

**Strategic Trade in Large Commercial Aircraft:
Europe v. America**

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Europe v.s America: Strategic Trade in Civil Aeronautics

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‘Throughout much of its history the American aircraft industry has benefited from a makeshift, but nonetheless effective industrial policy’ (Laura D’Andrea Tyson, *Who’s Bashing Whom? Trade Conflict in High Technology Industries*, International Institute for International Economics, Washington, 1993, p. 157).

‘... unlike automobile manufacturing, which could be sustained by a middle-class consumer economy, aviation was always a super-luxury endeavour that could not thrive without massive government aid.’ (Wayne Biddle, *Barons of the Sky*, Henry Holt, New York, 1991, p. 13).

Introduction

This paper addresses key aspects of the de facto industrial policy of the USA towards its aerospace sector and its implications for the trade in commercial class aircraft. I argue that US trade in aerospace products is the *sine-qua-non* of strategic trade and that the success of this sector results from a powerful and effective industrial policy which subsidizes commercial aerospace manufacturing. In consequence I suggest that the numerous US complaints in the 1980s and 1990s about subsidy and the role of the state in the European commercial aircraft industry are based on a misunderstanding of the real character of the American aerospace industry and arguably the aerospace industry per se.

In my view the liberal characterization of the US economy in the post-war period is exaggerated and overblown. Some sectors, such as consumer electronics, have felt the chill wind of global competition, others have not. Protection has been apparent in agriculture at one extreme and aerospace at the other. Judith Goldstein has outlined three models of trade relations based on an analysis of ideological and institutional factors which determine the prospects for political support. She conceives fair trade and redistributive trade as additional models to the orthodox free trade mantra.¹ But based on a realist perspective I would add a fourth category of strategic trade in products centrally linked to issues of national security. Post-1945 US trade in defense and aerospace has never simply been about commercial factors. Civil aeronautics exports have been closely linked to security issues and on occasion have arisen on the back of defense sales. In terms of assessing which industries are likely to receive aid and protection Goldstein noted how those prone to unemployment and those

considered successful and highly competitive were most likely to obtain high level political assistance.² Again aerospace fits this categorization. As I shall argue below the more overt mercantilist policy of the Clinton era is related precisely to the competitive challenge mounted by Europe in civil aeronautics in the last 20 years and the high levels of unemployment experienced in the US industry after the end of the Cold War. According to Jens Van Scherpenberg the neo-mercantilist aspects of this process are becoming more pronounced as the constraints on conflict with allies in Europe are loosened. In his view aerospace exports are now at the centre of an executive steered advocacy policy which is seeking the rents and positive externalities due to the state which bankrolled the West's Cold War security policy. As Van Scherpenberg notes, 'Linking military dominance with an aggressive pursuit of economic interests has since become a core element of the US economic policy agenda'.³

The Enduring Nature of Mercantilism

Mercantilism is the oldest of the theoretical traditions in political economy.⁴ In descriptive terms it arose as a characterization of the economic philosophy and trading practices of the states that arose in Europe after the treaty of Westphalia in 1648. In essence mercantilism amounts to economic nationalism. In the tradition's basic precepts military security and economic self interest are indivisible. Accumulated national wealth is the foundation of a strong state and such wealth is best stored in bullion or precious metals. According to mercantilist theory trading surpluses are the means for national wealth to grow and are best converted to reliable stores of wealth such as gold and silver.

The theoretical dominance of mercantilism was challenged by the classical laissez-faire economics of Adam Smith and the later liberalism of David Ricardo. Both advocated a drastic reduction in the role of the state in economic affairs and the removal of tariffs, quotas and other restrictive trade practices. Because the modern period in the Anglo-Saxon world is associated with the philosophical dominance of liberalism it is all too easy to believe that the ideas of Smith, Ricardo and other liberals were actually embedded in the dominant social practices of Western states after 1800. But nothing could be further from the truth. After 1815 Britain enacted the Corn Laws to protect its agricultural interests and to secure self sufficiency in food production. In the United States leading federalist politicians such as Hamilton also recommended the mercantilist creed:

It is well known ... that certain nations grant bounties on the exportation of particular commodities, to enable their workmen to undersell and supplant all competition in the

countries to which those commodities are sent. Hence the undertakers of a new manufacture have to contend not only with the natural disadvantages of a new undertaking, but with the gratuities and remunerations which other governments bestow. To be enabled to contend with success, it is evident that the interference and aid of their own government are indispensable.⁵

After the repeal of the Corn Laws and other reforms in the 1840s Britain attempted to liberalize the world trading system in order to benefit its strong industries. But as Stein has persuasively argued this was a matter of degree.⁶ Even in the heyday of lower tariffs in the 1860s Britain depended on import duties for 20% of its fiscal revenue.⁷ Invariably moves towards or away from free trade policies have always had political causes and cannot be deduced from some inexorable market logic. Bilateral deals on trade have always been linked to discrete and particular political objectives. Stein notes, 'It is important to understand, therefore, that political rather than commercial or philosophical considerations motivated Britain's shift in its commercial practices'.⁸

From Mercantilism to Military Industrial Policy

Another era of trade liberalization was sought after 1945, but again this was a matter of degree. The USA did not unilaterally abandon all its trade protection legislation after the Second World War. In fact GATT enshrined the search for politically motivated bilateral and multilateral deals. The USA had a clear self interest in freer trade because of the strength of its own industries which produced half the world's manufactured goods.⁹ But security loomed large in trade calculations. As Balaam and Veseth note, 'In many instances, the United States acted in a mercantilist fashion, when, for example, it used its trade and foreign aid as another weapon in the battle against communism'.¹⁰

In the post-1945 era in the Anglo Saxon world the philosophy and language of mercantilism has not sat easily with the ideology and rhetoric of liberalism. US global leadership ensured a rhetorical commitment to orthodox economic liberalism as countries seeking US aid were invited to celebrate the benefits of free markets and free trade. However, in Europe this was a socially engaged market liberalism. For the sake of social order Keynesian demand management policies were pursued in order to smooth out the effects of the business cycle and fiscal policy sought to compensate the disadvantaged through the assorted levers of the welfare state. Thus 'embedded liberalism' coupled Adam Smith to the disciples of social democracy. In the United States government direction of economic affairs was not designed to achieve social justice, nevertheless, it existed in the way the federal budget privileged large corporations whose outputs were considered vital to US security. With regard to government policy a strategic vision of economic interest was vital to a rational cold war policy. The main goal of the US government's foreign policy was the blunting of communist influence

on the societies of the Western allies and the neutralizing of the general military threat from communist states, especially the USSR. Washington was in essence a military H.Q. As the historian Ernest May remarked, 'The main business of the U.S. government had become the development, maintenance, positioning, exploitation and regulation of military forces'.¹¹

As I have indicated above a central contention of this paper is that since 1945 the United States has had a de facto sectoral industrial policy in the form of a state directed orchestration of high technology production capacities and priorities in industries critical for defense. Pivotal here has been aerospace. Aerospace technology has been the physical backbone of a global policy which extended from the requirement of close tactical air support at one extreme to the capacity to wage inter-continental strategic nuclear warfare at the other. The same aerospace technologies also required and drove the systems integration that was the basis for the global command, control, communication and intelligence - C³I - functions which provided the critical systems integration for this multi-layered world security system. Even the internet (ARPANET) was conceived by the Defence Advanced Research Projects Agency (DARPA) in response to the post-Sputnik Soviet missile threat in order to secure survivable and robust communications in the event of war. In US Air Force procurement strategy no possibility of falling behind the Soviet adversary was permissible, but such superiority had to be planned. As Hooks observes, '... the airforce could not rely on market forces to maintain the world's largest and most technologically advanced aircraft industry. National security had become equated with industrial policy'.¹²

The Emergence of US Market Dominance

The USA's post-war dependence on air power had been prefigured in World War Two. During the Second World War the US economy boomed on arms manufacture. In 1940 Roosevelt had called for aircraft production goals of 50,000 planes a year.¹³ This was easily surpassed. During the War the US produced in excess of 300,000 aircraft and more than 800,000 aero-engines. As a matter of course corporations such as Boeing, Douglas, Martin and Lockheed earned enormous profits.¹⁴ Between 1940 and 1945 the United States spent \$185bn on armaments, with a massive \$46bn bill for aviation weapons. Biddle notes, 'In order to win the war the United States spawned a weapons industry of titanic scope'.¹⁵ Boeing, which is frequently perceived not to have had a large defence portfolio, developed its main expertise in producing heavy bombers, such as the B17, B24 and B29, the last of which delivered the atomic bombs to their targets in 1945. The B17 Flying Fortress, arguably the most

important aircraft in US World War Two air strategy, was launched in the mid-1930s when the US industry was in the doldrums.¹⁶ But the return of big earnings for Boeing began in earnest in 1938 when mass production of the B17 started. By 1940 the US government wanted as many B17s as Boeing could produce. This emphasis on airpower symbolized a sea-change in military affairs; a process had been initiated which would transform the US aircraft industry. In 1939 the industry ranked 41st in output dollar value, in 1944 it was first.¹⁷

After 1945 the leaders of the US aircraft industry were fearful of cuts in federal expenditure as American military forces were de-mobilized and the economy was reshaped to concentrate on civil production. However, the dawning of the Cold War in 1947 and the Finletter Air Policy Commission of July of the same year soon promised a new era of plenty for the manufacturers. With respect to the Finletter report Biddle notes how ‘...the aviation industry got more than it could ever have hoped for - in effect, a pronouncement that the manufacturers were so vital to national security that they should be freed from the normal pressures of supply and demand’.¹⁸ But now the resources and research and development required by the industry would be even greater as there were new and more complex technological ingredients in the equation. The arrival of the jet engine required enhanced levels of engineering precision and materials integrity, as well as access to a raft of critical strategic minerals. Jet aircraft could also fly faster and higher placing new demands on the airframe and the need for more complex structures and technologies to protect the crew. Most important of all aircraft would need to be designed according to radically different aerodynamic principles in order to accommodate the jet engine and make maximum use of its potential. Here Boeing were perfectly placed as their research for the Army Airforce’s B47 jet bomber had given them access to top secret materials removed by the Americans in 1945 from the German Messerschmitt factory. Fortunately for Boeing their chief aerodynamicist in the post-war period, George Schairer, had been a member of the special team tasked to obtain the research the Nazi regime had developed on jet powered flight. Thus German research on swept wings and tail-planes fell straight into Boeing’s hands. At the same time US acquisition of the research of eminent scientists, such as Werner von Braun, gave America the capacity to develop missile technology and therefore to contemplate the future conquest of space.

The real fillip to the aircraft manufacturers came with the Korean War in 1950. Until then the Truman Administration had struggled to convince key sections of the US Congress that massive increases in defence expenditure were really necessary. But now the picture changed dramatically. In National Security Council document 68 (NSC68) Paul Nitze outlined and dramatized the communist threat and the new role required for US military power. The document had a dramatic effect and,

coupled with the outbreak of war, was enough to secure support for Truman's new policy. Indeed, the President remarked that 'economy in defence policy was dead'. These words were apt. In 1950 Pentagon spending on procurement from the US aeronautics industry was \$2.6bn, by 1954 it stood at \$10.6bn.¹⁹

I have mentioned the central role of the Cold War in the rise of the post-1945 US aerospace industry in order to give a context to the dominance of the USA in commercial aeronautics. With regard to industrial policy the key is the fact that the huge expense of research and development was largely borne by the state in funding defense programmes. As Mowery and Rosenberg note, '... the history of technical development in commercial aircraft consists largely of the utilization for commercial purposes of technical knowledge developed for military programmes at government expense'.²⁰

Today's market leader, Boeing, had already acquired invaluable research on swept wings and podded engines from its B47 contract. Clive Irving, author of a seminal study on the B747, noted its importance: 'no one at Boeing could fail to see the significance of this contract. Whoever built the Army Air Force's first jet bomber would have a commanding foothold in the dawning jet age'.²¹ Following on from the B47 contract a string of military orders were secured in the 1950s that cross-subsidized Boeing's commercial aircraft manufacturing and allowed it to benefit from Department of Defence funded R&D for projects such as the B52. The table below indicates the massive scale of Boeing's military order book in the 1950s. A key point to note here is that Boeing's first successful large civil jetliner, the B707, began life as the KC-135 tanker first contracted by the Pentagon in 1955. This fact warrants emphasis as a recent and recurrent perception of Boeing has downplayed its post-1945 military order book.

In total Boeing was contracted to produce 4,422 aircraft by the Pentagon in the 1950s, the period when the foundations of its future global supremacy in commercial manufacture was being laid. In the 1960s the B727, B747 and B737 followed the B707, giving Boeing a family of aircraft with which to achieve global market dominance. In the early 1990s chairman Frank Schrontz acknowledged the benefits that the military contracts had brought, '[A] defense-commercial mix provides long term stability and a testing ground for new technologies lacking immediate commercial application. Financially there have been times when the defense side carried the commercial business'.²²

Defence contracts help to alleviate conditions in the aircraft industry which make profitability

difficult to achieve. The huge development costs of aircraft make a large programme essential if profit is to be realised. Defence sales ease the burden when commercial production has not reached the minimum efficiency of scale (MES) necessary for a particular aircraft's production run. Similarly, contrasting commercial and defence cycles offer potential buffers against market downturns. In addition economies of scope offer development and production savings when military and civil products have essential synergies. These benefits of cross-subsidy in the American industry are neatly summarized by Laura Tyson: 'All of the nation's commercial aircraft producers have been major defense contractors, at least at critical moments in their development. The enormous flow of federal government contracts has provided profits (and even in some cases covered tooling costs) that could be applied to the development of commercial aircraft'.²³

Table 1. Boeing Aircraft Military Orders 1950-1959.

YEAR	AIRCRAFT TYPE	VOLUME
1950	B-47	82
	C-97*	14
1951	B-47/RB-47	590
	TB-50	24
	KC-97*	231
1952	B-47	788
	B-52	13
	KC-97*	231
1953	B-47	864
	B-52	43
	KC-97*	262
1954	B-52	25
1955	B-52	77
	KC-135	29
1956	B-52	133
	KC-135	68
1957	B-52	213
	KC-135	118
1958	B-52	101
	KC-135	130
	VC-137	3
	CH-46 Chinook	3
1959	B-52	39
	KC-135	81
	CH-47 Chinook	5

(Source, *United States Navy/Air Force Serials*, ed Peter A. Danby, statistical analysis, Peter Cullen, ARG, UWE, Bristol).

The problem of minimum efficiency of scale also puts a premium on export sales of aircraft. Even in the US, which has the largest domestic market, export sales are vital to maintaining the size of production run necessary for profitability. The politically significant issue of employment levels is also highly export sensitive. In a study undertaken in the late 1980s Lopez and Yager concluded that: 'at least 25,000 aerospace jobs are related to each billion dollars of exports including both aerospace employees and employees in areas that support aerospace'.²⁴

The wider value of aerospace exports is also underlined when one examines the contribution of the industry to the overall health of the US economy. In the post-1945 period aerospace emerged as the key success story in US international trade. As Vicki Golich notes, 'Since the late 1950s aerospace has been the leading industrial contributor to U.S. export earnings. Since 1982, aerospace exports have increased at a rate of \$1bn a year'.²⁵ Thus a product which is essentially 'strategic', because of its links to issues of national security and its dependence on high technology, is also one which is 'strategic' to US export success. Further, as many observers have noted, the global presence of US manufactured jet aircraft has been a compelling symbol of US power projection. To reiterate my earlier claim, trade in jet aircraft is the *sine-qua-non* of strategic trade. For the US this trade has been essential, as its oligopolistic advantages in aerospace allowed it to offset its growing trading weakness in other commodities, such as automobiles and consumer electronics.

A vital aspect of American success in trading aerospace products has been the US's role as a provider of security to friendly countries. As Anthony Sampson comments, 'the Pentagon has been relentless in making the connection between the commercial and diplomatic choices'.²⁶ With European industry shattered after the war and the Germans legally prevented from producing armaments, US dominance in NATO was an ideal springboard from which to secure overseas sales of military aircraft to friendly countries. With regard to aeronautics the Germans had been Europe's largest exporter of aviation products before the war and had led the world in wing design, jet propulsion and missile technology in the late 1930s. As we have already seen at the end of the Second World War all of the research upon which this was based fell into US hands.²⁷ In the late 1940s and through the 1950s Britain and France attempted to build an aerospace industry to match that of the USA, but with defence comprising 70% of the market it was difficult to compete with the large corporations funded by the Pentagon. On the commercial side Great Britain had an excellent opportunity with the de Havilland Comet, the world's first civil jet-liner, but a flaw in the design of the fuselage and the previously unknown phenomenon of metal fatigue caused a number of fatal crashes,

which led to the plane being withdrawn from service. The potential of Britain's lead in jet propulsion was thrown away because inadvertently an inadequate design was put into production. For France the Korean War opened up possibilities for the newly restored industry and Dassault produced a number of fighter aircraft. But for the European industry the writing was on the wall; the domestic markets in Europe could not support a large industry on anything like the scale of the USA.

We have seen above the inventory of Boeing's military orders in the 1950s. In 1955 its civil supremacy was prefigured when Pan Am placed an order for the B707, the civil version of the KC135. This vindicated the company's decision to design an aircraft which had dual-use potential. In essence Boeing had ingeniously found a way for the Department of Defense to cover the cost of developing its civil jet through Independent Research and Development funds. Not surprisingly, as the years passed and the commercial market increased, as the public became used to the new form of transport, US manufacturers held sway, with Boeing and Douglas establishing the dominant positions. US airlines were also highly nationalistic in their purchasing policies. According to Golich, 'U.S. airlines were likely to consider foreign aircraft only if no domestically built alternative existed'.²⁸ But in reality airlines had virtually no alternative to US products. By the early 1960s, in the biggest market, the USA itself, US airlines were operating 2,136 aircraft and of these 2,076 were American manufactured. The USA established global hegemony by first dominating its large home market. ²⁹

The European Response to American Market Dominance

After the Second World War all the West European countries faced considerable obstacles in seeking to rebuild their aerospace industries. By the mid-1960s it was clear that these obstacles had not been overcome. Individual European nations lacked the resources to compete with the giant US aerospace corporations, whose order books had been swelled by the Cold War. On the commercial side the only rational response was for Europe's major aerospace nations to collaborate in partnership. After the mixed experience of the Concorde supersonic programme this move to collaboration bore fruit with the birth of Airbus Industrie in the late 1960s.³⁰ But national tensions and differences were not easily put aside and the rise of Airbus was not without its mishaps and conflicts. At the start of the Airbus initiative the British had negotiated a 37.5% work share, but the Wilson government pulled out of the project to build the A300, leaving British participation to Hawker Siddeley Aviation, who committed \$30m towards the development of the A300 wing.³¹ Fortunately for Hawker Siddeley, the German government, who were keen to have Britain on board, agreed to extend financial assistance to HSA

and the project to produce the A300B moved towards completion in the early 1970s, with a roll out ceremony in Toulouse in September 1972.

It is worth pausing to consider Britain's lukewarm response to Airbus. Not only were the West Europeans inconvenienced by UK government ambivalence to the project, they were also frustrated by Rolls-Royce's attempt to provide engines simultaneously for the Lockheed L1011 as well as the A300. Having originally insisted on a 75% share of the Airbus engine, work at the Rolls-Royce Derby plant soon prioritized the US destined engine. In essence the UK appeared to be attempting to ensure that Airbus was stillborn. In the USA a unified state was fully supportive of its aerospace companies. But in Europe strategy was fragmented, as Britain continued its game of facing simultaneously across the Channel and the Atlantic. Compared to France, where the political elite had a coherent and integrated framework for industrial policy and a matching foreign policy, Britain had neither. Airbus did emerge and prosper, but in the early days this was despite rather than because of any British contribution. Not surprisingly dominance on the first Airbus project went to the French, '... consistent French support for and commitment to a truly European response to the American challenge in civil aerospace was translated into project leadership on the A300B'.³² As a result Toulouse became the emotional as well as the physical home of the European aircraft industry.

The A300B was certificated in March 1974, a time that was extremely difficult for aviation as a whole. After the OPEC oil crisis of October 1973, which quadrupled the price of oil, the West plunged into recession and the era of stagflation began. From 1975 on it was clear that Airbus would have an enormous fight on its hands to establish a market. The A300B was a new concept, a wide bodied twin-engined aircraft for short to medium haul. It was a concept airlines liked, but the market was flat. Between 1975 and 1977 promotional world tours helped to sell just two aircraft. Then in 1977 Eastern Airlines agreed a deal to lease 23 A300s and a further 25 of the new projected A310. A real market battle had begun.

The EU/US Subsidy Dispute

In order to meet the huge costs of aircraft development the Airbus partner companies agreed loans with their governments known as launch aid. Such aid was a strategic commitment by the Airbus governments to the new collaborative venture. In the future these loans were to become highly contentious elements in the conflict which materialized between the EU and USA over allegations of

unfair competition. But one thing needs to be crystal clear; without launch aid the consortium would not have had a chance to successfully enter the marketplace. As Laura Tyson notes, 'Given the industry's economics, Airbus would not have stood a chance against American producers without massive development, production and marketing support during its first 25 years'.³³

The strategic nature of trade and manufacture in commercial aircraft was evident in the late 1970s when Airbus was aiming to develop its second product, the A310. Concurrently, the British government were seeking to merge the UK's two largest aerospace companies, BAC and HSA. They were also reconsidering the decision to remain outside the Airbus consortium. As the newly created British national champion emerged - British Aerospace - it was clear that its participation in Airbus would be welcomed in Europe. It was also clear that the new aircraft would require a different wing to the A300B, which British expertise could provide. Across the Atlantic Boeing saw a tactical opportunity. Now sensitized to the potential of Airbus, after the sale to Eastern Airlines, Boeing moved to recruit BAe as a major subcontractor on its rival to the A310, the B757. Boeing's aim was to '... prevent the return of the British to Airbus and draw in the British airframer and engine builder in constructing the B757'.³⁴ In general this was a non too subtle move to tie up British engineering expertise and capital and keep the UK estranged from Airbus. But the tactic failed and British Aerospace joined the Airbus consortium on the A310 project with a 20% workshare.³⁵

The incident described above, which involved contacts at Head of State level, emphasizes and illustrates the high level strategic competition in the sphere of aircraft trade and manufacture. But this was just a foretaste of what would become an intense and acrimonious rivalry. In the late 1970s Airbus' orders for its new aircraft signalled the start of a global sales competition with Boeing and MDC which became increasingly bitter. By 1979/80 Airbus was taking a 20% share of the market for large commercial aircraft and had pushed one US company out of the civil business. The USA was now acutely aware that it had a serious competitor from Europe. Airbus also showed that it could outgun the Americans in the area of technical innovation. On the A300B the technology was not particularly innovative, but the overall concept was. On the A310, though, Airbus pioneered significant technical innovations, such as the forward-facing cockpit crew, wing-tip fences and a rear fuel tank in the horizontal tail plane in order that fuel could be moved to reconfigure the aircraft's centre of gravity, allowing improved trim and fuel consumption. In Seattle and Long Beach some of these innovations were met with scepticism, but they are now industry standards, as is Airbus' innovative vertical acceleration instrumentation.³⁶

With a furious sales battle going on in sectors such as the Middle East the US industry chiefs began to take their concerns about Airbus to the federal government. On the US side a concerted effort was made to prevent the development of Airbus' third product, the narrow bodied, twin engined A320. The politics of this bear consideration.

In order to develop the A320 Airbus began looking for finance and potential customers in new environments. One approach was made to the Canadians through the government of the province of Quebec as Airbus were hoping to secure Canadian industrial participation.³⁷ But although not public knowledge the US authorities had been shadowing Airbus activity for some time. When the Canadian initiative came to light the United States Trade Representative in Canada, William E. Brock, sent a letter to the Canadian Minister of Industry, Trade and Commerce. The letter had a tone that was clearly threatening, 'Any implied or actual commitment on the part of Canada to purchase Airbus products or encourage their purchase, as an adjunct to industrial participation, would be a major concern to the United States Government'.³⁸ Ironically, USTR Brock justified his intervention on the grounds that Airbus Industrie was using government to government politics to secure project funding and sales. Clearly, using the same methods to block a project launch was seen in a different light.

As the decade wore on the US side increased the pressure on Europe through the lobbying of its USTRs and other diplomatic channels. But it became clear that the A320 would go ahead and American anxiety grew. In the market place blocking tactics failed as the DC9 derivative, the MD80 series, and Boeing's B737-300 failed to blunt the attraction of the new Airbus. After its launch in 1987 the A320 became the fastest selling commercial aircraft in history. In the US Boeing executives wanted a Cabinet task force to monitor Airbus and to co-ordinate export support in the United States. At the roll out of the 767-300 in Seattle in 1985, Boeing's Tom Bacher asserted that the company was, '... getting pretty damn mad'.³⁹ He then went on to give Airbus some friendly advice regarding an alternative area of comparative advantage for the Europeans, 'You build good train systems and things like that in Europe and we do not'.⁴⁰

This comment of Bacher's may be a clue to the bitterness that has been widely expressed in the US concerning Airbus. When the consortium started manufacturing aircraft no one across the Atlantic was taking it that seriously. But as it began to eat into US market share, a sense of unease was apparent and a feeling was occasionally manifested that predominance in aeronautics was almost an American right. In consequence the assumption has been that Airbus' success must, by definition, represent some form of sharp or dubious practice. Thus, as the industry dragged government into the

dispute, a certain ideological zeal was evident.

As the tension grew in the mid-1980s USTRs began to lobby European ministers directly on the Airbus issue. Moreover, as McIntyre asserts, the American side began to believe they were making some progress with their continuing call for the industry in Europe to be run on stricter commercial lines.⁴¹ In order to increase the pressure in 1987 the US called for ministerial talks, with the target now the blocking of the launch of the A330/340. The US position was clear and hard-line, '... the US government was not going to stand idly by and accept the unfettered subsidisation of Airbus, particularly when that unfettered subsidisation was leading to displacement of U.S. exports by the number one export manufacturing industry in the United States'.⁴² The tough line was echoed by Boeing, which began to crystallize its critique of Airbus's defects. In essence the US side began a process to try and undermine the consortium's credibility as a commercial organization and viable business. Using the assumptions of market economics and the legal framework of GATT the US policy was aimed to delegitimize Airbus through accusations such as the following: 'These subsidies lead to launch of new programmes without viability, incorporation of technologies that cannot pay for themselves, building of whitetails that are offered at fire-sale prices and widespread underpricing to gain market share'.⁴³

To some degree these comments are understandable. In the 1970s, when the A300B came onto the market, new aircraft were stacking up on the tarmac and customers were in short supply. Further, no one in Europe was denying the role of state aid in Airbus's product development. But on the US side there was a continuing blindness to the role that defence procurement and publicly funded R&D played in the success of the American companies. Also by the 1980s the stereotypical American view of Airbus was outmoded. Airlines, including US ones, were buying the product because it met their requirements. Moreover, the European consortium's investment in high technology was reaping dividends in the growing perception in the marketplace that Airbus had some competitive advantages. Thus in the early 1990s it is not surprising that Laura Tyson noted how Airbus had 'achieved technological parity with Boeing...' ⁴⁴

The Battle of the Reports and the 1992 Agreement

As we have seen US accusations of unwarranted subsidy were taken around European capitals in the late 1980s in an attempt to blunt the A330/340 programme. Ultimately though the issue was to end up under the jurisdiction of the GATT Subsidies Committee.

An issue which had long troubled the European side was that aircraft were traded in dollars. Thus the European manufacturer faced a form of double jeopardy. On the one hand dollar depreciation meant that the revenue from sales was deflated, on the other dollar appreciation meant larger real payments to the extensive network of American sub-contractors used by Airbus. In this context it needs to be borne in mind that an Airbus aircraft can have up to a 30% US work share. In this situation what the Europeans wanted was dollar stability. In response to this Deutsche Airbus agreed a deal with the German government in 1988 which would give them protection from dollar fluctuation. This FOREX deal was worth DM2.6bn. From the US point of view this was the straw that broke the camel's back. The issue was taken to GATT.

Prior to this the US Department of Commerce had commissioned a report into Airbus' funding by Gellman Research Associates, of Jenkintown Pennsylvania. The report, issued in September 1990, was a damning indictment of Airbus' financial arrangements. The brief had been to, 'deepen the understanding of the complex web of relations between the participating companies, the governments and the AI consortium'.⁴⁵ However, as Thornton points out, the report was in reality much narrower and dealt exclusively with the question of Airbus' credentials as a commercial organization.⁴⁶

Using 1990 dollar values the Gellman Report claimed that Airbus had been the recipient of more than \$13bn of government support since its inception in the late 1960s and that the real commercial market value of this subsidy was \$26bn. The report's conclusions were highly critical and indicated that Airbus had distorted the US industry because of its state subsidy and ability to pursue ventures without regard to commercial criteria. In a wider context this pattern of thinking then became reinforced as scores of economists jumped on the anti-Airbus bandwagon. US textbooks on International Economics frequently cited Airbus as a clear example of the damaging effects of industrial policy and strategic trade.⁴⁷ The US position was also bolstered in early 1992 when the GATT Subsidies Committee found in favour of the US on the issue of German FOREX compensation.

Airbus Industrie did not take this assault lightly. In response to Gellman the Toulouse consortium commissioned a report by Washington based lawyers Arnold and Porter on government support of the US commercial aerospace industry. Arnold and Porter identified three categories of assistance, DoD, NASA and benefits accruing from the US tax code. In the previous 15 years they estimated combined supports worth between \$33.48 and \$41.49bn in current dollars.⁴⁸ But more important than the specific identification of discrete elements of support was the overall and indisputable fact established by Arnold and Porter that the US industry was not a stand alone entity

divorced from government policy and political supports. The Arnold and Porter study showed clearly that the US industry was embedded in an infrastructure for research and development, financing and commercial manufacturing assistance funded by the federal government, which greatly enhanced the competitiveness of American aerospace firms. As we have indicated above a key problem with this area of debate has been the presence of an 'idee fixe' in the US about the liberal nature of its economy. Hence the conviction that there was no corporate welfare, no industrial policy and no support for strategic trade in aerospace products. Since the Arnold and Porter report this misconception, at least, has been less easy to sustain.

In the early 1990s there seemed every chance of a trade war between the USA and EU in commercial aeronautics. In the end, though, this was obviated by the 1992 Bilateral Agreement on the funding of Future Large Civil Aircraft. In article four of the agreement the EU accepted a cap of 33% on government funding for development of future aircraft, with loans repayable over a maximum of 17 years. Conversely, article five put limits on indirect support in the USA. For the industry as a whole this was limited to 3% of turnover, while for specific firms a maximum of 4% was stipulated.

Renewed Hostility

The 1992 Agreement did not end the tensions over EU/USA trade in commercial class aircraft. Global recession and the end of the Cold War meant job losses and painful rationalization in the EU and USA. On the back of this the Clinton Administration chose to reopen hostilities with a series of public statements about Airbus. After the July 1992 Bilateral Agreement, USTR Mickey Cantor referred to the EU side as 'screaming pigs stuck in a gate'.⁴⁹ At the Everett Boeing plant in 1993 the President promised enhanced support for Boeing and blamed Airbus for US job losses. What was clear was that the new Democratic administration was going to pursue a more overt industrial policy, with strategies to bolster US high technology industries and a new brief for NASA to give its research more commercial relevance.

With regard to trade policy the Clinton era has seen more pronounced state involvement in export advocacy and more unilateral interventions in global trade issues, such as the threat to impose penalties on firms trading with Cuba.⁵⁰ Through the aegis of the Trade Promotion Co-ordinating Committee (TPCC), the Departments of Commerce, Defense and State have been orchestrating a more overt neo-mercantilist policy to use executive level state inputs in a global strategy to enhance

export sales in high technology sectors.⁵¹ The late Secretary of Commerce, Ron Brown, was tragically killed in the former Yugoslavia while on just such a mission to secure US export sales.

Another example of increased sales advocacy was the 1993 Boeing Saudi deal, which involved Presidential contacts with King Faud and other Saudi authorities and was announced to the world's media on the steps of the White House. This move should not engender surprise. President Clinton had been elected on a ticket to secure American jobs and improve living standards. His mercantilist instincts were also reinforced by his advisers. As Lynn notes, 'Around him were theorists and advisers who believed that it was time to start turning the military and political might of the United States into harder coinage: money, trade, jobs'.⁵² According to some commentators political involvement may even have gone further. Press reports asserted that agents of the National Security Agency bugged the Airbus sales team at the time of the Saudi deal.⁵³ Strategic trade now almost certainly includes industrial espionage.

In Search of New Rules

As I have shown an early problem with many of these issues in commercial aircraft trade was a reluctance on the US side to see any government funded contribution to the performance of American aerospace companies, because of a blanket assumption that the USA did not operate industrial policies. However, the trade discussions of the last decade and the proliferation of reports into government funding and supports have now created a dialogue where at least certain parameters should be known. The 1992 Bilateral Agreement formalized an acknowledgement that indirect support did exist in the US system. Nevertheless, the EU side is posed with a serious difficulty. The real value of indirect support to US manufacturers is inherently contestable in terms of the precise contribution to the commercial viability and competitiveness of products that reach the market place.

Despite the July 1992 agreement members of the US administration continue to deny the contribution made by publicly funded R&D to the commercial aircraft industry. Moreover, the calculation of the worth of DoD and NASA programmes which benefit US firms is also difficult because some figures are hidden in black, secret programmes which are classified. For this reason policing adherence to the 1992 agreement on the US side is problematic. Because of the methodological problems in studies of indirect support in the US, reports often specify an enormous range between minimum and maximum figures.⁵⁴ In terms of establishing whether indirect supports are a given

percentage of turnover of the US industry the EU faces a daunting task. In 1997 the EU Trade Commissioner, Sir Leon Brittan, sought to reopen the 1992 agreement. But not surprisingly the US side were not interested.

A Qualitative Analysis

This paper has sought to propound two key propositions. First, that the US aerospace industry is the beneficiary of a huge supportive infrastructure which underwrites key elements of the manufacturers' competitiveness via NASA and DoD programmes. In my lexicon this comprises an informal or unrecognised (covert) industrial policy. Secondly, I believe that in the 1990s we can identify a policy orientation which can be meaningfully characterized as the new mercantilism. If traditional mercantilism meant general economic nationalism, the new mercantilism is more sectorally specific and relies heavily on trade policy as a surrogate for overt industrial policy. The new mercantilism reflects a new conjuncture where the structural and ideological conditions have materialized to encourage more overt executive support for high technology/export sensitive industries; classically aerospace. In essence the new mercantilism results from two key phenomena. First, the recognition in the United States that its pre-eminence in commercial aeronautics is under serious challenge and secondly, the realization that American security now depends on the strength of key commercial technologies.

Bearing in mind the arguments above the search for a viable model of how to quantify the extent and role of government support for the US aerospace industry must continue and will be a necessary precondition for trade agreements which are fair and can be policed. But in the meantime it is also essential to establish a qualitative interpretation of the structural characteristics of the US industry. This can be done by exploring the following areas:

- the historical development of the US commercial aircraft industry;
- the role of military procurement and R&D in the commercial success of the civil aircraft manufacturers;
- the use of trade policy as surrogate industrial policy in certain sectors of the post-war US economy;
- specific publicly funded projects and initiatives, where the value-added benefits to commercial aircraft manufacturers are incontrovertible;

- the contribution of executive level support for export sales of commercial aircraft.

In particular it needs to be recognized that publicly funded research and development reduces the technological and financial risk associated with the launch of new programmes. As I have indicated above one should also note a pronounced shift in recent years to a more overt industrial policy.

Seeds of the New Mercantilism

The US civil aeronautics industry is one of the jewels in the American industrial crown. As Mowery and Rosenberg comment, 'Judged against almost any criterion of performance - growth in outputs, exports, productivity or innovation - the civilian aircraft industry must be considered a star performer in the [post-war] US economy'.⁵⁵ In addition it is the largest exporter and a symbol of national prestige, which resonates with America's optimism about the role of technology in society. The belief that there has not been a national strategy to protect and foster this industry is vacuous. The only period when the US industry was left to the vicissitudes of market forces was in the early 1920s when it nearly disappeared. In the late 1920s and through the 1930s air travel was subsidized in order to provide a market for larger and more comfortable passenger aircraft and to secure a national mail service.⁵⁶ In 1938 the Civil Aviation Administration was created within the Department of Commerce to provide, 'direct subsidies to promote passenger travel, economic regulation of the airlines, air traffic control, and safety'.⁵⁷ During the war, as we have seen, a massive industry was spawned and successful civil designs, such as the Lockheed Constellation, Lockheed Electra and Douglas DC6 were prefigured in military forerunners. At the same time Boeing developed the skill base for manufacturing large military aircraft which had dual-use potential, such as the B-29 which formed the basis for the B-377 Stratocruiser. In 1954 Pentagon orders for the KC-135 allowed Boeing to utilize the benefits of its prior work on swept wings and podded engines (engines hung on pylons; not directly on the wings) on the B-47 and B-52 bombers. From its inception the KC-135 was conceived as a dual-use tanker and civil jetliner project.

Although the KC-135 story is 'old hat', it bears some rehearsal. A key advantage for the US manufacturers has been the synergies that exist between defence and civil aerospace technologies. As Eberstadt notes:

The single greatest means by which U.S. government policy has affected the competitiveness of the commercial aircraft industry is in the procurement of military aircraft and funding of the related R&D... In some cases whole systems developed for the military have been 'spun off' to commercial applications, reducing development costs and risks to the commercial users.⁵⁸

The KC-135/B707 linkage was a clear example of this defence/commercial synergy. Production of the two aircraft shared the same plant and 20% of the parts and tooling.⁵⁹ Both aircraft were derived from a common prototype and had concurrent development programmes. Regarding the prototype it must be remembered that the B707 was a revolutionary aircraft and that the military funded project helped Boeing iron out potential technological glitches. As Rodgers observes, 'any bugs in the basic design found in shaking out the tanker during its early days in service would be worked out at government expense'.⁶⁰ In addition common production runs increased the speed with which progress was made down the learning curve and hastened the arrival of economies of scale.⁶¹ The learning curve is critical in aircraft manufacturing as learning elasticity is estimated at .2, i.e. production costs reduce by 20% with a doubling of output. Regarding the B707 the simultaneity of the commercial and defence programmes significantly reduced the financial risk of the aircraft's launch, with Boeing ultimately selling 820 KC-135s to USAF. To this day many Boeing officials deny the significance of the dual development, but in an authoritative study of the Boeing Aircraft Corporation by analyst M. J. Hardy we find the following:

Without the huge KC-135A programme there would almost certainly have been no Model 707, as its unit costs would have been too high, especially without the benefits of using some KC-135 jigs and tooling... and it was not until 1963, when just over 1000 of the 707, 720, and KC-135/C-135 series had been sold, that Boeing finally passed the break-even point on its jet transport programme.⁶²

This is an old tale, but by retelling it one can balance the accusations against Airbus which point to the large infusions of state aid that helped the consortium survive in its early days. The point about the B707 is that it was the commercial product which helped initiate Boeing's dominance of the world market. Arguably Boeing's most critical and daring decision was to proceed with the development of the enormously successful B747. But even this product, Boeing's commercial trade mark, was originally conceived as a large military cargo aircraft. Development began in response to an Air Force procurement proposal. Although ultimately the contract went to Lockheed for the C-5A, the Boeing design teams working on the new heavy-lift wide-body jet gained the valuable experience that was

necessary for producing a civil version.⁶³ Clearly, another advantage of the defence/commercial mix is the creation of expertise that can be used on both sides of the divide. Even if military orders are cancelled or slimmed down, engineers will have been trained who can be transferred to commercial projects.

Fortuitously for American manufacturers downturns in commercial orders, such as at the beginning of the 1980s, have frequently coincided with upturns on the military side. In short Pentagon contracts give the US market stability and help to subsidize commercial production, either when times are hard on the civil side or early in production runs when development costs have not yet been amortized. This point has been acknowledged by Boeing executives regarding the recent acquisition of McDonnell Douglas, which will increase the defence turnover of the company to approximately \$14bn. But contrary to some perceptions this situation is not new. According to leading aerospace analyst Wolfgang Demisch, this process sustained Boeing through its loss making first 20 years of jet aircraft manufacture.⁶⁴

In recent times Boeing executives have repeatedly claimed the spin-off synergies between defence and commercial products have reduced. Indeed, former Boeing executive Ronald B. Woodard, asserted in 1996 that there are none.⁶⁵ He also posed the question that if defence helps the commercial side then why have Lockheed and MDC failed on their civil programmes? But this is a fatuous argument. The underwriting of the industry by the Pentagon did not guarantee which US manufacturer would come out on top in commercial aircraft manufacture. Moreover, the vast increase in aircraft development costs in the last three decades indicated market exit for at least one player, as the production run necessary for profitability approached 600 units.⁶⁶ As Tyson explains in the late 1960s all three major manufacturers were seeking a successful, new high capacity wide-bodied jet.⁶⁷ Ultimately only one was to succeed in commercial terms. But why was it possible for three firms to compete to over-supply the market place? 'Neither Lockheed nor McDonnell Douglas could have survived, let alone dared to undertake head-on competition in their wide-body designs without their military operations'.⁶⁸ It was precisely the largesse accruing to Lockheed and Douglas from the Pentagon that allowed them to engage in a costly head to head competition in the same market segment, where there was no chance of commercial viability. Ironically, this is precisely the argument that Boeing used in the 1980s against Airbus's move to launch the A320 and A330/340. The difference was that Airbus had correctly gauged the market's requirements.

Returning to the case of the 1970s' wide body competition Lockheed's L1011 launch was

delayed because the development of the engines for the L1011 fell foul of Rolls-Royce's bankruptcy. Meanwhile, the American company's own bankruptcy was only averted in 1971 by a federal loan guarantee of \$250mn. Concurrently, MDC's DC10 suffered a number of catastrophic accidents and arguably was an aircraft which the FAA should never have certificated, due to faults in the locking system of the cargo doors and the vulnerability of all three hydraulic control systems to buckling of the cabin floor because of depressurization. In other words the B747 came out on top in the US because of errors made by Boeing's competitors, not because Boeing was less involved in defence work. Boeing courageously pursued a new and radical concept which itself restructured the market by offering genuine mass air transportation and gave the company a monopoly product. But regarding Mr Woodard's recent comments many in Europe wonder why the acquisition of MDC is a good idea if defence provides no spin-off? Former MDC executives could certainly have provided an answer. At the end of the life of the DC10 the company was helped through to the launch of the MD11 by orders for the military version of the tri-jet, the KC-10 tanker. Although, in the interim, it has become clear that the MD11 has also not succeeded commercially, perhaps because it has failed to meet its predicted performance parameters for range and payload. If Boeing continues the MD11 line it will be as a cargo aircraft.

The Fruits of Consolidation and Public Support

Turning to the present day the US aerospace industry is highly integrated and consolidated with economies of scale and scope being attained. In the 1990s in excess of \$100bn of merger activity has created three giant aerospace conglomerates with Boeing at the apex.⁶⁹ This consolidation reveals mercantilist motives and has not resulted from market forces. As Dowdy notes, 'This rapid consolidation of the American ... industry can be partially attributed to conscious policy decisions of the Department of Defense'.⁷⁰ The same point is made in a US General Accounting Office document: 'DoD has encouraged the defense industry to consolidate and eliminate excess capacity to remain competitive and financially viable'.⁷¹ Included in the planning was a DoD incentive to create mergers by reimbursing a portion of the cost. In consequence, Secretary of Defense William Perry's instruction in 1993 for the major players to consolidate (the so called 'Last Supper') has resulted in an unprecedented degree of integration with the three major corporations now having combined turnover approaching £110bn. These corporations dwarf their European equivalents, (See Table 2 below).

In the commercial market the major consequence of the American consolidation is that the largest manufacturer (Boeing) now has an enormous defence business portfolio. But as we have seen Boeing itself claims that defence/commercial synergies have declined. However, this can be contested. Oliver Sutton notes, 'Boeing's ... merger with McDonnell Douglas will further facilitate access to dual use technology R&D, largely funded by the US defence department and NASA'.⁷² This should come as no surprise. In its role as a sub-contractor for the B2 Boeing developed new machinery for the manufacture and testing of composites which were used for the B777. Some of the funding for this came from the MANTECH programme (now the Defense Manufacturing Science and Technology Programme). Previous MANTECH projects assisted in fuselage and wing development for MDC and Boeing. Additional funds are also available through the Pentagon's Independent R&D Recovery Programme, which allows non-product specific research to be partly recouped through contractors making an additional overhead on military orders.⁷³

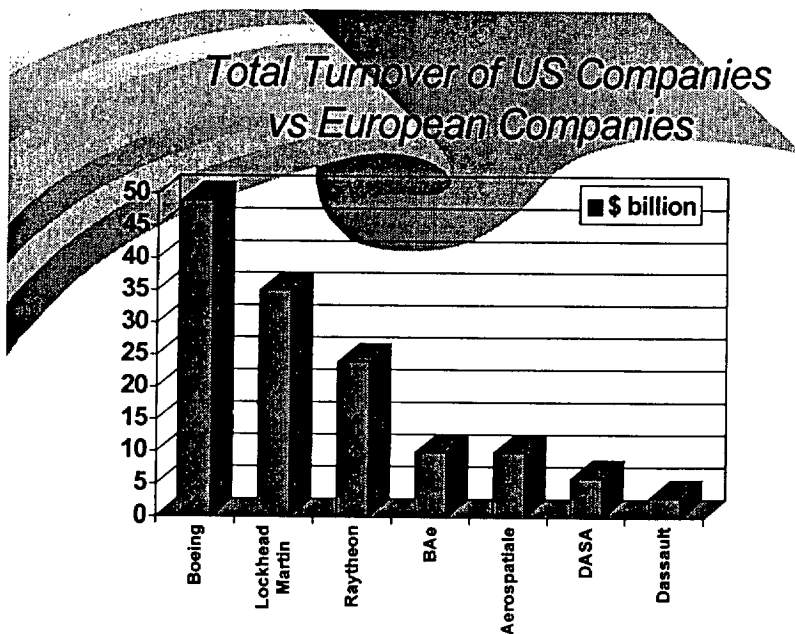


Table 2: Total Turnover of US Companies vs European Companies, Source, *Aerospace International*, (February, 1998, p. 14).

In seeking to emphasize the role that military funded programmes have played in the development of US civilian industry one encounters another prejudice which militates against a serious analysis of American high technology industries. The doctrines of laissez faire economics

have generally downplayed the significance of the military in the US economy. However, I support the following contention of David Noble:

I would like to suggest that this conventional view of the role of the military in technological development is problematic on both counts. First, because the military role has not been the “externality” that it appears to be when viewed through the lens of the neo-classical economist. Rather it has been central to industrial development in the United States since the dawn of the industrial revolution.... Second, the influence of the military on technologies is not temporary, something removed when the technologies enter the civilian economy. The influence spills over in the specific shape of the technologies themselves and in the way they are put together and used.⁷⁴

As Noble argues in order to understand the nature of DoD industrial policy it is essential to see the role that the US military has played in driving and proving new technologies. However, in the 1990s this has been given a new twist. The competitive trade threat posed to the EU by Boeing's new defence arm is underscored by the US government's heavy investment in a new Dual-Use Programme. In order to get better value for money from its huge procurement budget the Pentagon has encouraged its contractors to seek cheaper commercial technologies to input into military systems and, as we have seen, the defence and civil sectors have been encouraged to merge together. In some circles this has led to the false assertion that commercial/defence spin-on means that the civil side is now subsidizing defence. But this misses the point of the Dual-Use Programme. The dual-use philosophy recognizes that the technological superiority of the US military will now depend on the strength of American civilian high technology industries. Thus, instead of a defence R&D spin-off, which produced a makeshift industrial policy in the aerospace sector, the commercial industry will now be supported more directly in order that the Pentagon can leverage the critical technologies for defence. A key element in the new Dual-Use programme was the Technology Reinvestment Project (TRP), which by 1995 had awarded \$800mn to firms seeking DoD funds for dual-use applications.⁷⁵ Government statements make transparent the benefits that will accrue to the civil sector: ‘As an additional benefit, a dual-use strategy will allow DoD's continuing investments in technology to contribute more to our nations commercial performance and economic growth’.⁷⁶ Thus industrial strength and military might are now linked together more tightly than ever. With regard to the commercial aircraft industry a key TRP project was the Advanced Composites for Propulsion Programme (ACP). Aiming to reduce the production costs of composites by 30% the programme secured \$130mn public funding and was geared to improving commercial competitiveness.⁷⁷ Another TRP project which illustrates the benefits of the Dual-Use Programme for the commercial industry was the Fly-by-Light Advanced System Hardware project (FLASH).

The main contractor on FLASH was McDonnell Douglas and the programme enabled MDC to accelerate its development of fly-by-light avionics for defence and commercial use. FLASH, which took a significant share of the 1993 TRP budget of \$464mn, will assist in competitiveness by lowering aircraft weight and reducing the overall amount of electrical wiring.⁷⁸

In 1996 TRP, which had already been renamed the Dual Use Applications Program (DUAP), was replaced by the Defence Dual-Use Technology Initiative (DDUTI) which funded TRP projects begun before October 1995. In tandem with the successor to MANTECH (the Defense Manufacturing Science and Technology Programme) these programmes have put substantial funds into projects aimed to increase the competitiveness of the US aircraft industry. Overall the DoD was appropriated \$1.965bn for Dual-Use in FY1996. The successor to MANTECH (DMSTP) was allocated \$185mn.⁷⁹ The following programmes are supported by DoD funding:

- Design and Manufacture of Low Cost Composites Wing and Fuselage Initiatives;
- Manufacturing Technology for Welded Titanium Aircraft Structures;
- Active Matrix Liquid Crystal Displays (these offer superior visibility for flightdeck crews when instrumentation is viewed in sunlight. They are also smaller, lighter and use less power);
- Metal Forming Simulation to improve product quality and reliability;
- Large Aircraft Robotic Paint Stripping;
- National Flat Panel Display Initiative.

As we have seen the Department of Defense funds a large number of research and development programmes. While some have military only applications, other have direct relevance for the commercial aircraft industry in areas such as manufacturing technology, avionics and airframe development programmes. However, the stated policy is to bring the two closer together. A US National Science and Technology Council paper on aeronautics illustrates the point perfectly:

The significant basic technological commonality between military and civil aviation products and services must be exploited to increase the productivity and efficiency of our R&T development activities. This requires government and industry, working together, to actively seek technological goals that are common to both civil and military applications...⁸⁰

The Role of NASA

In the section above I have given an overview of some of the supports available to the civil aircraft industry from the DoD, as well as indicate the broad policy implications of the Dual-Use initiative. The second major locus of institutional support for the large commercial aircraft industry is the National Aeronautics and Space Administration (NASA). In focusing on NASA we should remember that its official aim is to promote the supremacy of the US commercial aeronautics industry. Moreover, during the Clinton administration NASA's Aeronautical Research and Technology Programme has had a central role in the new Presidential policy for the promotion of advanced technology. The new focus on NASA was made clear in 1994 by US Transportation Secretary, Frederico Pena:

While eschewing any return to regulation, we have defined a new role for government as an active player in aviation. One example of this philosophy in the Administration's initiative is the proposal to increase NASA's budget by 18%, so that the agency can *subsidize* [my emphasis] launches for private-sector projects. The programmes to receive the bulk of this funding are the Advanced Subsonic Technology programme and the High Speed Research Programme⁸¹

In order to fulfil its mission NASA provides research facilities for US firms, it institutes invaluable demonstrator programmes, it pays US firms to do research and it increasingly seeks the optimum routes to commercial applications of new research. However, in the sensitive climate of renewed concern over political support to the US aerospace industry corporate executives are keen to distance themselves from the public support provided by NASA. At the Paris airshow in 1997 Boeing's Phil Condit offered the following reassurance: 'Since 1993 when we have submitted reports to the US government on this issue, there have been no benefits accruing to US commercial airplane programmes from currently funded Department of Defense or NASA programmes'.⁸² But interestingly, in a political climate where Congress is seeking better value for money, NASA is more frank than previously concerning its ultimate aims:

Future U.S. competitiveness in aeronautics... is dependent on sustained NASA advances in aeronautics research and technology. The aeronautics Enterprise will pioneer the identification, development, verification, transfer, application and commercialization of high-payoff aeronautics technologies. Activities pursued as a part of this enterprise emphasize customer involvement, encompassing U.S. industry, the Department of Defense and the Federal Aviation Administration.⁸³

Thus, rather paradoxically from the industry's point of view, sensitivity in the US about government expenditure is increasing the openness of the industrial policy in aerospace. NASA now explicitly links its R&D to the issue of US national interests and commercial competitiveness. As pressure on budgets increases, so too does the need to have a clear and logical rationale for public support of commercial aeronautics. In the US Congress there is a keen understanding of the implications of NASA's programmes for strategic trade:

NASA undertook these efforts [HSR and HST] largely in response to fears that the U.S. aircraft industry was falling behind Airbus in its technological capabilities, as well as to help the industry address the gap that had emerged in its commercialization of new technologies... In addition, NASA is trying to make its own research efforts more responsive to the commercial manufacturing cycle by timing the development of new technologies to coincide with the onset of new U.S. commercial programs.⁸⁴

The overall picture of state support to the US aerospace industry is complex and difficult to disentangle. But NASA's own statements give the lie to the claim that the commercial industry does not receive substantial government supports. In its 'Spin-off 97' document NASA Langley recalls its own contribution to the B777:

In May 1996, the first Boeing 777 stopped by Langley Research Centre as a salute to NASA's involvement in its creation. Several Langley innovations were instrumental in the development of the aircraft, such as:

- fundamental mathematical procedures for computer-generated airflow images which allowed advanced computer-based aerodynamic analysis;
- wind tunnel tests, confirming the structural integrity of 777 wing airframe integration;
- knowledge of how to reduce engine and other noise;
- radial tires that are used on the aircraft underwent strength and durability testing;
- increased use of lightweight aerospace composite structures for increased fuel efficiency and range. The 777's floor beams, flaps and tail make use of lightweight composites.⁸⁵

The NASA document also details other aspects of the extensive contribution the agency made to the B777's development. Research at the Marshall Space Centre contributed to the development of the

Pratt and Whitney engines, while NASA Ames assisted with new inlet, hinge and strut blankets to make the aircraft more resistant to fire.⁸⁶ Perhaps most important of all NASA (and DoD) assisted Boeing in the development of radical new fly-by-wire and fly-by-light technologies for the new automated flight management system on the B777.⁸⁷ This is critical in terms of competitiveness as previously Airbus had pioneered new, automated flight management systems for the A320, A330 and A340. The NASA document concludes: 'Together, industry and government skills melded, jointly contributing to the airplanes operating efficiency, passenger service, environmental compatibility and safety'.⁸⁸

With regard to the trade issues raised by the 1992 Bilateral Agreement NASA programmes highlight the problems posed for the EU in monitoring US compliance. The only projects which the US side reports to the World Trade Organization as indirect subsidies are the Advanced Subsonic Technology and High Speed Research programmes. But in the six years since 1992 NASA has spent approximately \$400mn annually on its Research and Technology Base programme which aims to develop new technologies for subsequent long term commercial aeronautics' applications. Since 1992 this represents a total spend of \$2,428bn which has not come under WTO scrutiny.⁸⁹

The US refusal to recognize the R&T Base programme as a subsidy to the commercial aircraft industry goes to the heart of the problems analyzed in this chapter. R&T Base represents public investment in R&D designed to develop new technologies. Some of these technologies contribute to innovations which can be seen to contribute to public welfare in areas such as safety or environmental protection. However, many lead to the emergence of new technologies which directly benefit private companies. Basic research is expensive and often cannot quickly be applied to any commercially viable technology. NASA funding of this research thus significantly reduces the two key areas of technological and financial risk for commercial companies such as Boeing. In the area relevant to airframe manufacture R&T Base focuses on aerodynamics, materials, controls-guidance-human factors, flight systems, systems analysis and hypersonics. These are critical in airframe manufacture.

In its 1996 fiscal year budget report the NASA Office of Aeronautics indicated that the following applications could be traced back to earlier R&T Base projects:

- supercritical wing for the B757 and B767;
- winglets for the MD-11 and B747-400;
- acoustic nacelles for the MD-11, B757, B767 and B747
- composite structures and advanced alloys for the B757, B767, B747 and the MD-11;

- advanced displays for the B757, B767, B747 and B777.

As the factual evidence and arguments presented above indicate the NASA R&T Base programme has contributed much to technologies used in the design and manufacture of highly successful commercial aircraft. This should be clearly recognized in Europe, but even in the US critical questions have been asked about the programme. In the FY 1996 House of Representatives hearings of the committee responsible for NASA appropriations, the chairman, J. Lewis, put forward the following written question, 'Most of the efforts being funded are for the direct benefit of civil aviation.... What is the rationale for these government expenditures which benefit private businesses'.⁹⁰ This is precisely the question Europe should be asking at future trade negotiations on the funding of large commercial aircraft manufacturing.

Conclusions

The qualitative analysis and evidence outlined above shows clearly that it is meaningful to speak of a US industrial policy for the aerospace sector. But the fact that NASA and DoD programmes clearly involve an industrial policy for commercial aircraft manufacturing does not obviate the problem that the precise benefit of such activities cannot be ascertained. An urgent need in this area is for a model which can act as a test of the commercial value of the large DoD and NASA inputs. In the meantime a clearer understanding of the history of the US industry and an appreciation of the neo-mercantilist strategy of the Clinton Administration points to more meaningful conclusions than the traditional assessment offered. In the past firms producing aircraft for the commercial sector benefited from synergies and cross-subsidization between defence and civil. Major risks could be taken on the commercial side because the defence contracts strengthened the capital base of the companies.⁹¹ In the 1990s the defence and commercial sectors have moved to integrate and synergies now go both ways. Further, the new giant aerospace units can now receive more focused political support, precisely because the competition is overseas and not domestic. With the Cold War long over, competition with allies in high technology sectors can be more aggressive and aims, in my view, at recouping some of the vast investment in defence that the US previously made on behalf of the Western Alliance.⁹²

Mergers in US aerospace cannot simply be seen as the play of market forces; they represent strategic calculations and include Pentagon and executive input. In the Clinton administration

economic strength is recognized as the foundation of national security and pre-eminence in high technology is regarded as the bedrock of economic strength. In order to secure effective defence procurement the Dual-Use programme now explicitly focuses on commercial industry and, in itself, is a form of industrial policy. Neo-mercantilist support for Boeing and other aerospace giants is an attempt to protect high technology sectors, regarded as critical to US military and economic security. It is a classical example of strategic trade investment policy (STIP).

Regarding export advocacy the US government now has a coherent and effective policy directed from the Department of Commerce Advocacy Centre in Washington. This center supports export sales worth in excess of \$20bn a year and secures several hundred thousand US jobs. As Jeffrey Garten has recently asserted business is at the heart of US state policy: 'Throughout most of American history, commercial interests have played a central role in foreign policy, and vice versa'.⁹³ Today aerospace is the prime example of linking commerce and foreign affairs. What's good for aerospace is good for America.

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