1. OVERVIEW OF THE AEROSPACE SECTOR: BACKGROUND

The space economy evolved from the aerospace industry and the two still share many aspects, components and technologies (e.g. space launchers are modified guided missiles). Detailed examination of the space sector is hampered by this legacy since many data are still classified according to categories defined for aerospace. As the UN International Standard Industrial Classification (ISIC) summarised in Box 1.1 shows, this covers everything from hang gliders to space shuttles, so national statistical offices and space agencies are working to make a clearer distinction between space and aerospace classifications. This will enhance the availability and accuracy of data on the space economy in the future.

The present classification is useful though for establishing the space economy in the wider context of the aerospace sector, and the following sections examine trends in aerospace production, value added, and business research and development. The OECD data are based on the broad aggregated ISIC Class 3530: Manufacture of aircraft and spacecraft.

1.1. SIZE AND GROWTH OF THE AEROSPACE SECTOR – PRODUCTION

According to ISIC 3530, the aerospace industry comprises the production of all aircraft and spacecraft, but space-related services such as telecommunications are not included. They may however be indirectly reflected in aerospace production as intermediate inputs. This section explores the aerospace sector by examining the size and growth of the industry in OECD countries.

Highlights

The largest aerospace producer in 2003 was the US (USD 126 billion), followed by the rest of the G7 (see Figure 1.1a). Italy (the smallest G7 aerospace producer) manufactured twice as much as Spain, the leading non-G7 producer.

OECD production since the 1980s shows two trends (see Figure 1.1b):

1. Value has been rising.
2. Domination of OECD aerospace by the G7 countries is not a new phenomenon, but relative performances have changed. In 2001, for example, 95% of OECD production came from the G7, but over the past two decades, G7 production has shifted away from the US and Italy towards France, Germany and Canada (see Figure 1.1c). Data from 1991-2001 show that production in France and Canada grew by over 10% on average, while that of the US and Italy varied little (Figure 1.1d).

After a commercial downturn in the late 1990s, data for 2005 and 2006 reported by national industry associations show significant growth in revenues (since 2004), supported largely by global demand for air transport and defence equipment (Table 1.1)

Definition

The aerospace industry refers to Class 3530 of the United Nations' International Standard Industrial Classification (ISIC) Revision 3.1 which covers the manufacture of aircraft and spacecraft. This broad class comprises the manufacturing of both non-space items (passenger and military aeroplanes, helicopters, gliders, balloons, etc.) and space items (including spacecraft, spacecraft launch vehicles, satellites, planetary probes, orbital stations and shuttles). This also includes the manufacturing of their parts and accessories, used in civil or military applications. Production refers to the total value of this class of goods produced in a year, whether sold or stocked.

Methodology

Production includes intermediate inputs (such as energy, materials and services required to produce final output). An item produced in this industry may show up twice in production: as the final output of one enterprise and the intermediate input of another one. This means that double counting could potentially be a problem.

Data comparability

The data here come from OECD's Structural Analysis Statistics (STAN) database, which includes statistics for all OECD countries (except Turkey). Countries that either had no or zero values were Austria, the Czech Republic, Denmark, Greece, Ireland, Luxembourg, New Zealand, Portugal, the Slovak Republic and Switzerland. German data prior to 1991 only cover Western Germany. Although some statistics are actual country submissions, most are estimates based on surveys or other data from the OECD member countries. To put the values into a common measure, Purchasing Power Parities (see Annex for details on PPP) were used to convert current production values into US dollars.

Data sources

- AeroSpace and Defence Industries Association (ASD) (2007), ASD Industry Figures 2006: The Status of the European Aerospace and Defence Industry 2006, June.
- Aerospace Industries Association of Canada (AIAC) (2006), *Performance Results for Canada's Aerospace Industry in 2005*, July.
- Associazione delle Industrie per l'Aerospazio i Sistemi e la Difesa (AIAD) (2007), website *www.aiad.it*, February.
- Groupement des Industries Françaises Aéronautiques et Spatiales (GIFAS) (2007), *French Aerospace Review 2006*, 16 March.
- OECD (2007), OECD Structural Analysis Statistics, STAN Industry database, OECD, Paris, April.
- OECD and Eurostat (2007), Purchasing Power Parities and Real Expenditures: 2002 Benchmark Year 2004 Edition, OECD, Paris, April.
- Society of British Aerospace Companies (SBAC) (2007), *UK Annual Aerospace Survey*, June.

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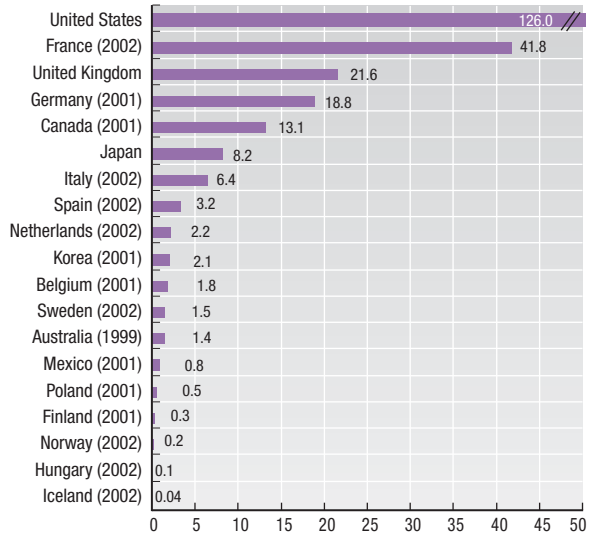
Figure 1.1a. **Production of aerospace industry in OECD countries, 2003 (or latest year)**

Billions of current US dollars using PPP

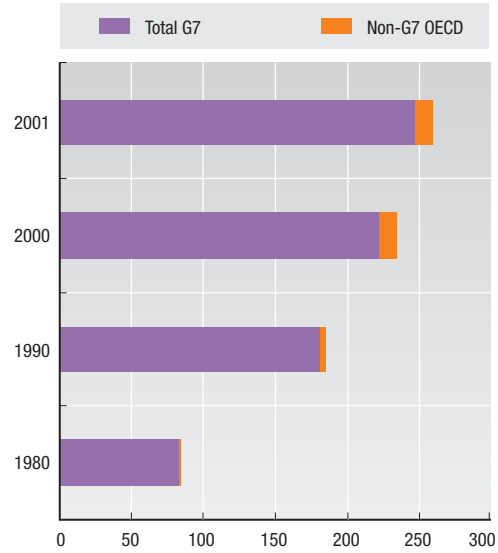


Source: OECD (2007), Structural Analysis Statistics, STAN Industry database, April.

StatLink http://dx.doi.org/10.1787/104883872725

Figure 1.1b. **Total aerospace production breakdown in OECD countries, 1980, 1990, 2000 and 2001**

Billions of current US dollars using PPP

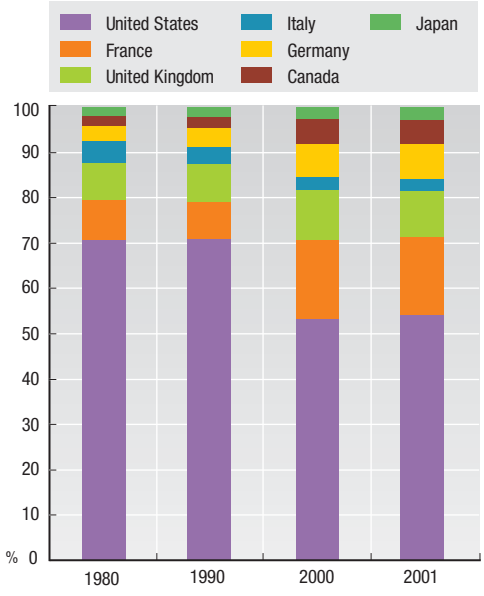


Source: OECD (2007), Structural Analysis Statistics, STAN Industry database, April.

StatLink http://dx.doi.org/10.1787/105012515873

Figure 1.1c. **Breakdown of G7 aerospace industry production by year**

Percentage of total aerospace production in G7 countries

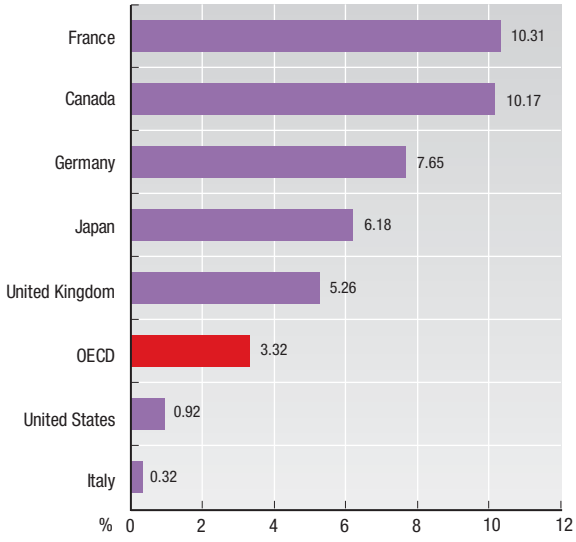


Source: OECD (2007), Structural Analysis Statistics, STAN Industry database, April.

StatLink http://dx.doi.org/10.1787/105032652352

Figure 1.1d. **Average annual change in aerospace production, 1991-2001**

Average percentage change in production



Source: OECD (2007), Structural Analysis Statistics, STAN Industry database, April.

StatLink http://dx.doi.org/10.1787/105044624671

Box 1.1. **The United Nations International Standard Industrial Classification (ISIC) Revision 3.1 Detailed Structure of Class 3530: Manufacture of aircraft and spacecraft**

This class includes:

- Manufacture of aeroplanes for the transport of goods or passengers, for use by the defence forces, for sport or other purposes.
- Manufacture of helicopters.
- Manufacture of gliders, hang-gliders.
- Manufacture of dirigibles and balloons.
- Manufacture of spacecraft and spacecraft launch vehicles, satellites, planetary probes, orbital stations, shuttles.
- Manufacture of parts and accessories of the aircraft of this class, including:
  - major assemblies such as fuselages, wings, doors, control surfaces, landing gear, fuel tanks, nacelles.
  - airscrews, helicopter rotors and propelled rotor blades.
  - motors and engines of a kind typically found on aircraft.
  - parts of turbojets and turbo propellers for aircraft.
- Manufacture of aircraft launching gear, deck arresters, etc.
- Manufacture of ground flying trainers.

This class also includes: Maintenance, repair and alteration of aircraft or aircraft engines.

This class excludes:

- Manufacture of parachutes.
- Manufacture of military ballistic missiles.
- Manufacture of ignition parts and other electrical parts for internal combustion engines.
- Manufacture of aircraft instrumentation and aeronautical instruments.
- Manufacture of air navigation systems.

Source: United Nations (2006), International Standard Industrial Classification (ISIC) Revision 3.1.

Notes: As mentioned in the Introduction, ISIC Revision 4, due in 2007, is not expected to change the aerospace classification from Revision 3.1.
This box contains a summary of what Class 3530 covers. For a comprehensive overview of what is included in the aerospace industry please refer to the United Nations *Classification Registry's* detailed structure and explanatory notes on ISIC Revision 3.1 *Class 3530: Manufacture of aircraft and spacecraft*.

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Table 1.1. **State of the aerospace sector in 2005-2006 in selected countries**

Estimates based on national currencies and current years[1]

USA	The US aerospace industry had a successful 2006, with total deliveries projected (in late 2006) to surpass USD 184 billion, up more than 8% from USD 170 billion in 2005. While sales increased in nearly all product and customer categories, there was a 21% surge in the civil aircraft sector, with overall exports rising to USD 82 billion. Combined with relatively flat imports of aerospace products, the net trade surplus for the sector was expected to surpass USD 52 billion. There were 630 000 aerospace workers in 2006 compared with 1.1 million in 1990 (US Aerospace Industries Association, AIA, December 2006. The AIA includes more than 100 major American aerospace and defence companies, and 175 associate member companies.)
Europe	The European aerospace sector continued its upward trend, reporting EUR 121 billion in turnover in 2006 (up 7.17 % from 2005), with employment rising to 638 000 people (614 000 in 2005). (The AeroSpace and Defence Industries Association, ASD, June 2007. The ASD represents the aeronautics, space, defence and security industries in Europe. ASD members are 31 National Trade Associations in 20 countries across Europe, representing over 2 000 aeronautics, space and defence companies.)
France	French aerospace's consolidated revenues continued to grow, with 2006 revenues at EUR 25.7 billion (73% from exports). Unconsolidated revenues were up 9% compared with 2005, reaching EUR 32.1 billion. The civil sector (mainly aircraft) generated 67% of revenues. The total French aerospace workforce was 132 000 people (Groupement des Industries Françaises Aéronautiques et Spatiales, GIFAS, April 2007. GIFAS has 250 members, ranging from major prime contractors and system suppliers to small specialist companies. They cover the full spectrum of skills from the design, development and production of aerospace systems and equipment to maintenance and operation. Activities range from civil and military aircraft and helicopters to engines, missiles and armament, satellites and launch vehicles, plus major aerospace, defence and security systems, equipment, subassemblies and associated software.)
United Kingdom	The UK aerospace industry had a turnover of GBP 20 billion (63% from exports) in 2006, up by 5.5% versus 2005. New orders increased by 6% to GBP 26.2 billion. Direct employment remained at 124 234 jobs, with the sector supporting a total of 276 000 jobs in the UK, while British aerospace companies employed 48 785 people abroad and generated GBP 7.9 billion of turnover outside the UK (The Society of British Aerospace Companies, June 2007. SBAC) is the UK's national trade association representing over 2 600 companies supplying civil air transport, aerospace defence, homeland security and space products and services.)
Italy	The Italian aerospace industry generated an overall turnover of around EUR 11 billion in 2006, employing over 50 000 workers (The Associazione delle Industrie per l'Aerospazio i Sistemi e la Difesa, 2007. AIAD has more than 100 members.)
Canada	Despite the appreciation of the Canadian dollar (CAD) relative to the US dollar in 2005, the Canadian aerospace industry posted revenues of CAD 21.8 billion, virtually unchanged from the previous year. Export sales in 2005 generated CAD 18.5 billion (85% of total industry revenues) while domestic sales totalled CAD 3.3 billion, with the US remaining the single most important market for Canadian aerospace goods and services. Direct industry employment in 2005 was 75 000, up marginally from 2004 (Aerospace Industries Association of Canada, AIAC, July 2006. The AIAC represents more than 400 companies in Canada's aerospace manufacturing and services sector.)

1. Note that data presented here come from private sources (aerospace industry associations) to illustrate recent trends nationally and regionally. As such, and due to industry associations' distinct methods in data definition, collection and analysis, as well as reporting in national currencies, international comparability is very limited.

1.2. SIZE AND GROWTH OF THE AEROSPACE SECTOR – VALUE ADDED

Value added for an industry refers to its contribution to national Gross Domestic Product (GDP). It is often considered a better measure of output than basic production since it reduces the likelihood of double counting that is possible with the production approach.

Highlights

G7 data for 1980, 1990, 2000, 2001 and 2002 reveal that the total value-added output of the aerospace industry continued to rise in current US dollar terms, except in of 2002, which was slightly lower than 2001. This was also true for individual countries, except the US (which had lower output in 2000 than in 1990), and Italy and Canada (both saw a marginal decline in 2001 from 2000) (Figure 1.2a).

An examination of "aerospace value added" as a percentage of "total manufacturing value added" for the G7 shows variations depending on country and time period (see Figure 1.2b). However, overall, aerospace represents a small percentage of the total manufacturing value added. For example, in Canada and France, the percentage was just over 3% of the total in 2002. In the early 2000s, most countries saw a significant decline compared with the 1980s and 1990s. Nevertheless, the cyclical nature of aerospace activities and more recent trends show a rebound for the sector in the latest years (see also Section 1.1).

Definition

The data refer to Class 3530 of the UN International Standard Industrial Classification (ISIC) Revision 3.1, which covers the manufacture of aerospace (*i.e.* aircraft and spacecraft). Value added comprises such elements as labour costs, consumption of fixed capital, indirect taxes less subsidies, net operating surplus and mixed income. However, the exact calculation can vary depending upon the country and the extent to which taxes and subsidies are included. For example, Canada uses factor cost in valuation, while the United States uses market prices, and many other countries use basic prices.

Methodology

Value added for a particular sector or industry is residually calculated as the difference between gross production and intermediate inputs (*e.g.* energy, materials, labour and services) that are used during the accounting period. Production includes the cost of the intermediate inputs (such as previously made materials) in the value of the final product, and thus can lead to double counting (as the value of the intermediate input can also be included in the final production figures of another establishment in the same industry). The data on value added are submitted to the OECD from member countries and are included in the OECD Structural Analysis Statistics, STAN Industry database. The very limited nature of value added data for OECD countries in aerospace has circumscribed the analysis to the G7 countries.

Data comparability

Although the United Nations System of National Accounts 1993 (SNA93), along with the European System of Accounts 1995 (ESA95), requires a submission to be provided at basic prices (the value of production includes taxes less subsidies), there are some country variations (*e.g.* Canada has values at factor costs). However, attempts are made to standardise the data as much as possible.

The availability of value added data for the aerospace industry can be quite difficult to obtain. For example, 12 of the 23 non-G7 countries had no data or zero values for the aerospace industry value added. Hence, our analysis is limited to the G7 because of the availability of data and these countries' recognised significant contribution to aerospace production.

All statistics were converted from current domestic currencies into billions of US dollars using Purchasing Price Parities (see Annex for details on PPP). Note that Canadian and German data for 2002 were estimated using 2001 values and that German data prior to 1991 only refer to Western Germany.

Data sources

- OECD (2006), OECD Structural Analysis Statistics, STAN Industry database, OECD, Paris, October.

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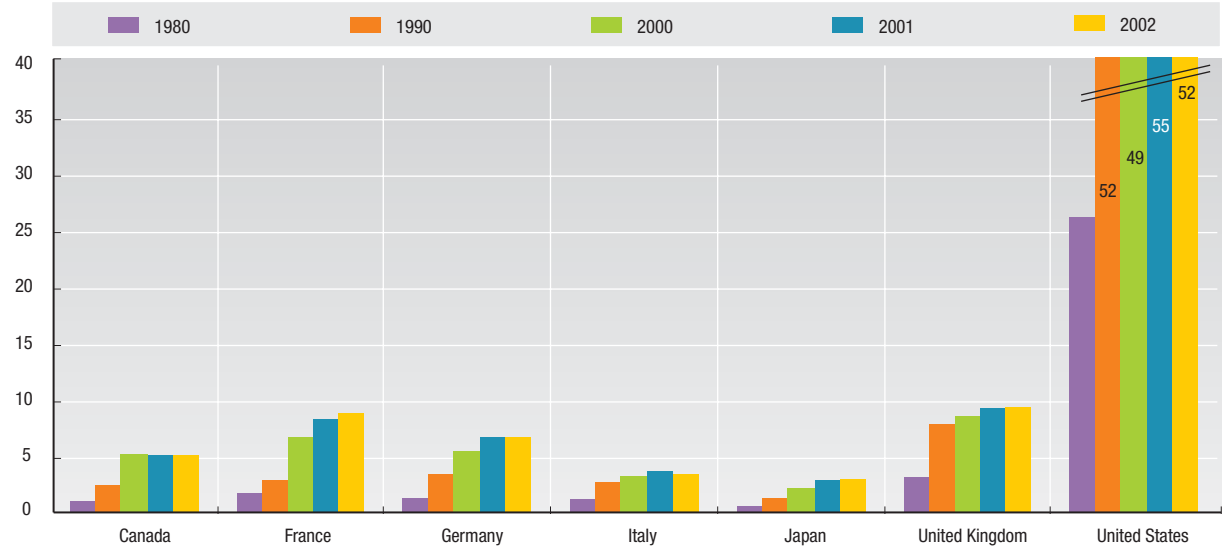
Figure 1.2a. **Value added by aerospace industry for G7 countries, 1980, 1999, 2000, 2001, 2002[1]**

Billions of US dollars using PPP

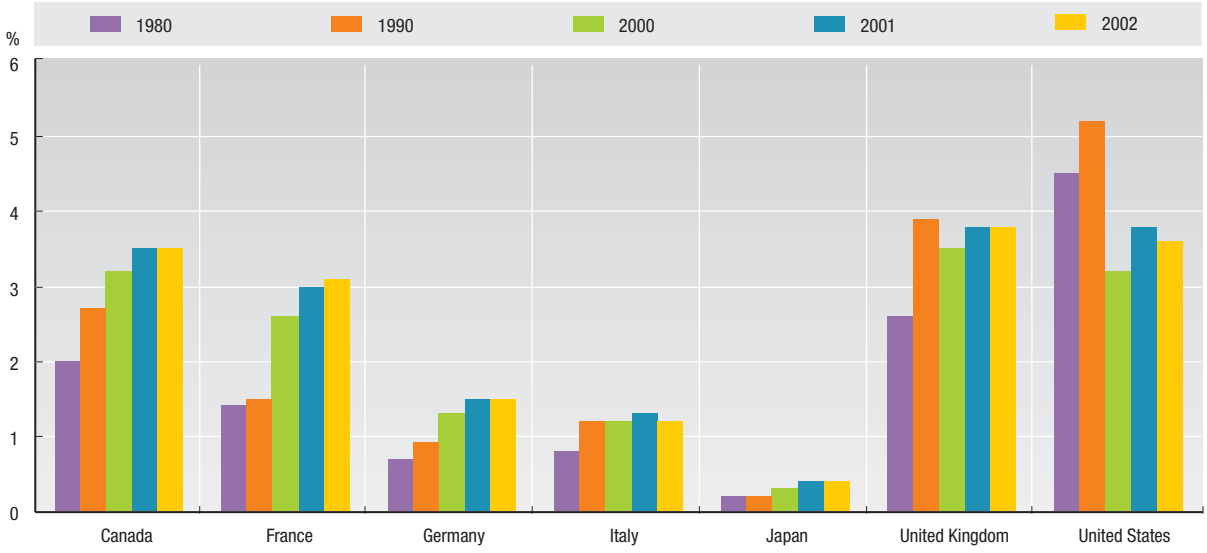


1. Canadian and German 2001 data used as 2002 estimate.

Source: OECD (2006), Structural Analysis Statistics, STAN Industry database, OECD, Paris, October.

StatLink http://dx.doi.org/10.1787/105047100357

Figure 1.2b. **Aerospace value added as percentage of national manufacturing value added for G7 countries, 1980, 1990, 2000, 2001, 2002[1]**



1. Canadian and German 2001 data used as 2002 estimate.

Source: OECD (2006), Structural Analysis Statistics, STAN Industry database, OECD, Paris, October.

StatLink http://dx.doi.org/10.1787/105056476328

1.3. AEROSPACE INDUSTRY RESEARCH AND DEVELOPMENT

The official OECD statistics relating to aerospace industry R&D presented here focus on business enterprise research and development (BERD) data. BERD is considered to be closely linked to the development of new products and production techniques.

Highlights

BERD data for aerospace, which totalled USD 19.8 billion in 2002, are heavily dominated by a few large countries (Figure 1.3a). Four of the OECD's largest industrial spenders - the US, France, the UK and Germany – account for 84% of the total.

Examination of BERD as a percentage of all manufacturing R&D for 1991, 1996, and 2002 shows a general decline in all G7 countries (except the UK and Japan) (Figure 1.3b). The largest proportional decline was in the US, where it fell from 18% to less than half than amount over this period. Among the non-G7 countries, the results were mixed, with some increasing and others decreasing the proportion of aerospace R&D expenditure. Furthermore, only two OECD member countries spent proportionately more on aerospace R&D in 2002 than 1991 (Spain and Norway).

Looking at expenditure for 1991, 1996 and 2002 (all expressed in US dollars using Purchasing Power Parities), the largest spender remained the US, although its expenditure declined substantially in absolute terms (Figure 1.3c). As mentioned before, the cyclical nature of aerospace activities and recent industrial trends have lead to a rebound in the US since 2002.

Definition

The aerospace industry encompasses the manufacture of a wide range of aircraft and spacecraft products (including passenger and military aeroplanes, helicopters, and gliders, as well as spacecraft, launch vehicles, satellites, and other space-related items).

Business enterprise research and development (BERD) expenditure refers to all R&D that is carried out in the business enterprise sector (*i.e.* by market-oriented firms and institutes) regardless of the source of funding. The examination here was of R&D by the aerospace industry.

Methodology

The data on R&D expenditures by the aerospace industry are based on official statistics provided to the OECD by its member countries. These data are then adjusted by the OECD for any existing deficiencies and anomalies to ensure they are comparable and consistent with OECD requirements. These data are then included in the OECD Analytical Business Enterprise Research and Development (ANBERD) database. ANBERD is subject to revisions because it depends upon a number of estimation techniques that are constantly being refined and reviewed. There are major issues when adding government R&D (GBAORD) to the business R&D presented here. This process may lead to some double counting since any government R&D funding sent to a private enterprise may appear as R&D expenditure in both accounts.

Data comparability

All statistics were originally current domestic expenditures that were converted into US dollars using Purchasing Power Parities (see Annex for details on PPP). Thus, comparability across currencies should not be a major concern. Furthermore, as the data are adjusted for deficiencies and anomalies that may have existed in the original data submitted by official respondents, the level of international comparability can be expected to be quite acceptable. The ANBERD database includes statistics on only 19 of the 30 OECD member countries.[1]

Notes

1. These 19 countries are: Australia, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Spain, Sweden, United Kingdom, United States.

Data sources

- OECD (2006), OECD Structural Analysis Statistics, STAN Industry database, OECD, Paris, October.
- OECD (2006), OECD Analytical Business Enterprise Research and Development (ANBERD) database, OECD, Paris, September.

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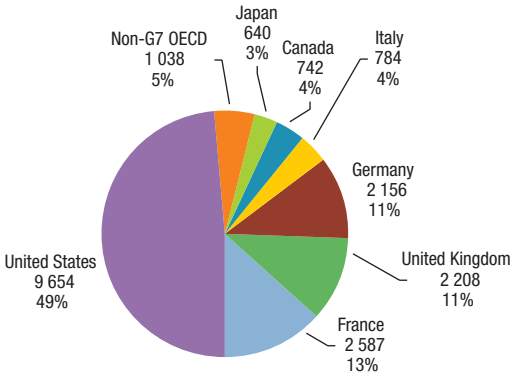
Figure 1.3a. **R&D expenditures in aerospace industry by OECD country, 2002**

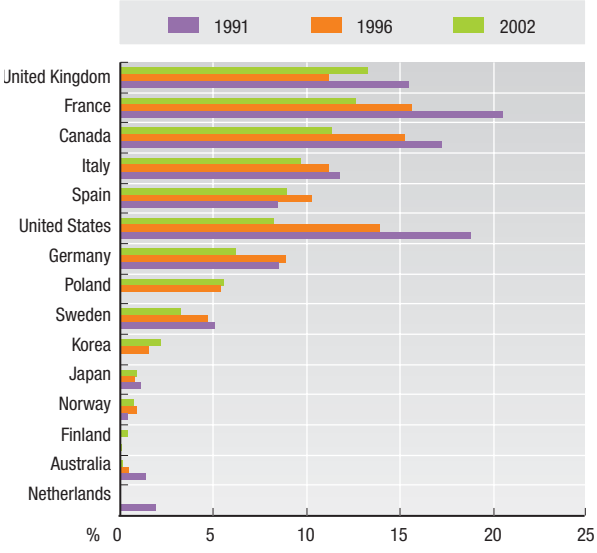
Millions of US dollars using PPP and percentage of OECD aerospace R&D total



Source: OECD (2006), *Structural Analysis Statistics, STAN R&D database,* OECD, Paris, October.

StatLink http://dx.doi.org/10.1787/105065142286

Figure 1.3b. **Aerospace R&D as per cent of manufacturing R&D for selected OECD countries, 1991, 1996, 2002**

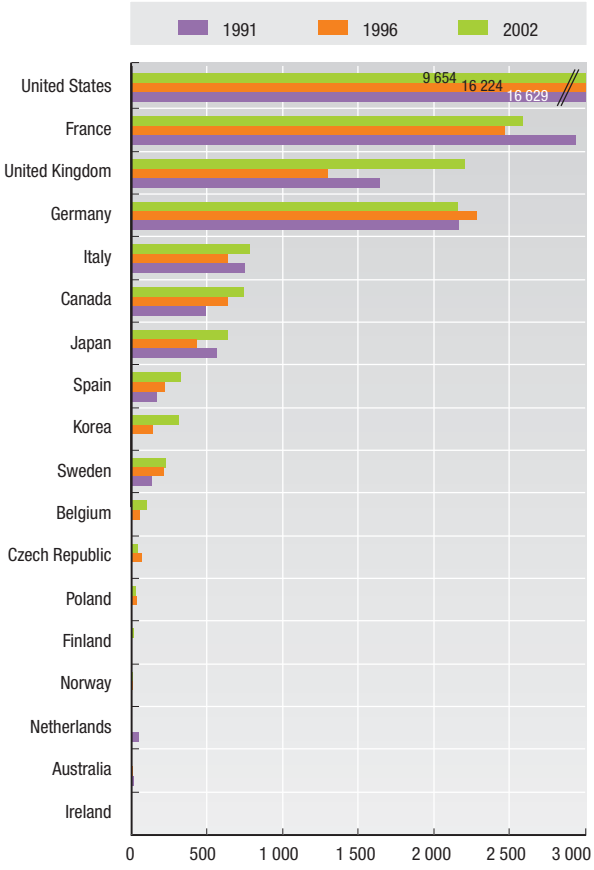


Source: OECD (2006), *ANBERD database*, OECD, Paris, September.

StatLink http://dx.doi.org/10.1787/105080617625

Figure 1.3c. **BERD of aerospace industry for available OECD countries, 1991, 1996, 2002**

Millions of current US dollars using PPP



Source: OECD (2006), Structural Analysis Statistics: STAN R&D database, OECD, Paris, September

StatLink http://dx.doi.org/10.1787/105110638536

List of Acronyms

AIA	Aerospace Industry Association of America
AIAC	Aerospace Industries Association of Canada
AIAD	Associazione delle Industrie per l'Aerospazio i Sistemi e la Difesa (Italian Industry Association for Aerospace Systems and Defence)
AIPAS	Associazione Italiana PMI per l'Aerospazio (the Association of Italian Small and Medium Aerospace Enterprises)
ANBERD	OECD Analytical Business Enterprise Research and Development database
ASAS	Associazione per i Servizi, le Applicazioni e le Tecnologie ICT per lo Spazio (Association for Space-based Applications and Services)
ASD	European AeroSpace and Defence Industries Association
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
BTD	The OECD STAN Bilateral Trade database
BERD	Business Enterprise Research and Development
BNSC	British National Space Centre
CAD	Canadian dollars (currency code)
CAST	China Academy of Space Technology
CNES	Centre National d'Études Spatiales (French Space Agency)
COMTRADE	United Nations' Commodity Trade Statistics Database
CPI	Consumer Price Index
CSA	Canadian Space Agency
CSG	Centre Spatial Guyanais (Space Centre in French Guiana)
DARS	Digital Audio Radio Services
DBS	Direct Broadcast Satellite
DTH	Direct to Home satellite
EO	Earth Observation satellite
EPO	European Patent Office
ESA	European Space Agency
ESA95	European System of Accounts 1995
ESTEC	European Space Research and Technology Centre
ESTP	European Space Technology Platform
EU	European Union
EUR	Euro (currency)
EUROSTAT	Statistical Office of the European Communities
FAA	US Federal Aviation Administration
FAI	Fédération Aéronautique Internationale (International Aeronautic Federation)
FAA/AST	US Federal Aviation Administration's Office of Commercial Space Transportation
FSS	Fixed Satellite Services

G7	Group of 7 leading industrial nations (Canada, France, Germany, Italy, Japan, United Kingdom, United States)
GBAORD	Government Budget Appropriations or Outlays for R&D
GBP	British pounds (currency code)
GDP	Gross Domestic Product
GIFAS	Groupement des Industries Françaises Aéronautiques et Spatiales (French Aerospace Industries Association)
GPS	Global Positioning System
IAF	International Aeronautic Federation
ICT	Information and Communication Technology
IFP	OECD International Futures Programmes
INSEE	Institut National de la Statistique et des Études Économiques (French National Institute for Statistics and Economic Studies)
IPC	International Patent Classification
ISIC	United Nations International Standard Industrial Classification
ISS	International Space Station
ITCS	International Trade in Commodity Statistics Database (UN/OECD)
JAXA	Japan Aerospace Exploration Agency
MSS	Mobile Satellite Services
NACE	Nomenclature d'Activité dans la Communauté Européenne (Economic Classification System in the European Community)
NAF	Nomenclature d'Activités Française (Economic Classification System in France)
NAICS	North American Industry Classification System
NASA	US National Aeronautics and Space Administration
NOAA	US National Oceanic and Atmospheric Administration
NOK	Norwegian krone (currency code)
NSC	Norwegian Space Centre (Norsk Romsenter)
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing Power Parities
R&D	Research and Development
RIMS II	Regional Input-Output Modelling System II
ROI	Return on Investment
SBAC	Society of British Aerospace Companies
SESSI	Service des études et des statistiques industrielles (French Service for Industrial Studies and Statistics)
SIA	US Satellite Industry Association
SNA	UN System of National Accounts
SOHO	Solar and Heliospheric Observatory (ESA and NASA)
SSB	Space Studies Board (US)
STAN	OECD Structural Analysis Statistics database
UK	United Kingdom
UN	United Nations
US	United States
USD	US dollars (currency)
USGS	US Geological Survey
USPTO	United States Patent and Trademark Office
VSAT	Very Small Aperture Terminals

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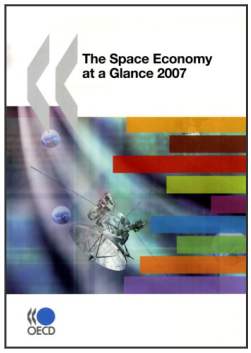

From:
The Space Economy at a Glance 2007

Access the complete publication at:
https://doi.org/10.1787/9789264040847-en

Please cite this chapter as:

OECD (2007), "Overview of the aerospace sector: background", in *The Space Economy at a Glance 2007*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/9789264040847-3-en

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