50 years of European Aeronautics. How further?

Fred Abbink

RWTH Aachen, 28 March 2017
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1. Introduction
2. Airbus
3. Garteur, EREA and CEAS
4. EU Aeronautical Research Programmes
5. How further?
6. Conclusions
Milestones and enlargement of EU

- 1951 Treaty of Paris (European Coal and Steel Community ECSC)
- 1957 Treaty of Rome (EEC, ECSG, Euratom) (6 members)
- 1986 Single European Act (12 members)
- 1992 Maastricht Treaty (EC, CSFP, PJCC, JHA)
- 2007 Lisbon Treaty (EU)
- 2013 Growth to 28 members
- 2017 Brexit

European achievements

- Single European Market
- Single Outer Border (Schengen)
- Single Currency (Euro)
- European Aviation Safety Agency (EASA)
- European Defence Agency (EDA)
- ESA, ArianeSpace
- Copernicus and Galileo
- Single European Sky (SES)
- European Framework Programmes
- JUs CleanSky and SESAR
European Aeronautics RDT&E

- **European Research and Research Establishments**
  - 1952 AGARD (NATO)
  - 1973 GARTEUR (GE, FR, IT, NL, SP, SW, UK)
  - 1976 DNW (GE-NL)
  - 1988 ETW (GE-NL-FR-UK)
  - 1993 Council of European Aerospace Societies
  - 1994 EREA (GE, NL, FR, SP, IT, SW, PO, RO, CZ)

- **European FrameWork Programs**
  - 1989-1992 FWP 2
  - 1992-1994 FWP 3
  - 1995-1998 FWP 4
  - 1999-2002 FWP 5
  - 2003-2006 FWP 6
  - 2006-2013 FWP 7
  - 2014-2021 Horizon 2020

- **EU Joint Undertakings**
  - 2007-2024 Clean Sky and SESAR
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National European Jet Airliners
(“Quantity has a Quality of its own”)

<table>
<thead>
<tr>
<th>United Kingdom</th>
<th>Boeing</th>
<th>Douglas</th>
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<tbody>
<tr>
<td>• De Havilland Comet, 1949 (114)</td>
<td>• Boeing 707, 1957 (1.010)</td>
<td>• DC8, 1958 (556)</td>
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<tr>
<td>• Hawker Siddeley Trident, 1962 (117)</td>
<td>• Boeing 727, 1963 (1.832)</td>
<td>• DC9, 1965 (973)</td>
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<td>• Vickers VC10, 1962 (54)</td>
<td>• Boeing 737, 1967 (6.000)</td>
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<td>• BAC 1-11, 1965 (244)</td>
<td>• Boeing 747, 1969 (1.416)</td>
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<thead>
<tr>
<th>France</th>
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<tr>
<td>• Sud Aviation Caravelle, 1955 (282)</td>
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<td>• Dassault Mercure, 1971 (54)</td>
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<tr>
<th>Germany</th>
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<tr>
<td>• VFW 614, 1971 (19)</td>
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<thead>
<tr>
<th>The Netherlands</th>
<th></th>
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<tr>
<td>• Fokker F 28, 1967 (241)</td>
<td></td>
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</tr>
</tbody>
</table>
1967 Airbus
“Toulouse or not To Lose”

- **1960s** French and UK 200 seater airliner plans:
  - Sud Aviation: Galion,
  - BAC: BAC 2-11,
  - HSA/Breguet/Nord Aviation: HBN 100

- **July 1967** France, Britain and Germany ministers agreed to take appropriate measures for the joint development and production of an “airbus.” (FR 37.5 %, UK 37.5%, GE 25%). Rogier Béteille became technical director of A300 Programme.

- **Dec 1968** Britain announced to pull out. (Airbus Brexit). GE proposed to step up to 50% if FR did the same. HSA needed £35 million for tools to design and build the wings. GE provided the loan.

- **May 1969 Paris Airshow** A300 born as partnership (GIE) of Sud Aviation, HSA and Deutsche Airbus.
Airbus (New technology and “Economy of Scale”)

1972: A300
• 561 produced

1982: A310
• 255 produced

1987: A320
• 7,421 produced
Airbus Deliveries and Market Share

Deliveries and market share

<table>
<thead>
<tr>
<th></th>
<th>A300/A310</th>
<th>A320 family Single aisle</th>
<th>A330/A340/A350</th>
<th>A380</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total orders</td>
<td>816</td>
<td>13066</td>
<td>2881</td>
<td>319</td>
<td>17082</td>
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<tr>
<td>Total Deliveries</td>
<td>816</td>
<td>7421</td>
<td>7421</td>
<td>207</td>
<td>10208</td>
</tr>
<tr>
<td>Backlog</td>
<td>0</td>
<td>5645</td>
<td>1117</td>
<td>112</td>
<td>6874</td>
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<tr>
<td>Aircraft in operation</td>
<td>336</td>
<td>7101</td>
<td>1649</td>
<td>207</td>
<td>9293</td>
</tr>
</tbody>
</table>
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1973 GARTEUR MoU

Council
Executive Committee

Groups of Responsables

Aerodynamics
Aviation Security
Flight Mechanics, Systems & Integration
Helicopters
Structures & Materials

AG
AG
AG
AG
AG

EG
EG
EG
EG
EG
1976 European Wind Tunnel integration

1976 German Dutch Windtunnel DNW
-German-Netherlands (50-50%)

1988 European Transonic Windtunnel
-Started as German-French-UK-NL
(NL 7%, the others 31% each)
-At Present German, UK, NL
(NL 10%, the others 45% each)
1994 European Research Establishments

- 11 Research Establishments
- 5000 researchers
- 0.5 Billion Euro /yr. research projects
- 175 MSc/PhD thesis/yr.
- 6000 Publications/yr.
- 10 Billion Euro worth of facilities
1993 Council of European Aerospace Societies

- 1993 Paris Airshow: Signing Confederation of European Aerospace Societies CEAS
- 2003 Hamburg: Foundation of the Council of European Aerospace Societies CEAS
- 2017 CEAS has 13 Member Societies, over 34,000 individuals, CEAS quarterly Bulletin, and peer reviewed Space and Aeronautical Journals
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1988 EUROMART and BRITE EURAM
2000-01 Aeronautics for Europe & Vision 2020
2001-today ACARE

Strategic Research & Innovation Agenda
Volume 1
EU Funding for Aeronautics RTD

Since 1990 the EU has funded over 400 RTD projects representing a budget of about €4 billion (EU funding ± 50%).

- 350 SESAR
- 800 Clean Sky
- 950 Collaborative RTD
2007-2024 Clean Sky

- EU Contribution for Clean Sky: 800 MEuro and for Clean Sky 2: 1.755 MEuro
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Major Global Changes

• 1989 End of Cold War, break up of USSR
• Unification of Germany, Peace dividend
• Gulf war, Bosnian & Kosovo wars, Iraq war
• Climate Change (Kyoto, IPCC, Kopenhagen, Paris)
• Increasing energy costs and limited resources
• Globalizing of the economy (China, India, Brazil)
• 2008 Financial crisis
• Wars in Libya and Syria, mass migration
• Crimean annexation,
• Cyber, Brexit and new US President
## World Population and Defense Spending 2015

<table>
<thead>
<tr>
<th>Country</th>
<th>Population (Million)</th>
<th>Defense Spending ($Bn)</th>
<th>GDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>7400</td>
<td>1676</td>
<td>2.3</td>
</tr>
<tr>
<td>USA</td>
<td>324</td>
<td>596</td>
<td>3.3</td>
</tr>
<tr>
<td>China</td>
<td>1381</td>
<td>215</td>
<td>1.9</td>
</tr>
<tr>
<td>EU</td>
<td>500</td>
<td>195</td>
<td>1.4</td>
</tr>
<tr>
<td>Russia</td>
<td>147</td>
<td>66.4</td>
<td>5.4</td>
</tr>
<tr>
<td>UK</td>
<td>65</td>
<td>55.5</td>
<td>2.0</td>
</tr>
<tr>
<td>India</td>
<td>1311</td>
<td>51.3</td>
<td>2.5</td>
</tr>
<tr>
<td>France</td>
<td>67</td>
<td>50.9</td>
<td>2.1</td>
</tr>
<tr>
<td>Germany</td>
<td>82</td>
<td>39.4</td>
<td>1.2</td>
</tr>
<tr>
<td>Italy</td>
<td>61</td>
<td>23.8</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Sipri 2016 Factsheet
European-built EU Fighter Aircraft
(The EU Air Forces operate around 2100 Fighter Aircraft)

- **Eurofighter Typhoon**
  - First flight 1994
  - 488 built
  - 446 used by the UK, GE, IT and SP Air Forces

- **SAAB JAS 39 Gripen**
  - First flight 1988
  - 247 built
  - 232 used by the SW, CZ and HU Air Forces
  - 36 ordered by Brazil

- **Dassault Rafale**
  - First flight 1986
  - 154 built
  - 131 used by the French Air Force and Navy
  - 36 ordered by India
US-built EU Fighter Aircraft

• **General Dynamics F-16 Fighting Falcon**
  - First flight 1974
  - 4573 built
  - 463 operated by BE, DK, NL, NO, GR, IT, PL, PO and RO Air Forces

• **Boeing Northrop EF-18 Hornet**
  - First flight 1978
  - 1480 built
  - 148 operated by SP and FI Air Forces

• **Lockheed Martin F-35 Lightning II**
  - First flight 2006
  - 200 built (foreseen market > 2500)
  - 344 ordered by DK, NL, NO, IT and UK Air Forces
The **European Union** should evolve from a **political and economic union** of 28 (27) member states also into a **strong European Defence Union with a joint European**:  
- Foreign Policy  
- Department of Defence  
- Army, Navy and Air Force  
- Military Procurement Organisation  
- SES and Air Traffic Management Organisation  
- Outer Border control  
- **Civil and Military aircraft industry**  
- **Civil and Military aeronautical RDT&E programmes**  
- Aeronautics and Space Administration  
- Institute of Aeronautics and Astronautics
Pericles (500 BC)
• Freedom is the sure possession of those alone, who have the courage to defend it.

Niccolò Macchiavelli (AD 1513)
• The chief foundation of all states are good laws and good arms.

• There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.
“It is not the strongest of the species, nor the most intelligent that survives. It is the one that is the most adaptable to change.”

Charles Darwin: The Origin of Species (1859)
In the last 50 years Europe has made enormous steps towards the consolidation of the civil aeronautical industry, aeronautical RDT&E and infrastructure. This has resulted in the Airbus Group, that gradually obtained 50% of the world commercial airliner market.

Europe still suffers from the fact that it has 28 (27) nations that form the EU. This results in fragmented (national) military aircraft industry, research, infrastructure, procurement and operations.

Europe needs to increase its military budget to over 2% of its GDP and become as successful in the military aircraft production as Airbus for the commercial aircraft production.

Germany has been an example for Europe in many ways. As well as for the realisation of the European commercial aircraft industry, as for the European aeronautical research. Germany should now take its role for the further consolidation of the European aeronautical industry and European RDT&E infrastructure.