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British Postwar Scientific Exploitation, Intellectual Property Law, and Tacit Knowledge

Abstract: The efforts by the United Kingdom following the Second World War to exploit German science and technology for the benefit of British industry were a key site of a shifting understanding of state-sponsored technology transfer. Amidst Parliamentary and bureaucratic debates about the relationship between scientific knowledge and gaining economically useful technology, British industrial investigators scoured Germany for patents, blueprints, trade secrets, and in some cases, skilled personnel. Though this was initially conceived in part as a diplomatic tool to draw together American and British intelligence, the difficulties in transferring technology via written – and therefore easily reproducible – means forced a shift towards a more self-interested exploitation style emphasizing 'know-how,' or 'tacit knowledge.' These scientific exploitation efforts, in turn, were part of and influenced a broader process in which ideas of 'know-how' were permeating British intellectual property law and policy debates over the state's role in promoting export industry and scientific excellence.

Introduction

British policymakers in the final years of the Second World War saw in front of them enormous challenges and opportunities in terms of using science and technology to boost economic competitiveness. British inventions and innovations – radar most of all - had been absolutely crucial in the Allied victory, yet the "unsurpassed...genius" of British invention seemed to face daunting obstacles to reviving an export trade made all the more crucial by heavy war debts.[1] Germany, it was felt, had too frequently seized upon a characteristic British failure to utilize its own inventions and had built chemical and other industries into powerful cartels utilizing British ideas, thereby 'infiltrating' other countries and producing such terrifying marvels as the thousands of V-1 and V-2 missile launched against England. It was in this context, tied fundamentally to international questions of early Cold War positioning and diplomacy, that the United Kingdom launched a series of programs aimed at "scientific exploitation" of German science and technology and began reform of British intellectual property law.

These two fields – scientific exploitation and domestic patent law – are not necessarily an obvious pair, and their historiographies rarely overlap, yet both were focuses of government action driven by anxiety over increasing British exports, supporting colonial possessions, and navigating international politics.[2] Further, both were shaped by (and themselves informed) increasing attention given to the idea of 'know-how,' or 'tacit knowledge' – that is, knowledge embedded in physical experience and intuition, such as riding a bicycle, as opposed to 'explicit knowledge' which can be conveyed easily in written form, such as the price of a particular

[1] Hansard, HL, 29 April 1948, Vol. 155, col. 568-90

[2] One notable contribution to these issues is Jörg Fisch, "Reparations and Intellectual Property," in *Technology transfer out of Germany after 1945*, ed. Matthias Judt and Burghard Ciesla(Amsterdam: Harwood Academic Publishers, 1996). However, Fisch is interested in a valuable but separate issue of the legality of so-called 'intellectual reparations' as part of international law.

bicycle. The basic idea of 'know-how' was nothing new, of course. The earliest British patents were intended specifically to entice foreign technicians to teach apprentices their crafts on British soil, and thereby transfer the technology to Great Britain, as early as the fifteenth century.[3] During this early postwar period, however – and deriving partly from recent wartime experience – the differences between tacit and explicit knowledge drew significant attention as a barrier to achieving policy objectives, among them the exploitation of German science and technology for the benefit of British industry. This, in turn, gave further impetus to ongoing efforts to reform patent and trademark law in both the United Kingdom and the British occupation zone in Germany to better harness the minds of both nations for British gain.

The costs of British scientific exploitation policy are themselves telling of the dramatically increased importance of science and technology to the state in this period. David Edgerton has written about how much of the historiography of postwar Britain has erroneously emphasized British disinterest in and low prioritization of science and technology as the source of an industrial 'decline,' yet far from disinterest, British policymakers were willing to expend a great deal of money and diplomatic capital on scientific exploitation.[4] These costs included both the sprawling apparatus of investigators travelling through Germany and irritation from the United States when policies increasingly diverged over the issue of tacit knowledge. Meanwhile, Parliamentary discussion about rewriting patent law to post-facto legalize these exploitation efforts were full of effusions about the value of science and technology for the British economy, even if there was considerable debate and confusion (as still today, in many ways) over exactly how the state might influence 'pure' science to become 'applied' technology of economic value. When the direct exploitation efforts ended it was not, as is commonly portrayed in the historiography of this event, an issue of the occupation zone governors simply wishing to stop the harmful exploitation so that the zonal economy might support itself; rather, these governors acted in large part to reinstitute intellectual property (IP) law into the British Zone (and later Bizone and West Germany) in order to establish a longer term solution for harnessing German ingenuity for British industry.

It is worth pausing to clarify some terminology. In both the contemporary archival records and subsequent historiography, the term 'science and technology' is used to encompass academic science, industrial research, engineering, and manufacturing processes; 'German scientists' is taken to mean both academic physicists and factory-level technicians with some knowledge of a skilled manufacturing process.[5] This broad usage was not entirely unreflective –

[3] Christine MacLeod, *Inventing the Industrial Revolution: The English Patent System, 1660-1800* (Cambridge: Cambridge University Press, 1988), 6-11; Christopher May and Susan K. Sell, *Intellectual Property Rights: A Critical History* (Boulder, CO: Lynne Rienner Publishers, 2006).

[4] David Edgerton, *Science, technology, and the British industrial "decline", 1870-1970* (Cambridge; New York, NY, USA: Cambridge University Press, 1996); David Edgerton, "Science and the nation: towards new histories of twentieth-Century Britain," *Historical Research* 78, no. 199 (2005); David Edgerton, *Warfare State: Britain, 1920-1970* (Cambridge University Press, 2005).

[5] As one example of this, see David Cassidy's excellent pair of articles on control of German science, in which he clarifies simply by writing, "in this paper, 'science' refers to both science and technology." David Cassidy, "Controlling German science. I: US and allied forces in Germany, 1945-1947," *Historical studies in the physical and biological sciences* 24, no. 2 (1994); David Cassidy, "Controlling German science, II: Bizonal occupation and the struggle over West German science policy, 1946-1949," *Historical studies in the physical and biological sciences* 26, no. 2 (1996).

as will be discussed, the relationship between science and technology was open for debate in Parliamentary discussions of these issues – but it would be deceptive to use the terms today without highlighting their expansive meanings in this context. Additionally, the British English meaning of 'scheme' and the technical use of the terms 'exploitation' and 'war booty' diverge from common American English in that none are intended to connote moral judgment. They are used here in the amoral/technical sense in which they were (mostly) used at the time. There exists a popular historiography related to these 'intellectual reparations' very much focused on the morality of this 'plunder' and employing 'Nazi scientists,' but moral issues are relevant here only insofar as they are of interest to the actors involved in the exploitation schemes.[6] Finally, I will refer to 'BIOS-related' programs as an umbrella term for the agencies directly involved in exploiting German science and technology, rather than list the acronyms and affiliations of each agency every time.

Scientific Exploitation and Conceptions of Technology Transfer

The postwar effort by the victorious Allied powers to exploit German science and technology has rightly been dubbed one of the largest-scale attempts at technology transfer in history.[7] The United States, Great Britain, and to a lesser degree France, worked together to construct an inter-connected apparatus to harness the perceived value of German technology, while the Soviet Union pursued a strategy of joint USSR-East German institutions with more direct methods including forcibly shipping entire teams of technical personnel and factories into Soviet territory.[8] Most of the historiography of the Western Allies' efforts works from the American perspective, which fruitfully highlights the magnitude of the project and the dramatically increased perceived importance of science and technology to state power in the postwar world.[9] The American effort, like the British, cast a net over an extremely broad set of

[6] The term 'intellectual reparations' comes from John Gimbel, *Science, Technology, and Reparations: Exploitation and Plunder in Postwar Germany* (Stanford, Cali.: Stanford University Press, 1990). Works interested moral questions (mostly focusing on the American case) include: Tom Bower, *The Paperclip Conspiracy : The Hunt for the Nazi Scientists* (Boston: Little, Brown, 1987); Friedrich Georg, *'Unternehmen Patentraub' 1945 : Die Geheimgeschichte des groessten Technologieraubs aller Zeiten* (Tuebingen: Grabert, 2008); Gimbel; Linda Hunt, *Secret Agenda : The United States Government, Nazi Scientists, and Project Paperclip, 1945 to 1990* (New York: St. Martin's Press, 1991); James McGovern, *Crossbow and Overcast* (New York, W. Morrow, 1964).

[7] Gimbel, ix-x.

[8] Among the best treatments of the Soviet exploitation of German industry include: Norman M. Naimark, *The Russians in Germany : a history of the Soviet Zone of occupation, 1945-1949* (Cambridge, Mass.: Belknap Press of Harvard University Press, 1995); Andre Steiner, "The Return of German "Specialists" from the Soviet Union to the German Democratic Republic: Integration and Impact," in *Technology transfer out of Germany after 1945*, ed. Matthias Judt and Burghard Ciesla(Amsterdam: Harwood Academic Publishers, 1996); Raymond Stokes, "Assessing the Damages: Forced Technology Transfer and the German Chemical Industry," in *Technology transfer out of Germany after 1945*, ed. Matthias Judt and Burghard Ciesla(Amsterdam: Harwood Academic Publishers, 1996).

[9] Preeminent among existing historiography on the American case is Gimbel.; other notable works include the essays in Matthias Judt and Burghard Ciesla, eds., *Technology Transfer Out of Germany After 1945* (Amsterdam: Harwood Academic Publishers, 1996).; and Cassidy, "Controlling German science. I: US and allied forces in Germany, 1945-1947."; John Gimbel, "The American Exploitation of German Technical Know-How after World War II," *Political Science Quarterly* 105, no. 2 (1990).; Manfred Herrmann, *Project paperclip: deutsche Wissenschaftler in Diensten der U.S. Streitkräfte nach 1945* (S.l.:

fields, including synthetic fuel, die-casting equipment, ceramics, forest products, high-tension cables, motors, butter-making machinery, color film processing, precision grinding and machine tools, jet aircraft, wind tunnels, circuit-breakers, and many more.[10] However, this perspective can only carefully and partially be extrapolated to the British or French cases, despite the close cooperation of the nations' efforts and the bureaucratic similarity in their exploitation agencies. France faced the unenviable job of rebuilding factories and confidence in a postwar state from the rubble left by the German occupation and subsequent Allied invasion.[11] The United Kingdom, while more intact than France and facing similar problems to the United States of reconverting war industry onto civilian footing, faced an enormous wartime debt relative to GDP, a desire to maintain international and imperial influence, and new perceived threats from the Soviet Union necessitating maintaining close ties to the United States. [12]

.s.n., 1999).; Hunt.; Bower.; Clarence G. Lasby, *Project Paperclip: German Scientists and the Cold War* (New York: Atheneum, 1971).; Michael J. Neufeld, "The Nazi aerospace exodus: towards a global, transnational history," *History and Technology* 28, no. 1 (2012).

[10] Gimbel, *Science, Technology, and Reparations: Exploitation and Plunder in Postwar Germany*, 22-23.

[11] The French case has the least developed historiography of the major Allied nations, but still some quality work. I address some of these issues in Douglas O'Reagan, "French Scientific Exploitation and Technology Transfer from Germany in the Diplomatic Context of the Early Cold War," *The International History Review*, (forthcoming). See also Nicholas Chevassus-au-Louis, *Savants sous l'Occupation: Enquête sur la vie scientifique française entre 1940 et 1944* (Paris: SEUIL, 2004); Corine Defrance, "La mission du CNRS en Allemagne (1945-1950)," in *La revue pour l'histoire du CNRS* (2001); Jean-François Eck, "Les contacts entre groupes de l'industrie chimique français et allemands de 1945 à la fin des années 1960: Entre compétition et coopération," in *Réseaux économiques Et Construction Européenne: Economic Networks And European Integration*, ed. Michel Dumoulin(Bruxelles: P.I.E.-Peter Lang, 2004); Marie-France Ludmann-Obier, *Le contrôle de l'industrie chimique en zone française d'occupation en Allemagne (1945-1949)* ([S.l.]: [s.n.], 1986); Marie-France Ludmann-Obier, "Un aspect de la chasse aux cerveaux : les transferts de techniciens allemands, 1945-1949," *Relations internationales* 46, (1986); Marie-France Ludmann-Obier, *Die Kontrolle der chemischen Industrie in der französischen Besatzungszone 1945-1949* (Mainz: V. Hase & Koehler, 1989); Marie-France Ludmann-Obier, "La mission du CNRS en Allemagne (1945-1950)," *Cahiers pour l'Histoire du CNRS 1939-1989* 3, (1989); Dominique Pestre, "Guerre, renseignement scientifique et reconstruction, France, Allemagne et Grande-Bretagne dans les annees 1940," in *De la diffusion des sciences à l'espionnage industriel, XVe-XXe siècle : actes du colloque de Lyon (30-31 mai 1996) de la SFHST*, ed. André Guillerme(Fontenay-aux-Roses (France): ENS Editions, 1999); Jacques Villain, "France and the Peenemuende Legacy," in *History of Rocketry and Astronautics: Proceedings of the Twenty-Sixth History Symposium of the International Academy of Astronautics, Washington, D.C., U.S.A., 1992*, ed. Phillipe Young(San Diego: Univelt, for the American Astronautical Society, 1997); Jacques Villain, "L'apport des scientifiques allemandes aux programmes de recherche relatifs aux fusées et avions à réaction à partir de 1945," in *La France face aux problemes d'armement 1945-1950*, ed. Maurice Vaïsse(Bruxelles: Complexe, 1999).

[12]Existing historiography related to the British side includes: J. Agar and B. Balmer, "British Scientists and the Cold War: The Defence Policy Research Committee and Information Networks, 1947–1963," *Historical Studies in the Physical Sciences* 28, no. 2 (1998); Richard J. Aldrich, "British intelligence and the Anglo-American 'Special Relationship' during the Cold War," *Review of International Studies* 24, no. 3 (1998); Cassidy, "Controlling German science. I: US and allied forces in Germany, 1945-1947."; Cassidy, "Controlling German science, II: Bizonal occupation and the struggle over West German science policy, 1946-1949."; Michael Dockrill, *British Defence Since 1945 (Making Contemporary Britain)* (Wiley-Blackwell, 1991); Clive Edwards, "Technology Transfer and the British

Like in the American and French cases, British attempts at utilizing German science and technology were a veritable alphabet soup of acronyms for agencies, both civilian and military, with complex and evolving lines of authority. As such, the following summation will necessarily ignore some important nuance, but will hopefully provide a least a useable outline. A joint wartime effort between the United Kingdom and United States, led by the Combined Intelligence Objectives Sub-committee (CIOS) of the intelligence division of the Shared Headquarters, Allied Expeditionary Force (SHAEF) aimed at exploiting German military advances for the war on Japan. With the dissolution of the combined command in July 1945, CIOS split into American and British components. The latter of these, now called the British Intelligence Objectives Sub-committee (BIOS), shifted from strictly military intelligence oversight to the supervision of the Board of Trade, but continued to receive logistical support from the so-called 'T' Force units of the British occupation forces in Germany. BIOS and Board of Trade leadership began considering expanding this military exploitation to civilian industry, planning to work in conjunction with the United States' Field Information Agency, Technical (FIAT), which had essentially taken over for the American half of CIOS. A direct liaison group dubbed FIAT (British) (or 'FIAT (BR)') mirrored FIAT (US), though BIOS remained the primary agency in charge of exploitation. The Board of Trade then set out to recruit investigators from industry who would be given military uniforms, ceremonial rank, housing, and transportation to investigate German targets identified by CIOS and BIOS, after which they would write reports for use by the rest of their industries.

In an independent but related effort also sponsored by the Board of Trade, a panel chaired by Sir Charles Darwin - descendent of the famed naturalist – considered and then orchestrated an effort to recruit German scientific and technical personnel for the benefit of British industry.[13]

Furniture Making Industry, 1945-1955," *Comparative Technology Transfer and Society* 2, no. 1 (2004); J. Farquharson, "Governed or Exploited? The British Acquisition of German Technology, 1945-48," *Journal of Contemporary History* 32, no. 1 (1997); Carl Glatt, “Reparations and the Transfer of Scientific and Industrial Technology from Germany: A Case Study of the Roots of British Industrial Policy and of Aspects of British Occupation Policy in Germany between Post-World War II Reconstruction and the Korean War” (European University Institute, Florence, 1994); Margaret Gowing and Lorna Arnold, *Independence and Deterrence: Policy Making v. 1: Britain and Atomic Energy, 1945-52 (Vol 1)* (Palgrave Macmillan, 1974); Michael Hopkins, *Cold War Britain, 1945-1964 : new perspectives* (New York: Palgrave Macmillan, 2003); R. V. Jones, *The Wizard War : British Scientific Intelligence, 1939-1945* (New York: Coward, McCann & Geoghegan, 1978); Roy MacLeod, ""All for Each and Each for All": Reflections on Anglo-American and Commonwealth Scientific Cooperation, 1940-1945," *Albion: A Quarterly Journal Concerned with British Studies* 26, no. 1 (1994); Paul Maddrell, “Britain's exploitation of occupied Germany for scientific and technical intelligence on the Soviet Union” (1998); Paul Maddrell, "British-American Scientific Intelligence Collaboration during the Occupation of Germany," *Intelligence and National Security* 15, no. 2 (2000); Bernhard Rieger, *Technology and the culture of modernity in Britain and Germany, 1890-1945* (Cambridge, U.K.; New York: Cambridge University Press, 2005); Willam Paul Snyder, *The politics of British defense policy, 1945-1962* (Ernest Benn, 1964); Ian D. Turner, *Reconstruction in post-war Germany : British occupation policy and the Western zones, 1945-55* (Oxford, UK; New York; New York: Berg ; Distributed exclusively in the US and Canada by St. Martin's Press, 1989); Matthew Uttley, "Operation 'Surgeon' and Britain's post-war exploitation of Nazi German aeronautics," *Intelligence and National Security* 17, no. 2 (2002).

[13] For those familiar with the American case, the Darwin Panel is most analogous to 'Operation Paperclip,' while the BIOS efforts are most similar to FIAT. The French created a FIAT (France) – more correctly the Comité de Coordination Scientifique – but operated it very differently from the US or UK.

Within the British occupation zone in Germany, the Control Council for Germany and Austria (CCfG) initially assisted but later resisted these direct exploitation efforts – the rationale for this shift will be discussed later, but is usually given as its mandate to rebuild the zone's economy, and attempts to reduce occupation costs to the British taxpayer. The major players in the British side, then, were essentially BIOS, in charge of overall exploitation; FIAT (BR) as liaison to the US, and later France; the Darwin Panel independently focusing solely on German personnel; the Board of Trade as the government agency in charge of overall policy and industry liaison; and the Control Council in charge of running the German zone.

The president of the American Chemical Society argued in October 1945 that "the results of research which have been carried out by someone else...are priceless" and could be conveyed to great benefit, and this enthusiasm largely characterizes the American approach to FIAT and related programs. French policymakers, in contrast, expressed severe doubt about removing scientists and technical personnel from their contexts, as this rendered them 'practically sterile.'[14] British decision-makers, in this context, began with an enthusiasm similar to the Americans', yet faced with difficulties in effectively transferring German technology, increasingly came to feel that effective exploitation would require focusing to hands-on, tacit knowledge - "know-how," as it is frequently described in British files, including quotation marks - in additional to detailed, written reports. This shift, in turn, created a dilemma. Written reports could be copied and distributed equally to all interested parties, both within British industry and to allied nations. Indeed, selling such reports could be a valuable source of hard currency in an export-hungry economy. "Know-how," in contrast, was fundamentally personal. As a matter of internal policy, this meant re-imagining the methodology and cost-effectiveness of the BIOS programs from "benefit to industry" to "benefit to firms;" to what policy-makers thought was a less principled, more biased, and more easily corruptible system. As a matter of diplomacy, it meant frustrations with American policymakers of a different mindset, angry accusations from Soviet leaders of British (and American) cheating on reparations, and worry over permanent 'missed opportunities' in the French Zone.

Initial British proposals for exploiting German technology for civilian industry (as opposed to defense technology) focused around finding methods for benefiting the entirety of relevant industries, rather than individual firms, primarily on principled rather than practical grounds. As a result, they emphasized duplicable, written reports. In August 1945, the Board of Trade initially circulated a position paper on employing German scientists and technicians in civil industry that suggested the opposite approach. Granting recruited technical personnel to individual firms, the Board of Trade argued, would provide "in many cases the only way to get the full value out of these experts - and there is no point in having them here otherwise," yet the Foreign Secretary objected that the knowledge acquired through state means must belong to the

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Outside of a very small number of exceptional cases, the Soviet Union did not cooperate with the Western Allies in these efforts, though as I will discuss, did purchase the published results of American and British investigations.

[14] Dewey to Wallace and others, 23 Oct. 1945, RD 59, file 862.542/10-2445, NA; citation from Gimbel, *Science, Technology, and Reparations: Exploitation and Plunder in Postwar Germany*, 24-25. For the French ideas of decontextualized scientists becoming intellectually sterile, see Economie Nationale, "Le Problème de la recherche technique et scientifique allemande," 10 March 1946. ANFF, CNRS records, RG 19780283, carton 35. See also O'Reagan.

state and be for the public good.[15] The Foreign Office won the day, and the committee focusing on acquiring German personnel - later to become the 'Darwin Panel' - concluded that whenever possible, such Germans would work for government Research Associations and Research Establishments rather than private firms.[16]

This decision to serve industries rather than firms, cast in terms of "fairness," avoiding "jealousy' and favoritism, and making the "ethical" choice, was built into the structure of BIOS and the Darwin Panel scheme.[17] Though investigative teams were felt to lose productivity beyond 3-4 members, they sometimes sprawled in order to "be fully representative of the industry concerned i.e. they must include representatives of the main Trade Associations and the main NON-Association firms" [emphasis in original].[18] Whenever possible, competing firms were placed on the same team, with the anticipated result of each holding the other accountable for including everything in the final reports.[19]

Extensive publicity efforts sought to bring this material to the attention of even "smaller firms – and it is probable that individually and collectively they have the most to benefit from this insight into German methods – [who] will not use the material unless it is brought pretty forcibly to their notice."[20] BIOS began shipping copies of reports to libraries in industrial cities throughout the UK by late 1946, a policy that led to requests for inclusion from county libraries miffed at being left out as well as requests for fewer copies from city libraries lacking both demand and shelf space.[21] A small exhibit of reports and prototypes in Bristol, bulletins in the Board of Trade Journal, and occasional press releases supplemented efforts to advertise BIOS reports to all potentially interested parties.[22] Official policy discriminated against providing aid to firms that "refused to take part in BIOS investigations for fear of letting in their

[15] Derek Wood, "Minute Sheet," 9 Jan 1946. The National Archives (TNA): Public Records Office (PRO) BT 211/47.

[16] "First Meeting of Panel to Consider the Employment of German Scientists, Specialists and Technicians for Civil Industry in the United Kingdom," 3 Dec 1945. TNA: PRO BT 211/24; "Note of Meeting to Discuss the Formation of a Panel to Deal with the Employment of German Scientists Specialists and Technicians in the United Kingdom," 21 Nov 1945. TNA: PRO BT 211/24.

[17] "Record of a meeting to discuss further actions in connection with BIOS Group VII investigation of German wartime patent specifications," 17 Apr 1946. TNA: PRO BT 211/44; German Division, Board of Trade, "Facilities for Technical Investigations in Germany by Individual British Firms," 23 Oct 1946. TNA: PRO BT 211/21; DJ Ezra to Derek Wood, 13 Mar 1947. TNA: PRO BT 211/24.

[18] [Unknown] to VB Bennett, 16 Sept. 1946. TNA: PRO BT 211/24.

[19] WG Glennie, Deputy Regional Controller, 'Bristol Exhibition of Industrial Intelligence Work in Germany," 28 Dec 1946. TNA: PRO BT 211/22.

[20] Derek Wood to Mr. Somervell, "Distribution of Industrial Information from Germany," 19 Oct 1946. TNA: PRO BT 211/24.

[21] PW Bennett to The Under-Secretary, Board of Trade, 31 July 1946; EG Davies to Miss EF Magg, Acting County Librarian, Wakefield, 17 Apr 1946. TNA: PRO BT 211/11; Gilbert LuDunn, Borough Librarian to The Assistant Secretary, German Department, Board of Trade, 26 June 1947. TNA PRO: BT 211/162.

[22] WG Glennie, Deputy Regional Controller, 'Bristol Exhibition of Industrial Intelligence Work in Germany," 28 Dec 1946. TNA: PRO BT 211/22

"Darwin Panel Scheme: Draft Statement for Publicity," April 1948. TNA PRO: BT 211/476.

"Minutes of the 6th Meeting of the Panel to Consider Employment of German Scientists, Specialists and Technicians in the United Kingdom," 30 Jan 1946. TNA: PRO BT 211/24.

competitors…however much common humanity may lead us to sympathize with their attitude."[23] Written reports on German technical processes flowed through the country, and BIOS officials anticipated significant economic value to flow with them.

Reception for these reports wasn't entirely positive, however, and within months of the creation of BIOS, complaints that reports of any kind were insufficient became more urgent. The first formal meeting of the Darwin Panel in December 1945 addressed this issue straight away. The Chairman, Sir Charles Darwin, "agreed that it was far better actually to employ Germans in industries where the full power of their experience and criticism could be brought to bear, then to interrogate them. This was the only method of discovering the use of the people whom the Panel was considering."[24] Bringing these people over was a necessity for control purposes, he felt, as their knowledge and expertise would otherwise live on despite any industrial dismantling - the knowledge lived in the people, not the materials or patents.[25] While debating an industry proposal to allow investigators to make follow-up visits in July 1946, a representative of the Ministry of Fuel and Power argued that "BIOS reports are valuable up to a point, but for firms seeking to copy a machine or introduce a process developed by the Germans a further and more detailed examination is almost certain to be essential… BIOS Reports vary greatly in their practical value to industrialists and...few, if any, are likely to provide adequate information...to introduce and develop a German process in this country."[26] The Board of Trade by this point agreed: "The information contained in BIOS reports...is quite insufficient to permit potential new users, particularly those with limited research facilities, to set up and operate the process."[27] A report from October 1946 added that "experience has shown that if industry was left to prepare the reports they were of little value to firms which had not taken part."[28]

This could be read as a series of complaints about the quality of the reports rather than written reports in general, but leaders from industry and BIOS-related agencies believed that British reports were the best to be had, and even the Americans agreed with this assessment. Derek Wood, head of BIOS, boasted in October 1946 that "BIOS reports are widely recognized as being superior to those produced by the Americans. Our system of putting competing interests in the same team has undoubtedly done much to prevent concealment of the really interesting topics...Industry has lived up to its side of the deal, firms and associations sparing neither trouble nor expense to make the reports comprehensive and instructive."[29] US bibliographies of available materials were considered useless, combining too much material in too superficial a form; head of the US efforts John Green admitted that he was "envious of the polished materials you make

[23] Control Office for Germany and Austria, "Requests from British Firms for Facilities to Obtain Technical Information from Germany," 26 June 1946. TNA: PRO BT 211/21.

[24] "First Meeting of Panel to Consider the Employment of German Scientists, Specialists and Technicians for Civil Industry in the United Kingdom," 3 Dec 1945. TNA: PRO BT 211/24

[25] Economy and Industrial Planning Staff, "The German Clock and Watch Industry," Jan 1946. TNA: PRO BT 211/37.

[26] CH Noton to Derek Wood, 17 July 1946. TNA: PRO BT 211/21.

[27] German Division, Board of Trade, "Facilities for Technical Investigations in Germany by Individual British Firms," 23 Oct 1946. TNA: PRO BT 211/21

[28] Derek Wood to ER Wood, "Interrogation of German Scientists and Technicians in the UK," 18 Oct 1946. TNA: PRO BT 211/24.

[29] Derek Wood to Mr. Somervell, "Distribution of Industrial Information from Germany," 19 Oct 1946. TNA: PRO BT 211/24

available."[30] The French, it was felt, could or would not even produce reports for their own industry due to "lack of organization, personnel and equipment."[31] The Soviet Union cast a vote of confidence for British reports by means of purchasing every one at a cost estimated over $400,000 per year.[32]

Instead, complaints about the limited utility of BIOS reports reflected a conscious, ongoing struggle with the difficulty of capturing technology in written form. Industrial firms and trade associations pushed aggressively for finding methods of transferring tacit knowledge. At various points, they requested on-site inspections of German plants, embedding their engineers in these plants for weeks or months; hiring individual technicians; and limiting such activities for rival firms and allied countries. Textile and chemical company Courtauld's wrote to BIOS requesting additional inspections of IG Farben's plants, as even after sending a team, the information necessary for building a new facility "can only be obtained from the Dormagen technicians."[33] The Association of British Chemical Manufacturers got quite heated in their demands for follow-up investigations by individual firms to supplement BIOS reports. Such reports, an October 1946 letter argues, were very rarely sufficient to transfer a technology or process, and "we have not spent all the time and trouble in organizing investigating teams merely to produce a row of reports on the shelf…First hand investigation would eliminate a great deal of the usual trial and error in setting up a plant here…much of the 'know how' is impossible to put into words."[34] "In practice…no amount of 'given' information can ever be a substitute for the information obtained in the hard school of practical experience."[35] Nor was this a suggestion in which the author considered outside what readers would embrace - "the arguments above seem to be so conclusive that there can be no reply".[36] Similar statements by other industrial representatives repeated these sentiments throughout the life of the Darwin Panel and BIOS agencies.

Such complaints led to structural changes, starting in July 1946 and continuing until the programs' conclusions, designed to put investigators on-site in Germany for extended periods with fewer requirements for report writing. At a BIOS meeting in that month, one officer expressed ongoing concern about "abusing" their role as occupier by aiding individual British firms and re-emphasized that the Darwin Panel had only ever been agreed to with assurances of industries, rather than individual firms, being the benefactors. Still, this principle being accepted, there was "general agreement" among those present that BIOS was "not really of any general benefit" anyway, as the firms sponsoring investigators received almost exclusive advantage.[37]

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[30] Trevor Evans, "Smith and the Secrets of Schmidt," *Daily Express*, 9 Oct. 1945. TNA: PRO BT 211/24; John Green to Derek Wood, 31 Dec 1946. TNA: PRO BT 211/24.

[31] Derek Wood to K Unwin, Esq, 10 Oct 1946. TNA: PRO BT 211/25.

[32] Alexander King to HL Verry, 26 Apr 1946. TNA: PRO BT 211/17.

[33] MN Salmond to Derek Wood, "Further Visits to IG Farben, Dormagen," 21 May 1946. TNA: PRO BT 211/21.

[34] J. Davidson Pratt, The Association of British Chemical Manufacturers to Derek Wood, 7 Oct 1946. TNA: PRO BT 211/21.

[35] J. Davidson Pratt, The Association of British Chemical Manufacturers to Derek Wood, "Follow-Up Visits," 24 Oct 1946. TNA: PRO BT 211/21.

[36] J. Davidson Pratt, The Association of British Chemical Manufacturers to Derek Wood, 7 Oct 1946. TNA: PRO BT 211/21.

[37] "Report on a Meeting of Technical Investigations in Germany by Individual Firms," July 1946. TNA: PRO BT 211/21.

"In all honesty," a later report admitted, "BIOS investigations are…to some extent equally discriminatory in favouring firms represented in teams as opposed to firms who have to read reports."[38] "The practicable advantages of the Scheme were set off against the criticisms…of the discrimination to be shown to the favoured few," and despite fears that "it was wrong in principle that a specific firm should be able to acquire…trade secrets which were not for sale," the scheme was approved provided arrangements were made to pay the German firms.[39]

Impact of a Tacit Knowledge Focus on Foreign Relations

Neither BIOS nor its American or French counterparts should be taken in isolation, as each drove the others' policies and ambitions in direct and indirect ways. Proponents of scientific exploitation aimed at civil industry in both the United States and United Kingdom promoted the expansion of the military-oriented exploitation by arguing that the other was already doing so, and an opportunity was going to be quickly lost.[40] France began its exploitation efforts at the behest of its western allies, creating FIAT (FR) to coordinate efforts, but never escaped suspicion from the others that considerably lower enthusiasm for the project was a disguise for stealthy attempts to steal away scientists; whether they had "valuable information which they wish to keep to themselves, or whether they think we can be lured yet further with what may prove to be mediocre bait."[41] From the British perspective, CIOS had been a building block of the Anglo-American "Special Relationship" in intelligence sharing that had blossomed during the war, and BIOS-related programs were initially another avenue to bind the nations more closely together. The developing perceived need to shift focus to a tacit knowledge focus, then, came at a price – written reports could be shared with allies and published fruitfully around the world, but personnel with personal experience and British engineers implanted in German factories could not. The British decision to deprioritize written reports in favor of "know-how," then, made in this international context, is even more striking a demonstration of the elevated importance of science- and technology-based exports for the postwar state.

Given the close cooperation in exploiting military technology, and that even British policymakers argued from the start that exploiting civilian industrial technology was "a natural extension" of this program, it might seem obvious that similar cooperation would extend to exploiting civilian industrial technology.[42] Yet there was actually considerable debate about whether to include the Americans at all, and the extent of the "moral obligation" for full and open cooperation was never a fully settled issue.[43] The stated purpose for the third meeting of the Darwin Panel was to consider *whether* - not 'when' or 'how' - lists of German scientists required

[38] "Technical Investigations in Germany by Individual Firms," July 1946. TNA: PRO BT 211/21.

[39] "Report on a Meeting of Technical Investigations in Germany by Individual Firms," July 1946. TNA: PRO BT 211/21.

[40] CITE: For the UK argument that it was "understood that the Americans are already attracting" such German personnel, and the UK faced "missing a valuable opportunity," see "Employment of German Scientists and Technicians in Civil Industry in the United Kingdom," 28 Aug 1945. TNA: PRO BT 211/46. For the similar American claim, see Gimbel, *Science, Technology, and Reparations: Exploitation and Plunder in Postwar Germany*, 30-33.

[41] LR Poole to Derek Wood, 2 Aug 1946. TNA: PRO BT 211/17.

[42] "Employment of German Scientists and Technicians in Civil Industry in the United Kingdom," 28 Aug 1945. TNA: PRO BT 211/46.

[43] DJ Ezra to Derek Wood, 13 Mar 1947. TNA: PRO BT 211/24.

for employment in the UK should be exchanged with the Americans.[44] The matter "was settled for defense," but there were "fundamental differences of outlook held by civil industry and several additional difficulties," among them "whether, if co-operation was decided on as a policy between Governments, the American Government was capable of supervising adequately the activities of big business."[45] In the end, the Panel voted six to four in favor of sharing the information fully: "Those concerned with Trade Departments voting against, and those who were voting on general principles voting for the motion."[46] The Board of Trade concurred later that month "the balance of advantage undoubtedly lay in full co-operation," precisely because the value to be gained by reading American reports was assumed to be tremendous, even at the cost of the competitive of advantage of keeping reports to themselves. So eager were they for American involvement based on that prospect that the Board intended to override political obstacles faced by their American counterparts by leaking information to US business leaders, who (it was assumed) would then put pressure on the government to participate.[47]

Once operational, the American and British exploitation agencies generally enjoyed high levels of cooperation and mutual admiration, but the competitive dynamic that had led to each nation's efforts to expand to civil industry continued to drive policy and constrain choices. The first meeting of the Darwin Panel spent much of its time worrying if proposed contracts were "at least as favourable as the Americans were alleged to be giving," and if they were working quickly enough as "speed was the essential factor since the Americans were approaching these people with good offers."[48] When debating a shift in July 1946 towards normalizing relations with German industry to allow hiring personnel for regular salaries (as it was felt that they would be more helpful if hired than when questioned and their documents copied), the Board of Trade discussed reports that "private American businessmen were active in their zone" undertaking "private negotiations of the kind envisaged," thus "the Americans must have found some means of paying the Germans for their technical services" (in fact they did not).[49] The embassy in Washington was instructed to feel out the US on the idea of paying German scientists, but by no means to let the Americans know that BIOS intended to do so.[50] In late 1946, as the Control Commission for Germany asserted more strongly that "continued piracy of German methods" must wind down in favor of building up the German economy, they nevertheless admitted that it

[44] "Minutes of the 3rd Meeting of the Darwin Panel to Consider Employment of German Scientists, Specialists and Technicians in the United Kingdom," 17 Dec 1945. TNA: PRO BT 211/24.

[45] Ibid.

[46] Ibid.; "Minutes of the Interdepartmental Meeting held at the Board of Trade on December 20th..." 20 Dec 1945. TNA: PRO BT 211/24.

[47] "Minutes of the Interdepartmental Meeting held at the Board of Trade on December 20th..." 20 Dec 1945. TNA: PRO BT 211/24.

[48] "First Meeting of Panel to Consider the Employment of German Scientists, Specialists and Technicians for Civil Industry in the United Kingdom," 3 Dec 1945. TNA: PRO BT 211/24

[49] "Report on a Meeting of Technical Investigations in Germany by Individual Firms," July 1946. TNA: PRO BT 211/21.

[50] Derek Wood to ST Norman, Esq., British Commonwealth Scientific Office, 20 Nov 1946. TNA: PRO BT 211/24.

was impossible to cease operations if the US continued, since this could give America a monopoly on hiring, and thus the end date must be coordinated bilaterally.[51]

This dynamic of close coordination-by-competition began fraying as written reports in general, and especially those issuing from the US Department of Commerce (in charge of FIAT), fell in the Board of Trade's esteem. American bibliographies were considered "useless," as they contained too much information with insufficient depth and clarity.[52] By mid-1946, as BIOS shifted under pressure from industry towards maximizing tacit knowledge and recognizing the limits of written reports, new proposals envisioned "a subsequent phase to which…the BIOS plans of equal participation rights to all United Kingdom and United States industries cannot be extended."[53] By September 1946, bibliographies of FIAT records issued by the US Department of Commerce were officially "not to be made available to industry in this country…in view of their unsatisfactory character."[54] While inevitable that British industry would get some copies anyway, and orders from these bibliographies would still have to be fulfilled where possible, opinions of the value of US cooperation were not overly generous. A retrospective report from BIOS at the end of 1946 concluded that there was a "common belief...that the Americans are in most forms of exploitation always one jump ahead of us and that they invariably make the scale of our effort look small," but in reality the 10,000 British investigators dramatically outnumbered the about 600 from the US. [55] Moreover, the methodological switch was bound to be fruitful – "it must inevitably have been much to our advantage, at this present time of reconversion to peace-time production, to have this vast number of technical men from our own factories walking round German plants getting first-hand knowledge of the methods of German industry."

"Your guiding principle," one memorandum ordered BIOS sub-divisions, "should be that a substantial 'bite out of the apple' is better than a 'smell all round.'"[56] This focus on in-depth "first-hand knowledge" rather than breadth of information led to "very vigorous…very critical" reactions to American decisions over the course of the BIOS-related programs. The diplomatic stakes here were not alliance-breaking by any means – despite their disagreements, both American and British representatives on a number of levels celebrated the continued good relations enjoyed by BIOS/FIAT, even ending their collaboration with a party in London (the costs of which led to complaints from Treasury). Still, the initial planning and ideal scenario was one in which both nations shared and shared alike, bringing their economies up to the cutting edge and enhancing the 'Special Relationship' along the way. A shift to emphasizing tacit knowledge was no idle decision.

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[51] Derek Wood to ST Norman, Esq., British Commonwealth Scientific Office, 21 Oct 1946. TNA: PRO BT 211/24.

[52] "Copy of Brief Handed to Major J. Day, Board of Trade before departure for Washington," March 1946. TNA: PRO BT 211/41; JH Wheatcroft, "Lists of Classified and Unclassified CIOS Reports, Amendment No. 3," 6 Apr 1946. TNA: PRO BT 211/13.

[53] MN Salmond to Derek Wood, "Further Visits to IG Farben, Dormagen," 21 May 1946. TNA: PRO BT 211/21.

[54] "Memorandum for Mr. Norman," Sept. 1946. TNA: PRO BT 211/17.

[55] WG Glennie, Deputy Regional Controller, 'Bristol Exhibition of Industrial Intelligence Work in Germany," 28 Dec 1946. TNA: PRO BT 211/22

[56] JH Wheatcroft to G Mansell, "Reports awaiting industrial distribution," 6 Sept 1946. TNA: PRO BT 211/13.

The inability to capture tacit knowledge in BIOS reports had more explicit and obvious - albeit indirect - impact on diplomatic relations with the Soviet Union. As early Cold War tensions escalated, partly caused by controversy over reparations, an article in the state newspaper *Pravda* on 21 March 1947 accused the United States and United Kingdom of exactly the exploitation of German technical 'secrets' at allies' expense of which British policymakers had worked to avoid suspicions. The head of the UK Delegation to the Council of Foreign Ministers immediately requested that the Control Council provide him additional information on *Pravda*'s claims that "BIOS reports [were] valueless since the information they give is totally inadequate".[57] The official British response was to point out that, as mentioned, the Soviet embassy routinely bought both American FIAT and British BIOS publications at a cost that the head of FIAT (US) estimated at $400,000 USD per year ("a fact which will not be forgotten when the time comes to consider the loan of money to Russia").[58] Considering the earlier internal statements about the value of BIOS reports (i.e. "few, if any, are likely to provide adequate information for a firm wishing to introduce and develop a German process in this country"), this seems a less than exhaustive rebuttal.

American vs. British "Know-how"

Though this paper is not primarily focused on the American case and cannot go into the level of detail necessary to fully compare and contrast American and British exploitation policy and the sources from which they derived, emerging and contrasting concepts of tacit knowledge and 'know-how' were important drivers in that nation's policies as well.[59] The stated target of American investigations, repeated with some variation across agencies' mission statements and orders to investigators, was "German industrial processes, inventions, engineering, and 'know-how.'"[60] The meaning of "know-how" in the American context was not quite the same as its usage in the United Kingdom, however, or at least not consistently. In listing 'know-how' as a central part of the missions of exploitation efforts, American policymakers demonstrated a clear awareness of the importance of this intangible, yet different understandings of this concept, and technology transfer in general, shaped American exploitation policy in different ways than in the UK.

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[57] DL Haviland to Sir Mark Turner, 22 March 1947. TNA: PRO BT 211/235. Regarding the claims of over-classification, the CCfG responded that 321/2694 final reports were classified and 2/3 not graded higher than Restricted, a response "I think…supplies ammunition for a reasonably honest answer to the Russian allegations."

[58] Alexander King to HL Verry, 26 Apr 1946. TNA: PRO BT 211/17.

[59] For a fuller discussion of the American efforts, pending the publication of my own research, see Cassidy, "Controlling German science. I: US and allied forces in Germany, 1945-1947."; Cassidy, "Controlling German science, II: Bizonal occupation and the struggle over West German science policy, 1946-1949."; Gimbel, *Science, Technology, and Reparations: Exploitation and Plunder in Postwar Germany*; Herrmann; Lasby; Raymond Stokes, *Divide and prosper : the heirs of I.G. Farben under Allied authority, 1945-1951* (Berkeley: University of California Press, 1988); Stokes, "Assessing the Damages: Forced Technology Transfer and the German Chemical Industry."

[60] L.R. Warden, "Foreign Economic Administration," 29 July 1945. General Records, Department of Commerce, Record Group 40 (RG 40), box 3, National Archives at College Park, College Park, MD (NACP); "Apprendix A: Basic Directive, Technical Industrial Intelligence Committee," undated. RG 40, box 62, NACP.

Though some American scientific exploitation efforts dated back to the entry of the United States into the war, the Acting Chairman of the War Production Board complained to the Secretary of War in September 1944 that "no effort has yet been made to obtain the so-called 'know how' which can only be obtained on the ground by qualified engineers and technologists working directly with the military forces."[61] The Commanding General of the Army Air Forces suggested expanding the mission of ALSOS, the unit sent to Europe with the invading forces to investigate reports of a German atomic weapons program, but the G-2 (Intelligence) Division of the Army was not willing to expand ALSOS's mission beyond purely "scientific" objectives.[62] In response, the Joint Intelligence Committee established the Technical Industrial Investigations Committee (TIIC) on October 30, 1944, with a mandate to "receive, approve, and coordinate all governmental requests ... for investigations ... pertaining to industrial processes, patents, inventions, engineering, and 'know-how.'"[63] TIIC, in turn, instructed the representatives recruited from industry to distribute advertisements to other firms about efforts "to secure technical data and industrial 'know-how' which will be of value" to US industry.[64] Clearly acquiring this 'know-how' was a chief priority early on, and conceived of as a matter distinct from patents, processes, or purely 'scientific' knowledge; as something requiring skilled personnel on the ground in Germany to exploit effectively.

Effective acquisition of such personal knowledge was a difficult task, however, and even more so the mandate to make this knowledge available to all interested government (and later industrial) end users. Though not using the term, the general manager of the National Machine Tool Builders' Association expressed the chief problem facing exploitation as being "that these engineers come out of the Germany full of things they want to report but have a great deal of difficulty in expressing it in words."[65] His solution was to send "a skilled copy man from an advertising agency" to London to try to express things in "clear, explicit English that other people will understand," but this does not seem to have solved the issue. Similarly, the Good-All Electric Manufacturing Company were not especially impressed by reports of German machines, but wanted to send mechanics over to London to look at things in person regardless, as "mechanics can often visualize how something can be made if they look a thing over easier than they can if they have to look it over from photographs."[66] These businesses, too, seemed to share a concept of 'know-how' with which their British counterparts were simultaneously struggling.

Not all American policymakers shared this conception of 'know-how,' however. For some, the term seems to have been something much more similar to a synonym for 'knowledge' or 'details.' "The design data obtained on sweep back wings...is a very important addition to our 'know how,'" wrote one investigator.[67] Americans failed to copy one machine, argued another,

[61] James S. Lay, "Joint Intelligence Committee: Acquisition of German Technical Information of an Industrial Nature (Reference: JIC 220 Series)," 12 Oct 1944. RG 40, box 62, NACP.

[62] Ibid.

[63] L.R. Warden, "Foreign Economic Administration," 29 July 1945. RG 40, box 3, NACP; "Apprendix A: Basic Directive, Technical Industrial Intelligence Committee," undated. RG 40, box 62, NACP.

[64] Letter to W.J. Donald, 21 June 1945. RG 40, box 12, NACP.

[65] Tell Berna to Lt. Gen. Levin H. Campbell, 20 July 1948. RG 40, box 12, NACP.

[66] R.A. Goodall to U.S. Department of Commerce, 12 Oct 1946. RG 40, box 3, NACP.

[67] US Department of Commerce, "Fruits of Victory: Intelligence, Research and Development," undated. RG 40, box 3, NACP.

because of "an inability to comprehend certain details and lacked the know-how which is available both in the report and in Germany."[68] This stands in sharp contrast to complaints that 'know-how' *cannot* be placed into reports. Some documents used the term in vaguer senses, such as a complaint that one report "does not give specific information on 'know-how,' new industrial processes," or another that while the earliest TIIC investigations "found that their written reports could not physically contain all of the information necessary for a complete story," later documents did include this know-how.[69]

These different usages of this term explain at least part of what appeared to British eyes as American inconsistent policy decisions and shifts more compellingly than simple incompetence. The American organizations each sought to enact Executive Order 9568, issued by President Harry Truman on August 25, 1945:

> It is the policy of this Government...that there shall be prompt, public, free and general dissemination of enemy scientific and industrial information. The expression "enemy scientific and industrial information," as used herein, is defined to comprise all information concerning scientific, industrial and technological processes, inventions, methods, devices, improvements and advances...if such information is of enemy origin or has been acquired or appropriated by the enemy.

For those who understood 'know-how' as an important component of these "industrial and technological processes," defined by hands-on, experiential knowledge, acquiring personnel was the central – and perhaps only – way to truly fulfill their mission. One manufacturer, for example, was advised that specific individuals probably couldn't be brought over to the United States unless "it was reasonably certain that they had some 'know-how' that we wanted," in which case apparently the rules could be stretched.[70] Within Germany, the economic division of the Control Council for Germany "stressed that much more real value will be obtained from the interrogation of technicians and scientists than will be gleaned from examination of documents, apparatus or plans, in the absence of responsible key personnel."[71] Such scientific and technical personnel should, in turn, "be exiled" from Germany and "given first class jobs here" or with one of the other Allied nations, both for control purposes and as human "war reparations," their salaries paid by sale of German assets.[72] The same logic could work in reverse, however, as in FIAT's opposition to Project Paperclip (the American rough equivalent of the Darwin Panel) on the grounds that German personnel working in America would learn American technology and upon their return, transmit it back to Germany, thereby illegally aiding Germany's armaments industry.[73]

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[68] Ibid.

[69] "USSBS Reports Relating to Japanese Machinery Industry – Machine Tools," undated. RG 40, box 12, NACP; W.H. Reynolds to Robert Reiss, 5 Sept 1946. RG 40, box 3, NACP.

[70] Howard A. Pringle to W.C. Taylor, undated. RG 40, box 35, NACP.

[71] Economics Sub-Division, "Technical and Scientific Research in Germany After the War," undated. Records of the US Occupation Headquarters, World War II, Record Group 260 (RG 260), FIAT Administrative Records 1945-1947, box 17/3, folder 16, NACP.

[72] Ibid.

[73] Ralph M. Osborne to Col. E.W. Gruhn, 28 Sept 1945. RG 260, box 17/2, folder 25, NACP.

In comparison, the parts of the American program that saw 'know-how' as identical to knowledge, or less important for America in any case, were free to continue pursuing written reports in a way more akin to early British efforts. Such factions are probably not possible to identify strictly along bureaucratic lines, with one organization acting one way and another in sharp contrast, but rather by individuals who possibly never fully debated the means and limits of technology transfer. For investigators from the Koppers Company, German oil refining techniques "were considerably behind our American practices," yet the *data* from their experiments was still worth copying and might save some time – know-how might be important, in this take, but if the American technology and 'know-how' was already superior, then the objective all along should have just been to gain what explicit information could be of value.[74] For those not operating under the conception that German technology was superior, but simply that German labs had performed from useful experiments worth analyzing their findings, the shallow-but-broad American investigative plan was the most reasonable. Such sentiments are less frequently expressed in the sources than disappointment at not finding superior German technology, but cannot be discounted as a force behind American decision-making. Such investigations might have been perceived as less useful by British policymakers still hoping to acquire entire export industries and industrial technologies, but make sense within their context, and help explain some of the variety in American approaches.

Conclusions

Distinct though the worlds of Control Commission officials, BIOS personnel and industrialists involved with it, and the Houses of Parliament undoubtedly were, they shared more than an interest in increasing British export trade. One thread running throughout was the Board of Trade, an institution involved with each of these issues, and as such some of the same people were involved in each aspect of this story. Until September 1947, the Foreign Office left most considerations of German patents and trademarks, both within and outside of Germany, to the purview of the Board of Trade "in view of the extreme technicality of the subject," intervening at that point to help re-establish patents because of the "urgency of expanding German exports."[75] Darwin Panel meetings generally had more members present from the Board of Trade than any other agency; BIOS was itself a Board of Trade operation and its findings publicized in the Board of Trade Newsletter; Sir Stafford Cripps, President of the Board from 1945 to 1947, answered Parliamentary inquiries about the state of German patents and urged amendments to the Patent Law to indemnify companies utilizing BIOS information. Further, the worlds of industry and Parliament had considerable overlap. The honorable Member for Heywood and Radcliffe, Mr. Wooton-Davies, as just one example, drew upon his experience as an industrial chemist when arguing that a new Patent Law would be necessary for Britain be become a "scientific nation" and aid inventors.[76] Other Members drew upon their experience as patent lawyers, industrialists, and university professors in these discussions.

[74] G.R. Powell to Robert Reiss, 9 Sept 1946. RG 40, box 3, NACP.

[75] "Science Students at the Technische Hochschulen and Universities in the British Zone," Jan. 1947. FO 1032/93.

[76] Hansard, HC, 19 April 1944, Vol. 399, col. 216-312

This paper does not attempt a thorough evaluation of the economic value of the BIOS-related programs for British industry.[77] Instead, I have tried to emphasize the width of the gulf between investigating a technology and gaining economic value from it (much less the exclusive, zero-sum value implied by accusations of "plunder" and "war booty").[78] Certainly, investigators from many countries poured over German factories, blueprints, patents, and warehouses; interrogated scientists and technical personnel, hired individual for industry, and sometimes embedded their own engineers in German facilities. Yet these are not the same thing as "taking" German technology, and estimations built from totaling the cost German firms paid to produce their research, or the wide variety of fields investigated, or the large number of investigators and copies of publications purchased, all fail to take into account that communication depends on reception as much as transmission. Once 'taken,' documents had to be processed, and once processed, sent to interested and needful parties, yet German technology was not so broadly helpful as might have been anticipated. "The number of documents in any batch which are of real value to industry is very small," the head of one processing unit reported in February 1946, "possibly not higher than 5%. This fact cannot be determined from the title of the documents but only from expert evaluation."[79] A Members of Parliament by 1953, while discussing patent reforms, commented that "it is now generally agreed that the results [of investigations in Germany] were disappointing, and that although the reports of the teams may have infringed copyrights, they added little to our industrial knowledge."[80] Perhaps there was, indeed, great value in the "negative information" that "in very many fields investigation has disclosed that our own technicians have little to learn from the Germans," but it is immensely more difficult to estimate if so.[81]

Whatever the actual 'value' of these particular technologies – and there are many indications in all three of the western Allied nations that German technology was generally far less impressive than they had anticipated and hoped - the question of how best a state might aid industry in *making use of* new technology is one at the center of both BIOS-related schemes and the patent reforms underway in the UK in the 1940s and early 1950s. Both American and British policymakers were initially optimistic about their ability to overcome this gap between 'investigating' and 'making use of,' that the 'best' technology would simply win out and be a major boost to domestic industry, and thus entire industries could benefit fairly and evenly by publishing the results of German research. In the face of the challenge of putting this into action, however, British policy changed course to aiding individual firms through promoting longer on-site visits and establishing legal frameworks to license German technology. Helping individual firms might have seemed unfair, or at least ripe for corruption, but as one official argued, trying to help everyone would ultimately help no one.[82] This ideological commitment to equal, world-

[77] Those inclined for the best-informed projections should check Gimbel, *Science, Technology, and Reparations: Exploitation and Plunder in Postwar Germany*; Glatt.

[78] For example, the titles of Gimbel, *Science, Technology, and Reparations: Exploitation and Plunder in Postwar Germany*.; Arnold Krammer, "Technology Transfer as War Booty: The U.S. Technical Oil Mission to Europe, 1945," *Technology and Culture* 22, no. 1 (1981).

[79] JT Keyd to GS Mansell, 28 Feb 1946. TNA: PRO BT 211/41.

[80] Hansard, HL, 12 May 1953, Vol. 132, col. 395-420

[81] WG Glennie, Deputy Regional Controller, 'Bristol Exhibition of Industrial Intelligence Work in Germany," 28 Dec 1946. TNA: PRO BT 211/22

[82] "Report on a Meeting of Technical Investigations in Germany by Individual Firms," July 1946. TNA: PRO BT 211/21; Derek Wood to CS Low, Esq., 6 March 1947. TNA: PRO BT 211/24.

wide distribution of the fruits of German research via published reports was not just an internal commitment; it was the basis of the reciprocity agreement between the American and British investigatory programs. A loss of faith in the ability to help entire industries was just as much a loss of faith in learning from the American investigations and providing full value in kind. Later Soviet accusations of the US and UK retaining the sole value from their investigations were certainly self-serving and somewhat unfair, but they were not particularly untrue. To the considerable frustration of British policy-makers, German technology proved considerably less malleable to the ends of good diplomacy than they had anticipated. A "bite of the apple" was worth more than a "whiff all around," but it was considerably more difficult to make friends by sharing.

Volker Berghahn has argued that John Gimbel's study of the American FIAT operation looked at what "may have presented no more than a very special case of limited historical significance."[83] This was meant as part of an important argument that we should discuss American-German technology transfer in the 20th century in a wider context of German imports of American technology rather than American "exploitation and plunder" of Germany, yet the implication remains here and in much of the existing historiography of the postwar scientific exploitation efforts that they were a short episode of frenzied action, swiftly dying off to the objections of protective "governors" in the Control Commissions. There is some truth to this, and additional studies of the international (though competitive) efforts to exploit German technology would be beneficial, including further examination of the sources of the belief in such uniform interest in German technology that fields from machine tools to mining, large-scale chemical plants to wood-working techniques. However, BIOS was also part of a larger phenomenon, extending well beyond its nominal closure, of a state reconfiguring its tools to guard and package for sale its technical knowledge while most effectively utilizing innovations from abroad. It was indeed a very special case, but its historical significance extends beyond questions of reparations and 'Nazi scientists.'

[83] Volker R. Berghahn, "Technology, Reparations, and the Export of Industrial Culture. Problems of the German-American Relationship, 1900-1950," in *Technology transfer out of Germany after 1945*, ed. Matthias Judt and Burghard Ciesla(Amsterdam: Harwood Academic Publishers, 1996), 4.

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