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CEAS COUNCIL OF EUROPEAN AEROSPACE SOCIETIES
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GENERAL • THE AERONAUTICS BRANCH • THE SPACE BRANCH
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Editorial

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Editor -in-Chief, CEAS Bulletin

WELCOME TO THE HAES

At the CEAS Council Meeting held in Paris on 20 June, Dr G. Simeonides presented the candidature of the Hellenic Aeronautical Engineers' Society (HAES). After discussion,the Board decided to invite the latter to join the Council, and on 29 November in London at RAeS Head Office, where the CEAS General Assembly will take place, Sir Colin Terry will welcome Dott. Triantafillos Tsitinidis, President of the Greek Society.

So, growing from eight to nine Members, the CEAS marks a new step forward.

Founded in 1975, the HAES is the scientific and professional association of all licensed aeronautical engineers in Greece, its main purposes being the appraisal of the scientific level of its members,and the support and provision to the State of all services concerning aeronautics,with a view to promoting technology in the country.

Endowed with a quite important aeronautical educational structure- Technical Educational Institution of Halkis, National Technical University of Athens, University of Patras,specialised courses offered in many other Universities- Greece is very active in aircraft engineering, design, analysis and testing, Research and Technology Development (it participates in particular in many actions of the EC Framework Programme), aircraft maintenance and repair, airline operations, regulations and standards. There exists also significant activity on technology development-integration as well as design and production in the fields of defence electronics and security.

The HAES is the formal sectoral society of the Technical Chamber of Greece (more than 90,000 active engineers).

By joining the CEAS,the HAES will of course establish closer relations amongst the Aeronautical Societies and better integration within the European Aeronautical Community.

And on the other hand, there is no doubt that it will give a new decisive impulse to the CEAS,precisely at a time when we are experiencing a new phase in our development.

Thank you and congratulations, Dott. Tsitinidis!

CONTENTS

THE TWO LATEST CEAS COUNCIL MEETINGS

The third Meeting of the Board of Trustees of the CEAS was held at the ESA Headquarters, Paris, on Wednesday 20 June; the fourth one was held at the Estrel Hotel, Berlin, on Monday 10 September. The main issues resulting from them are summarized here below.

New CEAS members

– On 20 June, presentations were given by representatives of the Greek and Polish Societies, which covered the structure and size of the societies, their operation and the extent of aerospace activity in their countries. After Council member discussion, it was agreed that:
  - the **Greek Society** should be invited to join the CEAS;
  - the **Polish Society** should be invited to be associated with the CEAS for the next twelve months during which time it would be allowed to develop further with a view to facilitating its entry.

Concerning the Greek Society, a letter was sent in July to it by Sir Colin and a positive response was received. So, the HAES (Hellenic Aeronautical Engineers' Society) will formally join CEAS at the Annual Assembly on 29 November in London.

– Contacts are being established with two other Societies: the **Portuguese** and the **Finnish** ones.

– **Russia:** it was noted that the Russian aerospace industry was increasing in strength with significant collaborations with western companies. In this regard, it was agreed that it would be appropriate to engage with the Russian aerospace infrastructure and in particular with the TsAGI.

Memorandums of Understanding

- With the AIAA (American Institute of Aeronautics and Astronautics), the MOU has been signed in Berlin on the occasion of the CEAS Congress on Monday 10 September 2007.
- With the CSA (Chinese Space Society), it will be signed on 29 November 2007 after the Board Meeting in London.
- A MOU is being prepared by Jean-Michel Contant with the Indian Society.
- A MOU will also be prepared within the coming weeks with the KOA (Korean Aerospace Society), following discussions engaged with Professor Lee, president of the KOA, on the occasion of the CEAS Congress in Berlin.
- The MOU with the ICAS (International Council for Aeronautical Sciences) will be signed before the end of 2007.

The signature of the MOU with the AIAA Berlin, 10 sept. 2007.
From left to right: Sir Collin Terry, Jean-Michel Contant, Klaus Danneberg, Vincent Boles.

About the Aeronautics Branch

The Technical Committees are being set up, nominations having been received from many Member Societies. Alain Garcia plans to have held for each of them a kick-off meeting before the end of the year. It was decided that two additional committees should be established, namely **Testing** and **Sensors**.

About the Space Branch

The membership of a number of the Technical Committees is progressing following the earlier production of a list of possible members.

Publications

At the next CEAS Board Meeting (29 November, London), a solution will be presented by Joachim Szodruch covering both the CEAS Aeronautics Technical Journal and the CEAS Space Technical Journal.

About the EU support

Andrew Little reported he, together with Jean-Michel Contant and Wilhelm Kordulla, had attended a meeting in Brussels on 9 July 2007 at which representatives of the Commission had set out a possible funding opportunity for CEAS (and a number of other interested parties). Any bid will need to be completed by March 2008 following a call issued in November 2007.

CEAS representative for SESAR Administrative Board

SESAR (Single European Sky Advanced Research) is a basic research action conducted by the European Commission with a view to defining the future European Air Traffic management System for 2020 and beyond. Among three candidates, Dr Peter Hecker has been selected by the Board to be the representative of CEAS at the SESAR Administrative Board of the European Commission.

Awards

The 2008 Award will be presented to Jean-Paul Béchat on the occasion of the next RAeS-CEAS Conference, London, April 2008.

Three next CEAS Conferences

- 22-24 April 2008: the Annual Conference of the Royal Aeronautical Society (RAeS) which will include the CEAS Political / Economic Conference.
- 2009: CEAS Technical Conference, also organised by the RAeS in the UK.
- 2010: CEAS political/economic Conference in Brussels.

THE 1ST CEAS CONGRESS: A BIG SUCCESS

Overview

The first European Air and Space Conference which took place in the prestigious Estrel Hotel of Berlin from 10 to 13 September 2007 was extremely successful since overall, more than 1000 participants from about 30 nations were welcomed. This conference, focussed on the technological challenges facing aerospace in the coming years, brought together experts from a wide range of disciplines. Particular emphasis was put on the environment related problems and on the future space utilisation.

Why the choice of Berlin ? As in 2007 the presidency of the European Union was being held by Germany, the CEAS wanted to send out a signal in holding this first of a series conference in Berlin as a new start to gather the European aerospace societies, while opening up globally as well. Berlin was also chosen because of its long tradition in aeronautics.

An outstanding programme was presented with more than 500 high-quality papers and a series of lectures held in 12 parallel sessions.

A speciality about this congress was a short course about aircraft design held in four days, a number of workshops about astronautics, and a symposium for young scientists.

The Social Programme included three events:

- 10 September evening, the congress reception by the Senate in the Town Hall, invitation by the governing Mayor of Berlin, Klaus Wowereit;
- 11 September evening, the Parliamentary evening in the Estrel Hotel;
- 12 September evening, the Congress diner in the Estrel Hotel.

The accompanying persons programme included the classical big Berlin tour, a trip to the Pergamon Museum, a guided tour to Postdam-Sans Souci, a river cruise on Landwerkanal and Spree, a guided tour through the Palace of shopping.

A view of the Conference-Room during the Plenary Sessions.

The Conference Diner, 12 September, Estrel Hotel.

The press conference

It took place on Monday 10 September at 12:30.

The Press Conference. From left to right: P. Pletschacher, T. Reiter, J. Szodruch, Sir Colin Terry, D. Müller-Wiesner, D. Knoerzer.

The opening ceremony

Joachim Szodruch, president of the DGLR, during his opening speech.

Dr Joachim Szodruch notably declared:

« (...) It was in 1999 that we, the DGLR, came the last time to Berlin with our annual conference and of course we are very happy to be here again after 8 years and now in combination with this prestigious CEAS conference. You all certainly can imagine that we are very proud to have been chosen as the first national society to hold this new CEAS conference and we are glad to have it specifically here in Berlin which of course was no coincidence but design.
(...) Berlin is a city rich with aeronautics and space and has a long tradition the city represented by Universities, by Research Organisation like the DLR – the German Aerospace Centre, the industry, many services, museums etc, all in the Berlin-Brandenburg area. (...)
The DGLR by the way was also founded in Berlin. We are celebrating this year a number of events as you have seen:

- 100 years of aeronautical research in the DLR and the first helicopter flight in France,
- almost 80 years ago the first flying wing in the air
- 70 years ago Chuck Yeager went faster than the speed of sound,
- 50 years ago the first satellite Sputnik started into orbit and first flight of the de Havilland Comet and the B707

(...) As we the DGLR have two important names in our title – Lilienthal and Oberth – I am also proud to announce that on Friday this week we will, supported by the DGLR unveil a statue, a piece of art, to the memory of Lilienthal at the location in Stölln nearby Berlin were he died after his unfortunate last flight in 1891.
I have had the great pleasure to accompany CEAS for the last 7 years and I can assure you we came a long way but made fast progress recently. The DGLR is proud to have been chosen for holding this milestone event, the first CEAS Air & Space Conference as a window for our European competence in science and technology, as a place for discussion, a forum for exchange of ideas and the start of new partnerships (...) ».

After the welcoming, by Prof. Dr Joachim Szodruch, President of the DGLR, Sir Colin Terry, President of the CEAS and Harold Wolf, Mayor of Berlin and Senator for economics, technology and women's issues, two keynote speeches were delivered :
– Peter Hintze, Parliamentary Secretary of State at the Federal Ministry of Economics and Technology;
– Jean Botti, Chief Technical Officer, EADS.
The speeches of Sir Colin Terry and Jean Botti are hereafter reproduced.

The opening address given by Sir Colin Terry

« Minister, Ladies and Gentlemen, welcome to Berlin and this, the first European Air and Space Conference and the first Conference organised by the newly formed Council of European Aerospace Societies, CEAS.
I come from one of the oldest Societies in the world and many will know that in those far flung days of 1866, when my own Society was formed and into the turn of the 20th Century, there were many who voiced the opinion that this new Art / Science of Aeronautical Navigation would never amount to much and was merely an interesting diversion.
How wrong they all were, as we shall all see over the next few days. I must thank the DGLR and the Programme Committee for putting together such a splendid and rich content. Their work has been outstanding.
Could I also thank you the delegates for your myriad of papers and for your support.
Additionally, I should thank another important group, our Sponsors, for their generosity- it was good to see how much store they have placed in this groundbreaking event.
CEAS is acting as a lens for not only its over 30 thousand Members, but for the nine countries which they represent, but CEAS is more than that, as you have seen from the programme, with representatives from over 30 countries supporting this Conference.

CEAS itself has generated Memorandums of Understanding widely around the globe, firstly, with our international partners such as ICAS, and in the USA with the AIAA and hopefully soon in a wider context.

The Conference will focus on the technological changes facing aeronautics in the coming years, and we are so very lucky to have attracted so many experts from around the world here this week. I believe that the presentations and

subsequent discussions will act as a platform for Europe and indeed, elsewhere to build on previous successes in this important industry. In particular, we will focus on the environment and future space utilisation, so there will be much for you all to digest. Enjoy your time in Berlin.
You will meet old colleagues and make many new friends which will enable better sharing of good Science, Engineering and Technology and help shape the future of aeronautics here in Europe and elsewhere. It now gives me great pleasure to declare the CEAS Conference open. »

The keynote speech by Dr Jean Botti

« Secretary of State Hintze, Sir Colin, Professor Szodruch, Dear representative of the mayor of Berlin,
Ladies and gentlemen, dear colleagues,

I am delighted to be here today and to take part in this first congress of the Council of the European Aerospace Societies. But before I talk about some of the "Century Perspectives" for the aerospace industry, I would like to take this opportunity to thank Professor Szodruch and the DGLR team for organizing this congress. I also want to thank and congratulate the programme committee, chaired by my EADS-colleague Detlef Müller-Wiesner, for establishing this inspiring conference programme, which is focused on the main technological challenges facing aeronautics in the coming years.
I am preaching to the converted, so to speak, when I mention here the importance of international cooperation among academia, research institutes and industry. In more than a sense, this congress is all about such cooperation. And, in fact, it is also perfectly in line with the CEAS mission, which is to strengthen European alliances and working relationships between industries, universities and research establishments.
With this congress, CEAS has brought together experts from a wide range of technical disciplines. This conference is a unique chance for us to learn and exchange views about new discoveries in aerospace science and technology. In fact, I have asked many experts within my organisation to participate in this congress because I view it as an integral part of our knowledge-management.

And we all have set us a very ambitious goal for this conference as we want to discuss the "Century Perspectives" of our industry, which is known for its high level of innovation and its ability to make the impossible happen. The "can do-attitude" is what makes aerospace such a remarkable industry.
However, you will understand that I want to focus my talk on three topics I view as particularly fascinating and challenging:
- Firstly, the issue of aerospace industry and the environment;
- Secondly, the development of space tourism;
- Thirdly, attracting young engineers to ensure and expand our knowledge-base.

Ladies and gentlemen,
With regard to my first topic – aerospace industry and the environment – we all know how much environmental issues are currently in the focus of politics, the media and the public. Climate change is on everybody's mind and all industry sectors are being scrutinized as to how they are responsible for emissions.

We in this room probably all know that the aviation industry accounts for only about 2 to 3 percent of all man-made carbon dioxide emissions, making it the smallest contributor of all the transport industries. Surveys, however, show that many people believe that the negative impact of aircraft on the climate exceeds that of cars and that air travel should therefore be restricted for reasons of environmental protection. Surely, we produce emissions – if only a small percentage – but we are also – more than others – solution providers. The aviation industry is one of the most progressive industries when it comes to the development of environmental performance. Over the years we have constantly improved through research into new clean processes, materials and technologies and by designing aircraft that minimise overall environmental impacts across their entire life cycle. And we are committed to strengthening our efforts considerably!

I find it necessary that the debate by the public and in the media is to be conducted more realistically and based on the facts. I see this as an enormous communications challenge for everyone involved in the aerospace industry; we need to make the public aware of the following that:

- Fuel efficiency has improved by 70 percent over the last 40 years. Today's aircraft operations are 20 percent more fuel-efficient compared to just 10 years ago;
- Carbon dioxide emissions per passenger have been reduced by 30 percent in the last 10 years. In 2006, the aviation industry made savings amounting to 15 million tons of CO_2 by improving flight operations, for example by shortening flight routes;
- Nitric oxide emissions from aircraft turbines have been halved in the last 15 years;
- European aircraft today are 75 percent quieter than in the 1960s.

These are great achievements, but, of course, we are not just leaving it at that:

- all new Airbus aircraft entering the market from 2020 will be designed to produce 50 percent less CO2 emissions and 80 percent less Nitrogen Oxides than aircraft designed in the year 2000;
- they will also be designed to be 50 percent quieter.

These targets endorse the work and recommendations made by ACARE in the year 2000.

Airbus has also set itself targets of reducing energy consumption by 20 percent at its industrial and manufacturing sites, with carbon dioxide output and water consumption to be halved by 2020. In this context I would like to add that Airbus recently received its ISO 14001 certification – the standard against which industrial environmental performance is measured.

While our goals are already quite ambitious, we expect our customers will request from us that we deliver on these targets even earlier than 2020. Going this extra-mile, so to speak, will require a mix of efforts, including: new materials; better engine performance with higher bypass ratios and aircraft flow-control technologies, possible in the form of natural or hybrid laminar flow devices, which alone could generate up to a 10 percent fuel savings.

Another promising avenue is fuel cell development to replace aircraft power systems. We see applications as auxiliary power units, emergency power and in ground power supplies. Fuel cells need more development, though, before they can deliver the power density required to replace traditional designs.

IATA's General Director Giovanni Bisignani earlier this year presented the ultimate vision - aviation producing zero emissions by 2050 - which, of course, includes the "zero emissions airplane". Realizing this vision will require not incremental progress but a revolution in technology. Multiple actions need to be taken across the industry and around the globe in a unified effort from all key players.

Today, the "zero emissions airplane" is a vision that many will likely consider impossible to achieve within the next 50 years. But once again: this is exactly what inspires us engineers – realizing things that other people deem impossible. So when we talk about "Century Perspectives" for the aerospace industry, filling this vision with life is – in my view – a top priority.

That's the second topic I mentioned earlier: the future of space travel.

The vision of "normal" people living and working in space and to travel there as tourists - was hard to imagine 50 years ago. But look at where we are today. Certainly, those living and working in space today are not - "normal"- people but highly trained astronauts. However, as you all know, space tourism has started for those who have the determination - and the money - to do it.

We at EADS believe that taking a trip to space is going to become a key experience of the future – and, not long from now, it could become available to everybody. Space tourism is a market that has the potential to generate far more launch business than the current pace of delivering satellites into orbit. Market research has shown that the idea of space tourism is very popular indeed. We believe that many people – estimates are on the order of 40,000 - wish to go to into space at least once in their lifetime just to look down on our blue planet; to gaze at the stars and to have the truly "un-Earthly" experience of floating in zero gravity.

And we believe many of these people will wish to go out there repeatedly, and even live and work there. Space tourism could well be the largest unexploited new market! Once travel to space becomes a commercial service, the question of how to get to there will mainly be one of saving up for a ticket or looking for work in one of the space hotels that will be built. And so, just like aviation, the launch industry is likely going to find that eventually, most of its business will be carrying passengers.

My colleagues from EADS Astrium presented a revolutionary new vehicle for space tourism at the recent Air Show in Paris. This business jet sized vehicle is designed to carry four passengers 100 kilometres up into space, providing for more than three minutes of weightlessness. We are proposing a one-stage system, because it is considered the safest and most economical one to operate. If development begins in 2008, a first commercial flight would be possible by 2012. The development of such a new vehicle, which is able to operate at altitudes above aircraft and below satellites, could well be a precursor for rapid transportation 'point-to-point' vehicles or quick access to Space – opening up previously unexplored territory. Its development will contribute to maintaining and even enhancing European competences in core technologies of space transportation.

All of what I have said before will only be possible if we make sure that we have the right people with the required technical expertise in the engineering and science sectors.

That, Ladies and Gentlemen, is my third topic I want to speak to you about when we address the "Century Perspectives."

The technological orientation of the aerospace industry calls for a workforce, which has a high proportion of university graduates, averaging between 20 percent and 30 percent - or even up to 40 percent in the space sector. According to ACARE estimates, the number of engineers going into aerospace and defence employment will need to increase by about

20 percent in the coming years.

Joachim Szodruch told an aerospace publication earlier this year that European government research organizations alone will need some 1,500 new scientists in the near term. The challenge we have today is to attract more young people to undertake scientific or technical training in some form or other. In the next 10 to 20 years, more than 20,000 new planes are going to be ordered and we need lots of people to help us develop and build them.
Since we are competing with lucrative industries such as medicine, law, and banking, the aerospace industry will need to foster again the image of engineering and technology as being cutting edge and interesting – we must instil in the younger generation what I call "the passion of the job", or we will face some difficult times. It is also of vital importance to preserve the expertise that already exists. At EADS, we are taking steps to improve both attraction and retention of talent.

For instance, we have the "EADS Expert Initiative", an action at corporate level to identify experts and make them visible in the Group, offering them inside of EADS the same kind of career opportunities and recognition available to functional managers. In an additional effort, to recognize those who innovate or make innovation possible, we have initiated the EADS Innovation Hall of Fame. This Hall of Fame will honour inventors, innovators, and craftspeople throughout EADS. The first process is in progress now, with the first awards ceremony scheduled for November.

Ladies and gentlemen,
Aeronautics, Space- and certainly also Defence technologies will provide the means that people and goods all over the world can come together fast, safe and secure, at affordable prices for everybody, - without harming the environment. This is my century perspective for our community. I wish you a very successful conference and a fruitful debate of the technological challenges that we are facing together in the coming years. Thank you for your attention.

The Award Ceremony

The Award Ceremony: on the left Colin Terry; on the right, professor David Southwood

Presentation of the CEAS Award for 2007 to Professor David Southwood, 12th September 2007. Speech given by Sir Colin Terry

It gives me great pleasure and indeed, it is an honour as the president of CEAS to present this year's award to such a worthy recipient.
The CEAS Award was initiated in 1998 and seeks to recognise those individuals who have made an outstanding contribution to aerospace in Europe. This is 9th award to be presented.
The first recipient, in 1998 was Jean Pierson, then CEO Airbus Industries, for his contribution to the success of Airbus.
The last winner in 2005 was Rainer Hertrich, the CEO of EADS from Germany for his superb contribution to aerospace in Europe over many years.
The award is now firmly established in the Council's calendar.

This brings me to this year's winner – Professor David Southwood.

Professor Southwood has been Director of Science at the European Space Agency since 1st May 2001.
His present responsibilities encompass the planning, development and implementation of all ESA's space mission in astronomy, solar and planetary science and fundamental physics in space (...).

David Southwood is a space physicist who has spent the bulk of his career at the Blackett laboratory in the physics department of Imperial College, London.
He has worked on many space missions over the past 35 years, often with European, American, Japanese and Russian collaborators.
His most recent instrument responsibility was the magnetometer on the NASA Cassini Saturn Orbiter, which passed Jupiter and reached Saturn in 2004.
A native of glorious Devon in England, his undergraduate study was in London at Queen Mary College, where he completed his PhD at Imperial College in 1966.
After post-doctoral work in the USA he returned to imperial in 1971 eventually becoming head of the Blackett laboratory from 1994 to 1997.
He has had a long-term Visiting Professorship at the University of California and from 2000 and has held the prestigious position of Regent's Professor.
In addition to serving on many senior British science advisory committees, David Southwood has been chairman of many science committees in Europe and at ESA, including the science programme committee and the space science advisory committee.
Professor Southwood has published more than 200 publications and scientific articles, largely dealing with solar, terrestrial and planetary physics, and he has spoken widely on many platforms on science in space but also science policy issues.

Professor Southwood has many achievements to his name, but most recently in 2005 he was awarded the Royal Aeronautical Society's Gold Medal

It therefore, gives me great pleasure, on behalf of the Council of European Aerospace Societies, to add one more material recognition to you David.
The CEAS Award for 2007 is awarded to you, Professor David Southwood, for your outstanding contribution to aerospace in Europe and its continuing and world-class performance in the arena of space under your superb example and leadership. »

Acceptance speech of David Southwood, CEAS 2007 Gold Medallist

« I feel both very honoured and a little unworthy to receive this award.
Of course, I am immensely proud of the performance of the Science Programme of ESA in recent years and acknowledge that it has put Europe on the world stage. I am also proud of my part in initiating the Living Planet programme in Earth science a few years ago. For me, it is important to use space to look back at Earth as well as to look outwards.
If I feel unworthy as I stand here honoured now for ESA's programmes, it is because ESA has done so well only as a result of the intensive efforts and commitment of many people, inside the European Space Agency, in the science community and in European industry, some of whom are gathered together here today.
It is a particular pleasure to receive an award from the collective European aerospace societies and academies. Your primary interest is in engineering. However I was trained as a scientist. It is for the scientists to dream and to push for technology to take them further – but it is for the engineers to deliver the technology and to make the dreams become reality. For this you get my greatest thanks, for making dreams happen.
In recent years we have landed on Titan, we have orbited Mars, Venus and the Moon but these are not the limits of our capacity to dream and explore. Next year we launch the largest European scientific payload ever when Ariane 5 lifts two spacecraft, Herschel and Planck, into the cosmos. Planck will look out and back to the beginning of time, to the Big Bang. By looking at the ripples in space-time from the Big Bang still there in the sky, we will seek to decode how order came out of that first chaos, how structures like the first galaxies formed. Herschel, a large observatory working the sub-millimetre and infrared bands will look in more detail across the universe at the formation processes of galaxies, of stars, of planets. We are thereby by these missions, in a sense, decoding our own origins. For once there was no Earth, no Sun, but nonetheless, the atoms in our bodies existed. The elements that we are made of came together just after the Big Bang or were manufactured since inside stars. So I say to you that you are all, in a real sense, stardust....and I thank you for making it possible for us to know that. »

In the next pages, the reader will find some information about the Plenary Sessions of the CEAS Conference:
– Aeronautics on the one hand, pages 9 to 15;
– Space on the other hand, pages 16 to 21.

In addition in the Space Part, an article gives a description of the IXV programme (IXV=Intermediate eXperimental Vehicle) of ESA.

A 380 FORUM

During the Plenary Session of Tuesday afternoon 11 September, a detailed presentation of the A 380 programme was given by Robert Lafontan, Senior Vice-President Engineering, Senior Chief Engineer and Test Pilot at AIRBUS.

A 380: The flagship of the 21st century

This outstanding presentation comprised more than 170 slides, dealing with all aspects of the A 380 programme.

Figure 3.

Figure 1.

Figure 4.

Figure 2.
GFRP:Glass Reinforced Plastic
QFRP:Quartz Reinforced Plastic
CFRP:Carbon Reinforced Plastic
GLARE:Al2524 and Fiber Laminates

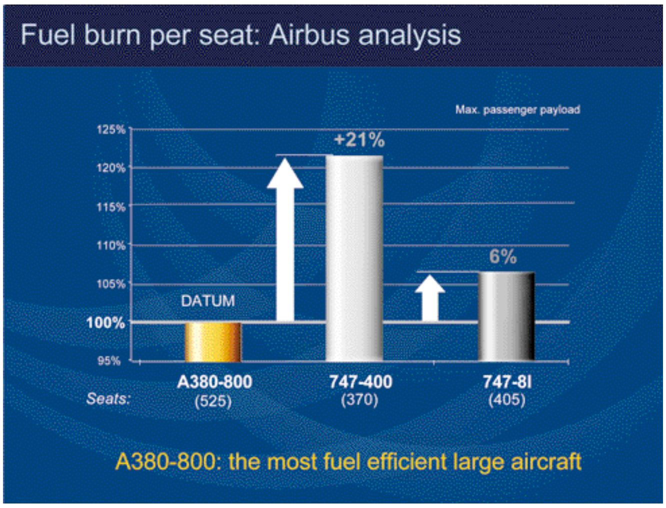


Figure 5.

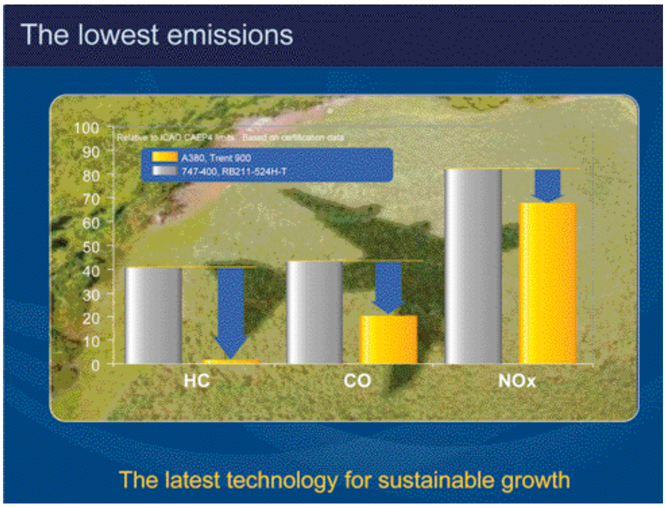


Figure 6.

– The A 380 was presented as a market-driven aircraft, defined from a long and deep customer involvement. Fulfilling customer needs, it is a more productive aircraft, second to none, designed for cost conscious operators, designed with the airlines for them and their passengers, environment friendly, designed with the airports for them to grow. Its concept is a family one, offering a strong potential for development: launch variant A 380-800 and A 380-800F; increased capacity A 380-900*; reduced capacity A 380-700*; increased range A 380-800R*.

– After having described the infrastructures – Toulouse, Broughton, Illescas, Hamburg – (€ 3.75 bn investment in facilities), the production process and the element transportation system, the lecturer explained how size effect, configuration optimization and introduction of advanced technologies enabled to meet airline targets,and how the fully integrated design and global approach allowed to reach initial market needs,viz 550 seaters, 7650 nautic miles range (*figure 1*). In particular, emphasis was put on wake vortex minimization,noise reduction and fuel consumption optimization. A long development was also devoted to structures and materials (*figure 2*).

– Then the following topics were entered upon:major system innovations (*figure 3*); passenger design; cockpit philosophy driven by flight safety enhancement, lessons learnt from airlines and introduction of advanced technologies (*figure 4*).
– Afterwards the flight test programme was described: tufting campaigns, ground loads measurements, VMU, wake vortex measurements, swimming pool tests, noise measurements, airport compatibility checks, Far East tour, high altitude campaign, cold weather campaign at Iqualit, cabin virtual first flight,natural icing trials,artificial ice shape, hot weather campaign, cross wind take-off and landing tests in Iceland, technical route proving (around the world,three times in 18 days)... In addition,throughout 2007, an unprecedented flight testing programme is being performed to demonstrate operability for entry into service (EIS).

– In conclusion,some examples of technical achievements were given among which:
- A 380,the most fuel efficient large aircraft (*figure 5*);
- A 380 has the quietest cabin in the sky;
- A 380 is the quietest working environment for pilots;
- lowest emissions (*figure 6*);
- wake vortex control (*figure 7*);
- excellent take-off and landing performances;

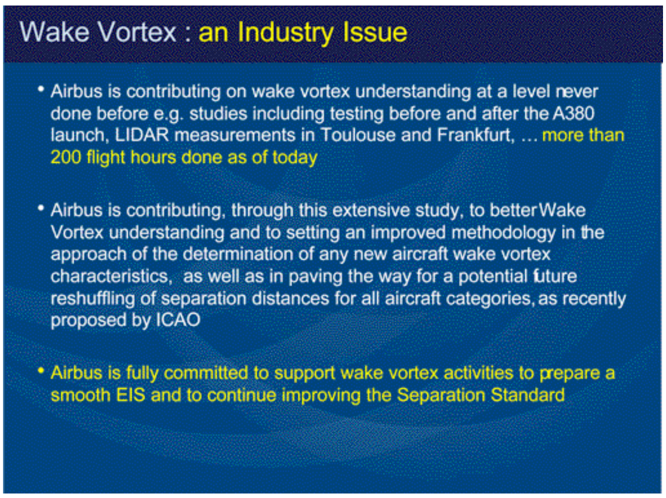


Figure 7.

- A 380: an aircraft built on innovation & technology.

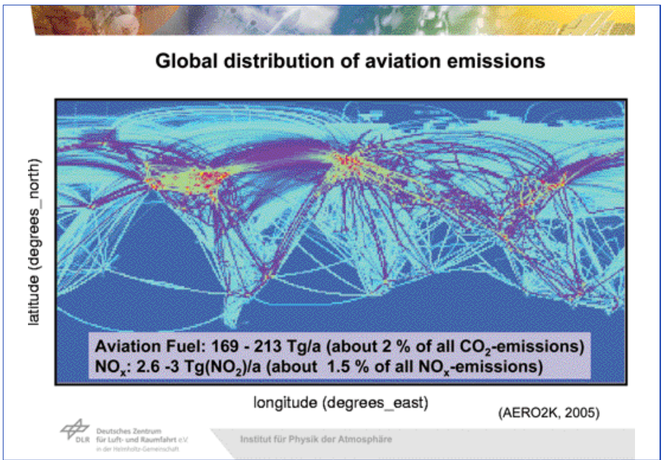
TOWARDS CLIMATE-OPTIMIZED AVIATION

During the Plenary Session "climate-optimized Aviation", two presentations were given on Wednesday morning 12 September: Climate impact on aviation, issues and present assessment by Ulrich Schumann, DLR, Institut für Physik der Atmosphere (Oberpfaffenhofen). ACARE goals and DLR – Contributions for Reductions of Aviation Climate Impact, by Cord Christian Rossow, DLR Braunschweig. They are briefly summarized here after.

• Climate impact on aviation : issues and present assessment

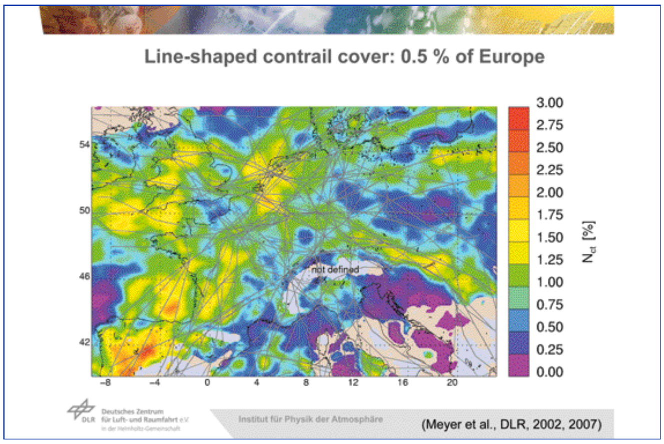
Global aviation contributes to climate change by emissions of carbon dioxide (CO_2), nitrogen oxides (NOx), water vapour, particles, contrails and cirrus changes. Carbon dioxide is the most important greenhouse gas. Its effect is independent of the altitude at which the emission occurs.
Nitrogen oxides from aviation at subsonic cruise altitudes enhance ozone formation and reduce methane ; both are greenhouse gases.
Water vapour and particles (soot, etc.) emitted at altitudes near the tropopause can induce contrails and cirrus cloud formation, likely enhancing the greenhouse effect.
Because of different lifetimes (CO_2 : about 60 years, NOx and H_2O: about 1 week, contrails: order of hours) the impact depends on the periods and scenarios considered.
Among the pictures shown: the global distribution of aviation emissions.

– About contrails and cirrus



Global distribution of aviation emissions.

Contrails and soot from cruising aircraft cause cloud changes. Contrails are caused by water vapour emissions from aircraft flying in cold and humid air masses, they evolve into "contrail cirrus" in humid air masses. Soot and other particles change contrails and cirrus properties and may cause cirrus far a way from air routes ("soot cirrus"): line-shaped contrails are detectable from space.



Line-Shaped Contrail cover 0.5% of Europe

The total cirrus change is estimated with still large uncertainty. Cirrus and contrails heat during night, they heat or cool during day.

– Radiative forcing and temperature change induced by aviation

Global aviation contributed to radiative forcing so far about 0,05 W/m^2. These are about 3% of the total radiative forcing from all anthropogenic effects as assessed in IPCC (2007).
Global aviation contributed to the observed global warming of 0.7°C about 0.03°C (ca.4%). There is very little uncertainty on aviation CO_2 impact.
The largest uncertainty comes from aviation contributions to changes in cirrus clouds, which are not included in the total therefore.
Including the presently known uncertainties, the aviation contribution is estimated within the range 2 to 8%.

The trends

Aviation fuel consumption (CO_2 emissions) grew globally by 2-3% per year from 1990 to 2004. Aviation NOx emissions grew by 4-5%/year from 1990 to 2004.
For the near future, further growth of global fuel consumption and global emissions of CO_2 and NOx is to be expected.
Scenarios of civil aviation CO2 emissions in 2050 show a potential increase by factors 3,3 to 5 (from David Lee, Univ. Manchester, UK). If Aviation emissions continue to grow while other emissions get reduced, the relative importance of aviation contributions grows, so CO2 emissions reduction has highest priority in the long term. Reductions of NOx and contrails has largest impact on climate mitigation at short term.

Conclusions

The aviation share in CO_2 emissions is presently about 2%. CO_2 is the most important greenhouse gas, its effect is independent of the emission altitude. Its radiative forcing is well assessed. NOx from aviation enhance O_3 and reduce CH_4. The radiative forcing has been assessed with fair certainty. Water vapour and particles (soot, etc.) emitted in cold and humid air induce contrails and cirrus clouds, that may form largest radiative forcing contribution.

The aviation share in radiative forcing is presently 3% (range 2-8%). The relative importance of short-lived (NOx, contrails) and long-lived (CO_2) emissions depends on the scenario and choice of timescale.

Possible mitigation options include: aircraft/engine with less emissions, fuel saving operation, contrail-avoiding routing. Reducing short-lived emissions (NOx, soot, contrails) may be more effective for climate mitigation than reducing long-lied effects (CO_2).

• ACARE goals and DLR – contributions for reduction of aviation climate impact

Cord Christian Rossow first recalled the goals fixed by ACARE concerning environment :

– reduction of fuel consumption and CO_2 emissions by 50%;
– reduction of NOx emissions by 80%;
– reduction of perceived external noise by 50%;
– reduction of impact of production, maintenance, and disposal of aircraft.

How to meet the 50% fuel burn target ?

Engine ~ 20 %; airframe ~ 25 %; ATM 10 %.

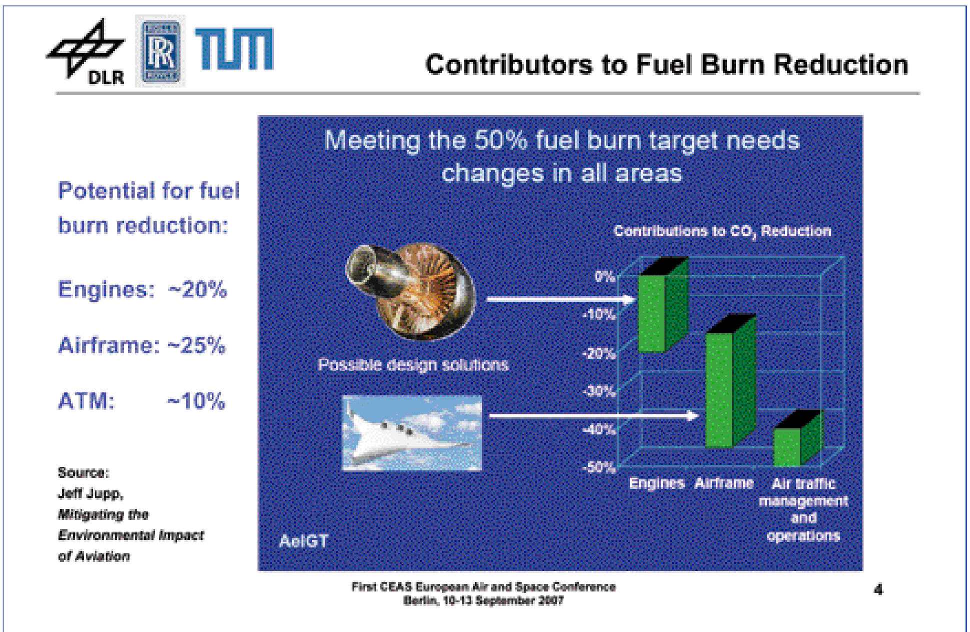
Engines : development of advanced propulsion concepts (increased efficiency, low noise, low emissions); development of a high fidelity CFD-code for 3D unsteady aerodynamics, aeroelasticity and aero-acoustics.

Airframe : drag reduction, engine airframe integration, laminar flow control, weight reduction.

Air traffic management : reduction of unnecessary fuel consumption during all flight phases from gate to gate; reduction of route extensions, efficient airport traffic management.

• *Overall conclusion*

Climate impact is at the top of the aviation agenda. Climate change is reality. In simple words: "1°C warming might be felt like heaven; 4°C might be felt like hell". The future depends on present decision. Many open questions remain but it is known enough to enhance action now. Contrails should be on the ACARE agenda: their climate impact may be reduced by proper air traffic management. Aircraft and aircraft engines are already very well optimized and hard to improve. Fuel reduction is driven by economy and fuel availability. The NOx/contrails issues need other drivers. The ACARE goals sound challenging but may not be challenging enough. (This statement refers to the finding of David Lee showing that only a small reduction becomes effective during the coming 50 years when reaching a 50% reduction in specific fuel consumption becoming operational slowly after 2020.) Still one may ask: are the ACARE goals reachable? On the other hand much reduction potential seems to exist in aircraft operations, for example fuel may be saved by increasing operational load factors.



Potential for fuel burn reduction

TOWARDS THE GREEN AVIATION

On Thursday afternoon, on the occasion of the Plenary Session "Towards the Green Aviation", three presentations were given. We publish here after a brief summary of those of Alain Garcia and Freder Beyer.

• Aeronautics is crucial to shape a future competitive and sustainable European economic growth

by Alain Garcia

CHALLENGES FACING AIR TRANSPORT

– **Regarding economy**, air traffic is of significant importance for the enlarged European economy, global competitiveness, our way of living. Aviation is one of Europe's strengths : 2.1 % GDP (Gross Domestic Product) ; 3.1 million jobs.

– **With respect to environment**, global warming being a worldwide recognised issue, Europe has fixed clear targets to

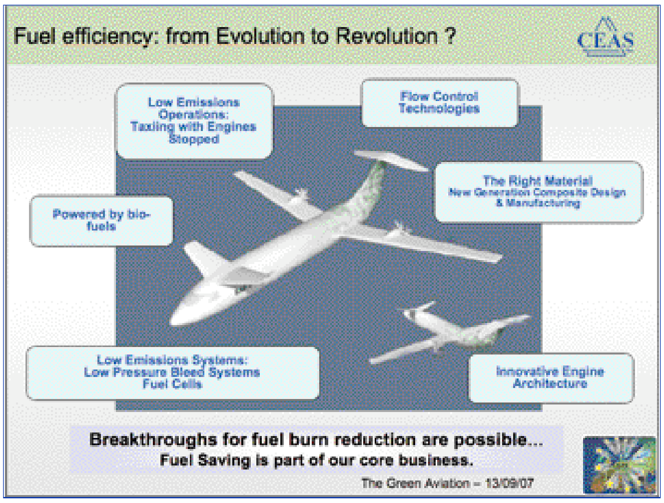


Figure 3

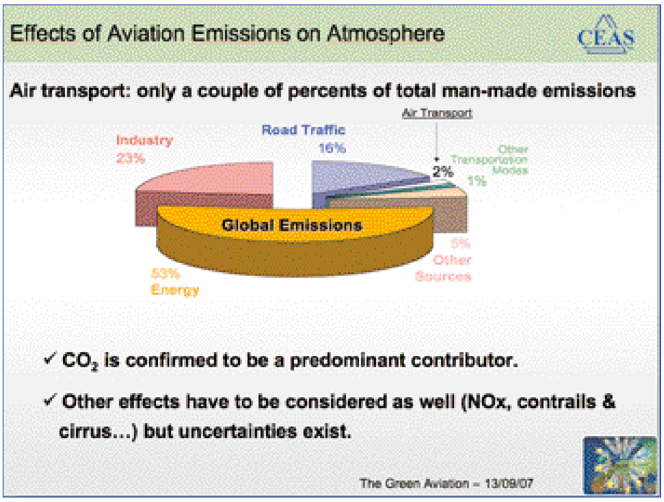


Figure 1

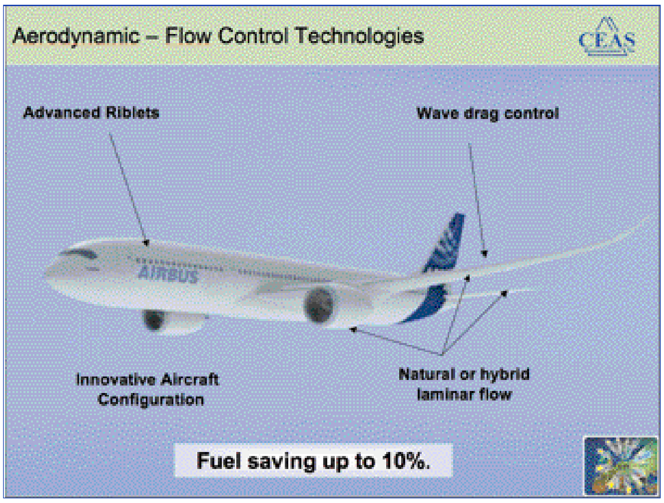


Figure 4

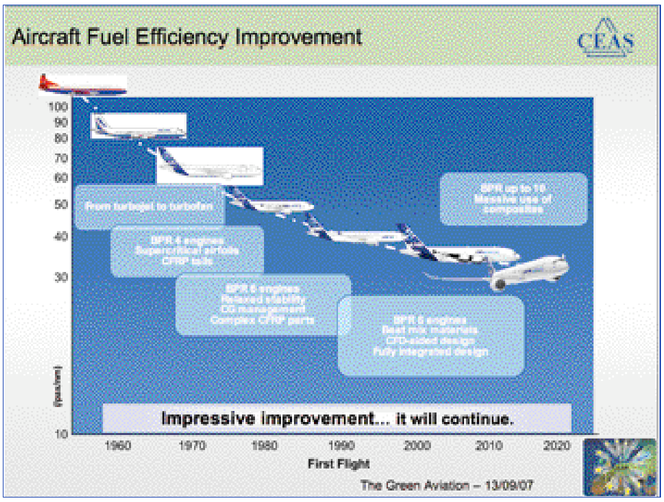


Figure 2

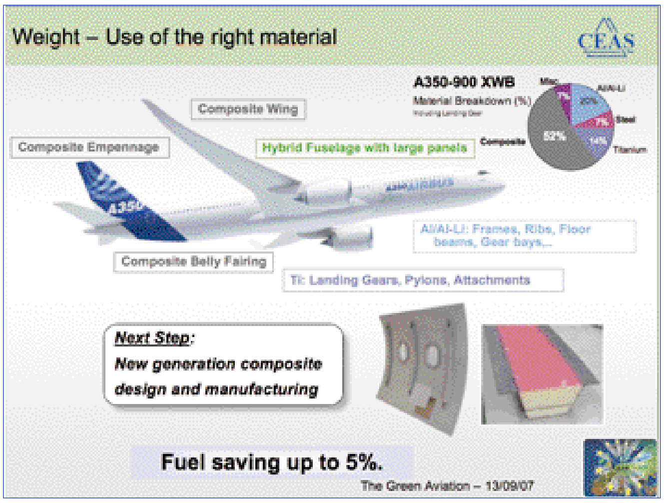


Figure 5

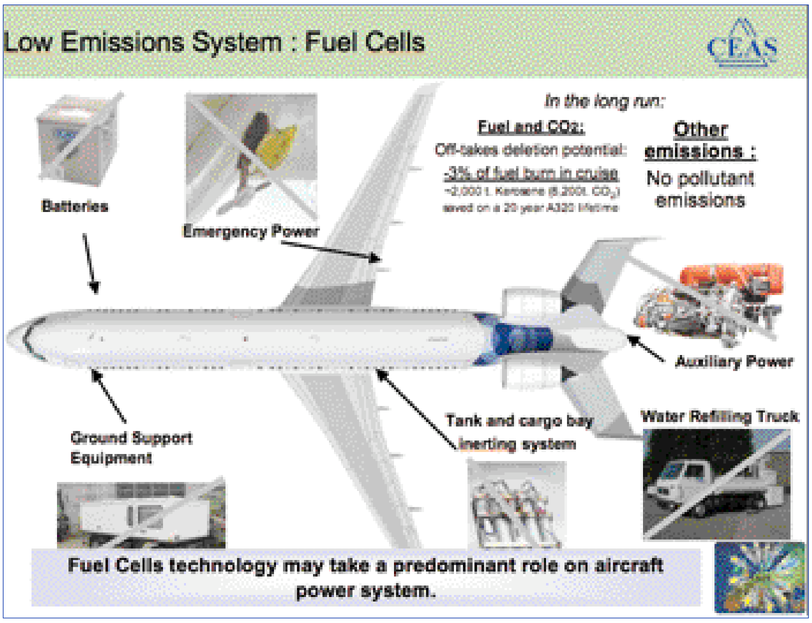


Figure 6

reduce negative impact, global demand for oil will continue to rise leading to extremely volatile prices and carbon trading is likely to increase.

Effects of aviation emissions on atmosphere

Air transport only generates a couple of percents of total man-made emissions : CO_2 is confirmed to be a predominant contributor; other effects have to be considered as well (NOx, contrails and cirrus...) but uncertainties exist (*figure 1*).

Aircraft fuel efficiency improvement

Since 1960, there has been an impressive improvement (*figure 2*). And this improvement will continue going maybe from evolution to revolution (*figure 3*).

- Fuel saving up to 10% is possible thanks to new flow control technologies (*figure 4*).
- Fuel saving up to 5% is possible thanks to the use of the right materials (*figure 5*).

Low emissions system : fuel cells

Fuel cells technology may take a predominant role on aircraft power systems (*figure 6*).

Innovative engine architecture

Innovation in engine may allow up to 25 % fuel saving (*figure 7*).

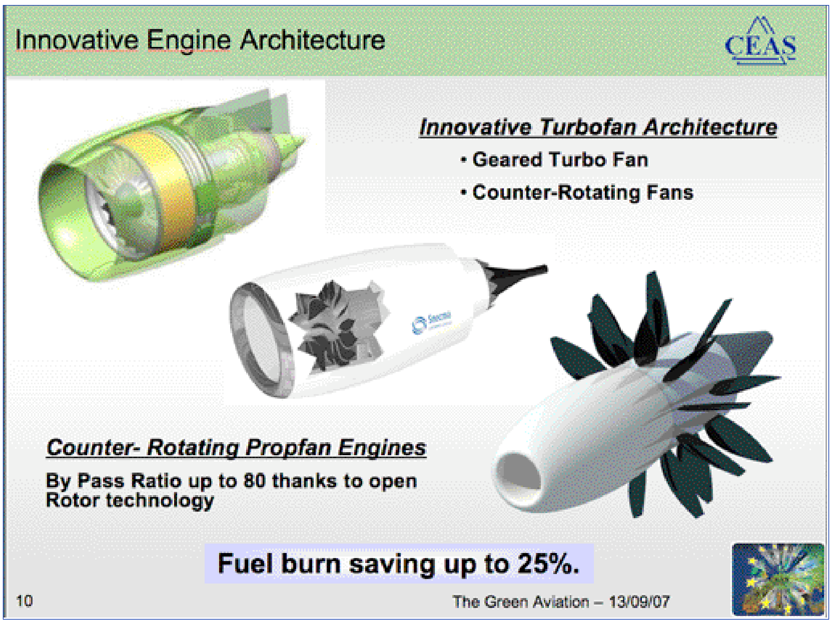


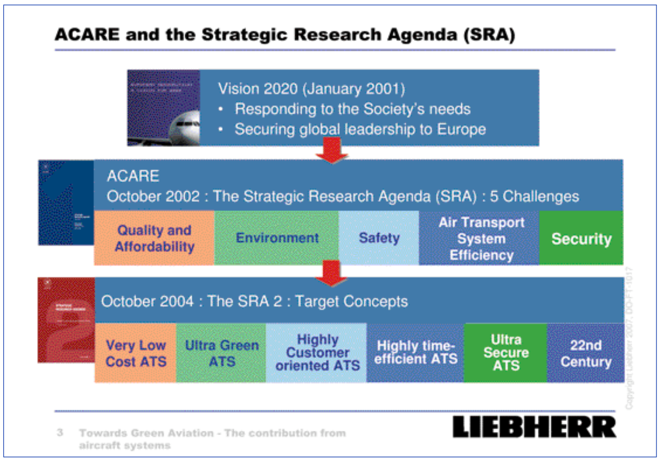
Figure 7

• The Contribution of Aircraft Systems

by Frieder Beyer, Liebherr – Aerospace DE

After having recalled the ACARE objectives, Frieder Beyer answered the double question:

– how can aircraft systems be an effective enabler for greener aviation?
– how does the European Aerospace Community provide the necessary technology?



The means to reach the objectives

– System design

• Electrical Systems. With an all-electrical aircraft, it will be possible to reduce the fuel consumption, why? (i) more efficient use of energy and less waste of energy than with today's hydraulic and pneumatic systems; (ii) removal of the engine bleed system can provide additional benefits which affect engine specific fuel consumption and engine design; (iii) lower total systems weight through easier integration of electrical systems. Besides, it will be possible to significantly improve environmental friendliness thanks to the replacement of conventional hydraulic actuators by electrical ones and to the introduction of new power supply technologies such as zero-emission fuel cells.

• Energy Management. The next step in all-electric aircraft design is to manage the complete energy on board.

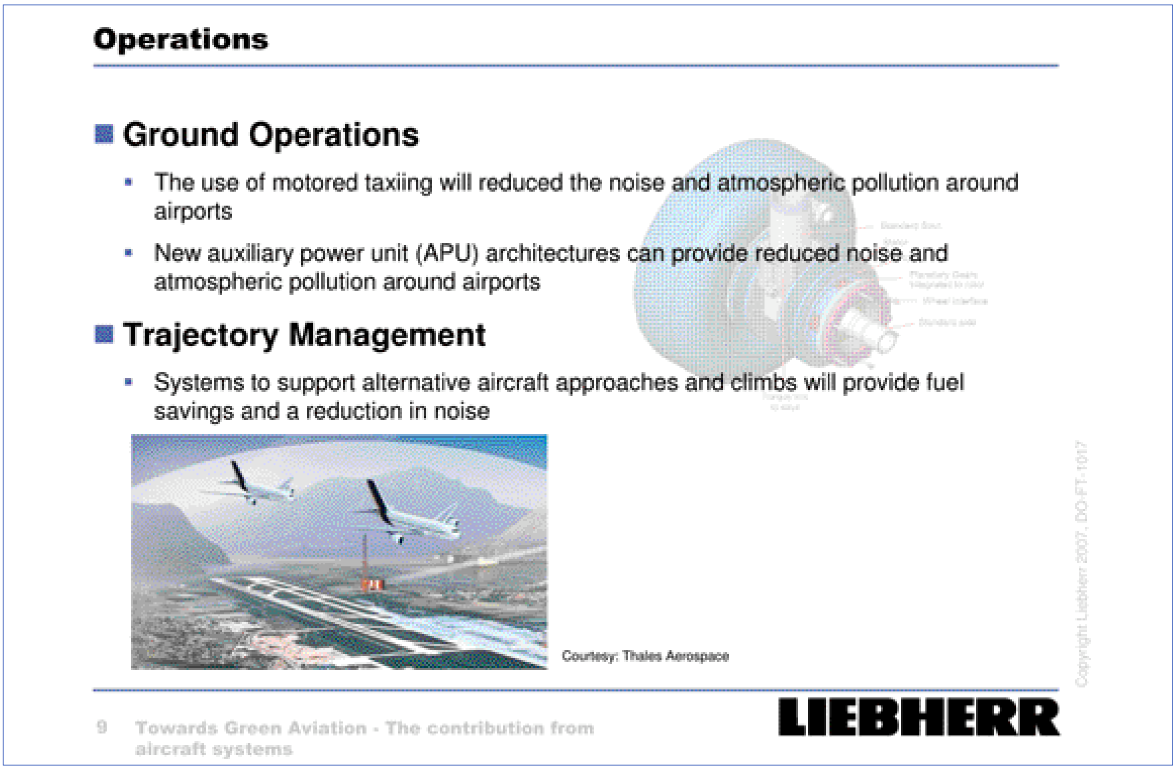
• Aerodynamic Design. Lower noise can be expected during approach from landing gear, flaps and slats.

– Operations

• Ground Operations: motored taxiing, new auxiliary power unit architecture.

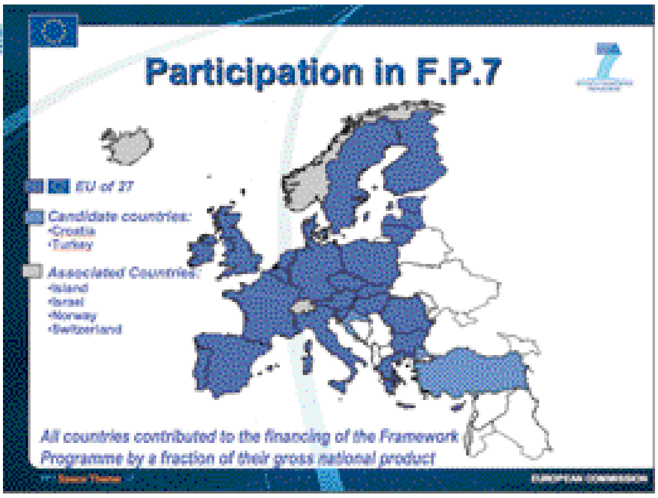
• Trajectory Management

– Manufacture: new materials, life cycle management.



THE EUROPEAN SPACE POLICY AND RESEARCH ACTIVITIES

On the occasion of the Plenary Session "Space Agencies Forum", 11 September morning, Dietrich Knoerzer,repla - cing Jean-Jacques Dordain, Director General of ESA, obli - ged to attend a meeting in Paris at this date, presented the European Space Policy Key Messages.



– The European Commission has adopted the European Policy Document,which reflects the key strategic importance that space systems and space applications have for Europe.
– It is a joint policy document of the European Commission and the European Space Agency.
– On 22 May 2007,it was presented to the Space Council,a joint meeting of EU and ESA Councils.The Resolution shows for the first time their strong political support at European level.

Some key-points and figures concening Space in Framework Programme 7 (FP7)

Draft Annual Budget:Commitment profile 2007-2013

- **€ 1.4 billion for FP7 Space theme;**
- **About 85 % for GMES(Global Monitoring for Environment and Security), i.e. € 1.2 billion , including for dedicated space infrastructures;**
- **About 15% for strenghtening space foundations and cross-cutting issues.**

Some words about GMES

- GMES is the next EU flagship for space after Galileo. It is an EU-led initiative in which the Commission will manage actions for identifying and developing services relying both on *in situ* and remote sensing data whilst ESA will implement the space component.
- Successive actions:

– R and TD, aimed at supporting the development of new capacity where needed and at exploring condition for long-term sustainability;
– Development and validation of pre-operational GMES services,starting with the Fast Track Services, followed by other pilot and downstream services;
– Integrating Earth Observation with Satcom and Satnav technologies;
– Support to the coordinated provision of data (space and *in situ*) for related projects in FP7;
– Development of dedicated space infrastructure for GMES.

- Indicative breakdown of the total amount of resources(€1.2 billion): about 30% foreseen for projects on service development; about 10% foreseen for data procurement, both space-based (ESA)and in situ;about 45 % foreseen for developing space infrastructure (ESA).

Some words about Strenghtening Space Foundations

- The objective of this budget chapter is to provide opportunities for those actors and activities which are currently not catered for yet at ESA or national level,thereby adding value to these: support to research in space science and exploration;new concepts in space transportation,space technologies and critical components;research into reducing the vulnerability of space-based systems.

Timing of the FP7-Space-2007-1(about 134M€):
- November 2007:start of negotiations;
- Early 2008:first set of grant agreements signed;

Future calls for proposals:
- Biannual Space research calls :2009,2011,2013.

• Potential topics: GMES; Space science and technology; cross-cutting activities(international cooperation,cross-border coooeration and ERA-NET).

SPACE TECHNOLOGY FORUM

During the Plenary Session "Space Technology Forum" which took place on Thursday 13 September morning, three speakers expressed their views concerning the future of space: François Auque – CEO, EADS Astrium Satellites ; Evert Dudok – CEO, Astrium Satellites, chairman of the managing Board, EADS Space Transportation ; Michel Fiat – CTO, THALES Alenia Space.

The keynote speech delivered by François Auque

Among the main messages addressed to the audience, were the following :

• Space industry evolution

« (...) evolutions for space industry will mostly be a direct consequence of Government's ambitions today.It is difficult to quantify the magnitude of space services that will be available from Galileo,GMES and Military space systems but infrastructures have to be built now if we want to deliver services in a near future.(...) I am concerned for Europe when I see the magnitude of efforts from the US and today from Russia as well,for developing space infrastructure,in particular in the field of Security and Defence,and in parallel the efforts of countries like China and India with similar space ambitions than Europe had 20 years ago.I am concerned when I see the growing gap between the range of key applications of space to support space policies in different domains like: Environment, Climate change, Information Society, Transport, Security and Defense, Research (in line with the Lisbon Agenda) and the difficulties from Member States to take decisions and to allocate the necessary support for putting in place the infrastructure neeed for such applications.
One of our big challenge for the years to come in our space domain is to have our stakeholders (Governments, Parliamentarians, Armed Forces)to decide now for results which will be seen in ten years,or more,from now.

• The ASTRIUM Corporate approach to prepare the future
Four ideas: Efficiency, Duality, Cooperation, Services.

– Efficiency is a preliminary condition to prepare the future.This will be even more important in the years to come for Security and Defense
(...) In 2000, european space industry had to face the end of the Internet dream,the technical difficulties of Ariane 5 and the emerging launchers competitors,mainly coming from Russian products(...). In less than 3 years, EADS has completely restructurd its space sector,with a heavy rationalisation of its competence centers in Europe.(...) As a result,Europe has regained market shares in the field of launches with Ariane 5 successes, in the field of Satcoms (...) and of our Astium E/O exports (Thailand,Algeria, Korea,...).

– Duality is a reality and a chance for end users
The first duality is between Defence and Civil applications of space.(...).Duality exists as well in services.(...).
This brings us to another duality:the duality of the markets between institutional and commercial customers. Arianespace is a PPP, a Public Private Partnership. Interests and duties of institutional: I mean governments,and of private industries such as EADS are merged in Arianespace. Through this PPP,the government sharing the cost of autonomous access to space with private users/operators,we obtain a guaranted return of high value work in contributing countries,when industry provides a reliable and competitive launcher thanks to increased production rates to satisfy the commercial market (...).

– Cooperation : space is a vehicle for international cooperation today and for the future
(...) with the creation and development of Astrium,we integrate space activities in five countries: France, Germany, UK, Spain and Netherlands, completed with long lasting industrial partnerships in Italy, Sweden, Belgium, Switzerland... and the ability to combine national assets is a real chance for Europe.(...).
In Europe we have 3 challenges ahead of us,which will be key for the next twenty years:to enlarge the cooperation to European new comers and future partners;to develop the space european cooperation for security and defence;to remotivate our governments on the strategic and economic importance of space systems (...). Another aspect is the cooperation between Europe and other countries.I can mention of course the cooperation with US for the ISS.Missile Defence could be an area for transatlantic cooperation,at least through NATO. GMES as an element of GEOSS is another opportunity. Cooperation with Rusia is not new,in launchers through our subsidiaries Starsem, Eurockot, and EADS has enlarged the cooperation in satellites through a

subsidiary, Synertec with a Russian partner-RNII KP-. Our successful cooperation with ISRO for pooling our competnces for small satellites is already a success with two orders: Eutelsat-Hylas. Definitely Europe and the European industry will reinforce their cooperation with the rest of the world in the coming years. This is the only way to have access to institutional markets.

– Services :the future of Space lies in a large extent and more and more with our ability to deliver services to the end user
As existing examples:imagery, launchers, astronaut training, several exploitation activities associated with the ISS. But we had to go a step beyond to bring more added values to our customers.This is what Astrium is successfully doing with Paradigm (Paradigm mechanisms: international competition, negotiation on new parameters-service, finance, insurance, third parties, customer's satisfaction). As a result through Paradigm, we: contribute to public spending savings (best value for money); give the customer full benefit of "state of the art" systems;open the door to new services (Astel 5-Willfare); give our industry new market perspectives.

The keynote speech delivered by Evert Dudok

« The approval of the European Space Policy in May 07 under the German EU-Presidency is a real step forward for the definition of the role of Europe in space, which is now in line with the European political and economic power.
Space is an important issue on the world market, and it will become even more important in the future because of new applications in the civil, environmental and security area.
With the 5.5 b€ per year for space, Europe is still keeping a strong position in the world.

It is "harvest time":
– Columbus and ATV launch in the next months, start of scientific activities on the ISS ;
– The ESA science programme can be considered as a top extraterrestrial programme in the world (Titan Landing, Mars- and Venus-Express) ;
– Very good performing ARIANE 5, Soyuz in Kourou is coming 2008/09 ;
– Excellent meteorological capabilities with EUMESAT (Meteosat, Metop) ;
– Outstanding earth observation instruments like the radar Satellites TerraSar and Cosmo ;
– Competitive European satellites in the world telecom market.
– On the institutional side:
  • "Space" in explicitly mentioned in the new treaty of the European Union!
  • Increasing budgets in Germany

The imperative tasks for the next 5 years:
• Bring Galileo into orbit; based on the pre-development of the first 4 satellites.
• Further implementing the GMES-Missions: National Missions, ESA-mission and Eumetsat-mission with strong financial support from the EU; starting with the core services in 2008 (I think that we have to be more explicit on the importance of having a permanent funding from EC to maintain the necessary infrastructures and another role for them is to act for better federating the public demand).

The challenges for the next 10 – 20 years:
The ESA-Ministerial conference in 2008 as well as the French EU presidency in the second half of 2008 will send out a strong momentum for this period:

❶ The urgency of global action with regard to climate change. Space supports very effective
– Weather forecast for 10 days.
– Global fire detection around the world (within a few minutes).
– Disaster warning (storm, flooding, earthquake, …).
– Environmental monitoring (Kyoto).
– Detection of resources (natural resources).

Cooperation of all space nations is necessary!

❷ The increasing threats to global security
– In Europe we have started to built up reconnaissance capabilities on national level (SarLupe; TerraSar, Cosmo; Helios, Pleiades)
– After the step of multinational cooperation (Musis, optical/radar) Europe and the EU will have the necessary number of military satellites to play its role in the world. Already 2008 we will have 10 to 15 military satellites in orbit. (can we be more precise will it be 10 or 15?)
– What is at stake is to increase the European cooperation and to pool these capabilities in order to build a stonger service offer to our Armed forces. This has to be both as a tool for strategic intelligence to prevent crisis and a tool to support the operations during the crisis.

❸ Exploration of the solar system
– European robotic missions to moon and Mars, landing and sample return
– Moon will be the first step, scientific missions with landing on the moon brings:
• Excellent scientific outcome
• High technological spin offs
• Fascination of the young people (motivation)

❹ Manned Space Transportation
– Europe will have an autonomous access to space for man

space missions. Possibly ARIANE-5 as launcher can be fitted for that
– This will be a political decision from member states and EU and this could start with those countries which have already developed key competences in this domain.

Within the next 20-50 years:
- Space tourism (more than one week in orbit)
- European woman/man on the moon

An adapted version of the keynote speech delivered by Michel Fiat

Thales Alenia Space and the Satcom Market

« In 2007, two years after the merger with Finmeccanica. Thales replaced Alcatel as a shareholder. Thales Alenia Space is now a joint venture between Thales (67%) and Finmeccanica (33%), along with our "sister" company Telespazio, in which the ownership shares are reversed.

There has been no change in the organization of the former Alcatel Alenia Space; the new Thales Alenia Space is a business group of Thales.

Together, Thales Alenia Space and Telespazio form a space alliance that offers the space solutions expected by end-users, based on a comprehensive, well-coordinated approach. Telespazio focuses mainly on satellite infrastructure operations to support operators, as well as providing satellite services to end-users.

Thales Alenia Space is a major space systems manufacturer with extensive vertically-integrated expertise, from turnkey system prime contractor to strategic equipment supplier.

Our convergence plan is on track. We are in an excellent position to leverage dual civil/military market opportunities by drawing on the Thales group and coupling space and terrestrial solutions for telecom applications. From this standpoint, Alcatel-Lucent has significantly increased its stake in Thales, allowing to continue our cooperation, as reflected in our joint venture for mobile TV.

Our footprint is clearly European. We operate 11 industrial plants, with a major presence in France and Italy and very active subsidiaries in Spain and Belgium.

Market position

Thales Alenia Space's market focus is clearly on integrated applications, or "systems of systems". We couple space-based solutions with new applications for mobile TV, high definition TV, digital audio broadcasting (DAB), advanced broadcasting, local services and low-cost universal rural telephony. The commercial market is strategic for the company, although 60% of Thales Alenia Space sales are generated by government contracts. But unlike US industry, we cannot afford to rely solely on government programs. The commercial market is therefore of strategic importance to Thales Alenia Space, which will continue developing its business in this market.

Number 1 in 2006

Thales Alenia Space led the world in satellite orders in 2006, signing contracts for eight geostationary satellites plus 48 second-generation Globalstar satellites. In fact, European industry won half of all orders worldwide in 2006, thanks to tremendous efforts to enhance competitiveness to overcome an ever-weaker dollar.

Thales Alenia Space is deeply involved in a number of European government missions. In space science and exploration, for instance, we are prime contractor for the ambitious Exomars mission design, Goce, Hershel-Planck and part of the Cassini/Huygens mission to Saturn and Titan. In satellite navigation systems, Thales Alenia Space is prime contractor for Egnos, and is playing a key role in Galileo.

Thales Alenia Space is also an acknowledged specialist in meteorological and oceanographic systems and satellites, through Meteosat / MSG and the Jason series, as well as radar and optical observation systems, including the first Cosmo SkyMed satellite launched successfully this past summer. In the defence sector, Thales Alenia Space is involved in a number of communications and observation satellites and systems, including major programs such as Syracuse 1, 2 and 3 in France, Sicral in Italy, and a participation in Germany's SarLupe satellites.

The other major business sector for Thales Alenia Space is orbital infrastructures and transportation, with a major role on the International Space Station. Our plant in Turin, Italy is supplying fully half of the pressurized volume on the ISS, including the MPLM, nodes 2 and 3 and Cupola. In addition, it is making a significant contribution to the Columbus laboratory and the ATV cargo vessel.

Market trends

Market conditions today are robust, and the recovery that started in 2006 is continuing in 2007. We are expecting a steady stream of orders, which should stabilize at about 20 satellites a year for at least the next few years.

Looking beyond this short-term view, we can't just extrapolate from current trends. We must consider how changing conditions around the world will impact the development of space business, while assessing whether the requested applications are technologically feasible and affordable.

Many different approaches are possible, but there are certain key geopolitical factors.

Space has always involved cooperation, and this is not going to change. But there are two opposing trends – strictly national policies, versus international or regional cooperation – and this will certainly impact the development of space business.

Socio-economic factors should be considered in conjunction

with geopolitical factors. The expected growth will largely depend on the degree of liberalisation and international cooperation, more specifically with developing countries.
Last but not least, environmental and energy issues will have a direct impact on the level and focus of research investments. This in turn has a significant effect on technology development, especially in the following areas:

- space exploration & science
- civil space infrastructure
- commercial space
- military applications and commercial spin-offs.

However, we cannot afford to wait for a definitive answer to these questions. Given the uncertain situation, we have to maintain our flexibility.

Driving flexibility

Operators today want to deploy a complete range of satellites to address a variety of markets across a variety of frequency bands. Thales Alenia Space of course offers a very large portfolio of solutions addressing all of these needs.
For the time being, we still consider that there are several main drivers to support this flexibility.
First, pursue Thales Alenia Space's "multi-market" approach, to be able to draw customers from three space sectors, namely commercial, civil and military.
Civil (government/state agency) and military markets are less sensitive to general economic conditions. They are characterized by national procurement policies with industrial "champions" and strong R&D policies with preparatory programs (conception, design preliminary developments). There are also certain constraints, especially with ESA rules on geographical "fair return", which imposes worksharing and does not always lend itself to optimizing industrial capabilities.

Nevertheless, in Europe the civil and military markets alone are not enough; we are far from a US model where major companies can stick to this market. In consequence, the commercial market continues to play a strategic role, and the two markets must co-exist. The commercial market is characterized by open competition on price and performance (and track record), and there is obviously no R&D support from customers.
Second , Thales Alenia Space believe that the increasing civil demand for security, improved environmental monitoring, traffic management and responses to natural or man-made disasters can and should be anticipated through a multifaceted approach:

- coordination at government level;
- increasing expertise in systems of systems and embedded security (software applications);
- investing in basic technology to support this increased need for security.

Thales as a group has strong assets in these areas and will actively support these initiatives.

In short, a dual approach should be key for Thales Alenia Space, based on the management of different objectives and drivers to foster fruitful cross-fertilisation: civil / military, commercial / governmental, national / export, fixed/mobile and sat / terrestrial, as reflected in our recent joint initiative with Alcatel on mobile TV.
This dual approach will help grow the market, identify innovative project funding methods, and support the spread of technologies.

Current market for satellite systems

The open market for satellite systems in 2007 is estimated at slightly over ?12 billion, with a product mix very similar to Thales Alenia Space's own sales distribution. In term of growth, we expect the following over the next 10 years:
- an almost flat commercial market:
- with replacement of existing satellites in a smarter (more flexible) way;
- mobile and HDTV development.

– 5% average growth in the civil and military markets, driven by:
- US exploration programs;
- higher ESA/EU contribution;
- ambitious space programs in China, Russia, India and Japan;
- milsatcom systems
- surveillance & reconnaissance and navigation programs.

However this expected growth will only be realized if European governments are willing to invest more in space.
Recent launcher losses will certainly increase insurance premiums, launch prices and launch manifest congestion, as well as shaking industry confidence. Even though insurance brokers remain optimistic that the market can absorb these losses, we do need to offer a complete value chain competitive with terrestrial solutions – but these solutions keep boosting their own performance and innovation.
To maintain and develop its business, space has no choice. We must:

- reduce costs
- add value to services
- create and develop new applications.

Cost reduction has to be a shared effort among all players. On the satellite side, Thales Alenia Space believes in the need for strategic partnerships to provide components or subsystems. The aim is to develop these as increasingly interoperable commodities, while focusing our efforts on key differentiators.
The recent Globalstar II contract awarded to Thales Alenia Space proved the effectiveness of a design-to-cost approach. This was based on a concurrent design phase involving the end-customer and prime, all the way down to low-tier suppliers, combined with an aggressive global selection of best-in-class suppliers.
In this quest for competitiveness, we must not forget the need for plug and play user terminals, offering high performance at low cost.

Applications

Before addressing technology issues, we should take a closer look at the applications that will shape the future of space. In my view, besides specific military needs in the short/medium term, space applications will remain focused on the following:

1) Navigation, since the increasing mobility of people and goods demands major infrastructure upgrades for air transport, road transport and public transport. Space will undoubtedly play a key role in several critical areas:
– fleet & traffic management (air, road, sea, space);
– location based services (information and navigation services, tracking services and network-related services to improve communications access);
– search & rescue (for emergency assistance).

2) Earth observation: space still offers unrivalled “big picture” capability, even as it is challenged by alternative technologies (unmanned vehicles in particular), in addition to its traditional role in military C3I systems, (communication, command and control, intelligence). A wide range of civil applications are called on by public organisations:
– environment (meteorology, natural disaster prevention, oceanography, etc.);
– land services (farming, urban planning);
– exploration and management of natural resources.

3) Telecommunications, undoubtedly the market segment most challenged by terrestrial alternatives. But demand for mobile and remote area communications should remain high and space can capitalize on excellent assets.

The growing cost of transportation should also open several application markets to space systems, including distance learning, telemedicine and bridging the digital divide.

An increase in broadband demand will certainly spill over into space applications, for multimedia entertainment or e-commerce.

Looking further ahead, the trendy new market of space tourism will depend to a great extent on economic growth and the ability to reduce the cost of access to space while guaranteeing high reliability.

Scientists will continue experiments in space, but spaceborne production remains a highly hypothetical proposition.

In short, the outlook is positive, but nothing can be taken for granted! »

THE ESA IXV PROJECT

PAVING THE WAY TO FUTURE SPACE TRANSPORTATION

Backround

The industrial activities related to the Intermediate eXperimental Vehicle (IXV) started in early 2005, when the co-existence of several ESA and national activities on re-entry and the sensitivity of the re-entry subject in Europe necessitated special effort to allow the creation of one single ESA project able to federate the consensus of the largest number of Member States.

A thorough trade-off was performed among several ESA and national existing concepts for re-entry in-flight experimentation with respect to shared requirements, including: experimentation (i.e. technology and system related), programmatic (i.e. technology readiness levels, development schedule and development cost) and risk mitigation (i.e. design feasibility, maturity, robustness and growth potential). The result of the trade-off led to the down-selection of the lifting body concept based on the extensive national (CNES: PRE-X) and ESA (AREV: Atmospheric Reentry Experimental Vehicle) efforts done and results available.

Therefore, the very early phases of the IXV project were structured to allow the utilization of data coming from national programmes but still ensuring one single ESA project file coherent with ESA technical and programmatic objectives and in line with ESA standards for project implementation (i.e. project phasing, reviews, documentation, design and development methodologies).

Mission and System Aspects

The IXV is a lifting body hypersonic experimental vehicle, to be launched and injected on a reentry path by the ESA VEGA Launcher via a suborbital equatorial trajectory, landing on the Pacific Ocean.

The primary objective of the IXV project is to serve as a system demonstrator for re-entry missions, covering all project phases, from requirements derivation to design, to manufacturing and integration, to flight. Furthermore, it provides a key opportunity to verify in flight critical reentry technologies performance, to collect precious aerodynamics and aerothermodynamics data and to derive flight dynamic data via specific vehicle model identification (VMI).

For this reason the IXV will be equipped with various instrumentations addressing the main experimentation objectives including:

- Thermal protections and hot structures in-flight performance verification;
- Aerodynamics and aerothermodynamics in-flight data collection;
- Innovative technology in-flight experimentation (i.e. thermal protection and techniques for health monitoring and GNC).

With respect to the overall project, one of the major driving requirements is the adoption of the design-to-cost approach, leading to several constraints such as:

- Proto-flight approach with dedicated qualification models for critical S/S;
- Maximum use of COTS for all technologies not part of the IXV experimentation objectives;
- Simple architecture, but guaranteeing the necessary mission success requirements;
- Possible re-use of existing Software.

Reference Mission Scenario

The IXV reference trajectory was selected as the result of extensive trade-offs performed for several sea and ground landing options and the following main constraints for the re-entry leg:

- De-orbit maneuvers to be performed by last launcher stage with debris fall-out occurring in ocean or safe area;
- Safety of whole trajectory, with re-entry flight not over populated landmasses and probability of loss of human life (population flown over) less than 10^{-7};
- Representative aero-thermal-mechanical re-entry environment for technologies verification and experimentation.

The trade-off led to the selection of the sea landing equatorial trajectory to minimize risks on safety (flight over non-populated areas) and to maximize launcher performance and, therefore, budgets for on-board experiments.

After launch from Kourou, the last stage of VEGA, will inject IXV on an equatorial (5 deg inclination) suborbital path (apogee about 500 km) towards the following targeted re-entry gate interface conditions:

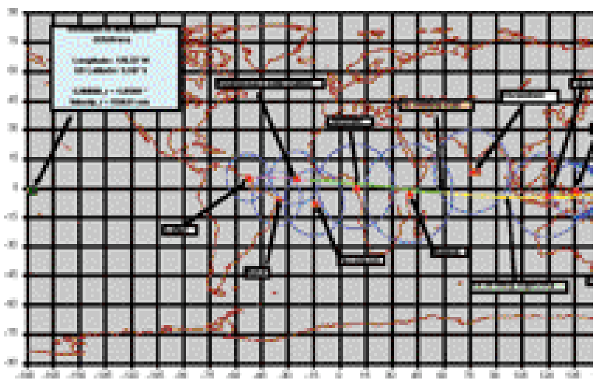


Figure 1. VEGA reference trajectory - ground track

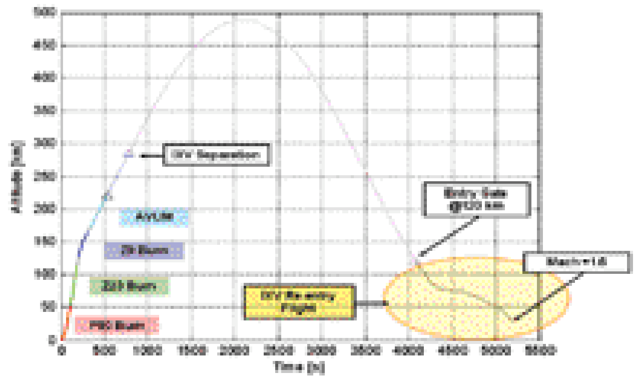


Figure 2. IXV reference trajectory-height profile

- Altitude h = 120 km;
- Relative velocity = 7.5 km/s;
- Flight Path Angle = -1.5°.

Once in the atmosphere, the IXV will be autonomously controlled by the combination of aerodynamic surfaces (FLAPS) and reaction control system jets (RCS), employing a hybridized inertial/GPS system for the determination of its state (position, velocity, attitude and rate).

It will take about 20 minutes and 7500 km of down-range from the re-entry gate to reach Mach 1.6 point (end of experimentation).

Once the Mach 1.6 interface is reached at 30 km altitude, a supersonic ribbon drogue chute will be deployed to slow down the IXV while ensuring flight stability through the transonic regime. Then, at Mach 0.3 at an altitude of 10 km, first a subsonic ribbon drogue chute and subsequently, at 3.2 km altitude, the main parachute are deployed to slow down the IXV to the final landing touch-down velocity of 6 m/sec. The IXV will be able to float by itself; however two flotation devices will be deployed for backup purposes. The IXV will then be recovered and transported back to Europe to ground AIV facilities for post-flight inspection and analysis.

During the whole trajectory (ascent, coast, re-entry and landing) the IXV will be continuously tracked from various ground stations which will also provide the means to download the important vital and experimentation data in real-time.

Vehicle Performance and Subsystems

The consolidated 4.4 m long IXV aerodynamic shape with lift/drag = 0.7 results from a detailed management of several design requirements, including maximization of the internal volume to ensure the vehicle layout feasibility and compliance with MCI constraints.

Detailed and accurate aerodynamics and aerothermodynamics databases are essential to perform key design and analysis tasks at system and subsystem level, such as flying qualities analysis, TPS sizing activities, and so on. For this purpose extensive computational fluid dynamics (CFD) computations (Euler and Navier Stokes) have been performed and will be perfor-

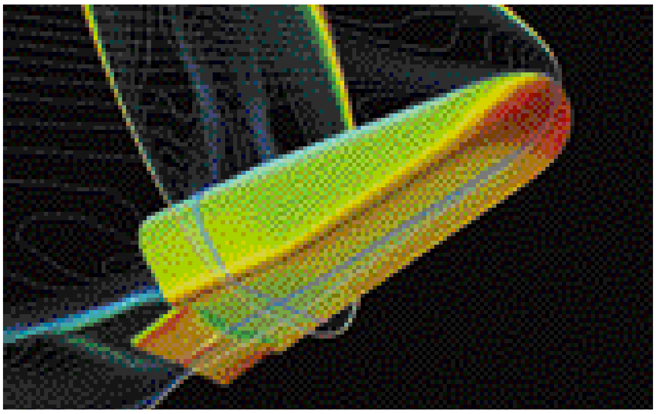
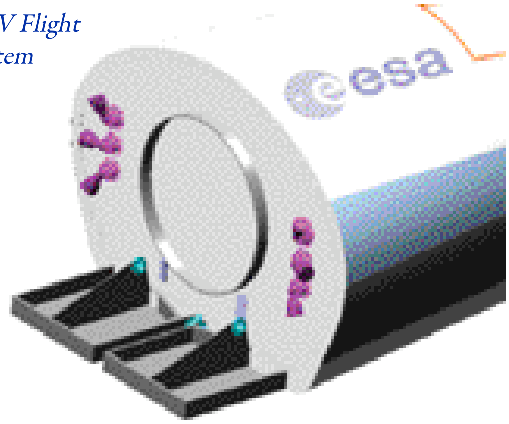


Figure 3. CFD Flowfield around the IXV aero-shape

Figure 4. IXV Flight Control System



med continuously along the project development phases to support the different design loops, as well as extensive wind tunnel testing campaigns in a variety of European wind tunnel test facilities. The flow regimes cover hypersonic down to transonic speeds.
The In-Flight Measurement System will be responsible for collecting and distributing the various measurements needed to fly the vehicle and to meet the experimentation objectives.

Conclusions

The development and flight experience of such an integrated system will provide Europe with relevant know-how applicable to several space fields in addition to reusable launchers, such as sample return missions, crew transportation, atmospheric planetary entry missions (Mars, Venus, ...), non-atmospheric planetary and interplanetary entry missions (Mercury, Moon, NEO, ...), space tourism.
With the objective to identify to which extent the IXV flight experience is contributing to the increase of European know-how for space applications other than future launchers, a detailed exercise was carried out by ESA with its results presented in the table hereafter.

Although the level of compliances might appear subjective, the strategic importance for Europe to advance in such critical re-entry domain is evident.
On the industry side, activities are running at full speed and heading towards key review milestones, such as System Requirements Review in December 2007 and Preliminary Design Review in August 2008.
On the agencies side, while the industrial activities are running, the highest priority is given to the successful completion of the harmonization process with national programmes, targeting:

- the integration of the CNES / PRE-X national data into the IXV project file for the mission similarities, ensuring consistency in the IXV design loops, with the objective to have a more consolidated IXV phase-B end design file leading to a potential reduction of phase-C/D cost for development and risk provision;
- the integration of national technical expertise from ASI / CIRA, CNES, DLR in the current IXV project team, with the objective to set-up a solid European team ensuring proper project implementation and follow-up to flight.

	SPACE APPLICATIONS					
	Reusable Launch Vehicles	Sample Return Missions	Spaceplane/Space Tourism	Crew Transportation Vehicles	Atmospheric Planetary Entry Missions (Mars, Venus,..)	Non-Atmospheric Planetary/InterPlan. Entry Missions (Moon, Mercury, NEO,..)
GNC	X	x	X	x	x	x
IMS	X	X	X	X	X	x
IMS experiments	X	X	X	X	X	x
TPS	X	x	X	X	x	
AED-ATD	X	X	X	X	X	
HOT STRUCTURES	X	x	X	X	x	
RCS	X	X	X	X	X	X
PARACHUTE	x	X	x	x	X	
AIV TECHNIQUES	X	X	X	X	X	x
OPERATIONS	X	X	X	X		
SAFETY	X	X	X	X		
STANDARDS	X	X	X	X		

LEGEND:
X = Fully Compliant
x = Partially Compliant

G. Tumino, S. Mancuso: ESA, Paris, France, and T. Walloscheck, S. Langlois, C. Philippe: ESA/ ESTEC, Noordwijk, Netherlands

The Council of European Aerospace Societies-CEAS

The CEAS,a non-profit umbrella organisation,aims to develop a framework within which the major aerospace societies in Europe can work more closely together. The Member Societies: AAAF (France), AIAE (Spain), AIDAA (Italy), DGLR (Germany), FTF (Sweden), HAES (Greece), NVvL (Netherlands), RAeS (United Kingdom), SVFW (Switzerland). Following its establishment as a legal entity conferred under Belgium Law,this new organisation began its operations on 1st January 2007.

Among the Main Coming Events

• AERONAUTICS

22-24 April 2008: RAeS Conference organized in co-operation with the CEAS

Aerospace 2008: the way forward

2008 sees the centenary of British aviation so it seems a good time to look forward at the state and future of aviation worldwide for the next 100 years. Aerospace 2008 will comprise three days: 22 April- Military Day; 23 April-Research and Technology Day; 24 April-Civil Air Transport Day.

Venue: Royal Aeronautical Society, 4 Hamilton Place, London W1J 7BQ.
Contact: Kirstie Eaton – Tel.:+44(0)20 7670 4345
Kirstie.eaton@raes.org.uk
www.raes.org.uk/conference

• SPACE

– 5-9 May 2008:Space Propulsion2008 – 5th Int. Spacecraft Propulsion Conference, 2nd Int.Symposium on Propulsion for Space Transportation.
Venue: Heraklion,Crete,Greece. www.propulsion2008.com
– 28-30 May 2008: IAA 1st Symposium on Private Manned Access to space.
Venue: Arcachon(France). www.avantage.aquitaine
– 30 June-5July 2008: 8th World Congress on Computational Methods in Applied Sciences and Engineering.
Venue: Venice, Italy. www.iacm-eccomascongress2008.org
– 13-17 October 2008: 6th Aerothermodynamics Symposium for Soace Vehicle Design.
Venue: Onera, Chalais-Meudon (France).

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