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## **A marriage of mutual convenience? The British Government and the UK aluminium industry in the twentieth- century**

*Andrew Perchard, Research Fellow, UHI Centre for History\**  
[andrew.perchard@thurso.uhi.ac.uk](mailto:andrew.perchard@thurso.uhi.ac.uk) / [andrew.perchard@strath.ac.uk](mailto:andrew.perchard@strath.ac.uk)

In a lecture to the Royal Economic Society in the late 1940s Siegfried Moos outlined the dilemma facing the native UK aluminium industry and the British State in the post-war period. During the course of his paper Moos posed a number of crucial questions: was the survival of native primary production of aluminium desirable, or should Britain focus on its semi-fabricated production supplied by imports of cheaper ingot from Canada? And if the former how was the native industry to be sustained: by nationalising it or offering preferential contracts to 'enterprising' companies? <sup>1</sup> Though the detail of Moos' paper suggests his unfamiliarity with the native industry, his core deliberations were pertinent to the predicament that both British aluminium concerns and the UK Government found themselves in the immediate aftermath of the Second World War. Between the closing year of the Second World War and the end of post-war control of the industry in 1953, there had been some discussion within British Government circles about the future shape of the industry in the UK. In view of the growing dependence of the UK on imports of Canadian aluminium ingot, some officials questioned whether there was any benefit in sustaining a native primary industry if favourable contracts with Canadian and other non-domestic producers could be secured to sustain the semi-fabrication side of the indigenous

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<sup>1</sup> Moos fled Berlin after Hitler's ascension to power as a noted left-winger. He settled briefly in Paris before moving to the UK. During the Second World War, he served under William Beveridge at the Institute of Statistics at Oxford. Following this he joined the economics department at the University of Durham. In 1966 he became an adviser to the Board of Trade. His other publications included a biography of Beveridge (1963): S. Moos, 'The Structure of the British Aluminium Industry', *The Economic Journal*, 58:232, (December 1948), p.524; D. Perman, 'Obituary: Lotte Moos', *The Guardian*, 15 January 2008.

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industry.<sup>2</sup> By 1953 the strategic realities of the post-war period (not least the balance of trade and dollar-exchange rate) had called into question the prudence of such a position. However British Government officials were not optimistic about any potential for further development of primary smelting capacity in the UK in the near future.<sup>3</sup>

It is perhaps unsurprising that in the 'light metals age' the fate of this most dominant of non-ferrous metals would become periodically intertwined with the strategic considerations of British, as well as other national, governments. Britain's war leader in the previous global conflict David Lloyd George's insisted that the lessons learnt from the British war economy of 1914-18 of the value 'State action, State help, State encouragement, and State promotion' would not be lost.<sup>4</sup> This was certainly to be evident in the approach of the UK Government to the aluminium industry over the course of the next thirty years. It is the relationship between UK-territorial producers of aluminium (and the Canadian industry) and the British Government during this period, and the impact of this interaction, that are the subject of this paper.

The leading historian of the European aluminium industry has described the metal as 'the material of national independence', and further noted that because of its strategic significance the industry enjoyed a 'special relationship with the State'.<sup>5</sup> Though aluminium was never the material of national sovereignty for Britain claimed for it in France and Germany, it became a significant martial metal and cemented a long relationship with the British State that was to profoundly affect the development and characteristics of the native industry. Moreover the UK Government played an important role in the growth of

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<sup>2</sup> At no point was nationalisation of the industry ever seriously contemplated by officials or Ministers during this period. From June 1941 until 1945, the Ministry for Aircraft Production (MAP) exercised control of aluminium: Letter from I. T. Little, Ministry of Aircraft Production (MAP), to A. R. Bull, Treasury, 16 November 1944, UK National Archives (TNA), SUPP 3/82.

<sup>3</sup> 'United Kingdom aluminium industry: Progress from 1946 to 1953', Memo from H. E. Thatcher, Asst. Secretary, Light Metals Division, Ministry of Supply, to armed service and supply departments, 1 October 1953, TNA, SUPP 14/217.

<sup>4</sup> Cited in R. H. Tawney, 'The Abolition of Economic Controls, 1918-1921', *The Economic History Review*, 15:1/2, (1943), p.11.

<sup>5</sup> I. Grinberg, 'Introduction: L'aluminium, matériau emblématique de la deuxième industrialisation' in I. Grinberg and F. Hachez-Leroy (eds.), *Industrialisation et sociétés en Europe occidentale de la fin du XIXe siècle à nos jours: L'Âge de l'aluminium* (Paris, 1997), pp.18-19.

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the Aluminium Company of Canada (Alcan). Aside from its significance as an important chapter in the history of the global industry, the historical interaction between the British industry and British Government departments in Whitehall and elsewhere, detailed in this paper, contributes to our understanding of business-government relations in the UK; and, as a sub-set of that, British war and peace time planning and another significant example of the development of Britain's 'civil-military-industrial' complex (the *Warfare State*).<sup>6</sup> As a particular example of the latter, it contributes to our understanding of British government policy designed to strengthen the infrastructure of native raw materials industries of strategic importance, and their planning for wartime controls.<sup>7</sup> In so doing it questions those who continue to maintain the picture of a British State poorly-prepared for war in September 1939.<sup>8</sup> Another feature (represented in this paper) of the increasingly sophisticated 'civil-military-industrial complex' emerging in Britain from the 1920s onwards is illustrated by the critical flow of information between the aluminium industry, officials in supply and service departments, and scientists in Government, trade association and university laboratories.

This paper will do this by focusing primarily on the relationship that developed between Britain's pre-eminent and largest native producer of virgin aluminium throughout much of this period, the British Aluminium Company Ltd. (BACo), although the experiences of other companies will be referred to. It will be sustained throughout by reference to the records of British Aluminium and British Alcan (Aluminium Company of Canada) (housed in Glasgow University Archives), as well as those of French and Canadian producers (held respectively at the Institut pour l'histoire d'aluminium in Gennevilliers, France; and Rio Tinto Alcan's Montreal headquarters, formerly Maison Alcan). Of added significance in this case, will be the use also of UK Government files (held at the UK National Archives), Parliamentary Papers and other state papers (deposited at the Bodleian Library, University of Oxford) that

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<sup>6</sup> D. Edgerton, *Warfare State: Britain, 1920-1970* (Cambridge, 2006).

<sup>7</sup> N. Rollings, 'Whitehall and the Control of Prices and Profits in a Major War, 1919-1939', *The Historical Journal*, 44:2, (June 2001), pp.517-540.

<sup>8</sup> For a more recent example of this see: T. C. Imlay, *Facing the Second World War: Strategy, Politics, and Economics in Britain and France 1938-1940* (Oxford, 2003).

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have crucially been overlooked by previous studies of the British aluminium industry, with one exception.<sup>9</sup> The paper places British native producers within the context of the global aluminium industry; and explores the relationship that developed between metropolitan UK Government (both UK-territorial and Colonial departments), on the one hand, and British and Canadian aluminium concerns (especially BACo and Alcan), on the other. It will examine the features of that relationship and the impact that it had on BACo and Alcan, including on the leadership and company culture of the former.

The history of the British aluminium industry has, with a couple of exceptions, evaded detailed serious academic attention. Aluminium represents, as historians of the global industry have shown in relation to the native industries of other countries and continents, a pointed example of the critical role of the State in shaping those concerns.<sup>10</sup> It also reflects the importance of recognising the socially embedded nature of businesses and thus their specific national (as well as global characteristics). However in the case of the British industry this has been largely neglected. Ludovic Cailluet's study of the fortunes of British Aluminium, for example, overlooks this crucial factor in the UK industry's development, instead attributing BACo's survival to 'the existing aluminium cartel'. Cailluet's oversight of Government involvement in the industry and supply-side interventions in the domestic market is all the more pointed given his 'cautious' deployment of BACo as an illustration of Chandlerian criticisms of British capitalism's failure to effect economies of scale and scope; all the more so, given the latter's allusion to the interaction between BACo and the British

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<sup>9</sup> I am grateful to the current Lord Addison and the Bodleian Library for permission to refer to the papers of first Viscount Addison held in the Ms. Addison collection. UK Parliamentary Papers (PP) were accessed through the on-line House of Commons papers service: <http://parlipapers.chadwyck.co.uk> (dates of access appearing after each paper).

<sup>10</sup> D. H. Wallace, *Market Control in the Aluminium Industry* (Cambridge Mass., 1937); R. Pivotal, *Histoire d'aluminium: metal de la victoire* (Paris, 1946); M. J. Peck, *Competition in the Aluminium Industry 1945-1958* (Cambridge Mass., 1961); D. C. Campbell, *Global Mission: The Story of Alcan, Volumes I-III* (Montreal, 1985-1990); S. Kendall Holloway, *The Aluminium Multinationals and The Bauxite Cartel* (London, 1988); B. Barham, S. G. Bunker and D. O'Hearn (eds.), *States, Firms, and Raw Materials: The World Economy and Ecology of Aluminium* (Madison, 1994); Grinberg and Hachez-Leroy, *Industrialisation et sociétés en Europe occidentale*, pp. 95-143; G. D. Smith, *From Monopoly to Competition: The Transformations of Alcoa, 1888-1986*, this edition, (Cambridge and New York, 2003); R. Lesclous, 'Nuclear power and the revival of primary aluminium production in Europe', *Cahiers d'histoire d'aluminium* (hereafter *CHA*) – *Special Issue No. 1: The European Aluminium Industry*, (2003), pp.29-36; *CHA*, Special Issue No.2 – *Comparative Perspectives on the Norwegian and Canadian Aluminium Industries*, various refs.

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State.<sup>11</sup> However Chandler's very brief reference to this relationship is symptomatic of what Terry Gourvish has identified as historians' neglect of the critical interaction between the State and business.<sup>12</sup> Crucially the one study to reflect in any comprehensive fashion on the relationship between native producers and the State – Ronald Graham's *The Aluminium Industry and The Third World*, which enjoyed its' silver anniversary last year – has been overlooked in much of the literature of the global industry.<sup>13</sup> Graham has provided a detailed account of the relationship between the British State, BACo, and other global producers of the metal. However in seeking to provide a coherent neo-Marxist analysis of the political economy of aluminium and its impact on the majority world, he paints an overly deterministic picture of a British State (and US State Department) forced to serve at the behest of multinationals.<sup>14</sup>

The UK aluminium industry also remains a remarkable omission from the literature of British government planning both during and between military conflicts.<sup>15</sup> For example, David Edgerton makes no mention of the metal either in his *Warfare State*, or in his earlier works on the technological development of Britain's air services and the Ministry of Supply. This is particularly curious given that aluminium represented such a clear example of both the cooperation of private businesses with the supply departments and those of the Armed Forces in technological advances that improved the preparedness of the fighting services (especially the Royal Air Force (RAF) and extended the scope of producers' civilian

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<sup>11</sup> L. Cailluet, 'The British aluminium industry, 1945-80s: chronicles of a death foretold?', *Accounting, Business & Financial History*, 11:1, (March 2001), pp.79-97. Subsequently reproduced in *CHA – Special Issue No. 1*, pp.73-88; A. D. Chandler Jr, *Scale and Scope: The Dynamics of Industrial Capitalism*, this edition, (Cambridge Mass., and London, 2004), p.321.

<sup>12</sup> T. Gourvish, 'Introduction: the business-government relationship' in T. Gourvish (ed.), *Business and Politics in Europe 1900-1970* (Cambridge, 2003), p.1.

<sup>13</sup> R. Graham, *The Aluminium Industry and The Third World: Multinational Corporations and Underdevelopment* (London, 1982).

<sup>14</sup> Ibid.

<sup>15</sup> J. M. Winter (ed.), *War and economic development. Essays in memory of David Joslin* (Cambridge, 1975); K. Burk (ed.), *War and the State: The Transformation of British Government, 1914-1919* (London, 1982); G. C. Peden, *British Rearmament and the Treasury: 1932-1939* (Edinburgh, 1979); J. Turner (ed.), *Businessmen and Politics. Studies of Business Activity in British Politics 1900-1945* (London, 1984); D. Edgerton, *England and the Aeroplane: An Essay on a Militant and Technological Nation* (London, 1991); H. Mercer, N. Rollings and J. Tomlinson (eds.) *Labour Governments and Private Industry: The Experience of 1945-1951* (Edinburgh, 1992); M. Chick, *Industrial policy in Britain 1945-1951* (Cambridge, 1998); G. C. Peden, *The Treasury and British Public Policy 1906-1959* (Oxford, 2000); Edgerton, *Warfare State*.

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markets; and the proximity of businessmen to officials and Ministers.<sup>16</sup> Similarly for an industry that was subject to periodic raw materials controls, at the centre of political controversy as a result of the pronounced tendency towards monopolisation (and as a result a *bête noire* of anti-trust campaigners), and the recipient of a number of government subventions, it is remarkable that only one paper has commented on aluminium in relation to one of these aspects.<sup>17</sup>

## I

The production of aluminium on a commercially viable industrial-scale was not realised until 1886 with the joint discovery by Frenchman, Paul Louis Héroult, and American, Charles Martin Hall, of a means of reducing aluminium oxide (alumina) in a bath of molten cryolite by passing an electrical current through it at a temperature of between 960-1000°C, building on the earlier work of chemists and physicists. Most significantly of these predecessors (from the point of view of this paper) was Henri Sainte-Claire Deville (1818-1881) who had produced a bar of the metal for display at the International Exhibition of 1855. Sainte-Claire Deville's work attracted the interest of and funding from Napoleon III, who could see the potential for this metal, not least in the martial sphere.<sup>18</sup> The impact of these discoveries collectively – and their industrial application – was evident in the impact on output and prices. The global total of aluminium produced between 1854 and 1887 was 140,000 pounds (around 64 metric tons), by 1903 global production for that year alone stood at 8,200 Mts. While prices fell from \$550 per pound (lb) to 61 cents per lb between 1854 and 1888 alone.<sup>19</sup> A number of other processes contributed significantly to the

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<sup>16</sup> Ibid; Edgerton, *England and the Aeroplane*; Edgerton 'Whatever happened to the British warfare state? The Ministry of Supply, 1945-1951' in Mercer et al., *Labour Governments and Private Industry*, pp.91-116.

<sup>17</sup> V. Cerretano, 'The Treasury, Britain's post-war reconstruction and the industrial intervention of the Bank of England, 1921-1929', *Ecole d'Économie de Paris*, Working Paper No. 2007 –22, p.6.

<sup>18</sup> J. Bocquetin, 'La fabrication de l'aluminium par électrolyse' in P. Morel with I. Grinberg (eds.), *Histoire technique de la production d'aluminium. Les apports français au développement international d'une industrie* (Grenoble, 1992), pp.22-30; Grinberg and Hachez-Leroy, *Industrialisation et sociétés en Europe occidentale*, pp.10-11; J. Plateau and T. Renaux, *L'aluminium et Paul Morin au Moulin noir 1857-1890. Une maire pour Nanterre, un métal pour l'industrie* (Nanterre, 2007), pp.15-24.

<sup>19</sup> Smith, *From monopoly to competition*, pp.4-7; Grinberg and Hachez-Leroy (eds.), *Industrialisation et sociétés*, Annex 1.1.

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industrial expansion of the industry. Between 1887 and 1892, Austrian chemist, Karl Josef Bayer, discovered a commercially viable method of extracting aluminium oxide (alumina) from bauxite, the third most regularly occurring ore in the earth's crust; In 1908 German metallurgist, Alfred Wilm, discovered the alloy Duralmin (a combination of aluminium, copper, manganese and magnesium). This alloy's properties would lend themselves to a number of applications in time (not least in the manufacture of metal framed aircraft) and offered the industry further opportunities to expand. The discovery of other important alloys containing aluminium followed over the next twenty years.<sup>20</sup>

Despite its teething problems, aluminium became a significant metal. By 1910, the relatively infant aluminium accounted for a larger proportion of the global market for non-ferrous than tin, and by the 1920s and 1930s was posing a very critical threat to zinc and copper.<sup>21</sup> After 1945, it had overtaken all of these metals, and by 1982 accounted for around 70% of the global output of non-ferrous metals.<sup>22</sup> However, aluminium failed to oust iron, steel and wood from their pre-dominant positions, except in civil aviation.<sup>23</sup> However, by any standards, the growth in supply of aluminium has been impressive. Over the course of the twentieth century, production of the metal grew by a mean average of 146%, whilst consumption, over the period 1903-1990, expanded from 8,200 to 17,878,000 Mts.<sup>24</sup> The price of aluminium competed favourably with that of copper for much of the latter part of the twentieth century, but remained significantly more costly than steel.<sup>25</sup>

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<sup>20</sup> For example, Alpax (aluminium and silicon) in 1920 and Almemec (aluminium, magnesium and silicon) between 1921 and 1927: P. M. Haenni, 'Light aluminium alloys: composition and properties', *The Times Trade & Engineering. A Monthly Review of Industrial Progress*, Vol. XL, No.877 (New Series), March 1937, p.vi ; M. B. W. Graham, 'R&D and Competition in England and the United States : The Case of the Aluminium Dirigible', *The Business History Review*, 62 :2, (Summer 1988), pp.261-285 ; E. Schatzberg, 'The Cultural History of Aluminium as an Industrial Metal', *CHA*, 35, (Hiver 2005-2006), pp.74-96.

<sup>21</sup> Wallace, 'Aluminium', p.215.

<sup>22</sup> Grinberg and Hachez-Leroy, *Industrialisation et sociétés*, figure 3, p.15; E. Schatzberg, 'The Cultural History of Aluminium as an Industrial Metal'.

<sup>23</sup> *Ibid*, pp.84-5.

<sup>24</sup> D. A. Buckingham and P. A. Plunkert, 'Aluminum statistics: US Geological Survey' in T. D. Kelly and G. R. Matos, *Historical Statistics for mineral and material commodities in the United States*, U. S. Geological Survey Data Series 140, (2005), <http://pubs.usgs.gov/ds/2005/140> (Accessed [14 May 2007].); *Metal Statistics* employed in I. Grinberg and F. Hachez-Leroy, *Industrialisation et sociétés*, Annexes 2.1 and 2.2.

<sup>25</sup> G. D. Smith, *From monopoly to competition*, chart c.1

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Throughout much of the century it was an industry characterised by rapid backward vertical integration, oligopolies and powerful cartels, as well as by a pronounced incidence of state involvement.<sup>26</sup> Prior to WW2, 90 per cent of the global output of aluminium was controlled by a handful of companies and national cartels.<sup>27 28</sup> Two cartels were formed prior to 1945. The first operated between 1901 and 1908. This cartel attempted to eliminate competitors after the expiry of the original Hall-Héroult patents by reserving national markets for territorial producers and apportioning the remaining competitive markets to members. Between 1918-23, the aluminium industry was characterised by arbitrary arrangements but no collaborative agreements. However almost immediately after the signing of the Armistice, there had been discussions between A. W. Tait, BACo's Chairman, Louis Marlio the of Alais, Forgue et Camargue (AFC) (one of the two leading French companies) and A. V. Davis of the Aluminium Company of America (Alcoa) about how to divide up global markets in the *post-bellum* world – leaving Alcoa to dominate North American markets and the French and British, Germany and Scandinavia.<sup>29</sup> After 1923 European producers organised a price-fixing cartel. By 1926, a formal sales cartel (of the main European aluminium producers) the Aluminium Association was set up to: regulate sales; expand

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<sup>26</sup> In Europe, aluminium is the common spelling for the metal and in North America, aluminum: D. H. Wallace, 'Aluminium' in W. Y. Elliott et al., *International control in the non-ferrous metals*, pp.213-4; Ibid; F. Hachez-Leroy, *L'Aluminium français. L'invention d'un marché 1911-1983* (Paris, 1999); M. Knauer, 'Une industrie née de la guerre. L'aluminium en Allemagne de 1890 à 1950', in Grinberg and Hachez-Leroy, *Industrialisation et sociétés*, pp.127-238; E. Hexner, *International Cartels* (London, 1946), pp.216-221; Peck, *Competition in the Aluminium Industry*; G. Jones, 'Multinationals from the 1930s to the 1980s' in A. D. Chandler, Jr., and B. Mazlich (eds.), *Leviathans: Multinational Corporations and The New Global History* (Cambridge, 2005), p.85.

<sup>27</sup> These were: (North America) the Aluminium Company of America [Alcoa] and Aluminium Ltd. (after 1928, the Aluminium Company of Canada (Alcan); Aluminium Industrie Aktien-Gesellschaft (AIAG) [during WW1 this came under the direction of the German war ministry and finally emerged in 1917 as Vereinigte Aluminium Werke AG (VAW)]; (UK) BACo Ltd; (France) La Compagnie des produits chimiques d'Alais et de la Camargue (PCAC), and La Société électrométallurgique française (SEMF) (who combined, after 1911, with some smaller firms to form a French cartel, L'Aluminium français (AF); and (Switzerland), Industrie AG of Neuhausen [which was linked to AIAG prior to WW1]: Ibid; F. Hachez-Leroy, *L'Aluminium français. L'invention d'un marché 1911-1983* (Paris, 1999); M. Knauer, 'Une industrie née de la guerre. L'aluminium en Allemagne de 1890 à 1950', in Grinberg and Hachez-Leroy, *Industrialisation et sociétés*, pp.127-238.

<sup>28</sup> This was headed by the 'pioneer' German-owned Swiss producer, Aluminium Industrie Aktien-Gesellschaft (AIAG) Neuhausen, and included La Compagnie des produits chimiques d'Alais et de la Camargue (PCAC) and Société électrométallurgique française (SEMF), BACo, and Northern Aluminium Company (the Aluminium Company of Canada's Canadian subsidiary).

<sup>29</sup> Letter from A. W. Tait to L. Marlio, 18 November 1918; Letter from L. Marlio to A. W. Tait, undated but reply written around same time, Alcan – Paris 001 – 0 – 11335.

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market opportunities; regulate quality; centralise key functions (such as research and development); and co-ordinating transport. The Association allotted members a share of the ingot market both domestically and abroad (with the exception of the United States). The pre-eminent historian of cartelisation in the early decades of the global industry Donald Wallace judged trans-national relations in aluminium during the period from 1927-31 to have been teetering on the edge, and suggests that it was only restraint exercised on the part of all the main players which prevented 'economic strife' breaking out.<sup>30</sup> That said aluminium – unlike other industrial sectors, for example, coal, steel and iron – was not characterised by the intense competition of these other sectors, and benefited from reasonably secure domestic markets for its products. The Aluminium Association was superseded in 1931, by the formation of the Alliance Aluminium Company (AAC), including the by now (in name and legal status) independent Alcan.<sup>31</sup> The move to a more comprehensive cartel in the aluminium industry was given added impetus by the rejection of proposals submitted to the World Economic Conference of 1927 for trans-national

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<sup>30</sup> Wallace, p.241.

<sup>31</sup> The first division shareholders were: AF, AIAG, Alcan, BACo, and VAW. The Alliance had three main constitutional aims: (1) the regulation of the output and reserves of its' members; (2) the division of and control of the markets; and (3) to coordinate marketing and research in the industry. The organisation did not however centrally devise prices. Price controls were reliant on member companies faithfully adhering to their pledge not to undercut the prices of the main plants. Allocations for sales were allocated on the basis of shares, with any extra needing dispensation requiring the authority of the 90% support or more of the first division of shareholders. Broadly speaking the quotas apportioned to all of the main players in the AAC tallied with their approximate aggregate proportion of aluminium ingot production since 1923: AF – 30%; VAW – 27%; AIAG – 23%; and BACo – 20%. A further 200 remaining rights were shared out amongst a number of other European concerns – French, Italian, Norwegian and Spanish – with a further 1,000 extra shares which could be delegated equally to either the controlling group or the second division shareholders. Although Alcoa did not directly participate in the scheme, it was a major shareholder in Italian, Norwegian, and Spanish companies (shareholders in the second group). In addition, the AAC purchased controlling shares in two of the two small, independent British companies, the Aluminium Corporation Ltd. and the International Aluminium Company (who refined alumina in the UK for export to their sole smelter at Glomfjord in northern Norway. These quotas remained largely unaffected until 1935 when VAW – to meet Germany's re-armament programme – started to buy more concessions to increase her output beyond her quota (with the permission of the other Alliance members): Alliance Aluminium Company, Terms and conditions, 3 July 1931, Maison Alcan, Montréal 00021 – 26; British Aluminium Intelligence Report, Note on International Aluminium Cartel – International Cartels, Berlin Congress Publication No.4, (Paris, 1937), IHA – 00161 – 08; Hachez-Leroy, *L'Aluminium français*, pp.218-220 ; Smith, *From monopoly to competition*, pp.141-2 Campbell, *Global Mission, Vol.I*, p.421-2.

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mechanisms for controlling global raw material supplies by fifty of the national representatives present.<sup>32</sup>

Cartelisation, oligopolies, and the heavy sunk costs eliminated and discouraged many 'latecomers' to the industry.<sup>33</sup> In 1948, between 72% and 75% of the total cost of manufacturing aluminium was attributable to alumina (in particular, the cost of bauxite) and electricity. By 1970, the costs linked to alumina production had fallen by 20%, but electricity had remained proportionately stable.<sup>34</sup> Towards the close of the twentieth-century alumina production and power costs accounted respectively for between 30 and 33 per cent and 24 and 26 per cent of full operating costs.<sup>35</sup> With electricity and raw materials like bauxite such expensive commodities in the process, then the economic location of the alumina production plants and aluminium reduction works was also critical. This led to a scramble to secure water rights (with hydro-electricity as the cheapest form of electricity for this purpose) and mining rights for bauxite. Reliance on hydro-electricity not only meant that the capital outlay on smelters, in particular, was very significant, but that increasingly firms were forced to look further afield to acquire interests in countries that held large untapped water reserves. Experiences with nuclear power in post-war Europe as an energy source for the industry never lived up to its expectations, and hydro-electric power remained dominant.<sup>36</sup> In 1991, around 57% of the electricity used for global primary aluminium production continued to be derived from water-power.<sup>37</sup> Unsurprisingly therefore, the capital outlay for primary aluminium smelters – and associated hydro-electric generating stations – was very considerable. As Alfred Chandler noted, aluminium ranks

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<sup>32</sup> This was a feature of some of the other non-ferrous metal and chemicals industries: J. Hurtsfield, 'The Control of British Raw Material Supplies, 1919-1939', *The Economic History Review (EHR)*, 14:1, (1944), p.13; Jones, 'Multinationals from the 1930s to the 1980s', p.85

<sup>33</sup> Chandler, *Scale and Scope*, pp.33-45.

<sup>34</sup> R. Lesclous, *Histoire des sites producteurs d'aluminium. Les choix stratégiques de Pechiney 1892-1992* (Paris, 1999), p.22.

<sup>35</sup> R. Gagni and C. Nappi, 'The cost and technological structure of aluminium smelters worldwide', *Journal of Applied Econometrics*, 15, (2000), p.419.

<sup>36</sup> R. Lesclous, 'Nuclear power and the revival of primary aluminium production in Europe', *CHA*, Special Issue 1, (2003), pp.29-36.

<sup>37</sup> Lesclous, *Histoire des sites producteurs d'aluminium* p.51.

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alongside oil and steel as facing some of the toughest strictures in terms of attaining 'minimum efficient scale'.<sup>38</sup>

The British Aluminium Company Ltd. was registered on 5 May 1894 as a limited liability company with an initial capital of £100,000. In the two months preceding, the Company's managing director had secured the acquisition of the exclusive British and Colonial rights to the Héroult process from the Neuhausen Company of Switzerland who held the global rights for the process. Between 1894 and 1895 British Aluminium developed into a vertically integrated aluminium concern acquiring the necessary upstream and downstream activities: two bauxite mines in Northern Ireland; an existing rolling mill in the midlands of England; a carbon factory in Greenock (Scotland) for making the electrodes necessary for the process; and the water rights to their first aluminium reduction works at Foyers on the banks of Loch Ness in the Scottish Highlands. The first Board of Directors included amongst their number three industrialists – one copper smelter, an iron master and a cotton spinner. The initiator behind the project though was Italian engineer Emmanuel Ristori, who had previously been Head of Ammunition at Nordenfeldt Guns. British Aluminium also enlisted the scientific services of Britain's foremost man of science of the age, Lord Kelvin; first as the Company's scientific adviser and then as a director. Without doubt one of their most valuable acquisitions in terms of human capital was the employment of an able ex-student of Kelvin's and engineer, William Murray Morrison, who joined the Company first as the manager of their Foyers works, and would eventually become the Managing-Director of British Aluminium.<sup>39</sup> Murray Morrison would prove himself to be as politically astute within the Boardroom and corridors of Whitehall as he

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<sup>38</sup> Chandler, *Scale and Scope*, 23-27.

<sup>39</sup> Emmanuel Ristori (b.22.7.1857) – Engineering Sciences, University of Rome (1879), followed by doctorate at University of Naples (1881); Asst. Astronomer, Observatory, Roman College, and Royal Observatory, Naples; Joined Nordenfeldt in 1883, and became Head of Ammunitions in 1885; and elected Fellow of the Royal Astronomical and Royal Meteorological Societies in 1883, followed by the Institution of Civil Engineers in 1888. Nordenfeldt Guns became part of Maxims: Memo and articles of association of the British Aluminium Company Ltd., 5 May 1894, Glasgow University Archives (GUA) [unless otherwise stated all BACo or British Alcan files derive from this collection], UGD 347/21/1/1; Notes on the formation of the British Aluminium Company Ltd., 1 May 1894, UGD 347/21/46/2; BACo, Register of Directors and Managers, 1894-1948, UGD 347/21/5/1; Register of applicants for membership of the Institution of Civil Engineers, 1888 – Dr Emmanuel Ristori, ICE Library.

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was proficient an engineer. The company started producing primary metal at their Foyers works in 1896; and had expanded and modernised their English and Irish assets, as well as their Greenock works by March 1898 expending around £141,000 over the space of four years.<sup>40</sup> They acquired a controlling share a French bauxite producer Union des Bauxites, in 1902, and in 1906 constructed a modest smelter in Stangfjorden in Norway.<sup>41</sup> To further meet rapid expansion in this rapidly growing market, the Company started work on their second and far more ambitious reduction works and hydro-electricity generating capacity at Kinlochleven, also in the Highlands of Scotland in 1904 at an estimated cost of £500,000; funding this through the raising of additional share options. Concurrently British Aluminium acquired water reserves in the Swiss Alpine region of Orsières (with the intention of expanding their primary reduction operations) in 1904. However the Swiss producer AIAG Neuhausen were able to successfully argue that the British producer only held the patent for aluminium production in Britain and the colonies, and that it AIAG had the exclusive rights for Helvetia. By this time, BACo had already successfully applied for a licence for and embarked upon the construction of a costly railway (to supply their planned smelting operations) to run through the St Bernard Pass connecting Switzerland with Italy. It was a major coup for the Swiss and Italian governments, who had long desired a railway link but balked at the price, but a disastrous error on the part of the BACo board.<sup>42</sup>

In 1908 British Aluminium attempted a takeover of the only other native producer of primary aluminium, the Aluminium Corporation Ltd. (Al. Corp), who had operated a small smelter and hydro-generating station at Dalgarrog in North Wales since 1907 and were in receivership. Al Corps creditors rejected BACo's offer of £50,000 in cash, £50,000 worth of fully-paid and £24,000 partially-paid preference shares, stating that they would prefer to

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<sup>40</sup> Crewdson, Youatt & Howard report to BACo Board of Directors on expenditure on fixed capital costs at Foyers, Greenock, Larne and Milton, 25 March 1898, UGD 347/21/46/2; BACo, Chairman's report to the first AGM of British Aluminium shareholders, 16 July 1896, UGD 347/21/46/2; Average costs per ton of aluminium and average works costs for Foyers, 1896-1900, UGD 347 21/34/1/6.

<sup>41</sup> BACo, Report of Directors to 9<sup>th</sup> OGM, 5 July 1904, UGD 347/21/6/2; S. Kloumann, 'Pioneers in Norway-attraction of cheap water power', *The Times – Trade & Engineering*, March 1937, p.xxxiv.

<sup>42</sup> G. Chappuis, *Le Chemin de Fer Électrique Martiny-Orsières* ( n. d. but around 1911-2), UGD 347 21/29/26; BACo, Directors Report and Accounts for year ending 31 December 1910, UGD 347/21/6/3.

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restructure the firm rather than be subsumed by British Aluminium.<sup>43</sup> To make matters worse for BACo their Kinlochleven scheme had suffered serious delays and only came on-stream fully in 1909; and bad floods that caused considerable damage at Foyers in 1902 delayed important development work.<sup>44</sup> Moreover the global market for the metal had seen a dramatic growth with an associated drop in prices of 30 per cent since 1894, and was experiencing a downturn.<sup>45</sup> Prospects looked bleak for BACo in 1909-10. The Company faced demands for liquidation and were only saved by financial restructuring.<sup>46</sup> They were over-extended and, like a good many English limited liability companies, had raised most of their capital to fund this expansion from calls to shareholders. Moreover BACo shareholders were no less 'inexperienced' in assessing risks and expectations than a good many other shareholders of this vintage, with the BACO Chairman Roger Wallace having to repeatedly remind general meetings of shareholders of the sheer scale of fixed capital costs associated with this industry.<sup>47</sup> BACo complained from the outset of conservatism amongst domestic users of metal, in particular it identified engineering and armaments.<sup>48</sup> Though there was substance in their judgements about key potential markets the ensuing pages will call into question their claims against Government armaments factories. Indeed this claim may well have owed more to attempts to cajole Government into offering contracts. In contrast to France and the United States lucrative markets such as those for components for cars and buses were slow to emerge in Britain. In 1914 around 80 per cent of US cars used aluminium components extensively. The French automobile industry was also active in promoting the use of aluminium, with an estimated one-seventh to one-fifth of France's domestic consumption of the metal used in

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<sup>43</sup> 'The development of the Aluminium Corporation, Ltd.', *The Electrochemical and Metallurgical Industry*, VII:1, (January 1909), p.165.

<sup>44</sup> A temporary factory at Kinlochleven started producing metal in 1907 but only produced 336 tons in its first year of production. The delays were caused by obstructions to the Parliamentary Bill authorising construction of the Kinlochleven scheme, shortages of labour and weather. Report from William Murray Morrison to BACo Directors, 22 November 1905, UGD 347/21/46/2; Loch Leven Water & Electric Power Company, Minute books 1 and 2, 1906-1911, UGD 347/21/2/3-4; Letter from L. S. F. Charles, BACo, to D. W. F. Hardie, Imperial Chemical Industries Ltd., 21 January 1955, Maison-Alcan, 00158-08.

<sup>45</sup> Lesclous, *Histoire des sites producteurs d'aluminium*, graph 16; Pivotal, *Métal de la victoire*, p.82.

<sup>46</sup> BACo, Directors' report and accounts for year ending 31 December 1910, UGD 347/21/6/3.

<sup>47</sup> For example, BACo, Chairman's speech to third OGM, 28 July 1898, UGD 347/21/46/2; L. Hannah, *The Rise of the Corporate Economy* (London, 1976), pp.19-22.

<sup>48</sup> BACo, Chairman's report to first AGM, 16 July 1896; BACo, Chairman's report to third OGM, 28 July 1898.

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that industry. Britain's car industry did not really take-off until 1909 (after the beginning of the recession in global aluminium markets) and prior to World War One it only used aluminium in cylinders.<sup>49</sup> By 1911 twenty-six omnibus companies across Western Europe, mostly in France and Germany, were testing aluminium wire for bus engines but none of these were in Britain.<sup>50</sup> The electricity industry in Britain showed itself more willing to use aluminium for wire and junction boxes but still lagged behind competitors in the States and France. In the United States a method for strengthening aluminium using a steel core for overhead cables was developed in 1908, and by 1912 consumed about 20 per cent of the annual output of the US industry. By 1914 2000 kilometres of aluminium cables were used in France. Between 1913 and 1914, manufacturers of electricity cables in Britain used between 11 and 13 per cent of the total output of native aluminium in cables, although where it was used it appeared to have been limited in its uses.<sup>51</sup> The slow growth for the electricity does not appear to have been for lack of enthusiasm amongst electrical engineers, but owed more to small-scale and municipal provision of electricity.<sup>52</sup> British Aluminium and Al Corps were not alone in being faced the threat of liquidation around this time. As well as Al Corps, two French producers l'Aluminium du Sud-Ouest (ASO) and La Société Electro-Métallurgie du Sud-Est (EMSE) were also victims. However Al Corps, ASO and EMSE were all 'latecomers', with the latter two having been formed in 1906. BACo has been identified as a 'first mover'. However she did not enjoy all the advantages that other 'pioneers' in the industry did. The Pittsburgh Reduction Company (subsequently Alcoa) and the Neuhausen company

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<sup>49</sup> Smith, *From Monopoly to Competition*, pp.91-3; J. M. Laux, *In First Gear. The French automobile industry to 1914* (Liverpool, 1976), pp.88-9, and 207; R. Church, *The rise and decline of the British motor industry* (Cambridge, 1995), pp.3-7.

<sup>50</sup> M. A. Mariage, 'The use of aluminium wire in traction motors', *The Tramway and Railway World*, 4 May 1911, pp.316-8.

<sup>51</sup> Departmental Committee on the Non-Ferrous Metals Trades (DC-NFMT), minutes of evidence: William Murray Morrison, 25 May 1917, TNA, BT 55/46; *The Engineer*, 13 October 1899, and *The Electrician*, 26 October 1900, no page number but held in UGD 347/21/29/2; Smith, *From Monopoly to Competition*, p.90; Hachez-Leroy, *L'Aluminium français*, p.62; Letter from N. McPherson, Aluminium Corporation Ltd. to L. V. Chilton, BACo, 'Dolgarrog Smelter Output', 27 March 1956, Maison-Alcan 00161-08; Letter from Chilton, BACo, to Hardie, ICI, 21 January 1955, Maison-Alcan 00161-08.

<sup>52</sup> For an enthusiastic endorsement of the metal, see: *Final Report of the Royal Commission on Coal Resources in the United Kingdom. Part X: Evidence – Qs.23659-23667- Professor G. Forbes, electrical engineer*, UK Parliamentary Papers (PP), 1904, (C. 1917); L. Hannah, *Electricity before Nationalisation. A Study of the Electricity Supply Industry in Britain to 1948* (London, 1979).

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enjoyed the distinction of having been the leaders, having acquired the global patents and experience of working with Hall and Héroult respectively. The Pittsburgh Reduction Company also had the financial backing and business acumen of venture capitalists the Mellons. Andrew and Richard Mellon sat on Pittsburgh's Board, and were under no illusions about a speedy return on their capital investment and remained major shareholders in the Company. It was they who engineered the Company's highly successful move to their Niagara Falls factory. Moreover Alcoa's chronicler George Smith maintains that even as US Treasury Secretary Andrew Mellon did not hesitate to use his influence to promote the business.<sup>53</sup> AIAG Neuhausen emerged out of negotiations between I.G. Neher Sons – iron masters keen to expand horizontally using their waterpower resources on the Falls of the Rhine into more secure new markets and interested by Héroult's process – with French inventor (who had found little interest with the French producer Produits chimiques d'Alais et de la Camargue (PCAC) and established themselves as the Swiss Metallurgical Society, joining forces in German Edison Company in November 1888 to form AIAG. As such they were early leaders with considerable established expertise, fixed assets and combined acumen.<sup>54</sup> The French firm PCAC were established in the mid-nineteenth century as producers of Chlorine and Soda, as well as other products. It was their expertise in this area that attracted Sainte-Claire Deville to set up his first industrial process for aluminium manufacture at their works in Salindres. Despite the early disinterest in Héroult's process their lengthy experience of working with aluminium, considerable fixed assets and their ability to effect economies of scope afforded them a strong market position and competitive advantage.<sup>55</sup>

However BACo's costly Swiss error revealed very real weaknesses in the strategic management of the firm. By 1913, BACo's Scottish reduction works were producing 11 per

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<sup>53</sup> Smith, *From Monopoly to Competition*, pp. 30-2, 49-81, 143, 153, and 196-8; D. Cannadine, *Mellon: an American life* (New York, 2006), pp.96-9.

<sup>54</sup> A. Von Zeerleder, 'Harnessing Switzerland's Water. Electrolytic Method of Production', *The Times Trade & Engineering*, March 1937, p.xx.

<sup>55</sup> M. Le Roux, 'Paul Héroult et son milieu. Des années de formation à <<l'aluminium à bon marché>>' and I. Grinberg 'Pechiney, pivot de la structuration de l'industrie de l'aluminium en France' in Grinberg and Hachez-Leroy, *Industrialisation et sociétés*, pp.23-37.

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cent of the global output of primary aluminium (around 92 per cent of the UK output).<sup>56</sup> Between 1911 and 1912, BACo expanded their operations in Norway and the UK, acquiring another small smelter at Vgielands and a rolling mill at Warrington in England, and installing the first extrusion plant in the UK (in order to diversify their product range for important new markets). In the following two years they invested in new mills at Warrington, purchased land to construct a large new alumina works at Burntisland in Fife, and extended their Kinlochleven works to include a carbon factory for the manufacture of electrodes on site. On the outbreak of war in September 1914, the Board of Directors of BACo was completely changed from that of 1894, although the company retained the skills of Murray Morrison as General Manager. Of this Board it was to be Murray Morrison and the Chairman for nearly twenty years Andrew Tait (a shrewd accountant with a mastery of the political) who would most influence the direction of the Company.<sup>57</sup> Though BACo played a central role as a leading producer in the interwar cartels, they became an increasingly small player in global terms. British Aluminium expanded both their upstream and downstream activities during this period, with the completion of the Burntisland works in 1918 and purchase of William Mills who operated a foundry in Birmingham, the addition of a far larger smelter and hydro-scheme at Lochaber in 1929, and expansion of their semi-manufacturing capacity. They acquired holdings in a number of other valuable concerns both domestically and abroad, notably shares in James Booth (the former Vickers subsidiary and alloy producer for specialist defence procurement markets) and Norwegian firm Det Norsk Nitrid. This was matched with a sustained capital investment programme in plant technology, if not in sales.<sup>58</sup> Concurrently the period saw competition intensify in domestic primary and semi-manufacturing markets with an increase in imports of Canadian ingot; and Alcan's establishment of their subsidiary the Northern Aluminium Company Ltd.

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<sup>56</sup> McPherson to Chilton, 27 March 1956, Maison-Alcan 00161-08; Chilton to Hardie, 21 January 1955, Maison-Alcan 00161-08; Grinberg and Hachez-Leroy, *Industrialisation et sociétés*, Annexes 1.1 and 2.1.

<sup>57</sup> BACo, Directors' reports and accounts for 1912-1914, UGD 347/21/6/5-7; BACo, Register of Directors and Managers, 1894-1948, UGD 347/21/5/1; Notes on the British Aluminium Company Ltd., Maison-Alcan 00161-08.

<sup>58</sup> BACo, Directors reports and accounts, 1927-1939, UGD 347/21/9/2; The North British Aluminium Company Ltd. (NBACo), Minute book no.1, 1924-1938, UGD 347/21/2/7; Notes on the British Aluminium Company Ltd., Maison-Alcan 00161-08; Smith, *From monopoly to competition*, pp.129-131 and 171-3.

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and acquisition of a foundry just outside Birmingham for the production of aluminium castings in 1926, a plant for hollow-ware close by at West Bromwich (extended and reequipped to enable them to carry out extrusion and moulding work) in 1927, and rolling mill at Banbury in Oxfordshire in 1931 to take advantage of the nearby car and aircraft factories.<sup>59</sup> After the Second World War BACo became largely a domestic producer, focusing on UK semi-fabrication markets (as a result of the expansion of this side of the business during WW2) while attempting to expand its upstream activities but had a weak capital structure. Britain, and Europe to a lesser extent, was flooded with cheap North American ingot. The market for semi-fabricated products in Britain became far more crowded and grew dramatically, with the purchase of plants such as Falkirk in Scotland and Newport in South Wales by BACo and Rogerstone in South Wales by Alcan largely constructed with the aid. In 1949 BACo finally acquired a controlling interest in Al Corp who had abandoned smelting in 1944, and turned their attention to semi-fabrication. During the war BACo and Alcan had also – along with AIAG Neuhausen – established a subsidiary called the South Wales Aluminium Company Ltd., operating a small smelter. Their subsidiary, the Gold Coast Bauxite Co. Ltd., had also commenced mining bauxite in 1941. Despite BACo's financial state it constructed a large smelter under its subsidiary the Canadian British Aluminium Company Ltd (CBACo) that entered operation in 1957. However it lost out on other prospects largely because of its poor finances. A weakened BACo was taken over by a partnership of US aluminium smelter and fabricator Reynolds Metals and UK semi-fabricator Tube Investments in 1959.<sup>60</sup> The impact on BACo's operations by Reynolds Metals-Tube Investments (RTIA) was mixed. RTIA pursued a low-cost model focusing on downstream activities and strengthening sales. This made BACo's balance sheets appear attractive but had a deleterious effect on their plant, particularly their smelting and semi-fabricating capacity. BACo constructed a 100,000 tons smelter, as part of the UK Labour Government's smelter programme (covered in other papers on this

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<sup>59</sup> 'Northern Aluminium Company Ltd: An Account of Its Growth, Equipment and Methods of Production', *Modern Metals*, Reprint, (November and December 1953).

<sup>60</sup> BACo, Directors reports and accounts, 1945-1959, UGD 347/21/9/2; Notes of the British Aluminium Company Ltd., Northern Aluminium and the UK aluminium industry, Maison-Alcan OO161-08; 'Northern Aluminium Company Ltd'; Lecture notes on the British Aluminium Company Ltd. 1945 to 1978 by R. E. Utiger, 27 April 1981, UGD 347/21/46/24.

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panel) at Invergordon on the north coast of Scotland, which entered operations in 1971. Due to crippling power contracts and an unsympathetic hearing from Government, this was forced to close in 1982. In the meantime BACo committed to completely reconstructing and modernising respectively Lochaber and Kinlochleven smelters between 1978 and 1981 (Foyers having closed in 1967). British Aluminium merged with Alcan Aluminium UK Ltd. (AUK) in 1983 to form British Alcan in a deal intended to strengthen both players, becoming the largest domestic producer in primary metal production, and a market leader in rolled and specialised products.<sup>61</sup> In 2007 Alcan International – Alcan Europe's parent company – merged with Rio Tinto Zinc (now Rio Tinto Alcan) to produce one of the largest global miners and a leading aluminium producer.

## II

It was the British industry's interaction with the State that was to have the most profound effect on it. While the British State remained consistent on the need for secure supplies of aluminium ingot, semi-fabricated alloys and raw materials in so far as the UK's strategic priorities were concerned; its' approach to the native industry was one of the ends justifying the means. Government Ministers and Officials views to the aluminium industry seen across the twentieth-century are best characterised by the observations made by Alcan Aluminium UK's John Elton in a letter to the President of Alcan Aluminium Ltd. Nathanael V. Davis after discussions with the UK Government over the smelter contracts in August 1967: 'It is difficult to be concise about the whole position of smelting in the U. K., as Government and Civil Servant views are still being formulated. I think it is now clear that

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<sup>61</sup> BACo, Directors reports and accounts, 1959-70, UGD 347/21/9/2; BACo, Directors reports and accounts, 1975-1981, UGD 347/21/6/28-34; Alcan Aluminium UK (AUK), annual reports and accounts, 1976-1981, UGD 347/21/6/72-78; Files on sales histories of BACo and AUK during takeover discussions, 1978-1981, UGD 347/10/3/4; Report on BACo raw materials from J. C. Winch, Alcan Management Group R & D, to I. Suchoversky, Alcan VP Research and Operations Technology, 1 November 1982, UGD 347/1/7/4; Memo re. BACo from R. Wagner, Alcan Aluminiumwerke GmbH, to P. J. J. Rich, Alcan Aluminium Europe, and G. Russell, AUK, 10 August 1982, UGD 347/1/7/1; British Alcan, Presentation to bankers on post-merger achievements, 11 December 1985, UGD 347/1/7/45; British Alcan, annual reports and accounts, 1982-1989, UGD 347/1/1/1-8; Alcan Primary Metals Europe, reports, 1990-2000; R. E. Utiger, *Never Trust An Expert* (London 1995).

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the Government wishes to have aluminium smelting but that the means of achieving it are still muddled, particularly in relation to power.'<sup>62</sup> That is not to wholly concede Michael Porter's point that the sum total of State policy to British industry can be reduced to 'inappropriate and rarely sustained' attempts at failed intervention; but in the case of aluminium it was the UK Government's failure to approach the subject in a consistent and measured manner that profoundly affected the native British industry.<sup>63</sup> In fact as far as aluminium was concerned, the British Government showed itself increasingly less interventionist, and less inclined to intercede even at times than its US counterpart was. Conversely British Government measures increasingly very certainly favoured the Canadian industry from the introduction of Imperial Preference Tariffs onwards. That said Government did also aid the growth of native producers directly through assured loans, civil and defence procurement, and research and development. The relationship also had a significant impact of the culture and leadership of British Aluminium, and became if not 'locked' in to its relationship with Government then certainly accustomed to it and assimilated to official procedures. This was seen in the degree of managerial 'path dependence' in the company, with some directors selected for their familiarity with Government departments and the Armed Services rather than business acumen.<sup>64</sup>

As Grinberg's remark elucidates, the rapid expansion of the aluminium industry in continental Europe was closely linked to its martial purposes: the British industry was no different from that of the rest of the Europe and North America.

Indeed it was arguably what interested British Aluminium founder Emmanuel Ristori in aluminium. As the former head of ammunition at Nordenfeldt Guns, Ristori would have had both a familiarity with aluminium (through its use in explosives, shells and artillery

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<sup>62</sup> Letter from P. J. Elton to N. V. Davis, 22 August 1967, Maison-Alcan 00161-08.

<sup>63</sup> M. E. Porter, *The Competitive Advantage of Nations*, this edition (Basingstoke, 1998), pp.504-7.

<sup>64</sup> P. A. David, 'Path Dependence, its critics and the quest for 'historical economics' at <http://www-econ.stanford.edu/faculty/workp/swp00011.pdf>, subsequently published in P. Garrouste and S. Ioannides (eds.), *Evolution and Path Dependence in Economic Ideas: Past and Present* (Cheltenham, 2000), pp. ; J. Zeitlin, 'Productive Alternatives: Flexibility, Governance, and Strategic Choice in Industrial History' in F. Amatori and G. Jones (eds.), *Business History around the World*, (Cambridge, 2003), pp.62-82.

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pieces), and close contact with the Royal Gun Factory at Woolwich. As early as 1862, the Royal Gun Factory experimented with aluminium bronze, and by the early 1890s was using aluminium bronzes in artillery pieces, rifles and shells.<sup>65</sup> Similarly the Royal Naval Dockyards were experimenting with aluminium bronzes by 1890.<sup>66</sup> More extensive use of aluminium by the armed services in Britain was primarily stunted by the small quantities of the metal available and its high cost prior to the development of electrolytic processes, and by an absence of laboratories in Government facilities to test the properties of the metal.<sup>67</sup> It seems entirely possible therefore that Ristori saw a blossoming opportunity for entrepreneurs with the specialised knowledge to exploit the new technology. Indeed British Aluminium were being more than a little disingenuous when they claimed that the British Government was not making the most of the opportunities that aluminium offered for military purposes.<sup>68</sup> This was, however, all part of a strategy to pressurise the armed services into greater usage of aluminium. In their sales brochure for 1908, the company stated:

The advent of aluminium now places a cheaper and a lighter material at the service of the War Office... sooner or later the British War Office will follow the example [of the Germans and Swiss], and Tommy Atkins will then have cause to thank the light, bright, clean, rustless metal for its share in diminishing the burden (if not the heat) of the day.<sup>69</sup>

In fact by 1908, both the British Army and the Royal Navy using it in reasonable quantities, not least on basis of experiences of uses in the Anglo-Boer War, and the newly established Government run National Physical Laboratory (NPL) had started conducting more

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<sup>65</sup> *Annual accounts of manufacturing establishments under the War Department for year 1862-3*, PP, (c.392), p.47; *Return of annual accounts of ordinance factories* (hereafter *Army Ordinance*), 1890-1, PP, (c.129), pp.98 and 104; *Army Ordinance*, 1891-2, PP, (c.144), p.92; *Army Ordinance*, 1892-3, PP, (c.61), pp.94, 114 and 116.

<sup>66</sup> *Balance sheets and accounts of shipbuilding and dockyard transactions* (hereafter *Navy dockyard expenses accounts*), 1890-1, PP, (c.147), p.194.

<sup>67</sup> *Royal Commission on scientific instruction and the advancement of science, Vol. II: Minutes of evidence, 1874*, PP, (c.958), Qs. 414-5: evidence of Lt. Col. Alexander Strange F.R. S; Russell, *Chemistry, Society and Environment*, pp.313-4.

<sup>68</sup> C. K. Cooke, 'The Advance of Aluminium', 1895, UGD 347/21/46/2; BACo, Chairman's speech to the third OGM; 'Aluminium manufacture', *Cassier's Magazine*, October 1899, pp.647-659.

<sup>69</sup> BACo, *Aluminium*, 1908, UGD 347/21/29/3.

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extensive tests into the properties and potential uses of the metal.<sup>70</sup> The NPL had also started to investigate the potentials of aluminium alloys for uses in airships, airframes and aero-engines, and aluminium powder as proofing for balloons on behalf of the Advisory Committee on an air force.<sup>71</sup>

Nevertheless, as with the other continental European powers, it was to be the First World War that would transform the relationship with Government and dramatically increase both the volume and diversify the uses of the metal.<sup>72</sup> As with all essential raw materials, sales of aluminium were controlled by the newly formed Ministry of Munitions during the First World War: aluminium being one of the earliest with control effective as from 18 August 1915. Under these arrangements the export of aluminium was prohibited from that month, with further restriction orders on the sale and purchase of aluminium, bauxite, cryolite imposed in June 1916 and January 1917. The latter were imposed after native producers who had complained of the impact of the first order on business were found to have been supplying civilian markets. This was followed by a complete control order on the industry with effect from 1 December 1915. Not until 1 March 1919 were all priority controls on these materials ceased.<sup>73</sup> The broader significance of aluminium is that it further elucidates the growing crisis in raw materials supply after the Somme campaign, along with an

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<sup>70</sup> *Army Ordnance, 1900-1*, (c.101), pp.34 and 46; *Army Ordnance, 1901-2*, PP, (c.84); *Army Ordnance, 1902-3*, PP, (c.116), pp.21 and 172-3; *Army Ordnance, 1904-5*, PP, (c.68), p.218; *Report of Adjutant-General of Yeomanry on stores for South African campaign, 1902*, (c.803), pp.121 and 134; *Report of Commissioners appointed to enquire into military preparations and other matters connected with the War in South Africa, Vol. II: Minutes of evidence, 1904*, PP, (c.1791), Evidence of Col. Forbes Macbean, C.B., CO 1<sup>st</sup> Battalion Gordon Highlanders, 18 March 1903; *Army Ordnance, 1906-7*, PP, (c.52), p.180; *Departmental Committee on the National Physical Laboratory, minutes of evidence with appendices and index, 1908*, PP, (c.3927), Qs.57-65: Evidence of Dr. R. T. Glazebrook; *Statistical report of the health of the Navy, 1909*, PP, (c.302), p.199.

<sup>71</sup> *Report of the Advisory Committee on Air for 1909-10* (hereafter *Air Force: Advisory Committee*), PP, (c.5282), pp.9, 90-94, 121, 165 and 174; *Air Force: Advisory Committee, 1910-11*, PP, (c.5453), pp.22-6; *Air Force: Advisory Committee, 1912-13*, PP, (c.6858), p.16.

<sup>72</sup> For accounts on the effects on other combatant nations in both world wars, see: (France, Germany and Italy) L. Cailluet, 'L'impact de la Première Guerre mondiale et le rôle de l'État dans l'organisation de la branche et des entreprises', M. Knauer, 'Une industrie née de la guerre. L'aluminium en Allemagne de 1890 à 1950', and R. Petri, 'L'industrie italienne de l'aluminium à la veille de la Seconde Guerre mondiale' in Grinberg and Hachez-Leroy, *Industrialisation et sociétés*, pp.95-105, and 127-152; (North America) Smith, *From Monopoly to Competition*, pp.126-131; Campbell, *Global Mission, Vol.I*, various refs.

<sup>73</sup> For details on the mechanisms and organisation of wartime control between 1914 and 1919, see: Ministry of Munitions, *Official History, Vol. 7: The Control of Materials* (London, 1922), pp.44-71, and part III, chapters I and V; R. H. Tawney, 'The Abolition of Economic Controls, 1918-1921', pp.1-30.

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intense (in some cases xenophobic) distrust of allies and neutral powers evident in Government circles identified by Simon Ball and David French.<sup>74</sup> As the Chairman and General Manager respectively of the largest native concern, British Aluminium, Andrew Tait and William Murray Morrison served in various capacities within the Ministry of Munitions and then Reconstruction during the War.<sup>75</sup> Both Tait and Murray Morrison would use their positions to further BACo's middle and long-term goals. In fact the relationship between British aluminium producers and Government during WW1 broadly followed that of relations between their French counterparts and the French state. One of 'serving the immediate public interests of national defence, and the medium term post-war interests of private sector business'.<sup>76</sup> At the outbreak of war in August 1914, native British production of primary aluminium stood at 7,500 tons (just over 90% of which was produced at either Foyers or Kinlochleven). In addition, Britain could rely on a further 3,000 tons from British Aluminium's plants at Stangfjord and Vgielands in Norway.<sup>77</sup> With the acquisition of new rolling facilities at Warrington in the north of England – to complement British Aluminium's smaller operations at Milton – the Company extended its capacity for rolled aluminium sheet. Current estimates of the rise in consumption of the metal in Britain between 1914 and 1919, contained in Grinberg and Hachez-Leroy, grossly underestimate wartime purchases of the metal, not just for British territorial forces but also as the armoury for Imperial forces and on behalf of Allies.<sup>78</sup> By 1916 British requirements of aluminium stood at 32,000mts, with 7,000mts of that destined for Russia and Italy, and home production as well as Norwegian supplies standing at 10,500mts (as against current estimated figures of 4,200mts in Grinberg and Hachez-Leroy).<sup>79</sup> Aluminium alloy castings were used in military motor vehicles, submarines and increasingly aeroplanes. Aluminium itself was being used

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<sup>74</sup> S. Ball, 'The German Octopus: The British Metal Corporation and the Next War, 1914-1939', *Enterprise & Society*, 5:3, (2004), pp.451-489; D. French, *The strategy of the Lloyd George coalition, 1916-1918* (Oxford, 1992); G. Hardach, *The First World War 1914-1915*, this edition (Harmondsworth, 1987), pp.11-19.

<sup>75</sup> BACo, Directors reports and accounts for years ending 31 December 1914-1917, UGD 347/21/6/7-10.

<sup>76</sup> L. Cailluet, 'L'impact de la Première Guerre mondiale et le rôle de l'État dans l'organisation de la branche et des entreprises' in Grinberg and Hachez-Leroy, *Industrialisation et sociétés*, p.101.

<sup>77</sup> Letter from Macpherson to Chilton; Letter from Chilton to Hardie, Maison-Alcan, 00158-08.

<sup>78</sup> Grinberg and Hachez-Leroy, *Industrialisation et sociétés*, Annex 2.1,

<sup>79</sup> Ibid; *Report of the Controller for the development of mineral resources in the United Kingdom, 1918*, PP, (c.9184), pp.23-4; Minute from D. A. Bremner, Ministry of Munitions, to Sir L.Llewelyn, Director of Materials, Ministry of Munitions, 31 August 1916, TNA, MUN 4/2046.

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in the manufacture of ammunition (shell fuses, shell linings, explosives and hand grenades) and machine guns (notably the cooling fins in Lewis guns).<sup>80</sup> To give some indication of the impact of the war economy on the demand for aluminium, it is worth reflecting on the increase in production for those munitions that used the metal. Between 1914 and 1917, the number of shells produced in British munitions factories increased from 500,000 to 76,200,000. The production of powder and explosives reached its peak of 186,000 tons in 1917, from a figure of 5,000 tons in 1914. And, perhaps most crucially, aircraft and aero-engine output rose from 2,000 aircraft and 1,000 engines in 1914 to 32,000 and 22,100 respectively in 1918.<sup>81</sup> What increasingly worried officials within the Ministry of Munitions was the increasing reliance on costly imports of ingot from both the United States and Canada, amounting to 70 per cent of their supplies by 1916. Between January and December 1915 alone, prices for imported ingot rose from £81 to £220 per tonne. By November 1916 one ton of imported aluminium ingot was costing £300. In response to the Inter-Allied Munitions Board's concerns about the rising cost of these imports, Edmund Phipps, the leading official in the Ministry of Munitions, issued a circular to the head of other civil service departments encouraging them to find alternatives to aluminium to conserve supplies.<sup>82</sup> Economy measures were highly effective in reducing the consumption of aluminium in certain areas but the growth of the aircraft programme in the last two years of the war more than compensated for these. For example, motor transport that accounted for 3,000 tons in 1916 had been reduced to around 2,100 tons by 1918. However the combined Admiralty and War Office air requirements increased five-fold from 2,000 tons in 1916 to the 10,840 tons required by the Admiralty for airships and by the

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<sup>80</sup> Bremner to Llewelyn, 31 August 1916, MUN 4/2046.

<sup>81</sup> Hardach, *The First World War*, Table 9.

<sup>82</sup> Sir Leonard Llewelyn served as a Director within the Ministry of Munitions between August 1915 and 1916 with responsibility for steel, copper, brass, spelter, aluminium and other metals, after which he was appointed to the post of Deputy-Director (Metals) with responsibility for all non-ferrous metals. After the formation of the Munitions Council in August 1917, the Non-Ferrous Metals Department came under control of Group M and Sir Ernest Moir and Llewelyn became Controller: Bremner to Llewelyn, 31 August 1916, MUN 4/2046; Memo from Inter-Allied Munitions Board (IAMB) to Phipps, 1 November 1916, TNA, MUN 4/1170; Circular from Edmund Phipps, General Secretary, Ministry of Munitions, to all heads of Government Departments, 28 November 1916, TNA, MUN 5/207/1830/1; Ministry of Munitions, *Official History*, Vol. 7, part III, p.8.

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Air Board for aircraft in 1918.<sup>83</sup> The Government also advanced £200,000 in 4 ½ per cent loans to British Aluminium to extend their water reserves at Kinlochleven; the work being carried out, in part, by German prisoners of war.<sup>84</sup>

What concerned British officials more profoundly was shortfall in native supplies of the metal, and control Alcoa had over crucial supplies of the metal. Their response to this was to have a long-term impact on Britain's domestic industry, and on Alcoa's approach to British Imperial markets.

In a minute to the Director of Materials Sir Leonard Llewelyn of 31 August 1916 the leading munitions official with responsibility for aluminium D. A. Bremner set out both the Ministry's concerns and the suggested approach to be taken. Bremner and his colleagues were at pains to locate aluminium production within the UK, or less preferably the Empire. Similarly the raw materials necessary for producing should be sought in Britain or its Commonwealth. Thus the comparatively greater expense of native production of ingot was justified by its strategic importance:

It must be said, however, that in spite of the relatively high cost of hydro-electric power in this country, as compared with Scandinavia, Switzerland, Canada and America, the British Aluminium Co. Ltd, and the Aluminium Corporation Ltd., have been able to justify their existence, and have rendered invaluable service during the war... Although the cost of power is an important factor in the commercial production of aluminium, the results achieved by the British Aluminium Co. Ltd., and the Aluminium Corporation Ltd., shew (sic) that even in this country, it is not prohibitive, and it would be unwise to assume that the economic possibilities of aluminium manufacture in the United Kingdom have been exhausted.<sup>85</sup>

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<sup>83</sup> Memo from IAMB to Phipps, 1 November 1916, MUN 4/1170; Ministry of Munitions, figures of aluminium released, December 1918, MUN 4/724.

<sup>84</sup> Report of US charge d'affaires of visit by E. G. Lowry to German Prisoners of War at Kinlochleven camp, 15 September 1916, TNA, FO 383/164; Report by Dr Schwyzer and A. L. Fischer, Swiss Legation to Kinlochleven camp, 27 June 1917, FO 383/277; Ministry of Munitions, *Official History*, Vol. 7, part III, p.76.

<sup>85</sup> Bremner to Llewelyn, 31 August 1916.

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Significantly for future developments (notably British Aluminium's at Lochaber), Bremner continued by saying that:

In view of the necessity of increasing our home production, not only of aluminium, but of certain essential ferro-alloys for which we are now dependent on America and Scandinavia, it would appear to be highly advisable that the potential sources of hydro-electric power in the United Kingdom should be thoroughly investigated. It may be that vested interests and legal difficulties have hitherto prevented the development of certain water powers, and that these obstacles may have to be swept aside in the national interests.<sup>86</sup>

Bremner duly considered other potential locations for secure aluminium production (and supplies of raw materials) within the Empire, acknowledging that the evident and considerable shortfall had to be met from outside the UK.<sup>87</sup> Yet it is clear from his minute that the only serious contender was the Canadian aluminium industry, which was to become the major secure supplier of aluminium to Britain for much of the next fifty years:

Unfortunately, however, none of these countries, with the exception of Canada, is favourably situated geographically to become the seat of any indispensable portion of the Empire's Aluminium (sic) manufacture. The United Kingdom being not only the largest British consumer of aluminium, but also the Arsenal of the Empire, it is essential that as large a proportion of as possible of her military requirements should be covered by home production. Supplementary supplies might be drawn from Canada with the minimum risk...<sup>88</sup>

In April of that year in a move that would contribute to the strengthening of the Canadian aluminium industry at the expense, in the long term, of the native British industry the Crown had sold mining rights for bauxite deposits in British Guiana to the Northern Aluminium Co. Ltd. of Canada on the provision that the Company construct in Britain or a British Colony an alumina refinery capable of producing 8000 tons of alumina per annum. One thing about the Canadian industry vexed Bremner though. In order that it could be counted on as a secure supplier: 'it would be necessary to render the Dominion independent of the United States for her Alumina.' Bremner continued in a similar vein of caution by noting that:

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<sup>86</sup> *Idem*.

<sup>87</sup> *Idem*; Letter from Edmund Phipps to Under-Secretary of State for India, 14 October 1916; Note from H. A. Hayden, Director of Geological Survey of India, 30 October 1915, TNA, MUN 4/2046.

<sup>88</sup> Bremner to Llewelyn.

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At the present time, the whole of the aluminium industry of the United States of America and Canada is practically under the autocratic control of Mr A. V. Davis, who is President of the Aluminium Co. of America, and the Northern Aluminium Co. Ltd. of Canada, the only producer in that country.<sup>89</sup>

Bremner's concerns about US control of Britain's major source of ingot were part of a longer running feud over bauxite mining rights within the Empire, which eventually drew in the British and US governments. Alcoa who were desperately looking for bauxite mining prospects to meet growing demand for aluminium saw in the colony of British Guiana an ideal reserve. The British Government – and native producers – wished to retain Imperial reserves for the domestic British industry, but were forced by practical concerns to concede mining rights to the US Company.<sup>90</sup> The frustration of Ministry of Munitions' officials at the granting of this concession (negotiated by the Colonial Office) was tangible in the evidence given by one of their number Captain Walter Broadbridge (with full Ministerial endorsement) before the Board of Trade's departmental Non-Ferrous Metals Committee appointed by the Board of Trade to give consideration to the non-ferrous trades after the War in June 1917.<sup>91</sup> This evidence seems to support the contention of an earlier academic study that suggests that the Alcoa coerced the British Government into granting the US Company a lease.<sup>92</sup> However, contrary to Spackman's suggestion, Broadbridge's evidence suggests this decision had far more to do with the British war effort's increased reliance on obtaining a significant proportion of her aluminium from Alcoa rather than political coercion emanating from Washington.<sup>93</sup> Negotiations with Alcoa over imports of ingot, conducted through the British Government's intermediary the banking house Morgan Grenfell & Co., worsened over the thorny issue of prices during 1916-1917, culminating in the Ministry of Munitions authorising the Governor of British Guiana to use his right to halt

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<sup>89</sup> Idem

<sup>90</sup> Graham, *The Aluminium Industry and The Third World*, p.21.

<sup>91</sup> Departmental Committee on the Non Ferrous Metals Trades, Minutes of Evidence – Captain Walter Broadbridge [hereafter DC-NFMC – Broadbridge], 26 June 1917, TNA, BT 55/46; *Report of the Departmental Committee appointed by the Board of Trade to consider the position of Non-Ferrous Metal Trades after the War* (London, 1918), BT55/46.

<sup>92</sup> A. Spackman, 'The Role of Private Companies in the Politics of Empire: A Case Study of Bauxite and Diamond Companies in Guyana in the Early 1920s', *Social and Economic Studies*, 24:3, (September 1975), p.347.

<sup>93</sup> DC-NFMT – Broadbridge.

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exports of bauxite to the United States from the colony. In a memo to the Inter-Allied Munitions Board, the Ministry stressed that the Board convey to the Company their intent 'to continue to make use of the export prohibition clause until the Company are prepared to be reasonable' about the 'excessive price of aluminium to be supplied in 1918.'<sup>94</sup> The British Government's distrust of Alcoa would continue for half a century. To further exacerbate the supply crisis, it became apparent that the IAMB and Ministry had wrongly assumed that they could include French shares of the output from the their Tysedal works in Norway for joint allied supplies.<sup>95</sup> French representatives of the Board confirmed that because of the growing military aircraft programme they could not afford to spare any metal. As a means of sourcing other supplies of metal, Andrew Tait claimed that shares were becoming available on the Board of AIAG Neuhausen and suggested that if the British Government could gain financial control (which British Aluminium could take over after the War) of AIAG Neuhausen then they might secure supplies of metal from Switzerland. Though a Swiss company, AIAG Neuhausen were largely German owned and until 1916 counted as one of their Board Dr Walter Rathenau (who headed the German war economy). The French authorities had sequestered their French assets in 1914. By 1916 they were still providing the Central Powers with a considerable quantity of aluminium, and receiving supplies of bauxite from Hungary and Austria.<sup>96</sup> Tait also suggested for good measures that not only could this have the effect of denying the German war effort of a valuable supply of metal but it could deprive of Germany of this source post-war. Tait had most probably calculated in this one move to hand BACo control of the Swiss industry and allow to finally develop their existing assets there. Though Tait's suggestions publicly articulated suggestions found favour with Ministry officials, not least Sir Budd Cecil, the Chief Adviser on metals, it ultimately foundered on French refusal in the event to supply alumina to the works (on the grounds of diminished

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<sup>94</sup> Memo from Ministry of Munitions to IAMB, 13 July 1917; Memo from R. H. Brand, IAMB, to IAMB Ottawa, 27 October 1916; Memo from W. Broadbridge to R. H. Brand, 2 January 1917; Brand to Broadbridge, 12 July 1917, all memos in MUN 4/5402.

<sup>95</sup> Memo from IAMB to Phipps, 1 November 1916; Letter from Adj. Col. J. Ronneaux to Under-Secretary, Ministry of Munitions, 7 December 1916, MUN 4/1170.

<sup>96</sup> Memo from Broadbridge to Wigglesworth, with attached translation of AIAG Neuhausen annual report for 1916, 16 May 1917, MUN 4/795.

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capacity to do so), and strategic concerns that with French alumina redirected to Neuhausen and the Norwegian works standing idle, Norwegian production might be used to supply Germany.<sup>97</sup> Evidently French producers privately could also hardly have been encouraged by the idea of British Aluminium gaining control of the Swiss industry and trying to encroach on central and West European markets after the war. Tait for his part knew that encouraging this scheme would find particular favour with Sir Cecil Budd (and Lloyd George's successor as Minister for Munitions Christopher Addison) – who had dredged up considerable xenophobic resentment against the Henry R. Merton company – and had pursued an agenda for an Imperial metals policy (subsequently developed as the Imperial Mineral Resources Bureau) and a public-private corporation (the British Metal Corporation) to encourage British firms to develop Imperial resources and preventing foreign companies taking over control of strategic reserves. Infamously this was pursued through the Non-Ferrous Metal Industry Act of 1918 directed at preventing the ownership of British smelting concerns falling into "alien control".<sup>98</sup>

Budd's agenda was visible in his conduct on the Board of Trade's Departmental Committee on the Non-Ferrous Metals Trades (DC-NFMT) appointed by the President of the Board of Trade in October 1916 to consider the immediate post-war position of this group of industries (on which he served on both as a member of the Committee and Chair of the Sub-Committee on aluminium) and the Minister of Reconstruction's own advisory committee on aluminium. Budd was joined on the Board of Trade's Departmental Committee by Andrew Tait and on sub-committee by William Murray Morrison (who also served alongside Budd on the advisory committee to the Minister for Reconstruction). Andrew Tait, Murray Morrison and Capt. Walter Broadbridge of the Ministry of Munitions (who was not averse to Budd's agenda) appeared as expert witnesses before the

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<sup>97</sup> Memo by Sir L. W. Llewelyn, 21 June 1917; Sir Cecil L. Budd to W. T. Layton, 31 January 1919, MUN 4/724; Ball, 'The German Octopus', p.459.

<sup>98</sup> Christopher Addison (later Viscount Addison) (1869-1951) served as Minister of Munitions between December 1916 and July 1917, when he became Minister of Reconstruction until January 1919: Christopher Addison notes for promotion of the Non-Ferrous Metals Bill, 7 December 1917, Bodleian Library, MS. Addison dep. c. 114, fols. 20-1; S. Ball, 'The German Octopus', pp. 460-1; Cailluet, 'L'impact de la Première Guerre mondiale et le rôle de l'État dans l'organisation de la branche et des entreprises', pp.102-3.

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Committee.<sup>99</sup> Tait and Murray Morrison used their appearance to appeal on the grounds of patriotism and the industry's wartime service for financial support and protective trade tariffs for the industry, as well as specific support from the Government to enable the smooth passage of their proposed water power bill (which was originally to be sourced from their catchment area in Argyllshire). They further resurrected the spectre of Arthur Vining Davis and Alcoa, and found a very sympathetic audience in Cecil Budd.<sup>100</sup> In his evidence to the Committee (which he inferred was supported by the Minister for Reconstruction) Walter Broadbridge had lamented the cost incurred by the exchequer from reliance on US and US-owned supplies, and urged the expansion of indigenous production notably promoting British Aluminium's forthcoming scheme with vocal support from Andrew Tait who was receiving evidence on the day.<sup>101</sup> The Committee's final report recommended that: aluminium be considered a "key industry"; attempts to block water power developments by the industry be overcome with Government support; French proposals over control of bauxite mines in France and export taxes on bauxite be carefully monitored by Government; that substantial duties be imposed upon cheap foreign imports undercutting native producers; and that support be given to Imperial producers. In connection with the last point it raised misgivings about US financial control.<sup>102</sup> It was a coup for BACo. It was also essentially Bremner's memo of August 1916.

The Ministry of Reconstruction's sub-committee which reported to Addison in June 1918, made almost identical recommendations, with impetus added by the withdrawal of BACo's original Loch Leven Water Power Bill of 1918 in the face of stiff opposition and in spite of support from President of the Board of Trade, Minister of Munitions and the Minister of Reconstruction.<sup>103</sup> Budd continued to pursue both the chance of British representation on

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<sup>99</sup> *Statement with regard to advisory bodies appointed by the Minister of Reconstruction, 1918*, PP, (c.9195), p.7; *Report of the Departmental Committee on the Non-Ferrous Metal Trades* (HMSO, 1917).

<sup>100</sup> DC NFMT, Evidence of Andrew Wilson Tait and William Murray Morrison, 25 May 1917, TNA, MUN, BT 55/46.

<sup>101</sup> DC NFMT, Evidence of Capt. Walter Broadbridge, Ministry of Munitions, 29 June 1917, MUN, BT 55/46.

<sup>102</sup> *Report of the Departmental Committee on the Non-Ferrous Metal Trades*, points 98 and 102

<sup>103</sup> Report of the Sub-Committee appointed by the Minister of Reconstruction to inquire into the post-war position of aluminium, 17 June 1918, MUN 5/207/1830/2.

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AIAG's board, and advocate support for the native British industry, lobbying the British Mission to the Versailles peace conference.<sup>104</sup>

In the years immediately following the end of WW1 the British Government, spurred by the experiences of wartime, pursued the search for and securing of bauxite within the Empire for British-owned business, including the appropriately named British and Colonial Bauxite Company Ltd. and the Gold Coast Bauxite Co. Ltd. both involving British Aluminium.<sup>105</sup> The recasting of British Aluminium's original water-power bill and government support ensured the passing of the Bill through Parliament in 1921. During the course of his evidence to Parliament, Andrew Tait made a point of identifying the company as part of a "key industry" for national defence. Moreover the construction of scheme was aided by a Government guaranteed loan of £2.5 million issued under the Trade Facilities Act to BACo's subsidiary the North British Aluminium Co. Ltd.<sup>106</sup> This was justified by the Treasury on the grounds that the BACo scheme was essential to national defence requirements rather than because the industry needed reorganising or to alleviate unemployment.<sup>107</sup> Support for the Bill required conceding to Government demands that BACo could, within a given period of notice, be required to sell their water rights to the State.<sup>108</sup> Thus by the end of the War,

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<sup>104</sup> By this time Sir Cecil Budd was also liquidator for non-ferrous metals: Notes from Budd to Mr W. T. Layton, 24 January 1919, Budd to Layton, 31 January 1919, and Budd to Mrs F. Woods, 18 February 1919, MUN 4/724.

<sup>105</sup> *First annual report of the Colonial Research Committee for period ending 31 December 1920*, (c.1144), Appendix I dispatch from Downing Street to Colonies and Protectorates on mineral resources; Letter from J. W. Evans, Imperial Mineral Resources Bureau, to Asst. Secretary, Colonial Office, 23 June 1920; Evans to W. Murray Morrison, 15 July 1920; Murray Morrison to Lord Milner, Secretary of State for the Colonies, 9 August 1920; Evans to Under-Secretary of State, Colonial Office, 17 August 1920; Draft agreement between Crown Agents for the Colonies and BACo, AI Corps and partners for bauxite mining rights in British Guiana, 1920, CO 111/634; Letter from Crown Agents to Under-Secretary of State, Colonial Office, 4 July 1928, CO 111/2.

<sup>106</sup> Memos for counsel, Lochaber Water Power Bill, 1921; Proof of Andrew Wilson Tait to select committee on private bills on matter of the Lochaber Water Power Bill, 1921, UGD 347/21/34/5/11; *Trade Facilities Acts, 1921-1924*, 1924, PP, (c.121); NBACo, Minute book no.1, 4 March 1925, UGD 347/21/2/7.

<sup>107</sup> W. Murray Morrison to Secretary of the Board of Trade, 7 August 1936, TNA, SUPP 3/82; Cailluet, 'Chronicles of a death foretold?'

<sup>108</sup> Minutes of meeting between President of the Board of Trade (Stanley Baldwin), Lord President of the Council (Arthur Balfour) and the Secretary of State for Scotland (R. Munro), 23 April 1921, and of meeting between these parties along with the Minister for Transport (Sir Eric Geddes), Minister without portfolio (Christopher Addison), and Chief Electricity Commissioner (Sir John Snell), 25 April 1921, TNA, CAB 27/148.

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despite a decline in global market share, British Aluminium has assured themselves of Government financial and legal support for expansion.

The War had also introduced aluminium and aluminium alloys to a large number of manufacturers who had no prior experience of the metal. Moreover the amount of research undertaken at the NPL, Royal Aircraft Factory and countless university laboratories and factories brought very real dividends in improvements to technology, processes and in diversifying product ranges. The light alloys sub-committee received ninety-three and the aero-engine sub-committee two hundred and sixty-seven separate reports, the bulk of which related to work on new aluminium alloys. This had greatly extended knowledge of a wide range of aluminium alloys, with increased applications for them. Specifically this work had greatly improved the efficiency of aero-engines with the replacement of iron and steel with aluminium alloys, and work on coating aluminium alloys to protect against corrosion including with colours resulted in an explosion in patents as its uses in the civilian consumer markets became apparent.<sup>109</sup> Part of the work was funded by donations from the industry itself, but mostly it was financed Government. In addition thirty-two scientific and professional societies had been set up (funded by Government, and working in conjunction with both military and civil laboratories and the newly established Department of Scientific and Industrial Research (DSIR), including the British Non-Ferrous Metals Research Association (BNFMRA) formed in December 1919.<sup>110</sup> Work into aluminium alloys continued unabated throughout the 1920s and 1930s, not least given the impetus to replace wood with light alloys in aircraft structures. By the late 1930s, earlier misgivings of engineers and the Air Ministry had been overcome by extensive research into the area and resulting improvements in alloys. In 1934 senior Air Ministry officials confirmed that in the expansion of the RAF's fighter squadrons that had taken

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<sup>109</sup> *Air Force: Advisory Committee, 1917-18*, PP, (c.8629), p.8; *Air Force: Advisory Committee, 1917-18*, PP, (c.9145), pp.9-20; *Air Force: Advisory Committee, 1918-9*, PP, (c.488), pp.16-19, and 51-74; *Advisory Committee on Aeronautics, 1919-20*, PP, (c.1120), pp.12, 35 and 50; *Report on Scientific and Industrial Research* (hereafter *Scientific and Industrial Research*), 1923-24, PP, (c.2223), pp.30 and 33; *Scientific and Industrial Research, 1926-27*, PP, (c.3002), p.4; *Scientific and Industrial Research, 1930-31*, PP, (c.3789), p.7.

<sup>110</sup> *Scientific and Industrial Research, 1919-20*, PP, (c.905), p.28; Sir H. Melville, *The Department of Scientific and Industrial Research* (London, 1962), pp.19, 102-3.

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place since 1925 at least 23 per cent of the metal used in new planes had been aluminium or aluminium alloys. By 1937 the Secretary of State for Air was able to declare that:

The problem of securing the greatest possible operational efficiency for defence purposes of the matériel of the Royal Air Force has involved an intensive programme of research and development... Improvements in the performance of present day aircraft have also resulted from intensive research on aluminium materials. In particular, the aluminium alloys, used to a considerable extent in the structure of aircraft, now shew (sic) a notable improvement in mechanical properties.<sup>111</sup>

Historians of RAF expansion during rearmament and the British aircraft industry have suggested that by the late 1930s most of the new military aircraft for the RAF were built of aluminium alloys, and have attributed the slower uptake in Britain more to weaknesses in the native airframe industry, notably its small-scale and conservatism.<sup>112</sup> Nevertheless by 1938, 50 per cent of aluminium produced in the UK was being employed in aircraft production.<sup>113</sup> Other research undertaken on behalf of DSIR and BNFMRA at Government establishments and laboratories had benefits both for the Armed Services and for wider civil uses. Notable discoveries included solutions to extracting nitrogen from reduction furnace to improve the quality of metal and aluminium-brass condenser tubes being used extensively in both civil maritime and Naval vessels. Though much of this research work was initially conducted for military purposes, it had brought great dividends in terms of civilian uses.<sup>114</sup> Throughout the 1920s and 1930s British Aluminium chief markets were in civilian transport (cars, trams, trains, ships and aircraft), military (aircraft and shipbuilding),

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<sup>111</sup> *Proceedings of the Second Air Conference held on 7<sup>th</sup> and 8<sup>th</sup> of February 1922*, PP, (c.1619), p.55; *Appropriation Accounts for Air Services, 1922*, PP, (c.44), p.81; *Scientific and Industrial Research, 1921-22*, PP, (c.1735), p.47; *Scientific and Industrial Research, 1922-23*, PP, (c.1937), pp.54 and 75; *Scientific and Industrial Research, 1924-25*, PP, (c.2491), pp.45, 61 and 64; *Scientific and Industrial Research, 1925-26*, PP, (c.2782), pp.11, 35, 47, 52 and 80; *Scientific and Industrial Research, 1927-28*, (c.3258), pp.24 and 88; *Scientific and Industrial Research, 1931-32*, PP, (c.3989); *Scientific and Industrial Research, 1932-33*, PP, (c.4254), pp.38 and 68; *Committee on public accounts with proceedings, 1933-34*, PP, (c.98), Q. 5228 Evidence given by Sir C. Bullock and B. E. Holloway (Holloway later became Director of Contracts at the Air Ministry), 29 May 1934 Statement of Secretary of State for Air in *Air Estimates for 1937-38*, PP, (c.5677), p.8.

<sup>112</sup> P. Fearon, 'The British Airframe Industry and the State, 1918-35', *The Economic History Review*, New Series, 27:2, (May 1974), pp.236-251; C. H. Gibbs-Smith, *Aviation: An historical survey from its origins to the end of the Second World War*, this edition (London, 2003), pp.219 and 231; S. Ritchie, *Industry and air power: the expansion of British aircraft production, 1935-1941* (London, 1997), pp.64-68.

<sup>113</sup> J. Hurtsfield, *History of the Second World War. The control of raw materials* (London, 1953), pp.100-1.

<sup>114</sup> *Scientific and Industrial Research, 1933-34*, PP, (c.4483), pp.12, 58, and 90-1; *Scientific and Industrial Research, 1934-35*, (c.4787), pp.72 and 102; *Scientific and Industrial Research, 1934-35*, PP, (c.5013), p.6 and 59; *Scientific and Industrial Research, 1936-37*, (c.5350), p.104.

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and the electricity industry. Here again the Government establishment of the Central Electricity Board in 1926 and the ensuing development of a National Grid in Britain brought great dividends for the aluminium industry. Between 1929 and 1933, for example, 12,000mts of aluminium were used in the Grid's pylons, with much of this metal derived from BACo's Highland smelters.<sup>115</sup> It also brought the industry, the armed services, civil servants and Government scientists into regular and close contact.

In spite of the Alliance provisions, British Aluminium experienced considerable competition in domestic markets, not least from German competitors using their increased quotas and heavy subsidies to off-load stock on British markets. The situation was compounded by the unwillingness of the British government to introduce import tariffs on aluminium products, and exacerbated by the high value of Sterling under the Gold Standard. Prior to the introduction of the first wave of tariffs in 1931, the Company reported to their shareholders that 13,000 tons (or 67% of the British market share) of relatively cheap ingot, along with 6,000 tons of semi-fabricated products and £370,000 of finished goods were being imported into the country. BACo continued to protest forcefully about what they saw as the inadequacy of these measures – even after tariffs were raised from 10%-15% for rolling mill products and to 20% for foil in 1934 – and expressed concerns about the trade situation until the end of 1936.<sup>116</sup> In the case of aluminium ingot, this was not aided by the fact that Canadian imports of primary metal (which formed the bulk of the UK imports of this product) paid, under the agreements of the Imperial Economic Conference of Ottawa of 1932, an Imperial preference rate of duty of 10 per cent in comparison to the 30 per cent paid by other foreign importers (the latter with the exception of Norway where an 1933 agreement allowed for a 10% preference rate on primary aluminium but not alloys or other aluminium products, presumably in part to avoid heavy tariffs on metal from BACo's

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<sup>115</sup> BACo, directors reports and accounts, 1927-1939, UGD 347 21/9/2; L. Hannah, *Electricity before Nationalisation: a study of the development of the electricity supply industry in Britain to 1948* (London, 1979), pp.118-9.

<sup>116</sup> BACo, Directors Reports and Accounts, 1931-1936, UGD 347 21/19/2; *Import Duties Advisory Committee – additional import duties, 1934*, PP, (c.4582), No.16; *Import Duties (General Orders), 1935-36*, PP, (c5052), p.34.

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Norwegian works).<sup>117</sup> To add to the Company's woes, Inverness-shire County Council served British Aluminium with dramatically increased local rates – calculated by including the hydro-electric scheme on the basis of legislation introduced in 1854 that previously had taken no account of electricity generating capacity.<sup>118</sup>

Yet more ominously for British producers were discussions taking place between the British Government and Canadian producers over long-term strategic supplies. With Alcan now established as being legally independent of Alcoa (A. V. Davis long recognising the benefits of marketing Alcoa's Canadian assets as a British company independent of US control, and aided by anti-trust actions in the United States), the British Government had begun to put aside previous concerns it had with relying on Canadian supplies of the metal. During 1930-1931, the British Government's Principal Supply Officer's Committee of the Committee on Imperial Defence (PSO-CID) approached the Canadian industry and Government about possible arrangements for the supply of metal in the event of war. At a meeting of Canadian and British Government representatives on the side lines of the Imperial Conference of 1930 in London, staff of the Committee on Imperial Defence and from the Board of Trade floated the suggestion that in the event of war that Canada would become the main supplier of aluminium for Britain and that supply of the metal for the Empire should reside there also. This was felt by both the Canadian (including the Chief of the Canadian General Staff and Canadian Minister for Mines) and British officials to be eminently sensible and agreed.<sup>119</sup>

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<sup>117</sup> *Ottawa Agreements 1932*, PP, (c.4174), p.33; *Agreement between the United Kingdom and the Kingdom of Norway in relation to trade and commerce, 1932-33*, (C.4254), pp.2 and 22; *Fifty-ninth statistical abstract for British Dominions and Protectorates, 1934-35*, (c.4819), No.105b – Exports of aluminium from Canada by markets; *Twenty-seventh report of Commissioners of Customs and Excise for year ending 31 March 1936*, (c.5296), table 83; *Twenty-eighth report of Commissioners of Customs and Excise for year ending 31 March 1937*, (c.5573), table 83; *Twenty-ninth report of Commissioners of Customs and Excise for year ending 31 March 1938*, (c.5876), table 83.

<sup>118</sup> BACo, Proceedings of the 26<sup>th</sup> Ordinary General Meeting, 31 March 1936, UGD 347 21/19/2.

<sup>119</sup> The PSO was established in 1927 to plan for control and administration of supplies in the event of war. Aluminium, bauxite and cryolite were early on identified as essential materials: Committee on Imperial Defence, Principal Supply Officers Committee (CID-PSO), PSO committee's 7<sup>th</sup> annual report, 1 August 1930-31 July 1931, and minutes of meeting with Canadian representatives during the Imperial Conference, 31 October 1930, TNA, SUPP 3/73.

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From this moment on British Aluminium, and other smaller producers, were in a much weaker bargaining position with Government. Though BACo's new General Manager G. A. Steel (Murray Morrison having become a Director in July 1927, and Managing Director in 1929) acted as the CID-PSO adviser on aluminium prior to the outbreak of war (with Murray Morrison and other members of the Board also periodically providing advice), and director Geoffrey Cunliffe serving as the wartime aluminium controller for both the Ministries for Supply and then Aircraft Production, the Company would never again have the same influence within Government circles that it had once had and continued to think it enjoyed.<sup>120</sup> Nevertheless it continued to pursue Government contracts and support, not least by the strategic deployment of staff in negotiations. With increases in demand prompted by rearmament and particularly the aircraft production programme, BACo despatched a memo from one of their directors, Lt. Gen. Sir Ronald Charles, who was a retired senior Army staff officer with connections in and knowledge of procurement processes to show their commitment to aiding rearmament (pressing their case for Government contracts and finance for expanding smelting capacity) before the Supply Board of CID-PSO in April 1935. Unlike other committees in the PSO, this was heavily composed of senior staff officers from all the branches of the armed services. Thus Sir Charles, a decorated and respected former staff officer, they opined, would carry more weight with this audience. This was followed up by discussions and correspondence between officials at the Board of Trade and the Air Ministry with British Aluminium's highly regarded MD and senior statesmen, William Murray Morrison, during 1936. On the pretext of establishing the supply requirements of the Government rearmament programme, they probed officials on the possibilities of another Government guaranteed loan for £2 million at a 3 per cent interest rate for extending their capacity at Lochaber. With the end of the Trade Facilities Act, this would have required a discrete Parliamentary order, and was fairly unusual. However the changed bargaining position of the Company was elucidated by the response of Treasury officials in particular, outlined in a series of Treasury memos in late 1936. In his memo of 12 September, Sir Frederick Phillips, the Under-Secretary at the

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<sup>120</sup> CID-PSO, Progress report, 11 July 1935, SUPP 3/82; BACo, Directors Reports and Accounts, 1927-1939, UGD 347 21/19/2.

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Treasury, opposed the proposal, suggesting that British Aluminium were a financial liability that the Government should not shoulder. Edward Bridges, at the time Head of Defence Materials within the Treasury, was more sanguine about British Aluminium's potential and proffered a deal by which a loan would be amortised against all the company's assets and subject to a clause under which the Company promised to provide aluminium to the Government at 'reasonable prices'. In this view, he was supported by Montagu Norman, Governor of the Bank of England. In the end, although a guaranteed loan was sanctioned by the Chancellor of the Exchequer, the offer was withdrawn when Alcan and Norwegian suppliers came forward with stockpiles of metal and BACo funded the extension to Lochaber themselves. What it illustrates is both how the Company approached transactions with Government, and the winds of change prevailing within Departments to native producers.<sup>121</sup> The altered climate would be seen again during wartime negotiations over loans to both British Aluminium and Alcan during the war.

Between 24 August 1939 and 22 May 1940 a series of statutory measures were gradually introduced to control first exports, then prices, purchases, output and then the industry as a whole under the direction of the Ministry of Supply: the aluminium control being one of fourteen sections set up within Supply. In August 1940, the aluminium control was transferred (reflecting where its uses lay primarily) to the Ministry of Aircraft Production.<sup>122</sup> For the early years of the war, the Aluminium Control was based at British Aluminium's headquarters in London before bombing forced their evacuation. As in the other combatant nations UK aluminium consumption expanded exponentially, from 65,000 tons in 1938 to 317,000 tons by 1943. At the outbreak of war the native industry was producing around 25,000 tons of ingot and 40,000 tons of aluminium alloy. Despite planning measures put in

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<sup>121</sup> My thanks are due to Dr John Bourne of the Centre for WW1 Studies, University of Birmingham, for information about Lt. Gen Sir. Ronald Charles: CID-PSO, Memo from Lt. Gen. Sir Ronald E. Charles, K.C.B., C. M.G., D.S.O., to CID-PSO, 29 April 1935; Letter from Murray Morrison to the Secretary, Board of Trade, 7 August 1936; Sir William Palmer, Board of Trade, to E. E. Bridges, Treasury, 11 August 1936; Sir F. Phillips to Sir R. Hopkins and Mr Barlow, Treasury, 12 September 1936; Memo from Bridges to Barlow, 22 October 1936; Memo from Bridges to Mr Wilson Smith along, with minute relating to Treasury Inter Service Committee – Proposed guarantee to British Aluminium Company, 23 October 1936, SUPP 3/82; BACo, directors report and accounts for 1936-1939; Peden, *The Treasury and Rearmament*, pp.72-9.

<sup>122</sup> For details of the administration of control see: J. Backman and L. Fishman, 'British War Time Control of Aluminium', *The Quarterly Journal of Economics*, 56: 1.1, (November 1941), pp.20-24.

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place since the 1930s by CID-PSO, the slippery problem for service departments of producing accurate or even meaningful estimates meant that a shortfall quickly developed.<sup>123</sup> Increasing demand prompted by the growth in aircraft production and losses in the Battle of Britain, water shortages at BACo's Highland works (a recurrent problem) saw a dramatic deficit by 1940. Papers to the meeting of the Lord President's Committee of the War Cabinet in July 1940 from the Minister for Aircraft Production (MAP), Lord Beaverbrook, and his Labour coalition colleague, Arthur Greenwood, concluded that as there was no new primary smelting capacity at home and extensions to Canadian capacity would take a further twelve months, the Government must meet demand by making economies, stepping up measures to acquire scrap metal, increasing secondary smelting capacity, and acquiring further supplies of North American metal.<sup>124</sup> To meet this immediate shortfall Geoffrey Cunliffe, the Aluminium Controller, was dispatched to Canada to negotiate further supplies of the metal in August 1941. Concurrently MAP invested in the construction of secondary and primary smelters, fabrication plants (notably rolling mills), as well as primary smelting capacity in Canada. Throughout the period 1941-1944, no less than 60 per cent of the aluminium consumed by the British war effort came from Canada.<sup>125</sup> During the course of the war the capacity for primary ingot production was expanded by 45 per cent, and semi-fabricating capacity by 75 per cent. This expansion required British Government expenditure of: £25 million for the development of upstream activities (supplies of bauxite and extension of primary smelting) and £28.5 million for fabrication; and loans of 55 million Canadian Dollars to further develop smelting capacity there.<sup>126</sup>

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<sup>123</sup> J. Hurtsfield, *The Control of Raw Materials*, pp.37, 49, 63, 73 and 100-1; M. M. Postan, *History of the Second World War: War production* (London, 1952), pp.38, and 89-91.

<sup>124</sup> Minutes of 11<sup>th</sup> meeting of Lord President's Committee of the War Cabinet, 26 July 1940, TNA, CAB 139/15.

<sup>125</sup> Cypher from UK High Commissioner (UKHC) in Canada to MAP, 19 August 1940; Telegram from UKHC in Canada to MAP, 26 September 1940, TNA, AVIA 46/457; MAP – Light Alloys and Magnesium Control, Report on arrangements for control of aluminium and magnesium and their alloys and the control of fabrication of those metals, 16 June 1941, CAB 139/15; Hurtsfield, *The Control of Raw Materials*, pp.164 and 172.

<sup>126</sup> *Ibid.*, pp.348-9.

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A number of incidents illustrate further the changing relationship between the British Government and native producers, on the one hand, and Canadian producers on the other. Both can be neatly summed up by the comment made by a Treasury official in discussion over a loan to British Aluminium negotiated in 1940. In correspondence referring to the investigation of criticisms of the unfair discrepancy between the far more preferential loan terms offered to Alcan than to BACo between 1940 and 1941, Treasury official Burke Trend noted:

I can appreciate the force of Sir Murray Morrison's argument that a British aluminium producer should not be expected to operate on terms less favourable than those accorded to a Canadian aluminium producer. But let us forget for a moment the aluminium aspect of the question, especially since in dealing with A.C.O.C. [Alcan] we were dealing with a Company not under our own jurisdiction and not, therefore, amenable to the influences that we can frequently bring to bear upon one of our own contractors.<sup>127</sup>

One surrounds the very incident that Trend was investigating. Between 1940 and 1941 the Ministry of Supply agreed to advance loans to both BACo and Alcan. Yet on Treasury advice the terms advanced to BACo were considerably more unfavourable than those for Alcan. In the case of British Aluminium, they sought a Government loan of £450,000 to further develop the water resources at Lochaber so that production could be expanded. The Treasury agreed to the loan at recommended rate 5 per cent interest, and further suggested that it be stipulated that in the event of no output repayments still be made. The Ministry of Supply with whom the original negotiations were conducted offered BACo the loan at 4 per cent but with the Treasury's suggested repayment stipulation. In contrast Alcan were loaned \$55 million Canadian dollars for capital projects in Canada at 3 per cent interest, and with the infinitely more favourable condition that repayment be suspended in any year where production fell below 60,000 tons. When British Aluminium discovered this from the former Aluminium Controller, Geoffrey Cunliffe, in 1944, they were incensed, and demanded a reduction on the interest paid by them and a review of conditions. In the investigations that followed, it was revealed that the main reasoning behind the conditions stipulated by the Treasury official involved, Frank Lee, was because he mistakenly

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<sup>127</sup> Letter from Trend to L. T. Little, MAP, 12 June 1944, SUPP 3/82.

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believed the two companies were intrinsically connected because of their involvement together in a small wartime smelter. Despite the very vocal support of MAP and the Board of Trade for British Aluminium, the Treasury refused to reconsider the conditions of the loan maintaining that BACo should be treated like any other UK defence contractor, although discussions in internal Treasury memos illustrate that they regarded the loan to Alcan as being very lax.<sup>128</sup> In his reply to the Treasury in June 1944, Sir William Palmer at the Board of Trade summed up the situation very pointedly: 'The British Aluminium Co. say it is impossible for them to compete with Canadians who get better terms from the UK Government than they do. As Canada is really the main importer in this market, this is a difficult one to answer.'<sup>129</sup> The response of Treasury official Arthur Fforde to Palmer was to say that he felt little sympathy for BACo, and that in his opinion they had been 'treated very favourably'.<sup>130</sup>

The same laxity where Alcan was concerned was also evident in the Government's negotiations with Canada over aluminium prices. Claims of profiteering and sensitivities to it were uppermost in officials' minds when it came to the British industry. Conversely, despite repeated criticisms raised by the UK High Commissioner to Canada, Sub-Committee on Air Services and the Parliamentary Select Committee of Public Accounts, the fixing of Canadian prices for aluminium were never properly investigated. Under arrangements within the CID-PSO, all negotiations over the price of ingot were to be negotiated between the Canadian Government and Alcan, with reference to UK Government. In the early years of the war much of this involvement from the UK side was to have come from the Aluminium Controller. In a report to the Winston Churchill on 17 May 1940, the Sub-Committee on Air Services levelled a stinging attack at the way aluminium control was being operated. One of the more benevolent comments they made

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<sup>128</sup> Treasury note – The British Aluminium Co. Ltd., Lochaber Loan, 6 March 1947, T 228/639; Treasury note – United Kingdom Government loans to the Aluminium Company of Canada (Alcan), 5 September 1958, T 228/642; Letter from Little to Trend, 6 June 1944; Letter Trend to Little, 12 June 1944; Letter from Sir W. Palmer, Board of Trade, to A. Fforde, Treasury, 21 June 1944; Letter from Fforde to Palmer, 7 July 1944, SUPP 3/82; Memo from Trend to Blunt, Treasury, 27 July 1944.

<sup>129</sup> Letter from Palmer to A. Fforde, 21 June 1944.

<sup>130</sup> Letter from Fforde to Palmer, 7 July 1944.

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– in an otherwise blistering assault – was gently criticising the ineffectiveness with which Cunliffe had pursued the price question with the Canadian Government.<sup>131</sup> Around the same time, the UK High Commissioner to Canada had complained that Cunliffe had failed to even consult with him prior to negotiations with the Canadian Government about conditions on the ground, notably the waste of aluminium and its continued sales in civil markets.<sup>132</sup> Subsequent investigations suggested that Alcan was making sizeable returns on its sales to the UK: a matter which was raised by the Parliamentary Select Committee on Public Accounts and refuted by MAP officials in their evidence.<sup>133</sup> Although Alcan's company historian questioned the validity of the charges levelled at Alcan and the Canadian Minister of Munitions, he did acknowledge that Alcan's Vice President, R. E. Powell and the Minister, the Hon. C. D. Howe, 'conducted a regular person-to-person liaison which cleared away red tape and expedited the company's efforts...'<sup>134</sup>

The experience of the war economy convinced officials that they could not rely on adequate supplies from the native industry to ensure that strategic priorities were met although post-war experience of shortages of raw materials and a reliance on costly imports of the metal (particularly before devaluation of sterling) from the dollar zone persuaded them of the desirability of maintaining a reduced primary aluminium capacity in Britain not least to support the burgeoning semi market. While still aluminium controller Geoffrey Cunliffe had stated in an interview with Alec Cairncross then a wartime civil servant in MAP that BACo had ruled out further sizeable expansion of primary aluminium production in the UK because it would have to rely on coal.<sup>135</sup> Cunliffe's remarks certainly cannot have helped to instil any confidence in Government about the future potential of the indigenous primary aluminium industry, although it is questionable whether any major smelter development using water power could have been undertaken in Britain after the

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<sup>131</sup> Memo to the Prime Minister from the Sub-Committee on Air Services, 17 May 1940, CAB 127/160.

<sup>132</sup> Cypher from UK High Commissioner (UKHC) in Canada to MAP, 19 August 1940; Telegram from UKHC in Canada to MAP, 26 September 1940, TNA, AVIA 46/457

<sup>133</sup> *Report from the Committee of Public Accounts – Evidence, 1943-44*, PP, (c.108-I), Qs. 4031-4038, 4116-7, 4130-4164: evidence from Sir Harold Scott, Sir W. Lindsay Scott and Mr H. P. Bruckshaw.

<sup>134</sup> Campbell, *Global Mission*, vol.I, pp.255-6

<sup>135</sup> Notes from A. Cairncross interview of Geoffrey Cunliffe, 25.6.40, AVIA 10/375.

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war. The continued control of aluminium prices in the UK until 1953, and Alcan's natural competitive advantages as well as British, Canadian and US Government wartime investment, left British Aluminium in a vulnerable position as the British Government aware. Even after the devaluation of sterling and the rise in Canadian ingot prices in 1949, British Aluminium's capital structure was weakened.<sup>136</sup> Ronnie Utiger, BACo's former managing-director, observed that BACo's management missed opportunities immediately after the war.<sup>137</sup> This neglects enfeebled capital state that the Company found itself in after aluminium was released from Government controls in 1953. Similarly Government inducements to engage with Commonwealth projects ignored their own role in weakening British Aluminium's market position and strengthening their chief competitor in UK markets.<sup>138</sup> Although BACo ended the war as peripheral player in primary aluminium production, they had a large semis producer, had expanded horizontally (and logically given their involvement with the aircraft industry) into magnesium production with a 70 per cent share in the Imperial Magnesium Company. Yet the culture within the Company, which was often referred to appropriately by senior figures as 'the service', and its long-term interaction with Government locked it in to a managerial path dependency symptomatic of those companies involved in defence procurement in Britain between the 1920s and 1950s.<sup>139</sup> This was seen in their selection of Board members: Lt. Gen. Sir Ronald Charles, a distinguished and highly decorated Army senior staff officer; Viscount Portal, the former Head of the wartime Air Staff who was a national hero, the man attributed with persuading Clement Attlee (Labour's first post-war Prime Minister) that Britain needed to be a nuclear power, and the first post-war Controller of the UK Atomic Energy Authority (UKAEA) from 1947 until 1951; Lord Plowden, who served as the Government's most senior planner throughout much of the war and after; and Commodore

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<sup>136</sup> Thatcher to Workman, Ministry of Supply, 21 July 1949, T228/640; Discussion between Minister of Supply and Lord Privy Seal and Aluminium Industry Council, 1 June 1951, BT 172/5;

<sup>137</sup> R. E. Utiger, 'The British Aluminium Company Ltd.'

<sup>138</sup> Note on the Volta River Aluminium Scheme and the British Aluminium Company, 6 January 1956, BT 258/128.

<sup>139</sup> Letter from Murray Morrison to Alexander Fraser, 8 February 1920; BACo directors report and accounts, 1945; G. Peden, 'Arms, Government and Businessmen, 1935-1945' in Turner, *Businessmen and Politics*, pp.130-145; Edgerton, 'Whatever happened to the British warfare state?', pp.98-116; Edgerton, *Warfare State*.

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Robert Gordon Hood Linzee, a former Naval Staff Officer, who had served with distinction in organising the evacuation of Allied forces from Dunkirk in 1940 and had run the Royal Navy's staff training establishment.<sup>140</sup> However these men were not simply selected for their social milieu or connections (which were significant to the Company) but also because of their intrinsic knowledge of State procurement and policy development. British Aluminium reliant as it was on Government contracts between 1915 and the 1950s required those skills to service a core part of their business. They continued for at least the first decade after the war to undertake Government procurement work, whether in contributing to the construction of post-war housing (a measure explicitly intended by Government to support both indigenous aircraft manufacturers and upstream and downstream aluminium production), electricity generation, rearmament for the Korean War or building specialised casing for nuclear reactors.<sup>141</sup> What had changed profoundly was the relationship from the Government's side as illustrated by the takeover of British Aluminium in 1958-9. Government records reveal that Conservative Ministers, whilst not committing themselves and simply watching from the sidelines, were passively supportive of the outsider raiders –Reynolds Metals and Tube Investments – and allowed their long-term distrust of Alcoa to colour their view of Alcoa's bid. Contrary to the attraction of a story for journalists and popular accounts to portray the takeover as a struggle between the establishment and the new guard or a national economic struggle, in reality the battle lines were far less well defined.<sup>142</sup> During the battle for aluminium Portal tried to arrange a meeting with the Prime Minister but was declined one. Ultimately Portal, like many of his fellow directors, failed to grasp what had occurred behind the scenes. The Government

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<sup>140</sup> D. Richards, 'Charles Frederick Algernon Portal', *Oxford Dictionary of National Biography*, <http://www.oxforddnb.com>; K. Harris, *Attlee* (London, 1995), p.289; R. G. H. Linzee, Naval service record, TNA, ADM 196/123/0/256; E. Plowden, *An Industrialist in the Treasury: The Post-War Years* (London, 1989).

<sup>141</sup> *Report of Select Committee on civil estimates, 1945-46*, PP, (c.158), Evidence: Qs. 172 and 236 – Mr O. S Franks and A. C. Gordon, 3 April 1946, and Mr E. F. Muir, 30 April 1946; *Fifth Report of Select Committee on estimates, 1945-46*, PP, (c.191-I), Evidence: Q.304 – Boddis, 23 July 1946; BACo, directors reports and accounts, 1945-1958; British Electricity Authority, *Second report and accounts for the year ended 31 March, 1950-51*, (c.267), pp.34, 38 and 42; UK Atomic Energy Authority (UKAEA), *Second report for the period 1 April 1955-31 March 1956*, PP, (c.323), p.19.

<sup>142</sup> S. Hatch and M. Fores, 'The Struggle for British Aluminium', *The Political Quarterly*, 31:4, (Oct-Dec 1960), pp.30-47; Note from Chancellor of the Exchequer to Prime Minister, 31 December 1958, PREM 11/2670; Note from President of Board of Trade to Prime Minister, 1 January 1959, PREM 11/2670; Minutes of Cabinet meeting to discuss British Aluminium Company, 8 January 1959, CAB 130/158.

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was ultimately suspicious of Alcoa's motives, and keen having a British partner on the Reynolds Metals approach. Yet just to insure against both options it insisted that both sets of suitors in the event of their success would retain a majority of British directors on the Board.<sup>143</sup>

The Wilson smelter programme will be addressed in more detail by another paper on this panel. It is worth remarking that the apparent lack of clarity amongst Ministers and officials about the detail of the project represent seen across the longer period both a recognisable inconsistency in British Government approaches to the aluminium (as indeed to many industrial sectors) and at the same time a return to an official approach to the industry not seen since the period 1915 to 1953. Equally the myopia exhibited by the BACo board to the flaws in the project were symptomatic of the Company's culture and its' proximity to Government. John Elton's observation that the British Government in 1967 seemed unclear about what it wanted to achieve from the smelter programme appears as a recurrent theme throughout the native industry's history. It both constrained and aided the industry, and was a major factor in determining its competitive environment.

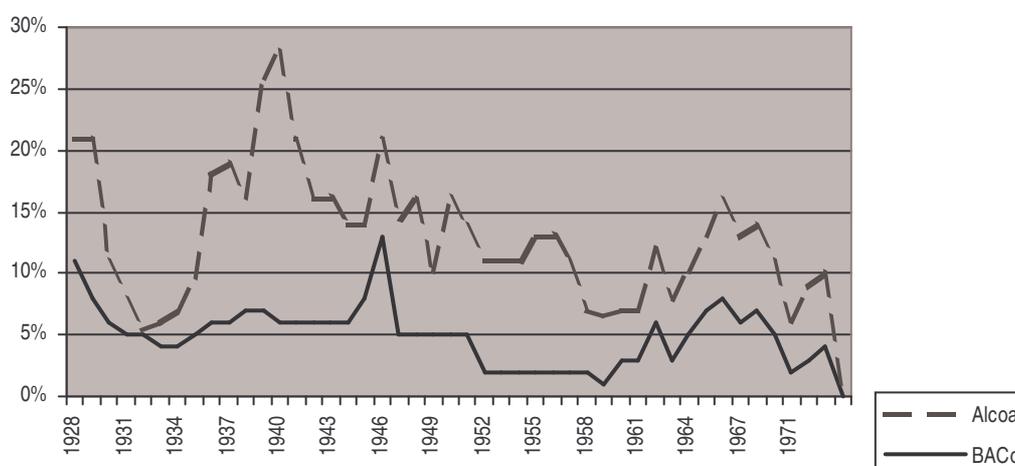
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<sup>143</sup> Letter from Prime Minister to Lord Portal, 5 January 1959, PREM 11/2670; Minutes of Cabinet meeting to discuss British Aluminium Company, 8 January 1959, CAB 130/158.

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## Appendix

### Return on capital expenditure (ROCE) for British Aluminium and Alcoa, 1928-1973



Sources: BACo, Annual reports, 1928-1973; Smith, *From monopoly to competition*, Appendix B.

Notes:

(a) Calculated using formula devised by Barry Elliott & Jamie Elliot. B., and J. Elliott, *Financial accounting and reporting* (London, 2007).

(b) Between 1940-1945 BACo was subject to the wartime Excess Profits Tax, and was controlled by the Ministry of Supply and then the Ministry of Aircraft Production. Until 1 January 1953, supplies of aluminium remained controlled by the Ministry of Supply.

(c) Net profit for the Group for 1962 include profits for the Canadian British Aluminium Company, but assets for that year do not include CBA's. Calculation for years 1963-8 includes both the profits and assets of CBA.