

Competitiveness of the EU Aerospace Industry with focus on: Aeronautics Industry

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Summary

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1 Summary

The focus of this study is on civil aviation, which explicitly excludes defence and space activities. However, military aviation is included in the analysis when interdependencies to civil aviation are significant or when available data do not allow for differentiation. The analysis covers the manufacturing of large jet airplanes, regional and business jets, helicopters, engines, intermediary input (equipment, avionics/electronics, aerostructures and components) as well as maintenance, repair and overhaul (MRO). They are considered in more detail.

The aim of this study is to give an overview of the current state of affairs of the European aerospace industry (AI), its relevance and competitive position in the global aerospace market.

The Consortium working on the Framework Contract Sectoral Competitiveness Studies for DG Enterprise and Industry of the European Commission has developed a common concept for the assessment of the competitiveness of the EU. It has been adjusted to the needs of the AI and is based on four modules:

- Supply side analysis: An in-depth investigation dedicated to disclose sectoral characteristics:
 - Structure of the industry by the size of companies, the intra-industrial organization along the value chain, production factors are taken into account by quality and quantity;
 - Regional distribution of the AI within the EU and division of labour;
 - Evaluation of the state in technologies and their future relevance;
 - Economic performance, driving factors and distortions in the development.
- Public policy assessment: The relevant regulatory and other framework conditions are identified and their impact on the performance of the industry is evaluated. Important areas for the AI are:
 - Quality of the workforce and its involvement in the industry;
 - Openness of third markets being dependent on the harmonization of technical provisions and fair behaviour in international competition;
 - Access to financial markets, a prerequisite to fund long-term aircraft programmes and risk-sharing ability;
 - Public schemes, testing facilities etc. dedicated to support R&D activities.
- Exogenous factors assessment: An in-depth investigation in the global market carried out to:
 - Identify most important and emerging competing nations, analysis of competencies and driving factors in particular public policies directed towards the AI;
 - Assessment of the performance in international trade and cooperations;
 - Performance of players in important market segments.
- Competitive assessment: The results are consolidated in an analysis of strengths, weaknesses, opportunities and threats and conclusions on the competitiveness of the EU AI are drawn.

An outlook for the AI is provided. Special attention is paid to the medium-term development, distorted – at present – by the global financial and economic crisis. The impact on the perspectives of the AI is highlighted, based on different forecasts.

1.1 Overview on the EU27 Aerospace Industry

Officially available statistics provided by Eurostat do not differentiate between the sub-sectors civil-, defence aircraft and space. These statistics are based on the harmonized European nomenclature, NACE. Time series for the aerospace industry can be found under NACE (Rev. 1.1) 35.3¹. Based on this classification the EU27 aerospace industry (AI) employed 375,300 people in 2008 and the output amounted to EUR 127.8 billion. The value-added came up to EUR 34.5. As compared with all of the EU27-manufacturing industries the AI commands a share of around 1.8% of value-added and 1.2% of the number of employees.

According to Eurostat figures, production of the EU27 grew between 2001 and 2008 at an annual - price adjusted - average rate of 1.5%. The number of employees grew only slightly at a rate of 0.1% p.a.

The regional distribution of the AI discloses a concentration in the bigger Member States. As measured by the value-added as a percentage of total manufacturing industries the United Kingdom is leading with 4.5%, followed by France with 3.5%. Germany, Italy and Sweden are following suit with shares between 1% and 1.5%. For other important countries of the European AI, such as Spain, Belgium, the Netherlands, Poland, the Czech Republic and Romania the share of the AI of the national manufacturing industry lies in the range of 0.5% to 1%.

The European association of the AI (ASD) compiles its own statistics based on surveys carried out by national associations of the industry. According to these data, in 2008 the EU AI reached a turnover of EUR 103.2 billion (thereof: EUR 5.88 billion space) and the number of employees was 497,201 (thereof: 30,301 employees space). The figures differ from official sources.²

Both of these statistics have been used. For the investigation into the performance of the sector and the international competitiveness only the official data base was applied. A differentiation of the AI by subsectors is only given by statistics of ASD and the national associations of the industry that are of relevance in the global aircraft market.

According to ASD, the European turnover of the AI in 2008 contained space products (7.1%), military aircraft (32.1%), helicopters (civil and military) (11.0%) and civil air-

¹ The latest revision of the nomenclature is NACE (Rev. 2.0) and the aerospace industry will be found under NACE 30.3. Statistics based on this revision were not available for this study.

² The discrepancies have been caused by different methods of data collection and definitions. The scope of ASD statistics is not limited to the AI. Beyond aircraft and aerospace products that are in the scope of NACE 35.3 ASD statistics also comprise figures of member companies in the value chain from other industries whose products are dedicated for the AI. ASD statistics only comprise member firms' information and estimations of employees and output not covered by the survey.

craft (49.6%) Of the latter large civil aircraft came up to 87.3%, regional aircraft to 4.6% and business aircraft to 8.1%.

1.2 Supply Side Analysis of the EU27 Aerospace Industry

1.2.1 Industrial organization

EADS/Airbus, the largest European group of the AI, has been created by a concerted political initiative. These days, the company is run by its industrial owners Daimler and Lagardère. However, economic decision making is diluted by national interests and incorporates the risk of suboptimal decisions, in particular in the area of production locations.

In recent years structural changes in the AI have been driven above all by actions initiated by the OEMs. The EADS/Airbus sourcing strategy follows this trend. Four major goals have been made explicit:

- Improve market access (meet offset obligations),
- Value to cost (low cost production),
- Access to resources (raw materials and human capital) and
- Risk management (e.g. currency volatility).

As a consequence, the share of non-EU procurement has to rise and risk-sharing partners have to assume responsibility for larger subsystems and work packages. The dollarization of procurement requires suppliers on Tier-1 up to around Tier-3 to take the exchange rate risk.

The structure of the EU AI is not optimally suited to meet related challenges. Compared to the US, there are fewer companies in the European AI that are able by their size, strategic orientation and their capability to allocate enough resources in order to become strong risk-sharing partners and system suppliers. The European AI faces a structural deficit in this respect that cannot easily be overcome. This is one reason why more big US manufacturers have been selected as suppliers for the more recent European aircraft programmes than before.

The spin-off of production locations by Airbus has been driven by the objectives to focus on system integration and to create high-potential risk-sharing partners in the value chain with the help of new financial and industrial investors. Heavy investment has been carried out to strengthen the viability of these facilities. But due to insecure perspectives it was not yet possible to attract investors for all of these spin-offs created in recent years.

1.2.2 Regional patterns

France, Germany and Spain are shareholders of the Airbus business. The United Kingdom has a big stake in the value chain for the manufacture of civil aircraft, in particular with the supply of wings. The delays and technical problems of new aircraft programmes, such as A380 and A400M have above all affected France and Germany. Moreover, these countries have started to allocate resources to the new A350 project that put additional pressure on financial performance. Spain has been much less affected by these burdensome factors. Additionally Spain – compared to for example Italy – has enjoyed a very strong development and integration into the European AI. Within these Member States there exists a certain specialization in the manufacture of parts and components. (Table 1)

Italy has become a stronghold in electronics for the aerospace industry and strengthened its integration in international projects. The country has fostered relationships with non-European AI partners. A joint venture with Russia has been launched to strengthen the Italian position in civil aircraft.

Table 1 Specialization of Bigger Member States in the Aerospace Industry

| | France | United Kingdom | Germany | Italy | Spain |
|---------------------------|--|--|--|--|---|
| Major Competencies | Cockpit technologies and manufacture, engine manufacturing, broadest range, e.g final assembly of wide-body aircraft, helicopter, aircraft funding | Manufacturing of wings, strong in related composite applications, engine manufacturing, military products, MRO | Avionics, fuselages, complex cabin equipment, high-lift systems, vertical tails, manufacture of and technologies for engines, final assembly of large civil aircraft, helicopter | Electronics, Military aircraft, helicopter manufacturing, strong integrated in non-EU value chains | Tail, fin and pitch elevator, growing strength in composites, assemblage of military transport aircraft and helicopters |

Source: Bauhaus Luftfahrt, Ifo Institute.

BAE has sold its shares in Airbus and the United Kingdom's link to the European civil aircraft activities has loosened. The British AI perceives its distance to Airbus as a detriment and fears to lose some of its competencies. In particular British smaller enterprises reported a growing competition from the new EU Member States and see few opportunities in niche strategies.

The integration of the accession states (2004 and later) has made noteworthy progress. Patterns of the intra-European trade indicate that the division of labour has increased. Cost advantages and well educated technicians on all levels of education are driving factors. However, wage increases incorporate the risk of a loss of competitiveness in the long-run.

1.2.3 State in Technologies

Large civil aircraft

The recent market launch of the A380 has set new standards in the segment of very large aircraft and Airbus has taken over the position from Boeing as the manufacturer of the world's largest civil aircraft. However, there was a delay in the roll-out caused by problems in the value chain and full pace of production has not yet been reached.

For decades Airbus was leading in the application of composites in aerostructures. With the "Dreamliner" B787 Boeing has leapfrogged Airbus in the application of these materials, though major difficulties have emerged with production. They have been aggravated by problems in the value chain. Outsourcing of large work packages, more risk sharing and insufficiently concerted activities have contributed to a delay of more than two years.

It is a challenge for future aircraft programs, such as the A350XWB, to avoid similar problems as emerged with A380 and A400M for Airbus and with the Dreamliner for Boeing in the future.

The replacement of the most successful aircraft of Boeing and Airbus, the A320 and B737, is postponed to after 2017. Bombardier, in the smaller regional jet segment, is preparing its C-Series, which is an advance in the same, profitable segment. Bombardier will have some leeway for the market launch of this aircraft based on the latest propulsion technology and broad application of composites.

Propulsion

In the propulsion segment the major two competing future concepts are the Geared Turbofan (of P&W and MTU) and the unducted fans or Open Rotor (of GE and Rolls Royce). Both are quite promising concepts in terms of emission reduction and fuel efficiency, but the Geared Turbofan concept seems to be closer to its market launch in Japanese and Canadian Regional aircraft.

Most important players in propulsion technologies for large civil aircraft (LCA) are part of transcontinental consortia, for instance SNECMA with its 50/50% joint venture with GE in CFM is by far the leading player in the market of engines for large civil aircraft. A decision whether the US or Europe is in the lead in related technologies cannot be clearly made.

Air traffic management systems

The US has been in the lead with its Global Positioning System (GPS). Its NAVSTAR GPS was introduced between 1985 and 1995 and provides comprehensive services worldwide. Europe has installed EGNOS and is about to develop it towards a full-blown GPS system. The European ATM will be based on EGNOS and the certification procedure for the application of EGNOS for air traffic will be concluded mid-2010. Europe is going head-to-head with the US in state-of-the-art levels of technology in this field. Close interaction of the responsible public bodies in Europe and the US should guarantee interoperability and reduce regulatory divergence as much as possible. The co-operation of Boeing and Airbus on this issue contributes to this objective.

Flight Mechanics, Navigation, Control and Avionics

Avionics, or aviation electronics, comprise electronic aircraft systems like fly-by-wire (or even fly-by-light) flight controls, system monitoring, anti-collision systems and pilot assistant/interface systems like communication, flight-management systems, navigation, or weather forecast systems.

European competencies in avionics occur for example in pilot night-vision systems for helicopters (superimposing a flight trajectory in the pilot screen for the landing approach), Traffic alert and Collision Avoidance System (TCAS) or the fly by wire technology. Airbus and Eurocopter were the first companies worldwide to introduce this technology in civil aircraft and helicopters. Big European Tier-1 and Tier-2 manufacturers are major EU vendors of flight avionics into the global market.

From the standpoint of aircraft manufacturers, advanced avionics have the potential to support aircraft operation and maintenance. These characteristics contribute to manufacturer competitiveness. Extended maintenance concepts and innovative integrated systems (highly cross-linked avionics) between aircraft and maintenance systems can provide the necessary step change and lower costs of aircraft operation.

There is a growing need to improve the interconnection of those systems to increase the overall efficiency, safety and redundancy. Additionally, cross-linking on-board systems with general air-traffic guidance systems and other ground systems have the potential to increase air-traffic management efficiency and thus reduce emissions. These technological areas of major importance for the stakeholders of the AI are complementary to objectives pursued by public policies of the European Commission and national governments. The strong position of the European AI in these technologies has been supported by public initiatives dedicated to reaching these goals (ACARE 2004).

1.2.4 Economic Performance

The analyses in this study are based on sectoral as well as on microeconomic statistics and focus on a comparison between the EU and US. The concept of comparative advantage has been applied to evaluate the relative performance of the AIs compared to all of their domestic manufacturing industries. The EU AI is on the leading edge in this respect. Compared to the US AI, labour productivity of the EU AI is much lower. However an investigation into the comparative advantages reveals that the EU AI in relation to the European manufacturing industry as a whole is better off than the US AI.

Key players of the EU and US AI have been compared by means of a balance sheet analysis. Over the period under investigation, the European AI's financial status has deteriorated. Profitability shrank and indicators on the ability to meet financial obligations, in particular short-term obligations, disclose that EU firms are definitely under more pressure than their US counterparts and the situation has become more precarious over the period under investigation, between 2001 and 2008.

To a certain extent this development is a consequence of aircraft programmes that have been launched in the recent past. Delays and technical problems have added to the financial burden by investment expenditure for future revenues. These are one time effects that will fade away as soon as the pace of production of A380 will accelerate and with the rollout of the A350 in the years to come.

However, it needs to be noted that scarce liquidity is a tough short-term challenge in the current environment, laden with the global financial crisis and a declining economic activity of client industry. The situation is not much alleviated by the fact that the EU AI is financially healthy with regard to long-term obligations.

1.3 Framework Conditions and Public Policies

1.3.1 Labour market

A skilled and qualified labour supply is essential for the competitiveness of the AI. Generally speaking, the quality of education and training in Europe shows a high standard. But there is no guarantee that Europe can keep up with the changing world in a way that maintains or enhances its technological position, as the demand for professional engineers and technicians will grow in all levels of the value chain.

Worries about skills shortages are widespread in aerospace industries. European industry sources indicate that the availability of skilled workers and engineers has emerged as an important issue. Demand for highly skilled European aerospace workers is also growing at the lower levels of the value chain. Most of the worries about skills shortages are directed at engineering.

The predominant demographic development in Europe is characterised by an aging population and declining younger age cohorts. In the course of the last 20-30 years, industry employment experienced a concentration of age structures in the middle age range (35-50 years). Lower recruitment rates of young persons – partly due to longer education and training periods – and a broad use of early retirement schemes increased the weight of the age groups which lie in between. This middle-age-range of employees reaches the brink of retirement within the next decade. The years after the number of retirees per annum will triple.

The demographic trend in connection with lower proportions of qualified young people who are opting for mathematics, physics and engineering is a concern for the aerospace industry, not only in Europe but in all mature industrialized economies. They face challenges posed by the emerging economies who are about to access the aircraft market and are not confronted neither with the problem of an ageing society nor a shrinking interest in natural science study programmes.

Labour shortages on the engineering level are not only a European but also a US concern. There has been a steady decline in the number of engineering graduates in the US since a peak in the mid-1980s. But the situation in the USA is different. More than EU Member States the science community in the USA can rely on immigrants. Around half of all engineers with PhDs in the US workforce under the age of 45 are foreigners. For the European AI it will be more difficult to access the global market for highly skilled employees, because of less open societies and language barriers, with the exception of the United Kingdom and Ireland. In general Europe is less attractive for these people than the US and most Member States are more restrictive. Concerted European initiatives by stakeholders of the AI and Member States could contribute to a better access.

The long-term aspect of dwindling labour supply is aggravated by the fact that regional mismatches in the labour market cannot easily be balanced. Cross-border mobility is an issue of concern for the European AI. Cultural, linguistic, and legal differences among European nations challenge companies' desires to shift work and employees between countries. It is necessary for training and education to coordinate multiple traditions and institutions and make them work across borders. Europeanisation and internationalisation of production requires transparent and recognised training courses and graduates. It increases interest in an internationally focused workforce with languages and intercultural competencies.

Workforce mobility is of growing importance for the European AI. National cluster units and the new European Aerospace Cluster Partnership (EACP) constitute opportunities to develop and expand transnational education and training programmes. The Hamburg Qualification Initiative (HQI) is an example of successful transnational cooperation. It has established an exchange in the field of training between the aviation clusters of Hamburg and the French aerospace valley of the regions Midi-Pyrénées (Toulouse) and Aquitaine (Bordeaux). The programme has evolved from the exchange of trainees to integrated transnational vocational training courses. In the meantime transnational activities have been expanded to Spain (Seville) and Italy (Campania).

1.3.2 The Openness of Third Markets

Safety and functional standards

Technical specifications, safety requirements and interoperability are important issues for the AI. In the past, Member States of the EU concluded bilateral agreements with the US FAA. These agreements were not well-suited to abolish barriers to trade and reduced the weight of Europe in international bodies. With the creation of the European Aviation Safety Agency (EASA) these national bilateral agreements have been replaced by EU-US agreements. Bilateral Aviation Safety Agreements (BASA) with Implementation Procedures for Airworthiness (IPA) has initialized technological cooperation between the European Aviation Safety Agency (EASA) and the US in the area of airworthiness.

There are noteworthy efforts taken by EU and US authorities to reduce barriers to trade and investment. However, much remains to be done and again and again national interests interfere with and put a brake on desirable developments.

Public support and fair international trade

The strong interest of governments in the aerospace industry has led to a broad range of schemes dedicated to support the sector. Since 1992 direct and indirect government support to the aircraft industry in the United States and the European Union has been regulated by the EU-US Agreement on Trade in Large Civil Aircraft (LCA). In late 2004, the US Trade Representative (USTR) gave notice of withdrawal from the 1992 EU-US LCA agreement, and requested consultations regarding alleged support to Airbus by the EU and some of its Member States. The rationale of the US added up to the allegation that government funding for Airbus (reimbursable launch investments) has to be regarded as interdicted and actionable according to the WTO-Agreement on Subsidies and Countervailing Measures (SCM Agreement).

The EU initiated a countermeasure by initiating WTO dispute settlement proceedings regarding a number of US measures, including federal state and local subsidies. For its part, the EU is challenging various US subsidies benefiting Boeing. In addition to the tax breaks (federal and off-shore agreements) the EU is challenging the US system under which:

- Boeing sees its own R&D expenses reimbursed;
- Boeing benefits from extensive cooperation with NASA and Department of Defence (DoD) engineers at no cost;
- Boeing is able to use testing facilities and equipment also at no costs; and
- A large number of patents and other technologies are also put at the disposal of Boeing free of charge.

The EU considers that the subsidies are in violation of articles 3, 5 and 6 of the SCM Agreement and article III of the WTO statute (1994). The EU intends to demonstrate before the WTO panel that the subsidies benefiting Boeing have allowed for aggressive pricing and put losses on Airbus.

On the 4th of September 2009 the WTO issued the interim report on the US-EU dispute to officials from the United States and the European Union. This preliminary ruling concerns the US complaints about unfair government support for Airbus. The interim report is confidential and not available for a discussion of the contents at this moment.

The current US-EU trade dispute is not a singular event. Brazil and Canada had engaged in a bitter and lengthy trade dispute concerning government support for their respective national aerospace industries. Canada put forward a complaint to the WTO and Brazil reacted with a counter measure. In the end both parties won but the practice of subsidising did not change. In the future, emerging competitors, such as China, Japan and Russia will access the global market with aircraft manufactured by national AIs that are nurtured by public funds.

The context of the much broader global development of the aerospace industry from the duopoly supply of large commercial aircrafts and new competitors entering the market for regional aircrafts casts new light on yet bipolar conflicts. There is some likelihood that the US withdrawal from the 1994 EU-US LCA agreement and the following WTO trade dispute may turn out to cause higher “costs” than any other possible result for both sides. A reconciliation of the EU and the US before the WTO final judgement and a common bilateral solution on how to guarantee fair trade in the global market for large aircraft could become exemplary in the advent of new emerging and publicly supported competitors.

1.3.3 Access to finance

The current financial crisis and the global recession have changed the sales market and funding terms for the AI. As a consequence it became harder for aircraft manufacturers to get credit or loans from banks for investment in their business. In addition to the recession and the credit squeeze, homemade difficulties have further complicated and aggravated the economic situation for the AI.

The global economic crisis imposed financial pressure on the air transport sector and forced major airlines to consolidate route networks. Both passenger and freight capacities had been cut already in 2008, but not sufficiently to avoid a drop in aircraft utilisation. Driven by this difficult operating environment, the profitability of airlines has weakened and the prospects for next year’s revenues are troubled. Low profitability of the airline business and the lack of liquidity in the financial sector pose a risk to new aircraft orders. Financing has become more difficult for clients of the AI. Additionally the aircraft leasing sector is shaken and contributes to a growing tightness in the market.

The absence of affordable credit is softened by sustained and increased government support in the form of export credit guarantees. As liquidity and financing are at risk, industry is asking EU governments to increase export credits in 2009 and beyond to support airline orders. In 2009 France pledged to guarantee EUR 5 billion in loans to airline companies to purchase aircraft and the German government announced to increase HERMES guarantees. Government backed export credit agencies (ECA) have significantly added on their aircraft financing activities. In 2008, around 15% of Airbus deliveries were safeguarded and 2009 this share is projected to rise to around 40%-50%.

Export guarantees are not limited to Europe. The support Boeing receives through U.S. government-backed loans and guarantees is essential to its ability to maintain a competitive edge. In fact Boeing benefits more than any other US company from loan guarantees provided by the public Ex-Im Bank. Additionally the US Export Credit Agency has expressed its willingness to provide funding to AI companies’ foreign sales.

In combination with the recession and the credit squeeze, domestic difficulties - as there are technical problems in aircraft programmes and delivery delays - complicate the economic situation mainly of smaller enterprises. The pre-financing of programme parts in the value chain has not been balanced by anticipated cash-flows. Therefore prime manufacturers should increase efforts to keep the programme paths.

Some suppliers in the value chain can hardly be replaced. Prime manufacturers are dependent on a viable supply chain, which is why they need to pay particular attention to the situation of smaller enterprises that are struggling to adjust to the worsened economic conditions. Some OEMs have developed backup sourcing structures in case suppliers of key importance may drop out, to safeguard their supply chains.

1.3.4 R&D Schemes

In all of the EU Member States with a noteworthy stake in the AI, the sector is perceived as crucial for the country's international competitiveness. Framework conditions have been created and clusters defined that contribute to strengthening the sector, but co-ordination is poor even within countries. France has been the only EU Member State identified as having noteworthy success in concerted initiatives by targeted funding. Generally speaking the objectives of public initiatives differ strongly among Member States (Table 2).

Table 2 Public Initiatives of Bigger Member States targeted at the Aerospace Industry

| | France | United Kingdom | Germany | Italy | Spain |
|--------------------------------|---|--|---|---|---|
| Possible role model for | Cluster initiatives: Coordinated approach for the distribution of R&D tasks by region (avoid double funding of similar activities) | Support for SMEs: Regional Development Agencies Productivity gains through restructuring/consolidation | R&D environment well inter-linked (cooperation of universities, research institutions and industry) | Decreasing dependency from defence sector (non-EU value chains) Strengthening of subsystem integrators | Clear industrial policy toward AI investment and R&D schemes |

Source: Bauhaus Luftfahrt, Ifo Institute.

The EU has created platforms for the co-ordination of initiatives dedicated for the AI. The EACP has been created for concerted actions of European AI clusters. ERA-NET is a European platform dedicated for the exchange of information among those involved in R&D: researchers, companies and public bodies. However, the AI has not yet made much use of this platform.

Generally speaking there exists a division of labour between the EU and the Member States in R&D schemes:

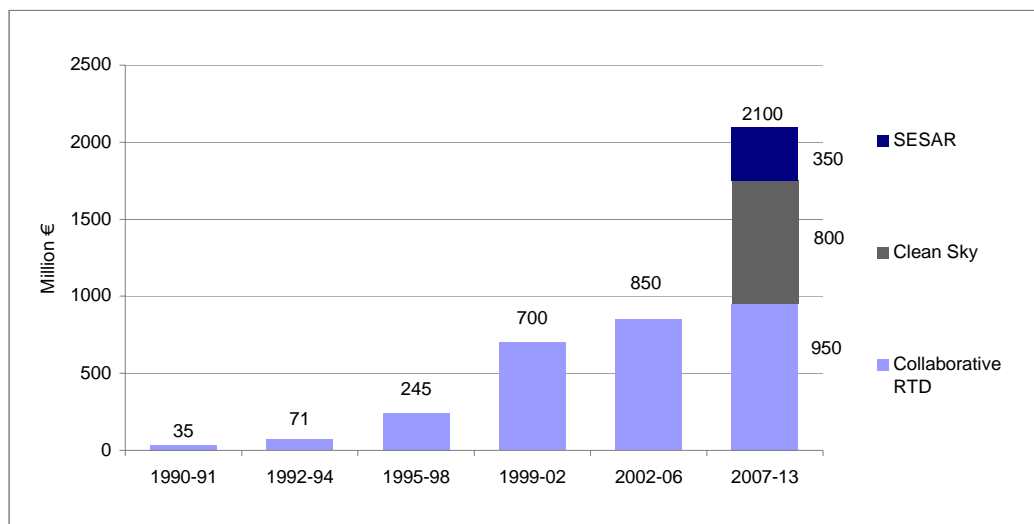
- Most of the basic research is funded by the Member States;
- Collaborative research is funded by the European Commission (this comprises feasibility studies and the development of demonstrators); and
- Development activities dedicated to new aircraft are funded by the Member States.

The EU has launched several initiatives for the AI. R&D schemes on aircraft technologies, air traffic management and the sustainability of air traffic have a direct impact on the sector and are targeted at improving the AI's competitiveness and the sustainability of airlines' service supply (Figure 1). These schemes are welcomed by the AI. However, some weaknesses have been identified:

- The administrative burden has grown in FP7 compared to FP6;
- A tool such as the Joint Technology Initiatives (JTI) – a new instrument created by the European Commission for FP7 to allow large-scale and long-term public private research partnerships to implement the ambitious research priorities of the Strategic Research Agenda (SRA) – is of major importance for the EU AI. However the rules for application and management are not adequate to the needs of large projects.
- There is some anxiety that the allocation of funds to these strategic projects is crowding out collaborative research at the European level.
- There is some concern that it is difficult to secure Intellectual Property Rights (IPR) in European projects. Proposals for projects have to provide detailed information on technologies and references.

Not all of these points raised by the industry can be solved. However, these arguments should be used to intensify the communication between the European Commission and industry stakeholders. Efforts to increase efficiency are important if one compares Europe and the US. The US AI enjoys the advantage of a much bigger defence and space sector and can benefit more from dual use of R&D. Additionally in an environment of tighter public budgets the development a more supportive set of framework conditions in the area of R&D must be high on the agenda. Even the coordination of R&D in defence projects by Member States incorporates not only the potential to more efficiency but to generate spill-over effects benefiting civil aircraft.

Figure 1 Funds of Relevance for the EU27 Aerospace Industries



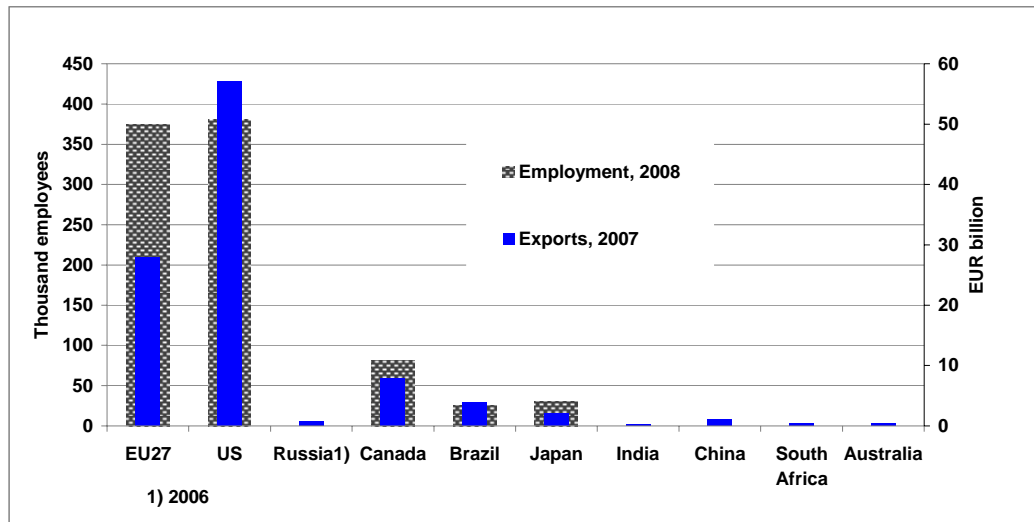
Source: European Commission DG Research.

1.4 EU27 Aerospace Industry in International Competition

The most important economies in the global AI market are the US, EU-27, Canada, Brazil and Japan. With the exception of Japan, headquarters of worldwide leading OEMs of

these economies are domiciled in these economies. Japan is strongly linked to the US value chain as a supplier of high-tech components for aircraft. Brazil is the only emerging country that commands a noteworthy stake in global trade. These days the other countries' AIs are only of minor importance. However, in particular Russia, China and India are within the focus of the study both as emerging competitors and promising sales markets. (Figure 2)

Figure 2 Key Figures for most Important Aerospace Industries



Source: Eurostat; Associations of the industry, National statistical bureaus, Comtrade; own calculations

The US is leading in international trade with exports of EUR 57 billion in 2007. Next in this ranking is the EU27 with around half that export volume. It needs to be mentioned that these figures contain not only civil but also military aircraft.

A more detailed analysis at subsector level discloses that the European AI has gained market shares in important segments. Europe has become the global leader in the supply of LCAs, the Airbus-Boeing duopoly. With the A380, Europe is leading the market for very large civil aircraft overtaking the decades-long monopoly of Boeing.

Additionally Europe is by far in the lead in international trade of civil helicopters. The success has been based on the development of superior technologies. It was supported by strategies dedicated to access foreign markets, the production in target countries followed by MRO services.

In regional aircraft markets there are also two dominant global players, Embraer (BRA) and Bombardier (CA). Embraer has been successful throughout the current decade and gained a major market share. Both of these manufacturers are about to launch new aircraft on the leading edge of technology. There are few European manufacturers in that market, most important is the French/Italian ATR that relies solely on conventional turboprop technology.

Business and General Aviation, the segment with the smallest aircraft, is dominated by US and other American manufacturers. The French company Dassault plays a relevant role in this market. Other European manufacturers only play a minor role.

Two main European OEMs, Rolls Royce (UK) and Snecma (F), hold almost 40% of the world market for engines. Additionally Snecma and GE (US) run a very successful joint venture in the global market dominating the market for LCA engines. Furthermore many first tier suppliers in this sector are European companies. Due to the existence of trans-continental consortia it is not easy to clearly see which economy is in the lead. The dominant engine consortium for LCA is the US-F joint venture CFM. It is far ahead in terms of market shares compared to the other important consortium IAE (US-UK-JP)

Europe plays a significant role in the market for maintenance, repair and overhaul (MRO). Aircraft need services regularly and in particular in the engine market their value is even higher than engine turnover. With a lifespan of more than 30 years services provide aircraft manufactures permanent access to their clients. (Table 3)

Table 3 The International Competitiveness within the Subsectors of the Aerospace Industry

| Indicator / Subsector | Large civil aircraft | Regional Aircraft | Business / general aviation | Helicopter | Engines | MRO |
|-----------------------|--|--|--|--|--|---|
| Market situation | Duopoly | Two dominant players plus smaller ones | Dominance of US players | Dominant European and US players | CFM, dominant US-F alliance for LCA engines IAE US-UK-JP alliance | Many independent and dependent players |
| Development | Regional suppliers enter the market, China builds A320/B737 competitor | Japan, Russia and China enter the market | Current decline offers the potential for consolidation | Ongoing trend growth due to lower dependency on civil market | Strong cooperation as potential problem for anti-trust authorities. Counter-movement: dissent about future technology inside IAE | <u>Negative:</u> Environmental schemes may foster fleet renewal <u>Positive:</u> Delayed replacement, high energy prices foster upgrading of aircraft by new engines, wing-lets etc. |
| European AI | Gained market share, balance to USA, common challenges | Small player, conventional technology | Dassault and some smaller players | Civil market leader, technology leader | Two large OEMs are in both relevant alliances | Strong European position |
| Trade surplus | Strong growth since 2001 2008: 30.2% (responsible segment LCA) | | Losses in trade shares and increased trade deficit | Strong growth since 2001 2008: >40% | na | Na |

Source: Ifo Institute, Bauhaus Luftfahrt.

Emerging competitors and patterns in international markets

Since long the market for civil aircraft has been divided between four economies. The US and Europe command the market for LCA. The market for regional aircraft has been dominated by Canada and Brazil. In recent years the market environment is changing. The well-established manufacturers of regional aircraft have launched programmes that by the size of the planes access the lower end of the LCA market. Moreover, new players are about to enter the regional aircraft market.

Canada is part of a North American cluster of the AI. The value chain for regional aircraft and LCA is characterized by strong cross-border deliveries of parts and components and enables companies to raise scale effects. The international trade in aircraft parts plays a

noteworthy role in imports and exports. It needs to be noted that the EU has become an important supplier of parts to the Canadian AI.

The Brazilian AI is located remote from mature industrialized centres. This regional particularity had an impact on the industry's structure. The companies of the AI are strongly dependent on Embraer, the Brazilian OEM. In foreign trade the exports of aircraft parts play only a minor role. The Brazilian AI can build on a comprehensive know-how for the manufacture of aircraft. This is in particular remarkable when Brazil is understood as an emerging country.

Russia is not a newcomer in the market for aircraft. However, it has never played a role in the global market for civil aircraft. Although Russia can trust in a strong defence industry the efforts to enter the civil market need Western support. The limited resources are merged for the development of a regional aircraft in a joint venture of UAC, a company created under the auspices of the Russian government, with the Italian Alenia. First tests disclosed that the aircraft performance meets international standards. However, many of the key-components originate from Europe and the US. Specific trade barriers are in force to protect the Russian market from foreign competition in this size class. The Russian airlines need to renew their fleets and the market provides promising perspectives. For LCA and small aircraft there are no major barriers to market access.

China has started opening up of the economy during the early 1980s. It has successfully progressed with cautious steps and pursued strong industrial policies, in particular for strategic branches. Aircraft based on Chinese design have not been convincing in the past and the restructuring of the Chinese AI has not made much progress. Most of the production is based on licences. The recently developed aircraft has been derived from a former McDonnell Douglas plane. Many key components from global players with specialized knowledge have been used to meet international performance standards. This fact underscores the importance of strong, know-how driven firms in the value chain for a competitive AI. US and EU companies have invested in footholds in China. Airbus has launched the final assemblage of aircraft in China.

India is one of the large emerging countries with promising perspectives. However, it opened its economy late. In recent years it has reduced barriers for the acquisition of domestic companies. Currently the Indian AI is dominated by a big state-held group, but the government has taken measures for more competition. Structural changes are on the way: large Indian industrial groups are poised to get a foothold in the AI and so do the global players of the AI. The latter have invested in India not only to exploit cheap labour supply for production, but to make use of qualified labour for engineering, design and software development. The Indian government has set-up a plan to improve and expand the infrastructure for air traffic that shall prevent bottlenecks in ground services, when air services will continue to grow strongly.

Japan is a high-tech country but has not been successful with the marketing of own civil aircraft. However Japan is integrated in the US value chain and has become a supplier of advanced parts and components. The Japanese AI has participated in several US aircraft programmes and can rely on domestic experience in design, testing and manufacturing. The US is dominating the Japanese market for civil aircraft. The Japanese AI is about to launch a regional aircraft. For marketing and global aircraft services Mitsubishi and Boeing have agreed on cooperation.

The integration of Japan and Canada in the value chain of the US AI is evaluated as an asset in international competition. The US can trust on two industrialized economies with their high-tech potential for aircraft programmes and can exploit scale effects.

Companies' strategies of major players are driven by globalization and target countries can be classified by two general objectives, the exploitation of comparative advantages, in particular driven by low-wages, but to a certain extent also by the supply of skilled labour. Brazil, Mexico, Malaysia as well as the new Member States are among these Low-Cost Countries (LCCs). The second group of countries is subsumed under the label Global Investment Strategies (GIS). They provide (beyond comparative advantages) bright business perspectives, such as China, India and Russia.

Traditionally the US AI is leading in globalization. It has higher shares in emerging markets than Europe. This is explained not only by the strength of US OEMs, but also by highly competitive sub-system integrators in the value chain. Moreover the US administration uses the strength in global defence markets to incite target countries to also procure civil aircraft. Europe is successfully following this pattern of globalization.

The major OEMs are poised in particular with respect to access to GIS countries. Target country governments ask for offset obligations and simultaneously envisage to develop their own AIs. The investment in production sites and research centres in emerging countries can be exploited to outbalance the shrinking labour supply in industrialized countries, but if this trend continues in the long-run it incorporates the risk to hollowing out the know-how basis of the European AI.

1.5 Competitive Assessment

The European AI has been created from national industries. Initiatives have started at the end of the 1960s. It has been recognized that individual states do not have the potential to allocate sufficient resources to catch up the lead of the overwhelmingly strong US AI. One crucial element of public policies was the foundation of a European OEM, with the ability to challenge the supremacy of the US. An overview of the SWOT-Analysis is provided with Table 4.

Strengths

The efforts have resulted in the creation of EADS and Airbus. The aircraft programmes have turned out to be successful. Civil aircraft became leaders in technology and met the requirements of airlines. Only recently Airbus became market leader in LCAs. The EU has been even more successful with civil helicopters. Unique technological concepts and global strategies supported by investment in important sales markets have been major drivers.

The EU AI strengths in technologies are manifold. Generally speaking, the EU is on par with the US. In particular in engine technologies, flight mechanics and aerodynamics the EU commands a good position. Europe can also count on a strong know-how basis in air traffic management systems (ATM).

It needs to be noted that the European AI has launched several aircraft programmes in parallel in the current decade. It has accelerated the pace of innovation in LCAs. This is

evaluated as an investment in future, a good strategic starting point that will pay back in revenues in the decades to come.

Table 4 SWOT Analysis

| Internal Elements | External elements |
|--|---|
| Strengths <u>Performance of the European AI:</u> <ul style="list-style-type: none"> Market leader with technologically advanced final products: LCA (A320, A380), civil helicopters Strong in engine manufacturing and MRO services Strong in ATM technology (but: deficiencies in procedural implementation of SESAR) <u>Innovation and R&D:</u> <ul style="list-style-type: none"> Strong position in flight mechanics and aerodynamics Heavy investment in new projects <u>Organisation and industry structure:</u> <ul style="list-style-type: none"> Long experience in the integration of increasingly outsourced subsystems Strategic commitment to increase efficiency along the value chain, but: outsourcing to non Euro-area goes to the detriment of European locations Integration of neighbouring countries in North Africa, eastern countries | Opportunities <u>Innovation environment:</u> <ul style="list-style-type: none"> Clear guidelines for future requirements on aircraft, in particular emissions and noise (ACARE SRE, FP7) Demanding environmental obligations (ACARE goals, ETS) and adjusted R&D funding (e.g. FP7) foster clean technology development, which may promote an important international winning margin (while it is a burden for European airlines) <u>National policies:</u> <ul style="list-style-type: none"> Strong interest of Member States in the AI and related initiatives <u>Labour supply:</u> <ul style="list-style-type: none"> Qualified personnel (but constant supply and necessary mobility are endangered) Accession of new Member States provided the opportunity for the exploitation of efficiency gains and cost savings by integrating these neighbouring countries in the value chain |
| Weaknesses <u>Performance of the European AI:</u> <ul style="list-style-type: none"> Weak position in the regional aircraft market Delay in market launch of A30X opens the opportunity for competitors to enter this profitable market segment <u>Innovation and R&D:</u> <ul style="list-style-type: none"> Economic performance has come under pressure in recent years (caused by too many new simultaneous aircraft programmes and delays) <u>Organisation and industry structure:</u> <ul style="list-style-type: none"> Corporate governance affected by national interests (ambivalent position of important private owners of EADS) Fewer companies of sufficient size and capability for large risk sharing projects than in the US | Threats <u>Innovation environment:</u> <ul style="list-style-type: none"> Spill-over effects for civil aeronautics from defence R&D less important than for the US Growing public budget constraints reduce R&D in the defence sector. Authorities' requirements for "reverse dual use" ask for spill-overs that put more strain on the AIs financial situation Big European projects (PPP) with far-reaching objectives not adequate organized Stability of framework conditions for aerospace industry at risk by frequent changes in environmental and security regulations <u>National policies:</u> <ul style="list-style-type: none"> Insufficient coordinated national R&D schemes, even within the Member States National interest in local employment and technology lead to non-complementary policies in the AI (duplication of activities) <u>Labour supply and image of the Industry:</u> <ul style="list-style-type: none"> Long-term decline in labour supply as in other mature countries, but a disadvantage compared to emerging countries Difficulties in cross-border acquisition of staff (language, different social systems) Europe still less attractive for foreign high-skilled staff than the US Growing labour costs endanger comparative advantages and profitability in the long run <u>Financial markets and exchange rate risk:</u> <ul style="list-style-type: none"> Europe as a production location suffers from exchange rate risks, as revenues are in USD European financial market provides less funding opportunities than the US Loss of attractiveness of the AI (general decline of manufacturing industries in the public opinion and environmental aspects in particular) |

Source: Ifo Institute, Bauhaus Luftfahrt.

The EU AI has a long-standing experience in the management of cross-border value chains. This experience reduces the risk of OEMs in their efforts to focus on their core activity, system integration and outsource more work packages to suppliers inside and outside the EU. The commitment of OEMs to increase the efficiency along the value chain vertically, by organizational changes, and horizontally, by regional diversification, contributes much to the efficiency of the EU AI. The US AI has only recently started similar activities and suffered from less efficient value chain management.

The high pace of innovation has induced high expenditures to gain future revenues. This has turned out to the detriment in the short- and medium-term period for the EU AI in face of the global financial crisis and the slowdown of air traffic as a result of the world-wide recession. Although long-term solvency is not in danger the shorter-term liquidity of many companies has come under strain.

Weaknesses

Up to now the market for regional aircraft is dominated by Canada and Brazil. Several emerging countries are on the brink of launching their own aircraft in this market. There are only a few European manufacturers in this market. They are not on the leading edge of technology. The business aircraft market is dominated by US players. One big European manufacturer and some smaller companies are in this business.

More of importance for the long-term competitiveness of the European AI will be the aircraft programme for the successor of the A320, the smallest European LCA. The decision to delay the launch of the A30X gives leeway to competitors that are about to launch new regional aircraft that by their size access the lower end of the LCA market that has turned out to be very profitable.

The most important private owners of the dominant European firm, EADS, are ambivalent with regard to their industrial involvement. This can turn out to become a risk for the EU AI. Long-term strategic decision making can turn out to be difficult and public intervention incorporates the potential of economically suboptimal decisions.

Compared to the US, the European AI has less large companies in the value chain. This is a detriment in the face of strategies directed towards the outsourcing of bigger work packages to suppliers with sufficient risk sharing potential. Such high-profile Tier-1 and Tier-2 companies form the backbone of the industry and contribute much to the strength of the US AI in the global market. This is one explanation why more US firms have become partners in the value chain of recent European aircraft programmes than before.

Opportunities

The close interaction between the EU and the industry is advantageous for the AI. Common initiatives are carried out to adjust the framework conditions and to meet political requirements. Of special importance in this respect are environmental aspects that have to be met by limit values, target values for CO₂ emissions, etc. The most important platform is the Advisory Council for Aeronautics Research in Europe (ACARE). If it turns out that Europe becomes a benchmark for other economies in this area these activities will add to the competitiveness of the European AI.

All Member States with a noteworthy stake in the AI understand the industry as crucial for progress in high-tech areas and expect spill-over effects to other industries. They support the AI by the provision of R&D infrastructure and basic research programmes. Cluster initiatives are dedicated above all to create networks that enable smaller firms to

strengthen their position in the market. To a certain extent these activities could contribute to reduce the risk of the EU AI if companies are incited to grow / merge to become firms with higher risk sharing potential and management abilities to run large work packages as subsystem integrators.

Currently the labour supply and its qualification on all levels are an asset as in international competition. The accession of new Member States (after 2004) to the EU has contributed to well qualified personnel becoming available at appreciable costs. The intra-European division of labour has made much progress the years after. The competitiveness of Europe as a production location has improved through these changes in the regional structure of production.

Threats

The defence and the space industry of the US are much bigger than their European counterparts and strongly dependent on public support. Spill-over effects are of importance for the US civil aircraft industry and provide advantages that can hardly be underestimated. This is to the detriment of the European civil AI that cannot build on spill-over effects of similar size. Moreover the European defence industry falls under responsibility of the individual Member States. Public budgets are fragmented and R&D projects less integrated.

Growing budget constraints have induced authorities to ask the AI to “reverse dual-use” that means the defence industry should benefit from spill-over effects from civil AI and not the other way round as usual. This would save public funds, but put additional financial pressure on the AI. An improved coordination on the level of the EU can contribute not only to a more efficient use of the funds, but could provide impetus to spill-over effects to civil AI and suspend financial stress to a certain extent.

The AI is dependent on long-term reliable framework conditions. The development of new products takes several years and the lifespan of an aircraft is up to 30 years. Environmental protection is a topic of outstanding importance and regulation is bitterly needed. Europe can build on an intense communication with the industry. However, frequent changes in provisions put additional imponderability on an industry in a high-risk business. Unpredictable changes could endanger European manufacturers in competition with players from countries that are less decided to pursue environmental objectives.

The EU is committed to support the evolution of the AI. The funds dedicated to technological progress and innovation have increased. However, there has been some criticism that the application for projects under the FP7 Framework Programme has become burdensome because of higher administrative requirements compared to FP6. The regulation of Joint Technological Initiatives (JTI) is not adequate to the size of these projects organized as public-private-partnerships (PPP). This can turn out to be a detriment for the AI, because these projects are dedicated to reach long-term objectives of crucial importance.

Member States foster their domestic AI. There are examples for common initiatives of countries. However, in general there exists no co-ordination or institutionalized information on activities. A potential risk of double work exists and synergies get lost. In the face of growing budget constraints all efforts must be taken to increase efficiency. The US is – in spite of the even bigger constraints in public budgets – in a better position. Spill-over effects from the defence industry can be increased. Emerging competitors such as China and India do not suffer that much from budget constraints as Europe.

Some factors will weaken the currently favourable supply of labour for the EU AI in the long-run. Above all these are the demographic development and shrinking interest in mathematics, informatics, natural sciences and technology. Moreover; the image of the AI is worsening. These are developments that take place in most other industrialized countries. But in the emerging economies the situation is different and their AIs will benefit from a trend to higher qualification in key-competencies. For the EU the situation is even worse than for the US that relies on greater highly qualified labour inputs from abroad than the EU. European countries should improve their attractiveness for qualified personnel from all over the world the more as the intra-European mobility of labour is lower than in the US.

The new Member States have been successfully integrated in the value chain of the EU AI and contributed to an increase in competitiveness. However, wage increases reduce their comparative advantages in the long run and the attractiveness of the EU as a production location will be weakened. Some relocation to countries further east and North Africa is an early indication on a division of labour that reduces the share of value added produced in the EU of the total output value of the EU AI.

The EU as a production location is faced with another problem. Traditionally the USD is the currency for invoicing in the sales market. Therefore hedging is an important topic for the EU AI. Financial hedging is a risky and costly business. OEMs try to reduce this problem by “natural hedging”, procurement from the US or countries with weak or USD pegged currencies.

1.6 Perspectives for the European Aerospace Industry

Medium-term outlook

The financial crisis affects the AI in two ways. The first is worsened access to credit, which endangers the funding of the operating business (short-term) as well as the participation in large (long-term) aircraft programmes. Scarce funding has a negative impact on the launch of projects and the allocation of resources and aggravates the situation induced by problems and delays in recent programmes. This incorporates the potential to force the industry to reschedule new projects (A350, New Short Range). The second channel is the clients' business activity that also suffers from the global crisis. This impact has been investigated by IATA in December 2008 and updated in September 2009. The latest forecast expects a more severe breakdown in 2009, but a more dynamic recovery in 2010 than at the end of 2008. However, the upswing in 2010 will not be sufficient to compensate for the slump in 2009, in particular in air freight.

This is the setting for the necessary capacities and the investment needs of airlines. Up to now, the current crisis has had only an impact on the reduction of new orders for the AI. The record height of order backlog has prevented deliveries from falling. 2009 will be another year with a higher number of deliveries, but in the years thereafter, output will shrink. The available forecasts vary between two and at least three years until the downturn bottoms out. For the years after, a strong recovery is expected, above the trend growth rate that has been around 5% for decades.

Long-term perspectives

The long-term forecasts for the globally leading OEMs are based by and large on an average annual growth rate 5% (for passenger flows somewhat lower for freight transported

somewhat higher). An interesting result emerged by comparing the prognoses published by Boeing and Airbus. Although they do not differ much in trend growth, they show different developments in the market by the size of aircraft. Airbus predicts stronger growth in the market for very large aircraft (A380), but also at the lower end of its product programme, the smaller large aircraft and additionally regional aircraft can enjoy a more dynamic development. Boeing expects high growth momentum in the middle of the size spectrum, where its Dreamliner is positioned.

The underlying reason for these differing expectations has been caused by the use of different scenarios. Airbus expects (due to high oil prices and a consolidation of airlines) that airlines will not introduce many new long distance city pairs over the next 20 years. Large hubs will benefit from this development and their strengths will be based on well elaborated regional networks. These changes will stimulate the demand of very large aircraft and commuter planes. Boeing will benefit more from the global air traffic if oil prices remain more moderate and airlines are opening up new, more client friendly city pairs.