist relatives in Italy, although he regarded himself as uninterested in politics. Arnold interrogated Pontecorvo a few times and concluded that although Pontecorvo had no clear 'political leaning', a potential risk from the security point of view existed because of his senior position in the establishment. AERE former chief physicist Herbert Skinner suggested that Pontecorvo apply for a new experimental chair about to be established at Liverpool University, where Skinner was now holder of the Lyon Jones chair of experimental physics. The advertised position was in the context of a plan for the expansion of the physics department and laboratory, where a new synchro-cyclotron had been built. In June 1950 he was offered the new chair.[59] But in July 1950 he was still very undecided about what to do. In fact, Cockcroft and Skinner had not disallowed the Italian physicist from staying at Harwell, they had just recommended him either to 'step down' so that he was not entitled to access secret documentation or to move to Liverpool.[60] At the end of July Pontecorvo decided to go to Liverpool University and soon afterwards he left to go on holiday in Italy.

But Pontecorvo never returned to Britain. Summer 1950 was characterized by an intensification of the witch-hunts, with several investigations and arrests carried out on both sides of the Atlantic. In the US, the simple allegation of having communist sympathies had become a matter for investigation and, at the beginning of October, ninety-odd foreign nationals were detained by US security authorities for their political ideals. In Europe many governments had decided to intensify vetting procedures for civil servants and, more generally, workers in the public sector. In September 1950 Ludwig Jánossy, a cosmic ray researcher employed by Dublin University, decided to stay in his home country of Hungary rather than come back to Ireland and face likely persecution. From a holiday resort near the Circeo Mountain in Italy, Pontecorvo was following the news on the witch-hunts, increasingly worried about his future. If the bubble of his communist acquaintances were to burst in the press, then he would become an easy target for the witch-hunts. Whilst in Italy, he let the Russians know that he wanted to leave the West and at the end of September he flew to Finland and then to Russia.[61] His departure obviously interrupted future plans of employment in Liverpool or any other project, and for several months nobody knew his whereabouts.[62] But by November 1950 it was almost certain that he had defected.

As we have seen, before his defection Pontecorvo had had a very important role at Harwell and full access to atomic secrets in view of his senior position in the British nuclear programme. Pontecorvo's expertise, built upon participation in the Canadian and British nuclear programmes, made him aware of different technologies and

59 Vice-Chancellor J. Mountford, Liverpool University, to B. Pontecorvo, 6 June 1950, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

60 Skinner wrote to Pontecorvo, 'As I told you some time ago, you are certain to get the offer of a B post at Harwell. … So I think you have to decide whether you prefer a University post to staying at Harwell.' H. Skinner to B. Pontecorvo, 12 July 1950, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

61 One of Pontecorvo's cousins was a prominent member of the Italian Communist Party (PCI).

62 In October Skinner wrote to Bruno's brother, Guido, 'I am afraid I am also beginning to be seriously worried about your brother … As regards this university, Bruno has not so far seriously let us down[.] … However, of course the lack of news over the last 5–6 weeks is certainly disconcerting'. H. Skinner to G. Pontecorvo, 10 October 1950, in 'Scientific correspondence, 1945–1950', PNVO 4/1/1.

materials in use in pile physics and different options for nuclear reactors. During one of the last PSC meetings he attended, he had analysed in detail the importance of developing heavy water reactors due to the decreasing cost of heavy water and their greater output with respect to graphite reactors. His intimate knowledge of pile physics included details of the production of fissile material, by-products and shielding problems and even how to run a pile.[63] At the same time, Pontecorvo's expertise on detector technology had made him an important expert in geophysical prospecting. The AERE regulation on work being done in this area was strict: it was considered secret in relation to British plans to achieve monopoly over uranium ores. The few American companies producing detectors for geophysical exploration competed to provide the CDT with more sensitive instrumentation and thus were interested in keeping the work being done an industrial secret. Pontecorvo was deeply implicated in all these areas.

Play it down! The assessment of the Pontecorvo case

From January 1950 Fuchs's arrest put the British atomic establishment under pressure, creating a feeling of distrust among the press, the public and British politicians. Moreover, the Fuchs affair was the subject of criticism from US political leaders, who had made their partnership with Britain in nuclear matters conditional on the adoption of tighter measures of atomic security. Thus Pontecorvo's defection happened at a key moment for British nuclear policy. What is revealed in the recently released papers is that in order to save the negotiations with the US on the exchange of nuclear information, a few British diplomats made a decision to play down the Pontecorvo case. It was this covert and highly secret agenda which determined official and public response to Pontecorvo's defection, as we shall now see.

In mid-1950 Britain was involved in important negotiations on nuclear matters with the US and Canada. From July 1946, thanks to the Atomic Energy Act proposed by Senator Brian McMahon, the US had withdrawn from cooperation with Britain and Canada on nuclear matters. Eventually, the shortage of uranium available for the US atomic programme had forced the Americans to reopen negotiations with Britain, whose uranium supply was less depleted. In January 1948 a new agreement was reached (the Modus Vivendi) including limited transfer of US nuclear information in exchange for Britain's uranium supplies. However, the Modus Vivendi did not satisfy the parties involved. The Americans needed more uranium for their fast-expanding weapons programme, while the British wanted information relevant to atomic weapons manufacture. US diplomats saw this as a major obstacle to further negotiations. For the following two years the negotiations proceeded erratically, although British diplomats in the US were confident that a new agreement would be reached.[64]

In the wake of Pontecorvo's disappearance, the British negotiators were worried that, if it became known that Pontecorvo was likely to pass nuclear information to the

63 Minutes of meeting, 9 January 1950, in 'Power Steering Committee, vol. 3, 1950', AB 12/105. See also M. Mafai, op. cit. (10), 128.

64 S. H. Paul, *Nuclear Rivals: Anglo-American Atomic Relations, 1941–1952*, Columbus, 2000, 103–66. On the impact of the Fuchs case on the negotiation see also R. Aldrich, op. cit. (35), 380–4.

Soviets, the negotiations would probably break down. Thus they tried anticipating US criticism. The British Ambassador in Washington, Oliver Franks, the Foreign Office under-secretary, Roger Makins, and Michael Perrin agreed a common strategy, and the Cabinet Office in London and the British Embassy in Washington exchanged top secret telegrams in which they agreed to play down the story.[65] The Cabinet Office asked the Embassy to inform the American authorities. The secret despatches stressed immediately that Pontecorvo was concerned with non-secret work and that he was only asked to advise on matters of detail in nuclear pile physics.[66] The Minister of Supply made a similar claim during a parliamentary briefing: Pontecorvo's access to secret documents, he insisted, was 'limited'. The information given to the press did not largely differ from that given almost three years before by the scientific journal *Nature* in its brief communication about Pontecorvo's appointment.

But the claim of a 'limited' access contradicted the content of the official atomic secrecy regulations. According to the report on 'Application of Secrecy Rules in Atomic Energy Research' drafted in 1948 to indicate how security rules applied to atomic energy work,

> The general object of the security restrictions is to protect information necessary for the production of fissile material. They therefore cover pile design, extraction chemistry, plants for separation of the isotopes of heavy elements, and also information about raw materials.[67]

The report also stressed that nuclear detectors were not necessarily classified, but that 'work associated with similar instruments would be classified only if they were used for secret application, as for example in searching for raw materials'. Strauss's claim also contradicted the specific assessment conducted on Pontecorvo by Arnold in April 1950, following Pontecorvo's interrogation. According to Arnold, 'As Bruno PONTECORVO has access to Top Secret information, thus from the security standpoint it is considered that a potential security risk exists'.[68]

Meanwhile the British Embassy in Washington observed with satisfaction that the press reaction was quiet. The American Senate elections had kept the American press busy and politicians had shown only 'passing interest'.[69] On 2 November Franks contacted Makins, asking for continued silence:

> I am accordingly anxious to let sleeping dogs lie and I have some hope that the matter may soon be forgotten. ... My concern is to ensure that as far as possible the Pontecorvo case shall not blight the prospects of the negotiations on the Pentagon's new plan for tripartite co-operation.[70]

65 'Emergency Top Secret Cypher Telegram' from Cabinet Office to British Joint Services Mission (B.J.S.M.), Washington, 20 October 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837. Makins was certainly aware of Pontecorvo's role in the British nuclear programme because he was in frequent touch with Cockcroft. The two had played a major role as negotiators within the Combined Policy Committee (CPC), the body behind the UK–US atomic agreements.

66 'Top Secret Cypher Telegram' from Cabinet Office to B.J.S.M., Washington, 23 October 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

67 'Application of secrecy rules in atomic energy research, draft', 5 May 1948, in 'Security, general', AB 6/115.

68 Harwell Security Service to the Ministry of Supply, 25 April 1950, 'Secret draft on the Pontecorvo case', in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

69 'Top Secret Cypher Telegram' from B.J.S.M., Washington, to Cabinet Office, 24 October 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

70 Oliver Frank to Roger Makins, 2 November 1950, in CAB 126/307.

Perrin was advised that Franks wanted to 'minimise the adverse repercussions of the Pontecorvo case on the forthcoming negotiations'.[71] He prepared the assessment on Pontecorvo's career carefully following this directive. This also constituted the basis for a second parliamentary briefing by Strauss, and for the request for information from the US Atomic Energy Commission. According to Perrin, Pontecorvo had withdrawn from technological work on heavy water piles, where his knowledge was in any case very limited:

> He was unlikely to have expert knowledge of the important technological features of the pile such as heavy water purification and recombination system; canning procedures, etc. He has a good general picture of the possibilities of different types of future reactors likely to be important in a power programme though he would not be able to write out a detailed specification for anyone.[72]

Perrin's portrait of Pontecorvo's career was precisely tailored to minimize the repercussions of the Pontecorvo case on the US–UK negotiations; no mention of his PSC membership, nor of his recent promotion of heavy water technologies at the PSC meetings, was made.[73] As far as Pontecorvo's expertise on detectors was concerned, Perrin stressed Pontecorvo's research on cosmic rays whilst omitting any mention of his work on geophysical prospecting. But Perrin certainly feared that Pontecorvo's expertise was likely to be very important for the Soviet effort to map their uranium deposits. In the late 1940s the Soviets were using a 'tactic of the broad front', prospecting large areas with different geological structures to find uranium ores.[74] In 1947 and 1948 two British intelligence reports indicated the shortage of uranium ores as the limiting factor of the Russian atomic weapons programme.[75] In 1950 their uranium supply was still regarded 'as an urgent problem' by Soviet geologists.[76] Finally, as we have seen, Russian instrumentation for prospecting was considered by American intelligence not adequate for geophysical exploration. Though Pontecorvo's expertise could thus potentially give a major boost to the USSR's nuclear programme, this fact was also omitted from the official British assessment of his defection.

Moreover, Perrin confirmed Pontecorvo's previous role as nuclear pile expert in Canada, but he did not mention his PSC membership. He certainly feared that Pontecorvo might disclose a recent PSC research programme, developed by the AERE and the Admiralty, focused on heavy water reactors for naval propulsion. During recent meetings, secret technical papers had been passed to other PSC members as well as

71 'Secret', R. Makins to Mr Perrin, November 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

72 'Secret and Guard', M. Perrin to R. Makins, 9 November 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

73 Perrin's argument was certainly contradicted by the recent pledge in favour of the adoption of heavy water reactors made by Pontecorvo at the PSC meeting of January 1950. See the relevant discussion above in this paper.

74 D. Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939–1956*, New Haven, 1994, 174–7.

75 M. S. Goodman, 'British intelligence and the Soviet atomic bomb, 1945–1950', in *Journal of Strategic Studies* (forthcoming). I am grateful to Michael Goodman for providing me with an early version of his paper.

76 D. Holloway, op. cit. (74), 177.

Pontecorvo.[77] Following Fuchs's arrest, Cockcroft became very worried that secret documentation regarding defence purposes had circulated among PSC members and decided that naval reactors should not be discussed at PSC meetings any more.

After Perrin's carefully constructed assessment asserted that Pontecorvo's defection presented no worries regarding the leakage of nuclear information, the FO was alert to any attempt to revive the story. For example, on 24 November the British envoy in Helsinki informed the FO that the Finnish authorities were very interested in 'hushing up' the whole story as Pontecorvo had entered Finland without a visa.[78] The FO replied,

> So far from wishing to frustrate any Finnish effort to play the matter down, we have in fact an equal interest with the Finnish authorities in discouraging any further publicity. Interest in the case appears now to have died down and it would not be to our advantage to do anything that might tend to revive it.[79]

During November international events kept the press busy as the Korean War, which broke out in June 1950, was reaching a stalemate after China had entered the conflict. Moving attention away from other issues, the Korean War also strengthened the political alliance between the US and Britain. Careful information management by government officials and restraints on access to secret information helped reduce the impact of the Pontecorvo case significantly.[80] In their attempts to 'play down' Pontecorvo's defection to protect UK interests in negotiations with the US, British diplomats appear to have succeeded. Yet other agendas were in play, which not only threatened the carefully constructed 'diplomatic' version of Pontecorvo's career, but also became the basis for the later mythology of the Pontecorvo case.

Play it up! The manufacture of an atom spy story

While British diplomats were playing down Pontecorvo's defection, some journalists began speculating on Pontecorvo's past, claiming that he had been an atom spy between 1943 and 1950. Worried about lax atomic security measures in Britain, they were quick to bracket Pontecorvo, Nunn May and Fuchs together as 'atom spies'. Their attempt to play up the Pontecorvo case never led to proof that secret information was passed. Yet the Pontecorvo case featured in speculations regarding the presence of Soviet 'moles' in British embassies, research facilities and security services. Indeed, the claim that Pontecorvo was a spy was used to imply a pressing need to reform MI5 and to introduce tighter security measures in government research facilities. Archival papers recently released show that the evidence presented against Pontecorvo was rather flimsy and

77 Two papers were produced to evaluate nuclear reactors for naval propulsion. The paper PSC 65 is still retained by the UKAEA. PSC 63 is in 'Power Steering Committee, vol. 2, 1948–49', AB 12/74.

78 Mr Kellas, Helsinki, to FO, 24 October 1950, in 'Disappearance of Dr. Bruno Pontecorvo in Finland', FO 371/86439.

79 'Confidential', FO to Mr Kellas, 20 October 1950, in 'Disappearance of Dr. Bruno Pontecorvo in Finland', FO 371/86439.

80 More generally, restraints on access to information about nuclear science and policy represented a crucial factor in shaping post-war UK defence policy. On this see J. Agar and B. Balmer, 'British scientists and the Cold War: the Defence Research Policy Committee and information networks', *Historical Studies in the Physical and Biological Sciences* (1998), **28**, 210 and 248.

also that MI5 had been efficient in his security vetting. Ironically, this evidence was distorted (but never fully disclosed) to prove that the British security services were inefficient and that Pontecorvo was an atom spy.

Immediately after Pontecorvo's defection, the FBI claimed that he should not have been allowed to travel to Italy. They pushed for a tightening of security measures, depriving scientists even of their civil liberties, as was already happening in the US.[81] The FBI also discovered that their records identified Pontecorvo as having communist sympathies and that they had communicated this to British intelligence years before.[82] However, they did not intend to make a public statement unless forced by the enquiries of American politicians such as Senator McCarthy.[83] Meanwhile, in Britain a secret Cabinet committee met to elaborate new vetting procedures for personnel working in government research establishments. Six days after Pontecorvo's disappearance, new guidelines for the introduction of the infamous positive vetting or 'purging procedures' (as defined by Labour Prime Minister Clement Attlee) were elaborated.[84]

During this period, the *Daily Express* science reporter Chapman Pincher used the Pontecorvo case as a battering ram to campaign against MI5 and to support arguments for the reformation of atomic security. Between Saturday 21 October and Friday 27 October 1950, Pincher 'scored' five headlines in the newspaper in which he cast more doubt on the British intelligence agency's conduct and the Italian scientist's reliability (Figure 5).[85] The very same day on which the Committee on Positive Vetting was meeting to launch the purging procedures, Pincher argued that Pontecorvo was never screened before being involved in secret work in 1943. He also claimed that a misunderstanding between British intelligence and the Royal Canadian Mounted Police (the military body who had been in charge of Pontecorvo's vetting in Canada) had resulted in Pontecorvo not being vetted.[86] At this stage, however, the impact of the Pontecorvo case on security legislation was not yet decisive and on 13 November 1950

81 'The State Department even removed the passport of an American atomic scientist who was due to go to India from his bedroom earlier this year because they had doubts about his reliability', in 'Top Secret Cypher Telegram' from B.J.S.M., Washington, to Cabinet Office, 21 October 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837. Historian Jessica Wang claims that in the 1950s the US loyalty-security system put suspected American scientists in a state of 'perpetual jeopardy' in which 'old charges were never settled definitely' and 'once cleared, an individual could confront the same accusation in subsequent loyalty-security investigations'. Jessica Wang, *American Science in an Age of Anxiety: Scientists, Anticommunism and the Cold War*, Chapel Hill, 1999, 256.

82 'Top Secret Cypher Telegram' from B.J.S.M., Washington, to Cabinet Office, 21 October 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

83 'Top Secret Cypher Telegram' from B.J.S.M., Washington, to Cabinet Office, 23 October 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

84 The positive vetting extends the right of security agencies to investigate the private life and political ideas of government personnel. M. J. Mookerjee, 'Science, security and the state', M.Sc. Dissertation (Manchester, 2002), 54. See also D. Vincent, op. cit. (8), 194–203.

85 In order, 'Atom man flies away' (21 October 1950), 'Atom family in Russia' (22 October 1950), 'Atom man knew atom spy' (24 October 1950), 'Atom house searched' (25 October 1950) and finally 'Atom man not screened' (27 October 1950).

86 According to Pincher, the Canadians relied upon British clearance, but British intelligence did not vet Pontecorvo because 'he was never in Britain before joining the Canadian project'. C. Pincher, 'Atom man not screened' *Daily Express*, 27 October 1950.

DAILY EXPRESS

No. 15,710 TUESDAY OCTOBER 24 1950 CONTROLLING SHAREHOLDER LORD BEAVERBROOK Weather: Dull

PROFESSOR Pontecorvo worked with Nunn May · PLANNER Festival contract given to Government man's firm · PHILLIPS Socialist secretary starts a row · PROBE Americans begin Red round-up

ATOM MAN KNEW ATOM SPY

Professor and Nunn May shared lab

NEW PROBE STARTS

By CHAPMAN PINCHER

PROFESSOR BRUNO PONTECORVO, the atom scientist from Harwell who has gone to Russia, worked for two years in a Canadian laboratory with Dr. Nunn May

—now serving a ten-year sentence for passing atomic information to Russia.

This discovery, made yesterday, switched inquiries about Pontecorvo to Canada. Security authorities there are checking on whether approaches were made to him by Russian agents.

MISSING PROFESSOR—PASSPORT PHOTO

—Daily Express exclusive picture.

Inside the locked, silent house

Sugar? You ought to revolt

Says Jamaica man

Stokes hurt in car crash

NOTHING WRONG, SAYS MORRISON

FESTIVAL ROW OVER ORDER

Chief Planner Plowden's firm gets contract

Express Staff Reporter

A FIRM which has Sir Edwin Plowden, the Government's Chief Planning Officer, on its board has got the contract to sell advertising space in 3,000,000 Festival of Britain programmes.

ARTISTS GAG MUNNINGS

Express Staff Reporter

The last man . . .

Figure 5. The witch-hunts starts. From the *Daily Express*, 24 October 1950. Other *Daily Express* splashes included ‘Atom man flies away’ (21 October 1950), ‘Atom house searched’ (25 October 1950), ‘Atom man not screened’ (27 October 1950) and ‘Atom family in Russia’ (29 October 1950).

another government committee, the Cabinet Committee on Subversion, ruled against any widespread use of positive vetting.[87]

But in the long run Pincher's and others' campaigning had an impact upon legislation on security measures in Britain, making it similar to that in the US. Pincher's ‘full story’ on Pontecorvo appeared in the *Daily Express* of 26 February 1951. According to Pincher, Pontecorvo was an ‘active, fanatical communist’ who was in frequent touch with Soviet agents from 1943 to 1950, passing them the ‘details about atomic explosive which his fellow spy Dr. Klaus Fuchs did not know’.[88] After his resignation from Harwell, he was commanded to go to Russia because working at Liverpool University would have reduced his value as an atom spy.[89] On the whole, the depiction of Fuchs, Pontecorvo and Nunn May as atom spies led to far-reaching revision of atomic security and the introduction of purging practices within research establishments. In the summer of 1951 a tripartite conference on security was held in Washington, DC. For US diplomats the definitive adoption of new measures of positive vetting in Britain was a crucial factor in the establishment of nuclear cooperation.[90] On 27 August the British

87 R. Aldrich, op. cit. (35), 384.

88 C. Pincher, ‘Pontecorvo – full story’, *Daily Express*, 26 February 1951.

89 C. Pincher, op. cit. (88). According to Pincher, ‘The report on Pontecorvo was detailed and obviously came from reliable sources but I cannot recall them.’ Private communication, 19 November 2002.

90 According to Lord Portal of the Ministry of Supply collaboration with the Americans was ‘essential for the proper development of our atomic energy schemes’, 17 August 1951, in CAB 130/20 (quoted in M. J. Mookerjee, op. cit. (84), 57).

Cabinet finally approved the positive vetting measures, which remain in force to this day in matters relating to national security.[91]

From the 1950s onwards the literature on atom spies featured Pontecorvo as one of the protagonists. In 1952 the *Times* journalist Alan Moorehead, who had followed the case from the beginning, cast some doubts about Pontecorvo being an atom spy.[92] According to Moorehead, if Pontecorvo's escape to Russia showed his 'betrayal', no final evidence was yet provided of his espionage activity whilst working for the British atomic programme. Moorehead claimed that the evidence available supported the assumptions both that Pontecorvo was an atom spy and that he was scared by the witch-hunts.[93] But a great help to the witch-hunters' cause came from a literary work written in 1952 by the novelist and Civil Service commissioner Charles P. Snow and published in 1954. The novel *The New Men* made the British atomic project a subject of fiction featuring many protagonists (under covert names) of the scientific endeavour.[94] Among others, the scientist Eric Sawbridge featured as an atom spy. Years later, in an interview, Snow claimed, 'There was never a Sawbridge case, but several rather related cases.'[95] But certainly some readers did notice that 'bridge' was the English translation for the Italian 'Ponte', this being Pontecorvo's nickname at Harwell, as the newspapers had widely mentioned.[96] Snow's literary work united three real scientists – Nunn May, Fuchs and Pontecorvo – in one fictional character. In doing so, it evoked the fear that the programme to harness nuclear energy in Britain experienced problems because of the presence of ideologically driven scientists. Their unreliability caused severe disruption to the scientific endeavour. And it also allowed atomic secrets to cross the Iron Curtain.

During the 'hot' moments of the Cold War, Pontecorvo's depiction as atom spy was enriched with new details in order to show that the defence of atomic security was of paramount importance for the Western states. In that sense, the 1950s Cold War propaganda was equalled only by that of the 1980s. In two books written in 1981 and 1984 Pincher discovered the FBI notes on Pontecorvo. He argued that they never reached MI5 because the diplomat Kim Philby suppressed them. In 1949 Philby was working at the British Embassy in Washington and was later revealed to be a Soviet agent. According to Pincher, Philby also communicated to Soviet agents that Pontecorvo had been discovered and these in turn advised Pontecorvo to leave Britain.[97] An attempt

91 M. J. Mookerjee, op. cit. (84), 62.

92 The 'picture of Pontecorvo as a traitor simply does not fit the facts: it would be as rational to believe that Einstein was a secret baby-killer or that Stalin was, in reality, a fox-hunting gentleman from the shires'. A. Moorehead, op. cit. (35), 171.

93 'The last two theories seem to come nearest to fitting the facts. In the end one is forced to leave the mystery unsolved and concentrate on other major aspects of the case'. A. Moorehead, op. cit. (35), 198.

94 C. P. Snow, *The New Men*, London, 1954.

95 John Halperin, *C. P. Snow: An Oral Biography*, Brighton, 1983, 163.

96 On the other hand, the geneticist J. B. S. Haldane had coined the Scottish nickname 'Crawbrigg' (in English, 'Crow-bridge') for his colleague Guido Pontecorvo, Bruno's brother and geneticist at Glasgow University. B. L. Cohen, 'Guido Pontecorvo ("Ponte"), 1907–1999', *Genetics* (2000), **154**, 497.

97 C. Pincher, op. cit. (11), 151. The same version appeared also in J. Costello, op. cit. (11), 533. Costello claims that Pincher received the information from former MI5 high-ranking officer and author of *Spycatcher* Peter Wright in an interview given in October 1980. But Pincher claims that 'I cannot remember whether or not Wright and I talked about Pontecorvo but the story which Costello referred to is there in *Their Trade is*

was also made to link Pontecorvo to the Soviet spy-ring in Canada. In 1980 H. Montgomery Hyde claimed that secret documents obtained from the Soviet Embassy in Ottawa referred to Gini and Golia. Considering that Fuchs confessed to be code-named Golia, Montgomery deduced that 'Gini more than likely was Bruno Pontecorvo, which may appear fantastic, but then Bruno Pontecorvo was in many ways a fantastic character'.[98] Soviet defectors also contributed to the confusion. In 1990 Oleg Gordievsky, a former KGB official, revealed that Pontecorvo was a spy of the same importance as Fuchs.[99] Yet, in substantiating his claim, he quoted Montgomery Hyde. Clearly much remains to be clarified about the later historiography of Pontecorvo as an 'atom spy', not least because it seems that many of the allegations against Pontecorvo were put forward with insufficient or ambiguous evidence.

However, new evidence suggests the whole Pontecorvo atom spy story to be a fabrication. As I have shown, the FBI claimed in the 1950s that Pontecorvo 'had communist sympathies'. This emerged from three reports written by FBI agents as early as February 1943. At the time the reports were sent to the British security Co-ordination (BSC), a wartime organization headed by Sir William 'Little Bill' Stephenson, based in New York and responsible for British security in the western hemisphere.[100] BSC was set up during the war for the operation of intelligence and counter-intelligence, including the vetting of British personnel working abroad. It was responsible only to the Security Executive and it was disbanded at the end of the war, when all its records were also destroyed.[101]

According to the FBI notes, Pontecorvo's house in Tulsa had been searched and 'numerous pamphlets and books on Communism had been found'.[102] The FBI sent the notes to the BSC in New York as the organization was responsible for Pontecorvo's vetting. But BSC officials, who cleared Pontecorvo, never included the information in his security file. In November 1950 Roger Hollis, director of section 'C' (Security) at MI5, met Perrin and Strauss and passed them his report on the Pontecorvo case. The investigation on the FBI notes led him to conclude that 'the reports could not have been seen by the officer who made the clearance' and that they were not attached to the Pontecorvo papers. So MI5 was not responsible for the early mistake. Nor was MI6, which never saw the notes. Hollis frankly admitted that there must have been 'some slip' in the BSC organization, so that the official(s) charged with dispatching the FBI notes to the man in charge of Pontecorvo's vetting did not do so. In any case Hollis

Treachery. So he may have assumed that Wright told me as he knew, by then, that he had been the main source'. Private communication, 19 November 2002.

98 H. Montgomery Hyde, op. cit. (11), 130.

99 C. Andrew and O. Gordievsky, *KGB: The Inside Story of Its Foreign Operations from Lenin to Gorbachev*, London, 1990, 312–13.

100 N. West, *A Matter of Trust: MI5, 1945–72*, London, 1982, 27.

101 BSC had been prominent also in the handling of the Gouzenko case. It is often believed that BSC was a branch of the Secret Intelligence Service (SIS, known also as MI6). But BSC was not dependent on MI5 or MI6 and was responsible only to the 'Security Executive', the security sub-committee within the Home Defence Executive (HDE) set up in May 1940 by the Prime Minister W. Churchill to respond to a possible German invasion. N. West, *MI5: British Security Service Operations, 1909–1945*, London, 1981, 151 and 154.

102 'Secret draft on the Pontecorvo case' in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

advised that 'the utmost care should be taken to avoid the release of this information'. The FBI could use the evidence to undermine previous agreements reached between the directors of the two organizations, J. Edgar Hoover and Percy Sillitoe, according to which 'neither organisation would say anything about the other's actions without consultation and agreement'.[103] With regard to Canadian intelligence, Hollis claimed that they had indeed vetted Pontecorvo and that in December 1946 they 'knew nothing to his detriment'.[104]

The FBI's claims of lax security measures on the grounds of their early notes were rather exaggerated. Whatever the FBI had discovered in 1943 was not relevant because American intelligence in 1946 had had a prominent role in the Canadian spy-ring operation.[105] That operation had produced the arrest of Nunn May, prompted the early investigation of Fuchs, and more generally led to the thorough investigation of all the scientific personnel working in Canada. If Pontecorvo was in the same spy-ring, then the FBI should have investigated his position in 1946 following the discovery of compromising evidence. But it did not do so, nor did it disclose at the time the early notes on the search in Tulsa. Even General Leslie Groves, who had been a 'key figure in prompting the Gouzenko enquiry', and a manager obsessed with security, had raised no objection to Pontecorvo's departure for Europe shortly after Nunn May's arrest.[106] Either he was certain of his loyalty or at least careful enough to promote his secret shadowing, which eventually came out with no proof of spying activity. In any case it is sensible to assume that in 1950 the FBI's early notes were used instrumentally to push indirectly the reformation of atomic security in Britain rather than in the real belief that Pontecorvo was an atom spy.

Moreover, the allegations about Pontecorvo had originated from rather flimsy evidence. The FBI search had led only to the finding of numerous books and pamphlets on communism. In the media frenzy that followed the witch-hunts, this flimsy evidence had become the unjustified allegation that Pontecorvo, because communist, was in touch with Soviet agents. Moreover, against the claim put forward by many who sought to demonstrate that Pontecorvo was an atom spy, the FBI notes had failed to reach the British services not because they were suppressed by Kim Philby, but just because they had been sent to another intelligence body. Finally, the FBI notes were sent in 1943 and not in 1949. This evidence shows also that in the 1950s as well as in the 1980s Pincher and others built up their story by mixing facts and hypothetical assumptions. If the early allegation about contacts between Pontecorvo and Soviet agents were Pincher's brainchild, the later allegations about the FBI sending documents to British security were true and 'leaked' from official security sources (British or American) but were eventually distorted. Ironically, an early public disclosure of MI5 documents relating to the Pontecorvo case would have avoided all these speculations.

103 For this reason the letter containing details on the FBI notes was classified 'Secret and Guard'. Mr Perrin to R. Makins, 9 November 1950, in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

104 'Secret draft on the Pontecorvo case' in 'Defection to USSR of Dr. Pontecorvo', FO 371/84837.

105 R. Aldrich, op. cit. (35), 105.

106 See note 35, above. Quote from R. Aldrich, op. cit. (35), 106.

Clearly, British diplomats involved in sensitive UK–US nuclear negotiations were not the only actors who wished to play down the Pontecorvo case. Security officials, too, had much to lose from uncontrolled public discussion of the case. As Chapman Pincher's critique of British security showed, the Pontecorvo case could be understood and used in many different ways. However, 'continued silence' on the issue by intelligence officers, together with uncontrolled speculation by journalists and spy-storytellers, granted MI5 extended power of control and vetting over scientific personnel. So, indirectly, for the security services this silence had a beneficial and unexpected pay-off.

Conclusions: a reappraisal of the Pontecorvo case

In 1955, during a press conference from the Institute of Nuclear Research in Dubna where he was now working, Pontecorvo claimed that he had left Britain as a consequence of the witch-hunts and the pressure put on him by security services during vetting. He stressed that he never contributed to the Soviet weapons programme although he advised Soviet nuclear experts on matters concerned with atomic energy.[107] He continued working in Russia and visited Italy in the early 1980s. Now involved in disarmament, he campaigned within international scientific organizations against the proliferation of nuclear weapons. Even if Pontecorvo confessed to have contributed to the Soviet atomic energy programme, the question of what contribution he made is unfortunately still unanswered. Pontecorvo's defection to the USSR was probably far more significant than their own many spying activities because Pontecorvo's expertise in geophysical prospecting dealt with the limiting factor in the Soviet programme – the shortage of uranium supply – on which he could provide some technical help. Moreover, Pontecorvo's defection could provide the Soviets with tacit knowledge and expertise to be used more effectively than single documentary pieces of nuclear information. Certainly the documentary evidence available to historians has clarified only Pontecorvo's contribution to the advancement of Soviet particle physics, whilst archival work is still needed to understand in what way, as Pontecorvo claimed, he contributed to the Soviet atomic energy programme.[108]

If the 1943 FBI notes had been included in Pontecorvo's UK security file, then his outstanding contributions to the British nuclear programme, documented in this paper, would never have occurred. The flimsy evidence about the FBI search would have been used to exclude Pontecorvo from the programme. Moving across constructed barriers between secret and open research, Pontecorvo had developed important research in the areas of pile physics and geophysical prospecting that helped solve the problems of mapping uranium ores and of transforming uranium in fissile material in nuclear piles.

107 Pontecorvo was deprived of his British citizenship according to the British Nationality Act (1948). Via diplomatic means, he communicated to British authorities that he considered it 'necessary to emphasise the fact that I have not shown any elements of disloyalty or unfriendliness towards the British people and that I still entertain the highest feeling for them'. B. Pontecorvo, 'Letter to Comrade Slavin, USSR Ministry of Foreign Affairs', 20 April 1955, in 'Citizens deprived of citizenship, including Bruno Pontecorvo', FO 372/7390.

108 Pontecorvo's nuclear research in the USSR is examined by V. P. Dzheporov, 'The genius of Bruno Pontecorvo', in S. M. Bilenky *et al*., op. cit. (10), 487–93 and by several others in the same collection.

Being primarily involved in cosmic ray research, Pontecorvo used the multifaceted character of nuclear science and technology to pass from cosmic rays to geophysical prospecting and from isotope production to nuclear pile design, using similar methodologies, practices and techniques. This fact reminds us that no single unique secret obstructs a country from achieving nuclear weapons, but that many different aspects of atomic knowledge and experimental practices are needed for the completion of a nuclear programme.

The purges that hit government research laboratories and affected around two hundred foreign and British workers between the 1950s and the 1980s originated from the widespread belief that in Britain there were three atom spies and that one of them was Bruno Pontecorvo. The 'gap' between what the public believed about Pontecorvo and what was known by a few security officials facilitated the operation. The manipulation of reports on Pontecorvo's vetting procedures meant that no objections were raised to the adoption of measures of positive vetting. Whether the manipulation originated in the FBI or in MI5, it is now evident that a distortion occurred.

The assessment conducted on the Pontecorvo case reflected the internal agendas of the British diplomatic and security services rather than an attempt to clarify the real threat represented by Pontecorvo's defection. While the British public believed that its governors were assessing the dimensions of this threat, it was actually being deceived about its significance. The fact that in the past Pontecorvo had been moving between the boundaries of secret and open research was now used to claim that because he was primarily concerned with open research he had limited access to atomic secrets. Ironically, the attempt to protect UK interests in the tripartite negotiations failed because new prospecting instrumentation developed by Americans helped discover high-grade ores in the Athabaska region in Canada. Thus US diplomats decided to delay further the UK–US negotiations in the wake of an increased supply of uranium. The explosion of the first British atomic bomb in October 1952 left these negotiations in their original state – 'a state of non-existence'.[109] The Pontecorvo case suggests that assessing the threat deriving from the spreading of nuclear information in the presence of contingent agendas may undermine its outcome. The presence of international agreements (and connected economic interests) and the establishment of preferential political partnerships are factors that lead to the manipulation of evidence gathered in order to play down (or play up) their significance and thus assess them accordingly.

Atomic security assessments, combined with the general fear that security in relation to scientific knowledge is too lax, impact upon the liberties of scientists, whether working in government research facilities or universities. Manipulating assessments led to new legislation that may encroach on researchers' freedom and thus limit their rights. Without this fear, new laws restricting liberties within research laboratories would encounter criticism and protest within and without the government. On the whole, the construction of an 'enemy within' is a powerful lubricant in the machinery of government, because it grants that a new security regulation, restricting the liberty of researchers, becomes generally accepted.

109 S. H. Paul, op. cit. (64), 198.