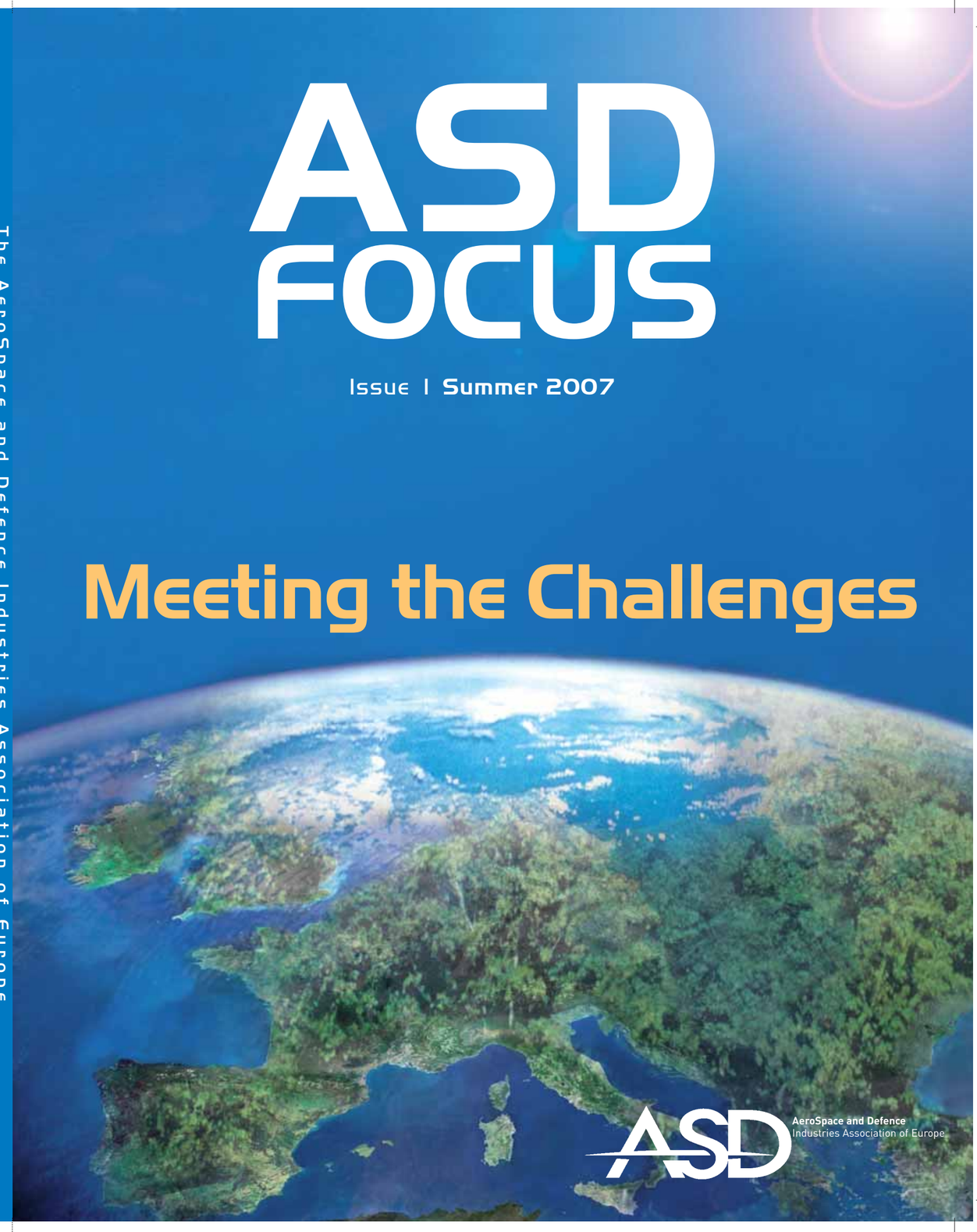
The AeroSpace and Defence Industries Association of Europe

ASD FOCUS

Issue | Summer 2007

Meeting the Challenges



AeroSpace and Defence Industries Association of Europe

FOREWORDS

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Charles Edelstenne,
President of ASD

François Gayet,
ASD Secretary General
and Publisher ASD Focus

"Who could have anticipated the growth that has taken place in the aerospace industry during the last 50 years? Today, flying is a means of transport that is accessible, affordable and used by everyone. We expect overnight deliveries from the other side of the world when we buy something via the internet. Our expectations are to go anywhere at anytime. The great improvements in performance and high levels of safety our industry has achieved often pale in the public eye and are frequently taken for granted. This can be a double-edged sword as we continue the quest for perfection.

Great success brings its own challenges and the more successful we become, the more scrutinised we are. As François Gayet alludes to, and it is something that I am proud to repeat, we represent an industry that through its own initiative has developed products that are technically so superior; few other sectors can match these achievements.

Being in the spotlight stimulates debate and it should be common knowledge that for decades we have invested heavily in Research & Development and we continue to do so as we strive to build cleaner, more efficient aircraft.

The debate surrounding climate change continues and it is, therefore, appropriate that the first edition of ASD Focus, launched to coincide with the Paris Air Show, tackles these questions head on.

For too long I believe that, we in the aerospace industry, have understated our achievements. With the launch of this new magazine we have an opportunity to put our case forward. This first issue of ASD Focus comes at the right time as International Air Shows always create a great deal of interest.

In concluding, I am hoping that you will find the ASD Focus an enjoyable read.

Charles Edelstenne

President of ASD

"As Secretary General of the AeroSpace and Defence Industries Association of Europe, I am delighted to introduce the first edition of ASD Focus magazine.

ASD Focus will be issued bi-annually; this year in June for the international air show and in October for the ASD Convention. Each edition will include articles highlighting topical issues affecting our Industry with contributions drawn from a wide range of experts, be they scientific, regulatory or from the areas of research and development.

This, our first edition, focuses on aviation in view of the challenges of climate change, with a particular emphasis on research and technological improvements.

In the last four decades, the industry has reduced noise by 75% and CO_2 by 70%. We have achieved these extraordinary environmental improvements whilst at the same time maintaining the highest standards of safety, delivering cleaner, quieter and more cost effective aircraft to our customers. We are also fully committed to achieving the demanding ACARE goals to reduce NOx by 80% and CO_2 and noise by 50% by 2020.

Finding new solutions can only be achieved through advanced R&D. Our member companies, both civil and military, are amongst the most innovative and technologically advanced in the world and typically spend 13% of their annual turnover (more than €12 Billion) on Research & Development. Continued support from both national and EU research funding programmes, including the Joint Technology Initiative Clean Sky and SESAR will be essential.

Based on this we invite you to read the articles on ACARE, the JTI Clean Sky and SESAR, as well as articles from our engine manufacturers on current Research Programmes and analysis on alternative fuels.

Besides technological progress, operational measures and infrastructure improvements, including the Single European Sky, play a major role in reducing aircraft emissions and should be widely supported. We are committed to working in partnership with all stakeholders to find solutions.

Finally, I think it is worth nothing that we, as European manufacturers, are proud of our record in developing products, which have brought, and continue to bring, huge social and economic benefits to Europe and to the rest of the world. We are confident that we can continue to rise to the challenge.

I hope you find the ASD Focus both interesting and informative.

François Gayet

ASD Secretary General and Publisher ASD Focus

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Ulrich Schumann is Director of the Institute of Atmospheric Physics.

> "The global aviation fleet presently contributes to 2% of all man made-made CO_2 emissions."

Climate Impact of Aviation

Robert Sausen and Ulrich Schumann,
Institute of Atmospheric Physics, German Aerospace Centre (DLR).

The climate impact of aviation has been receiving increased attention, in particular, since the European Commission published a concept for including aviation into the European Emission Trading System, and even more, since IPCC published its Fourth Assessment Report on Climate Change. The global aviation fleet presently contributes about 2% of all man-made carbon dioxide (CO_2) emissions. However, like other sources, aviation also emits other gases and particles affecting the climate.

Therefore, several questions arise: How can aviation impact climate? What is particular about aviation-induced climate change? What is the ratio between the total contributions and those from CO_2? How can we reduce the climatic impact of aviation?

RADIATIVE FORCING

Aviation emits gases and particles which change the composition of the atmosphere or change clouds and hence disturb the radiation budget of the Earth. In particular, aviation emits the greenhouse gases CO_2 and H_2O (water vapour). Aircraft also emit nitrogen oxides (NOx). through photochemistry in the atmosphere, the additional NOx enhances the formation of ozone (O_3) and destroys methane (CH_4). Both O_3 and CH_4 are greenhouse gases.

The water vapour emitted by an aircraft at cruise altitude can trigger the formation of contrails. Contrails are initially visible as line-shaped clouds. In cold and moist air masses, contrails may spread and in some cases eventually form so-called contrail cirrus, which resemble natural cirrus clouds. Finally, aviation induces aerosols (soot and particles formed from sulphur oxides). These aerosols may interfere with the atmospheric radiation directly or indirectly after modifying clouds.

The magnitude of the perturbation of the atmosphere's radiative budget is measured by radiative forcing (RF). A positive RF warms the atmosphere, a negative RF cools. For constant RF, after many decades, the Earth approaches a new climate, with a changed global mean temperature at the Earth surface approximately proportional to RF. Therefore, RF is used as a metric to compare the relative strengths of various perturbations to the atmosphere.

In 1999 the IPCC Special Report "Aviation and the Global Atmosphere" showed a first estimate of the aviation related radiative forcings. An update to those estimates was provided in 2005 .

Figure 1 displays the results: the red bars show the most recent estimate. The largest contributions come from CO_2 , O_3, contrails (all positive, warming) and CH_4 (negative, cooling). Small contributions are from H_2O, direct sulphate aerosol and direct soot aerosol. As can be seen from Figure 1, the total aviation-induced radiative forcing RF is about twice that from CO_2 . Note that no best estimate for RF from cirrus clouds (beyond contrails) is provided due to presently poor knowledge. The total amounts to about 3% of the radiative forcing from all man-made activity since the 18th century, with a substantial uncertainty. The largest uncertainty comes from aviation contributions to changes in cirrus clouds, which are therefore not included in the total.

IMPACT OF EMISSIONS

Carbon dioxide has an atmospheric life-time of more than 60 years and becomes well-mixed during this period regardless of where the emission occurred. Hence, CO_2 emissions from aviation have the same effect as CO_2 emissions from other sources. However, the RF caused by other emissions depends strongly on where and when they are emitted.

Because of a longer life-time and lower ambient pollution, a NOx molecule emitted at cruise altitude (8 - 14 km) produces a larger amount of O_3 than when emitted at the Earth surface. As the atmospheric temperature at cruise altitude is lower

than at the Earth surface, the radiative forcing per unit ozone is larger than the RF from the same amount of ozone near the surface (e.g., from road transport).

Contrails and cirrus clouds only form at the low temperatures typically occurring at cruise altitudes. Long-lived contrails occur mainly in the humid and cold regions near and below the tropopause. Thin cirrus clouds and contrails most probably cause a positive RF.

NON-CO_2 EFFECTS UNDER SCRUTINY

International aviation and international shipping are not included in the Kyoto Protocol because the parties could not agree on a national allocation of these emitters during the negotiation of the Kyoto Protocol. Therefore, the parties mandated the respective UN specialised agencies, ICAO and IMO to find a solution to the allocation problem, which has not yet been achieved.

Recently, the European Commission has developed a scheme on how to include aviation (domestic and international) in its Emission Trading Scheme. In this context, it has been discussed how to include the non-CO_2 effects of aviation into such a scheme.

Is there a good method to account for the non-CO_2 effects of aviation? One question is how to weigh the non-CO_2 effects in relation to the CO_2 -induced climate change. One might be tempted to use the ratio between the total aviation-induced RF to the RF only from the CO_2 emissions of aviation, the so-called Radiative Forcing Index (RFI). However, RF is a backward looking metric, i.e., it accounts for all the effects of processes that happened in the past. Aviation RF of the year 2000, as displayed by the red bars in Figure 1, accumulates all contributions of aviation since 1940 weighted with the life-time of the various species. While RF from NOx-induced ozone and contrails is essentially only from air traffic in 2000, RF from CO_2 is from the accumulated CO_2 since 1940. For constant air fleet and aviation emissions, RF from ozone and contrails were constant, but aviation CO_2-induced RF would grow because CO_2 would further accumulate. Therefore, neither the total aviation-induced RF nor the RFI are suitable measure to weigh the non-CO_2 climate effects of aviation.

The fact that RF at a given time does not include any information about the atmospheric lifetime of a perturbation to the atmosphere, is one of the reasons why RF was not used in the Kyoto Protocol to weigh non-CO_2 gases, i.e. to transfer them into equivalent CO_2 . The Kyoto Protocol rather makes use of the Global Warming Potential (GWP), which is the time-integrated RF arising over a given time horizon (100 years) from a unit emission of a particular gas, normalised by the time-integrated RF from unit CO_2 emission. In this way the individual life-times of the various gases are considered.

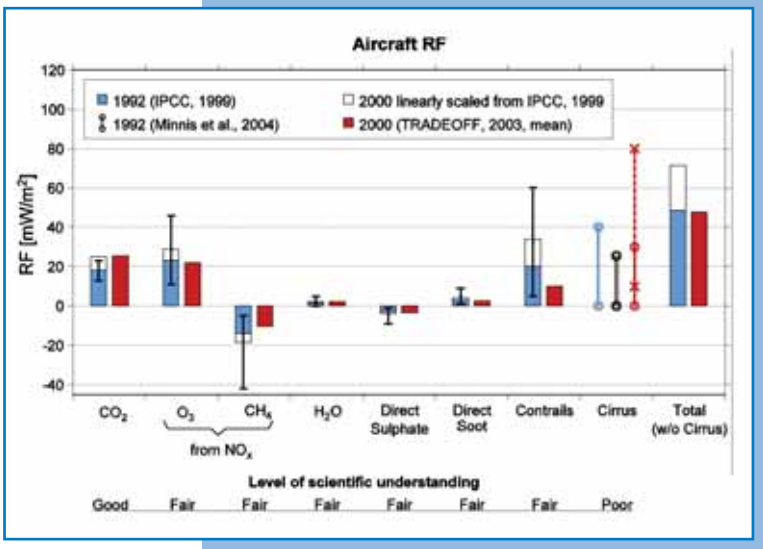
FURTHER RESEARCH

The GWP concept cannot directly be applied to aviation, mainly because the atmospheric lifetimes of important aviation effects are much smaller than the lifetimes of the Kyoto gases. Among the Kyoto gases, CH_4 is that with shortest lifetime, being around the order of 10 years. In the case of aviation we also deal with phenomena, which only live for a few hours, e.g., contrails. Moreover, the aviation-induced climate effect depends not only on the magnitude of the emissions but also on geographical region and altitude, and daytime and season of the emissions.

Currently several concepts for an inclusion of the non-CO_2 effects are being discussed in the science community, including such as time integrated RF from an aviation induced perturbation of the atmosphere or the temperature change resulting from such a perturbation after a certain time, e.g., after 100 years. The integrated RF would be in analogy to the GWP currently applied by the Kyoto Protocol. The temperature change would more directly measure the contribution of the perturbation to long-term global climate change. Proper methods for accounting the climate effects of non-CO_2 effects have still to be established, and further research must be undertaken to reduce uncertainties.

A scientifically sound solution for the inclusion of non-CO_2 effects in an emissions trading scheme (or other approaches) would eventually call for something else than a simple multiplication factor. Such a simple multiplication factor would weaken incentives to reduce the total climate impact beyond a reduction of the fuel consumption, i.e., there would be no benefit in reducing non-CO_2 effects. ■

FIGURE 1



RF [mW/m²] from aviation for 1992 and 2000, based on IPCC (1999) and results of the TRADEOFF project (Sausen et al., 2005). The whiskers denote the 2/3 confidence intervals of the IPCC (1999) value. The lines with the circles at the end display different estimates for the possible range of RF from aviation-induced cirrus clouds. In addition, the dashed line with the crosses at the end denotes an estimate of the range for RF from aviation induced cirrus. The total does not include the contribution from cirrus clouds.
The level of scientific understanding is indicated by the subjective grades "Good", "Fair" and "Poor".

Technological Progress

MANUFACTURERS ANSWER FREQUENTLY ASKED QUESTIONS

How has the aviation industry been proactive in delivering environmental improvements?

Aeronautical Manufacturers have a vocation to develop innovative technology and design highly performing products to achieve their mission of transporting people and goods on a given range at the highest level of safety, lowest cost and with minimum impact on the environment.

Even in the past, when the fuel price was far less than nowadays, the fierce competition between manufacturers has always been the main driver to reduce fuel burn and associated CO_2 emissions. The same is true with respect to the reduction of noise levels.

Reaching the maximum competitive advantage with a product having remarkably low fuel consumption and noise levels is the impetus behind each new aircraft type. This is the reason why Aeronautical Manufacturers are always looking ahead at technological solutions enabling significant environmental improvements.

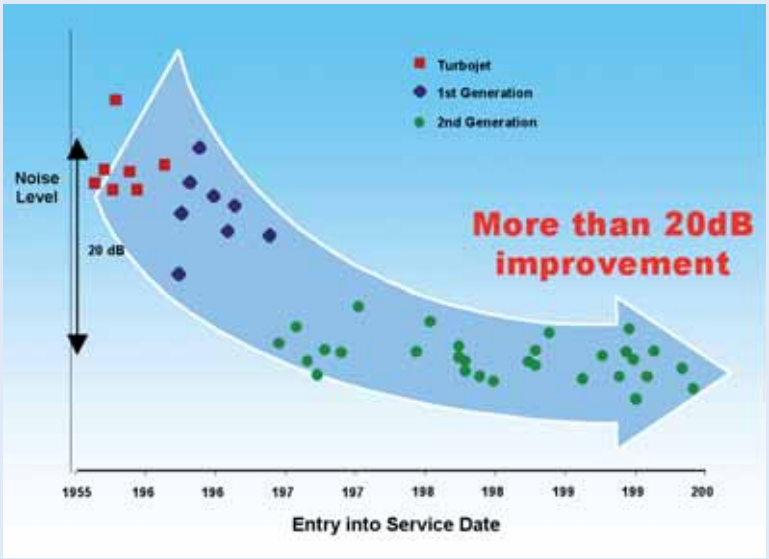
Therefore, generation after generation of aircraft, impressive results have been achieved through weight reductions - thanks to improved materials, manufacturing processes and systems improvements - aerodynamic improvements, engine performance improvements, specific combustion and acoustic focused technologies.

In order to realise the order of magnitude of such improvements, the following remarkable results have been achieved without compromising the highest standards of safety and reliability, which are our fundamental priority.

REMARKABLE RESULTS

NOISE

➜ 75% reduction in typical noise levels

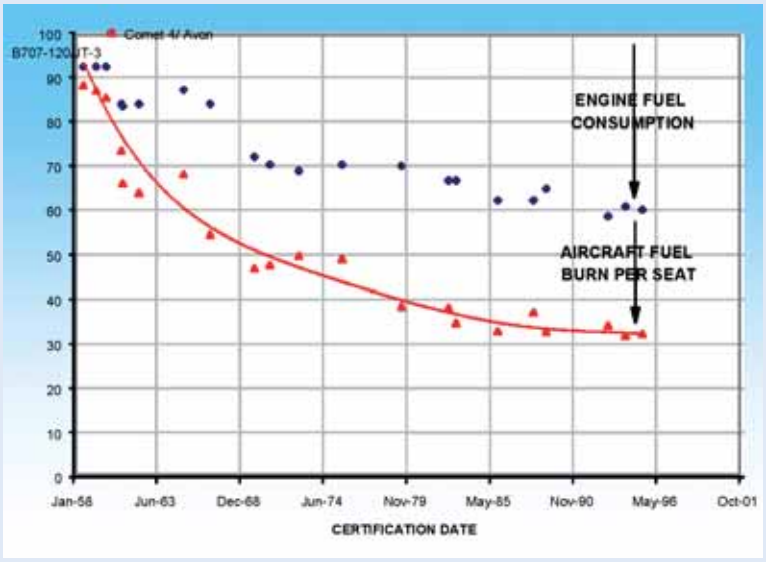


Source: IATA Environmental Review 2004

Aircraft entering today's fleets are typically 20 decibels per operation quieter than comparable aircraft 40 years ago, which represents 75% less annoyance.

EMISSIONS

➜ ~ 70% reduction in fuel consumption
➜ ~ 70% less CO_2 emissions per passenger/km



Source: IPCC Report on Aviation and the Global Atmosphere 1999

➜ Oxides of Nitrogen (NOx) emissions have been progressively reduced to meet 3 successive increases in ICAO stringency standards.

The progressive tightening of stringency coupled with the fierce competition between competing manufacturers, is in itself a very powerful incentive to develop technology that beats current standards by as wide a margin as possible as aircraft must remain in service for their economic life.

What are the Research Goals?

The European Aeronautical Manufacturers have endorsed the Strategic Research Agenda published in 2002 by the Advisory Council for Aeronautical Research in Europe (ACARE). This sets out a challenging programme, including four goals aimed at meeting the environmental challenge for 2020:

• To reduce fuel consumption and CO_2 emissions by 50 per cent.

• To reduce perceived external noise by 50 per cent.

• To reduce NOx by 80 per cent.

• To make substantial progress in reducing the environmental impact of the manufacture, maintenance and disposal of aircraft and related products.

These targets refer to the whole aviation system and as part of it, the manufacturers are strongly committed to contribute to their achievements.

What is the contribution of aviation to man-made CO_2 emissions?

The global aviation fleet presently contributes about 2% of all man-made carbon dioxide (CO_2) emissions.

Source: Sausen & Schumann (Cf. article on pages 4-5)

Is technology the only option to reduce emissions?

Beside the development of new technologies leading to more fuel-efficient aircraft, improvements to existing infrastructure and the use of operational measures all play an important part in reducing aircraft emissions. By working in partnership with all air transport stakeholders, outstanding results can be achieved and the manufacturers are contributing to this effort actively.

Technology is and will remain key.

How do aeronautical manufacturers design their products?

Any new aircraft and subsequently each of its components need to strike a balance between the following requirements. (See Figure 1).

Focusing on the environmental requirements, there is also a balance to reach in order to ensure that each new aircraft will bring environmental performance improvements across three dimensions: noise reduction, emissions reduction and minimised environmental impacts throughout its life cycle.

For instance, increasing the fan diameter of an engine would result in a noise reduction. However as this implies adding weight, it may result in an increase in fuel consumption.

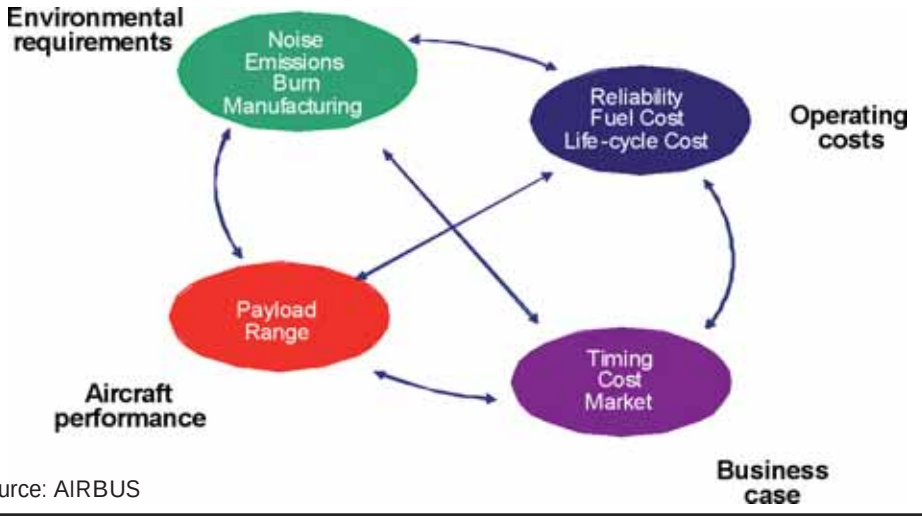
What are the benefits of a stable regulatory framework and of dependable scientific knowledge?

It takes approximately 10 years to design an aircraft. An aircraft type can be produced for 20 to 30 years with each aircraft being in service for 25 to 40 years. In such a long life cycle industry, today's choices and solutions must be sustained over decades.

Therefore, in order to take decisions to invest in future technologies, Aeronautical Manufacturers need a stable international regulatory framework based on dependable scientific knowledge. This will enable the best technology balance to deliver the largest environmental improvements across the noise, emissions and lifecycle dimensions.

Improving the scientific understanding of the atmosphere and the impact of aviation emissions is key to optimize priorities and weight factors in research, trade-offs and mitigation measures. Aeronautical Manufacturers and their Airlines cutomers therefore support transversal scientific research and contribute to atmospheric studies by enabling the collection of data by placing atmospheric measurement devices onto their aircraft following the requirements of scientists. The manufacturers are also sharing their technological scenario with regulatory authorities, decision-makers and scientists. ■

How do aeronautical manufacturers design their products?



Source: AIRBUS

Jane Hupe,
ICAO Secretariat

CAEP:

The past and recent work on aircraft noise and emissions

Jane Hupe,
ICAO Secretariat

The International Civil Aviation Organization (ICAO) is a specialized agency of the United Nations responsible for the safe and efficient development of Civil Aviation. ICAO is keenly aware of its responsibility and that of its 190 Contracting States "to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of the environment".

ICAO's activities in the environment field are primarily focused on those problems that benefit most from a common co-ordinated approach on a worldwide basis, namely aircraft noise and the impact of aircraft engine emissions.

ICAO's current environmental activities are largely undertaken through the Committee on Aviation Environmental Protection (CAEP), which was established in 1983, superseding the Committee on Aircraft Noise (CAN) and the Committee on Aircraft Engine Emissions (CAEE). CAEP consists of 21 Members[1] from Contracting States and 12 Observers[2] from States, intergovernmental organizations and non-governmental organizations representing aviation industry and environmental interests.

CAEP assists the ICAO Council in formulating new policies and adopting new standards on aircraft noise and engine emissions. The first meeting of CAEP (CAEP/1) was held in 1986. All of CAEP's work, to the extent applicable, must attempt to produce deliverables that are technologically feasible, environmentally beneficial, and economically reasonable. The interdependencies (e.g. how measures to reduce noise might affect emissions) of measures is also considered in this work.

CAEP/7

Last February, international experts on aviation and the environment gathered at the ICAO Headquarters in Montreal for the seventh meeting of ICAO's CAEP (CAEP/7). They reported on their work of the past three years and formulated recommendations to the ICAO Council. Seven new ICAO documents for addressing aircraft noise and emissions, as well as amendments to existing ICAO publications, were proposed and subsequently approved by the Council on 15 March. The 36th Session of the ICAO Assembly will take place from 18 to 28 September 2007 and will further discuss the Organization's environmental policies based on the latest recommendations from CAEP/7. The main ICAO's work on aircraft emissions is described in the following paragraphs. More information on ICAO's work on noise and further information on aircraft emissions are provided in the electronic version of this article, available at www.asd-europe.org.

AIRCRAFT ENGINE EMISSIONS

In the past, ICAO's policies to address the environmental impact of aircraft engine emissions focused primarily on the ground level effects. In 1999 ICAO requested the Intergovernmental Panel on Climate Change (IPCC) in collaboration with the Scientific Assessment Panel to the Montreal Protocol on Substances that Deplete the Ozone Layer to produce a comprehensive assessment of aviation's contribution to global atmospheric problems - The "Special Report on Aviation and the Global Atmosphere". This comprehensive assessment was a useful tool for drafting the Organization's policy on the impacts of aviation on climate and ozone.

The Kyoto Protocol, of the United Nations Framework Convention on Climate Change (UNFCCC), requires countries listed in Annex I to the Convention (industrialized countries) to reduce their collective emissions of six greenhouse gases, the one most relevant to aviation being carbon dioxide (CO_2). International aviation emissions are currently excluded from the targets. Instead, Article 2, paragraph 2 of the Kyoto Protocol states that the responsibility for limiting or reducing greenhouse gas emissions from aviation bunker fuels shall fall to the Annex I Parties, working through ICAO.

In 2001, the ICAO Assembly requested the Council to continue studying policy options to limit or reduce the environmental impact of aircraft engine emissions and to develop concrete proposals and provide advice as soon as possible to the Conference of the Parties to the UNFCCC. It called for special emphasis to be placed on the use of technical solutions, while continuing to consider market-based measures, and taking into account potential implications for developing and developed countries alike.

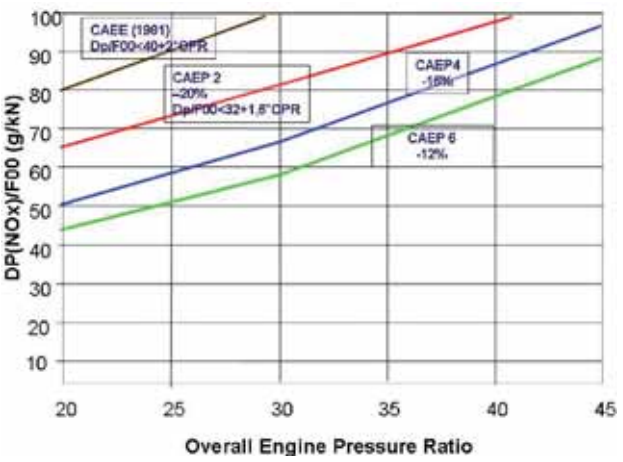
REDUCTION AT SOURCE

Aircraft produced today are required to meet engine certification standards adopted by ICAO. These are contained in Annex 16 (Environmental Protection, Volume II — Aircraft Engine Emissions) to the Convention on International Civil Aviation. In the early 1980s, ICAO adopted Standards regarding aircraft engine emissions. They are based on an aircraft's landing and take-off (LTO) cycle and establish limits for emissions of oxides of nitrogen (NOx), carbon monoxide and unburned hydrocarbons. There are also provisions regarding smoke and vented fuel. CAEP continuously studies policy options to limit or reduce the environmental impact of aircraft engine emissions and places special emphasis on the use of technical solutions. Of particular relevance to climate change is the Standard for nitrogen oxides (NOx), which is a precursor for ozone and at higher altitudes becomes a greenhouse gas. The first standard for NOx was adopted in 1981 and ICAO increased its stringency three times in nearly 15 years (1993, 1999 and 2004, see figure 1). This action was taken to

1 Argentina, Australia, Brazil,. Canada, Egypt, France, Germany, India, Italy, Japan, Netherlands, Poland, Russian Federation, Singapore, South Africa, Spain, Sweden, Switzerland, Tunisia, United Kingdom and United States

2 Greece, Norway, Airports Council International – ACI, Arab Civil Aviation Commission – ACAC, European Commision – EC, International Coalition for Sustainable Aviation – ICSA, International Air Transport Association – IATA, International Business Aviation Council – IBAC, International Co-ordinating Council of Aerospace Industries, Associations – ICCAIA, International Federation of Air Line Pilots' Associations – IFALPA, United Nations Framework Convention on Climate Change (UNFCCC) Secretariat, and World Meteorological Organization – WMO

Figure 1 : ICAO's NOx stringencies



ensure that the best of proven low emissions technologies are being used in new products. In 2004, the ICAO Council endorsed the CAEP/6 recommendation for an additional NOx stringency increase. This new standard will be applicable to new engines certificated after 2008, and it is 12% lower than the existing (CAEP/4) standard. This will produce an overall 40% reduction in NOx compared to the first NOx standard.

CAEP/8 will review the NOx stringency standards during its next work programme cycle starting in 2007 and ending in 2010.

OPERATIONAL PRACTICES

An efficient management of aircraft operations reducing delays and optimizing routing can reduce fuel burn and associated emissions. In 2003, ICAO published guidance material[3] to enable airports, airlines and other stakeholders reduce emissions by an efficient management of airport operations.

At CAEP/7 a new ICAO circular on noise abatement departure procedures (NADP) noise and emissions effects was developed and provides information to airports and operators on noise and emissions (NOx and CO_2/fuel) effects of departure procedures.

THE USE OF MARKET-BASED MEASURES

In 2001, the ICAO Assembly requested the Council to continue developing guidance for States on the application of market-based measures aimed at reducing or limiting the environmental impact of aircraft engine emissions, particularly with respect to mitigating the impact of aviation on climate change. The coming 36th Session of the ICAO Assembly will further deliberate on the Organization's policy in this field. In line with this policy decision, CAEP/7 proposed guidance for incorporating international aviation emissions into States' emissions trading schemes, consistent with the UNFCC process. Three market-based measures have been under consideration, namely voluntary measures, emissions related charges and emissions trading. More information on the work of ICAO regarding the first two items is provided in the electronic version of this article at www.asd-europe.org

Guidance on Emissions trading Schemes

One of the highlights of the CAEP/7 meeting was proposed guidance for incorporating international aviation emissions into States' emissions trading schemes, consistent with the United Nations Framework Convention on Climate Change process. The draft guidance focuses on aviation-specific issues, identifies options and offers potential solutions:

- Aircraft operators be the accountable international aviation entity for purposes of emissions trading;
- Obligations be based upon total aggregated emissions from all covered flights performed by each aircraft operator included in the scheme;
- States, in applying an inclusion threshold, consider aggregate air transport activity (e.g. CO_2 emissions) and/or aircraft weight as the basis for inclusion;
- States start with an emissions trading scheme that includes CO_2 alone;
- States will need to put in place an accounting arrangement that ensures that emissions from international aviation are counted separately and not against the specific reduction targets that States may have under the Kyoto Protocol;
- Regarding trading units, States will need to consider economic efficiency, environmental integrity, equity and competitiveness when making a choice.

On the subject of geographic scope, the draft guidance recommends that States take into account an ICAO Council request that CAEP include the different options regarding the geographical scope describing their advantages and disadvantages and start to address the integration of foreign aircraft operators under a mutually agreed basis, and continue to analyze further options. The draft guidance will include an introduction emphasizing that the majority of ICAO Council members does not favour a non-mutually agreed approach. The coming ICAO Assembly Session will further consider this issue.

FUTURE WORK - NEXT STEPS

As part of its future work for 2007 – 2010, CAEP will continue to address the impacts of aircraft noise and emissions reviewing technology and operational improvement prospects and goals, assessing and refining tools and databases aimed at helping the examination of future policy options (including the study of NOx stringency options), while looking into interdependencies aspects, and continuing to consider market-based measures. One of the items CAEP will consider in future is the further development of a methodology to carry out the environmental assessment of ATM projects. The goal is to quantify their impact on the environment in terms of fuel burned, greenhouse gas emissions, air quality and noise.

ICAO convened a Colloquium on Aviation Emissions from 14 to 16 May 2007 in Montreal. The Colloquium, provided a broad forum on aviation emissions, aimed in particular at disseminating the outcome of CAEP/7. Presentations were given by renowned environmental experts and scientists. The presentations and main highlights of the Colloquium are available at http://www.icao.int/EnvClq/Clq07/Documentation.htm.

Last but not least, this year ICAO will publish its first Environmental Report prior to the Assembly and will do so in every subsequent Assembly year.

REFERENCES:

- Annex 16 (Environmental Protection) to the Convention on International Civil Aviation - Volume I - Aircraft Noise (2005) and Volume II - Aircraft Engine Emissions (1993)
- ICAO Guidance on the Balanced Approach to Aircraft Noise Management – Doc 9829, 2004
- Assembly Resolution A35-5
- Independent Experts NOx Review and the Establishment of Medium and Long Term Technology Goals for NOx (Doc 9887) ■

3 Circular 303 – Operational Opportunities to Minimize Fuel Use and Reduce Emissions

Alain Joselzon,
Head of Engineering Environmental Strategy, Airbus

> "The market is a driving force of progress."

Manufacturers: the International Context

Alain Joselzon,
Head of Engineering Environmental Strategy, Airbus,

Former Chairman of the ICCAIA Environmental Committee and Chief Observer to ICAO/CAEP.

Aviation is international and global by nature, which means that aviation environmental issues need global solutions. Based on this, there are significant advantages in developing consistent / harmonized approaches at the international level even for local issues.

Through ICAO and beyond, manufacturers strongly support international co-operation, including Authorities, aircraft and airport operators, aviation navigation service providers, other aviation stakeholders, scientific and research communities, and other U.N. bodies.

Aviation is also a long-cycle Industry by nature, requiring a stable international framework: in particular, building efficient strategies overcoming the multiple challenges involved in the development of new environmental technologies requires a stable regulatory framework. This explains the roles played by organizations, like ASD, at a regional level, and like ICAO, CAEP and ICCAIA, at an international level. ICAO/CAEP is of special importance for manufacturers, because the international standards and recommended practices relative to aircraft and engines issued by ICAO have a direct influence on the products in service, production, development, and even in the study phase.

ICAO/CAEP gives the manufacturers the opportunity to bring their expertise into the decision-making processes, and to make their views and problematic understood and taken into account. In addition, it increases their visibility and allows them to better understand and anticipate future needs and requirements.

Finally, one of the most important benefits, is the opportunity to participate in a unique international forum grouping the best experts worldwide from all stakeholders, which stimulates productive exchanges, mutual understanding, more efficient, better optimised and balanced processes, co-operation and synergies.

INVOLVING MANUFACTURERS

The work of CAEP necessitates deep design engineering experience and high expertise, such that, in most activities, manufacturers' experts are very involved and manufacturers need to dedicate significant resources, both in quality and in quantity, to CAEP activities. This involvement is critical to the results and to the successes of ICAO/CAEP. As ICAO/CAEP needs to address, through a heavy work programme, multiple aspects and many subjects, and as the work scope is permanently expanding, whereas the complexity of subjects increases, the manufacturers are more and more solicited. For instance, environmental interdependencies are a very complex domain requiring additional analyses and new modelling capabilities, where special deep involvement from manufacturers is needed, at a high level of expertise.

CHALLENGES FACED

Optimising all characteristics, including environmental and ensuring safe, operationally reliable and economically viable products require considerable resources and time. This is due to the intrinsic aviation specificities: high technology, long cycles and high safety requirements. Improvements are becoming more and more difficult and costly to achieve, as technology breakthroughs are by definition challenging in themselves.

Nonetheless, through comprehensive programmes and extended co-operations, the manufacturers keep making huge permanent and constantly increasing efforts to develop new technologies and designs that get incorporated into new products, and whenever possible in existing ones. They also develop in parallel new supporting methodologies and tools.

Beside technology progress, and taking into account the above challenges, manufacturers encourage systemic, holistic approaches combining all ways of mitigating the impact of aviation on the environment, for efficiency and timing purposes. Other stakeholders generally also support this type of approach. However, sometimes due to a lack of full awareness of the technological challenges, the level of expectations for some of them tends to go beyond realistic reach.

Another general challenge is the need for a sound and robust scientific knowledge base, in domains that are still subject to large uncertainties today, especially concerning air quality and climate change.

Aviation environmental issues need **global solutions.**

The fact that the manufacturers' expertise is more and more needed in ICAO/CAEP decision-making processes dealing with technical issues of growing complexity is another challenge in itself, as it unavoidably generates some tensions relative to the question of the independency of such processes. The use of independent experts is an element of response. Elaborating processes that stimulate communication, tight exchanges of views, data and co-operation between all actors to increase objectivity and confidence levels could help addressing this issue.

PROGRESS DRIVERS

What drives technology progress within aviation? Market requirements and forces are primary drivers, but certification schemes and existing standards also influence strongly aircraft design and technologies, while influencing market requirements themselves. Technology, design, tools, methodologies, and new products are like an ever-turning wheel that societal needs are spinning: product requirements and development stimulate technology development and the emergence of new improved designs; in turn, technology progress and new design capabilities stimulate the creation of new concepts and new products.

Naturally, there are other key factors of progress that are interacting with design, technology and methodologies, in particular linked to manufacturing processes and operational aspects. This leads to an essential point: technological progress is absolutely and critically needed, and indeed subject to considerable efforts, but environmental issues linked to aviation, to be efficiently addressed, need to be tackled on a broad basis and through a broad vision encompassing all aspects.

All standards are set at the international level to ensure that new aircraft designs embody "feasible"/mature technology, enabling manufacturers to meet or exceed defined "minimum environmental performance thresholds," be it for aircraft noise or for engine emissions. Standards thus contribute to environmentally friendly aircraft designs by stimulating the development of technologies and efficient products, and the implementation of relevant mature technologies. Standards also minimise risks and bring high confidence in technical, operability and durability characteristics. ICAO standards, which rely on proven, very rigorously controlled, universally understood and accepted methodologies and processes, are a fundamental "safeguard" and provide a clear and robust framework for environmental progress, which is particularly important to manufacturers.

In contrast, fragmented and inconsistent local rules may disturb balances and optimisation processes, and generate counter-productive effects, such as driving improper trade-offs.

HANDLE WITH CARE

Economic instruments should be "handled with care", given the fragile balance of economical factors and the vulnerability of the Aviation Industry in this domain.

This is particularly true for taxes and charges. We have to remember that higher fuel price generates effects similar to taxation/charging system, and that strong market pressures, ambitious research targets, and technology development efforts, combined with operational measures are already contributing to drastically reduce the CO_2 produced by Aviation.

Concerning Emissions Trading, used to further reduce CO_2, there seems to be a promising solution in integrating the emissions from international aviation into existing emissions trading schemes. The prospects of such a solution depend on the capability to build and implement efficient, fair and consistent mechanisms satisfying all parties and requirements

STANDARDS STRINGENCY

Manufacturers support reasonable international environmental standards, which, combined with powerful competitive forces, act as effective stimulators for the consistent development and penetration of efficient, mature technologies into products. Manufacturers also support the principle that those standards must be kept up to date.

However, to preserve the meaningfulness of standards, the pace of evolution needs to remain consistent with the fundamental characteristics and pulse of the Aviation Sector. Technology is a key element of progress, supported by intensive research activities, and is naturally subject to high expectations. The idea that increasing stringency would be the most efficient means to resolve environmental issues is however less simple and conspicuous than it looks.

The challenge is to find the optimal combination of solutions to the set of environmental issues, taking into account environmental costs and benefits. This combination is a fragile balance between multiple evolving factors, and the risk that resources will be allocated to sub-optimal combinations is high.

Very severe and/or premature standards would likely generate disincentive effects, increasing technical and economic risks, impacting cost-efficiency, delaying improved product introduction, and reducing confidence levels. Also, technology-forcing standards would send wrong signals to Industry and would be counter-productive, if the technologies, designs and environmental trade-offs are pushed towards a non-optimal route that impacts environment in the long run.

Then a new stringency could be considered when and only when there is

a sufficient, reasonably widespread margin across the range of products, a clear need and a potentially efficient prospect for such a measure. The stringency levels should then be set on the basis of robust data and analyses, including interdependencies, trade-offs and economic analyses.

PROSPECTS FOR THE FUTURE

There is a clear trend towards growing complementary and interacting challenges and needs relative to the development and integration of scientific knowledge to reduce uncertainties. The same trend goes towards developing new technologies, and analytical and modelling methodologies and tools, for handling environmental interdependencies in particular, and towards growing co-operation needs between all stakeholders to get the best overall solutions to address the environmental challenges combined with worldwide sustainable growth issues. Addressing these issues will require innovative tools, approaches and processes, where all stakeholders will need to work closer together, and the total work will significantly increase. This is already perceived in ICAO/CAEP activities and will obviously mean increasing challenges for the international community as a whole, in filling the gaps between the needs and the objectives, addressing the technical, economical, political, legal, resources, funding, organizational, competitiveness, transparency, intellectual property rights, confidence and independence issues.

The manufacturers are active in this dialogue and coordinate with other actors, within ICAO and outside. In response to the challenges faced, manufacturers are also pursuing efforts to best understand and address specific issues in all domains concerned. Strengthening the combined and coordinated efforts of the whole community will be necessary, in which the Manufacturers are willing to contribute actively. ■

ICCAIA AT A GLANCE

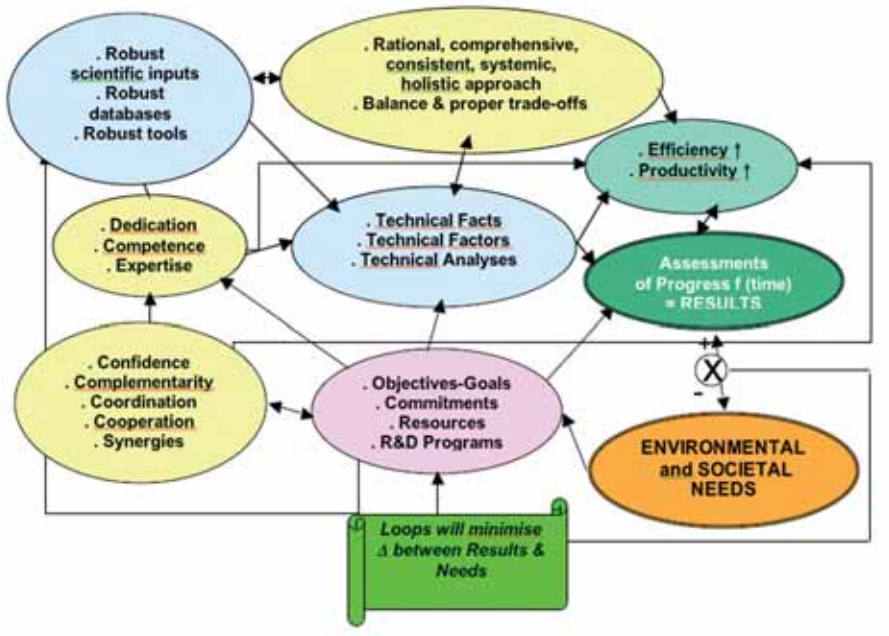
ICCAIA, the International Coordinating Council of Aerospace Industries Associations, consists of three committees. One deals with aviation environmental issues, the Aircraft Noise and Engine Emissions Committee (ANEEC), and gathers experts from the Airframe and Engine Manufacturers. The two other committees deal with airworthiness and CNS/ATM.

ICCAIA has the status of Observer in CAEP, the environmental committee of ICAO. On a triennial basis, CAEP elaborates decisions that are submitted to the ICAO Council, and eventually come before the ICAO Assembly.

CAEP currently has 21 Members representing ICAO State Members, and 12 Observers, including ICCAIA, IBAC, IATA, IFALPA, ACI, UNFCCC, WMO and the European Commission.

ICCAIA is the interface between manufacturers, other stakeholders, and ICAO within the international context.

Aviation & Environment: the "Virtuous Network"



GLOSSARY OF ACRONYMS

ACI	Airport Council International
ATM	Air Traffic Management
ANEEC	Aircraft Noise and Engine Emissions Committee
ASD	AeroSpace and Defence Industries Association of Europe
CAEP	Committee on Aviation Environmental Protection
CNS	Communication, Navigation and Surveillance
IBAC	International Business Aviation Council
ICAO	International Civil Aviation Organization
ICCAIA	International Coordinating Council of Aerospace Industries Associations
IFALPA	International Federation of Airline Pilots' Associations
UNFCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

Mogens Peter Carl
Director-General for the Environment,
European Commission

> "The EU has a special responsibility to take action."

Tackling Aviation Emissions:
a Global Imperative Where Europe Plays Its Part

Mogens Peter Carl,
Director-General for the Environment, European Commission

The world needs to combat climate change by making deep cuts in global greenhouse gas emissions over the coming decades. This will require contributions from all sectors – including aviation. Although its present share of total EU emissions does not seem very high (at 3%), this is comparable with that of the iron and steel industry, or other major industrial sectors, and this share is projected to increase faster than that of any other sector in years to come.

The ICAO has endorsed the principle of applying emissions trading to international aviation. It is a cost-effective and flexible way of ensuring that aviation makes a contribution without jeopardizing its future. Europe can and must show the way forward and inspire others to follow.

Air transport facilitates economic and cultural exchanges. It has become an integral part of modern society, not least in Europe where more competition in recent years has helped make air transport affordable to most citizens and has done much to promote European integration.

Unfortunately, air transport also has negative impacts on the environment. As awareness of the irreversible and potentially disastrous consequences of climate change increases, focus naturally turns to the growing contribution to this problem by aircraft emissions. Despite impressive progress in technology over time, traffic growth has outpaced fuel efficiency improvements, so that the impact of aircraft operations has grown steadily in absolute terms. Aviation emissions are projected to continue growing for decades to come, undermining the emissions reductions made by other sectors.

Against this backdrop, in 2005 the Commission adopted a comprehensive strategy for reducing the climate impact of aviation. It entails continuing and strengthening existing measures - including EU aeronautics research into greener air transport and improvements in air traffic management - but also identifies the need for stronger economic incentives to ensure that greater account is taken of environmental costs in business and customer decisions. To this end, in December 2006, the Commission adopted a legislative proposal for the inclusion of aviation in the EU greenhouse gas emissions trading scheme (the EU ETS).

Emissions trading is a cost-effective mechanism for reducing emissions.

Emissions trading is a cost-effective mechanism for reducing emissions. The EU ETS has been in place since 1 January 2005. It covers more than 11 500 energy-intensive installations and about half of total EU CO_2 emissions, so is already a key driver for the rapidly growing global carbon market.

Emissions trading is also favoured by the International Civil Aviation Organization (ICAO) which endorsed the use of open (i.e. not limited to a specific sector) emissions trading for aviation in 2001. In 2004, the ICAO decided not to develop a global scheme specifically for aviation, but instead recognised that a possible approach would be to incorporate emissions from international aviation into the existing schemes of Contracting States.

The Commission proposal aims to implement in Europe the approach endorsed by the ICAO. As a major player in global aviation and a region of developed countries with special obligations under the Kyoto Protocol, the EU has a special responsibility to take action. It can capitalise on its experience with the EU ETS to create a model for use by other States and regions. By extending the EU ETS to include aviation, our aim is to encourage action by the rest of the globe to address aviation emissions. ■

Francois Quentin,
vice Chairman ACARE

> "An objective of vision 2020 is to make Europe a world leader in aeronautics."

ACARE and ASTERA: the Background of a Successful Agenda

François Quentin,
Senior Vice President, Aerospace Division, Thales.

The basis of the Strategic Research Agenda in Aeronautics, was the report "European Aeronautics – a Vision for 2020", that was published in 2001. A fundamental perception in this report was that air transport is a key component of the global infrastructure that supports us in the 21st century. Based on this, it was clear that in order to reap any positive results on a European level, we needed a way to address air transport in way that was system-wide, strategic, and coherent.

Vision 2020 has two overarching top level objectives: to meet society's needs for an efficient air transport and to make Europe world leader in aeronautics.

Vision 2020 identifies five "challenge areas" and associated goals. These areas are: Noise & Emissions, Quality and Affordability, Safety, Security and Air Transport System Efficiency.

Each of the above challenge areas implies a number of specific goals which need to be achieved by 2020 in order to make the Vision a reality.

Based on this Vision and the identified need for a holistic approach to European aeronautics, the Advisory Council for Aeronautics Research in Europe, ACARE, was formed. ACARE's mission is to provide guidance for the future of the European aeronautics research. Today ACARE has 46 members representing a cross section of the full spectrum of air transport system's stakeholders: manufacturing, research establishments, academia, airlines, airports, the European Commission, Member States, regulators etc... ACARE's focus is to establish and carry forward a Strategic Research Agenda for aeronautics research shared by all air transport communities and able to influence all European stakeholders in the planning of research programmes, on both national and European levels. This research shall be in line with the Vision 2020 and the goals it identifies.

STRATEGIC RESEARCH AGENDA

The Strategic Research Agenda, SRA, is ACARE's plan for materialising the 2020 Vision and the associated goals. The SRA is not a research programme, but a set of broad guidelines to tackle those issues both at the technical and institutional level which are of key importance to materialise the Vision 2020 objectives.

The first Strategic Research Agenda (SRA-1) was published in October 2002. Towards the end of its preparation, the ASTERA (Aeronautical Stakeholders Tool for the European Research Agenda) project was launched to support ACARE's activities including the dissemination of SRA-1 and the development of its follow-on SRA-2. The EU-funded support action ran for about 30 months. Apart from promoting SRA-1, this first ASTERA phase analysed possible future world scenarios with a special focus on the implications for the Air Transport System (ATS). Other activities included: the development of a sensitivity model to identify bottlenecks within the ATS and a set of studies performed on a range of issues (economic impact of aviation, education, member states capability etc.) Based on this groundwork ACARE delivered SRA-2 two years later, in October 2004. SRA-1 and 2 currently provide a reference framework for the aeronautics research at both the European and national level.

Contrary to the segmented approach of SRA-1, SRA-2 considered the air transport system in its entirety and identified different views on how the ATS would look like under different scenarios, each of them stressing a particular aspect. These views were called “High Level Target Concepts” (HLTCs). Each HLTC identified the specific technology needs for each sector: aircraft, ATM, airports.

The five HLTCs developed are listed hereafter:

1. Highly customer oriented air transport system
2. Highly time-efficient air transport system
3. Highly cost-efficient air transport system
4. Ultra green air transport system
5. Ultra secure air transport system

TOOLS FOR AERONAUTICAL STAKEHOLDERS

However, without the proper and necessary administrative support the SRA and the 2020 Vision will remain but a beautiful dream. The Aeronautical Stakeholders Tool for the European Research Agenda – ASTERA – provides the necessary administrative support to ACARE. ASTERA is now entering into its third phase. ASTERA 1 and 2 supported the initiatives under FP6 and FP7 related to the SRA activities.

ASTERA 3 will run to mid-2008 and will continue to be the hub for all ACARE activities. This third phase has the objective to provide continuity to the overall management of ACARE . ASTERA will also provide the necessary support for an update of the SRA.

Several new activities will be introduced in the ASTERA 3 phase. Among these new activities is the establishment of mechanisms for the quantitative assessment of ACARE goals.

One expected achievement of ASTERA 3 is the delivery of a report presenting recommendations for the very long term research with the potential to transform the ATS. This contribution will identify key areas and new tools for research with the aim of delivering step changes in the next decade.

In conclusion, ASTERA has great potential and will develop more capabilities to achieve its support mission. Considering the multiplication of R&T programmes, ASTERA may become a reference point for further strategic activities in a European cooperative environment. ■

ASTERA 3
Proposed Activities

Implementation Support	Technical Support	Communication Activities	Strategic Thinking	Project Management Support

Clean Sky:
A New Horizon for Aeronautics

European industry's ability to remain a leading actor on the worldwide Aeronautics market depends strongly on our ability to develop and to use innovative technologies when developing greener aeronautics solutions.
The aeronautics market is global and highly competitive and Europe's continued leading position on this market might well depend on our ability to provide environmental friendly solutions. The Joint Technology Initiative Clean Sky turns this challenge into a competitive advantage on the international stage.

NEW RESPONSIBILITY

The Clean Sky JTI is a **dedicated response** to European citizens' desire to reduce any impact that aviation might have on the environment, while ensuring a sustained economic growth.
Through Clean Sky, **aeronautics manufacturers** come together in a technology research programme that will enable even greener aviation by reducing fuel consumption and emissions of future aircraft. Clean Sky provides all involved manufacturers with the platform needed to launch the necessary **innovative research** required for this change.

Jacques Barrot, European Commissioner for Transport

> "By developing today the cleaner and more efficient technologies of tomorrow, we give our industry a competitive advantage."

NEW IMPETUS

Clean Sky is a **Joint Technology Initiative (JTI)** within aeronautics for a **greener generation** of European Air Transport. JTI is a new instrument created by the European Commission for the 7th Framework Programme for Research (FP7), to allow the establishment of large scale and long term **Public Private Partnerships in research**.
The future of Aeronautics is a priority for the European Commission and the Clan Sky Joint Technology Initiative (JTI) is expected to be among the first JTIs.
The Clean Sky JTI is an industry driven research programme for a **greener generation** of European Air Transport.

NEW COHERENCE

The Commission-sponsored Advisory Council for Aeronautics Research in Europe (ACARE) drives the European Strategic Research Agenda within the aeronautics sector.
The necessary means to achieve the results identified by **ACARE** include adequate research infrastructure, a competitive supply chain, certification and qualification processes, an adequate educational system, and trans-European synergy. The **environmental challenge** is tackled under a wide scope of activities.
ACARE supports a sustainable **convergence on R&T efforts** and targets a figure of **€100 billion** for aeronautics research investment **over 20 years**.

Janez Potočnik, European Commissioner for Science and Research

> "ACARE has truly become a symbol of consensus building."

NEW VISION

Introducing environmentally focused technologies in the next generation aircraft requires a new approach to research, and a new structure, as well as new funding schemes.

Clean Sky federates European manufacturer's **spending efforts in Environment R&T**. During the period of FP7 (2007-2013), the aeronautics industry will invest **€800m**, representing 50% of Clean Sky programme.

The Clean Sky core industrial team and the EU Commission have reached an agreement on the principles of **governance** of the JTI. A commitment of 12% of public funds for SMEs has been confirmed, along with a commitment of openness and transparency.

Liam Breslin
European Commission's Head of Aeronautics Research

> "Under FP7 (2007-2013), the Union will continue to work towards wider SME involvement."

HIGH VALUE

By and large, Clean Sky represents a PPP joint investment in R&T of close to **€1.6 billion**.

It is estimated that between **12 and 20% of the total added value** generated by the European aeronautics industry between 2010 and 2035 could be dependent on the results delivered by Clean Sky. This estimate represents a figure between €100bn and €160bn.

Moreover, the total amount of carbon reduction attributable to Clean Sky (social cost of carbon benefit) may reach 2 to 3 billion tonnes, with an economic value of about **€700bn**.

Hans-Gert Poettering,
President of the European Parliament

CLEAR COMMITMENTS

Through the **Clean Sky Technology Domains**, Clean Sky contributes to the clear environmental goals defined by The Group of Personalities in their "Vision 2020". These visions are:

- Further 50% reduction of CO_2 emissions through drastic reduction of fuel consumption
- Further 80% reduction in NOx emissions
- Further 50% reduction in external noise.

> "What is needed here is nothing short of a 'new industrial revolution'."

A **Technology Evaluator** will measure the progresses achieved in the production of the deliverables of **Integrated Technology Demonstrators (ITD)**.

The Clean Sky programme has 6 ITD that address the full scope of aeronautics technologies and market needs:

- SMART Fixed Wing Aircraft
- Green Regional Aircraft
- Green Rotorcraft Sustainable
- Green Engine Systems for Green Operations
Eco-Design.

Each ITD is led by two major European manufacturers / organisations. Other participants will be European industries (including a large number of) SMEs and academia.

Jose Manuel Barroso,
President of the European Commission

> "Europe must continue to take the lead in the fight against climate change."

GLOBAL AMBITION

Clean Sky is hoped to lead the way to the earlier introduction of new and greener aeronautics products in Europe. A European programme sponsored by the EU Commission, Clean Sky sustains the European ambition to drive a global effort on environment.

Clean Sky is an invitation to do better and to go further.

It demonstrates the EU's determination to put ideas into action.

Christian Dumas,
SESAR Definition
Phase Project Director

> "An efficient ATM is by nature environmentally friendly."

Solutions for a Better Environment

Christian Dumas,
SESAR Definition Phase Project Director

SESAR, the Single European Sky ATM Research Programme, is the European Air Traffic Management (ATM) modernisation programme. It will combine technological, economic and regulatory aspects and supports the Single European Sky (SES) legislation to synchronise the plans and actions of the different stakeholders. It will also federate resources for the development and implementation of the required improvements throughout Europe, in both airborne and ground systems.

AMBITIOUS AGENDA

The products of the SESAR Definition Phase (2006-2008) will be the result of a 2 year study awarded to an industry wide consortium supplemented by EUROCONTROL's expertise. It will ultimately deliver a European ATM Master Plan covering the period up to 2020 and the accompanying Programme of Work for the first 6 years of the subsequent Development Phase (2008-2013).

The SESAR Definition Phase will produce 6 milestone deliverables over the 2 years covering all aspects of the future European ATM System, including its supporting institutional framework.

The SESAR Consortium has been selected to carry out the Definition Phase study which, for the first time in European ATM history, has brought together the major stakeholders in European aviation to build the Master Plan. This is considered to be a major achievement.

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Environmental awareness
All the European citizens have high expectations related to the future of Air Transport.

OPTIMUM BALANCE

There are no other means of transport that are contributing so much to minimize fuel consumption.

Environmental Sustainability in the Air Transport Industry is a key element of the future vision for ATM. ATM will deliver its greatest contribution to improving the environment.

SESAR incorporates and analyses concrete objectives in order to meet performance targets set in eleven Key Performance Areas (KPAs).

ATM shall support society as a whole, delivering its maximum contribution to European sustainability by achieving the optimal balance between social, economic and environmental imperatives. In order to deliver this vision up to 2020 and beyond, a number of required changes have been identified.

There is an urgent need for the European aviation industry including ATM to speak with one coordinated voice on environmental issues, inside the overall sustainability balance. This collaboration, harmonisation and spreading of best practice is facilitated by a pan European cross industry process for driving aviation sustainability.

This process consists in a consolidation of existing aviation sustainability initiatives. This collaborative arrangement provides agreed positions on key sustainability issues and forms the vehicle for effective communication of these positions to regulators (e.g. European Commission, European Aviation Safety Agency) and international bodies (e.g. International Civil Aviation Organization, other non European States). The ICAO Balanced Approach will be fully reflected in all measures taken.

RESULTS = PARTNERSHIP

In the context of increasing societal mobility demand for air transport services, societal sensitivity to the impact of noise, local air quality and climate change issues

will continue to grow. Airport operators, airspace users, manufacturers and ANSPs will have to work collaboratively at the local level to build trust and support among airport neighbouring communities. These communities should be fully integrated into aviation decision making processes.

Environmental sustainability in aviation is to be defined through a 'licence to operate agreement' between the aviation industry and society. This license is to be interpreted as having reached the conditions to operate without restrictions, because all stakeholders (airports, airspace users, manufacturers and ANSPs) work collaboratively in the decision making process, avoiding potential conflicts.

ACARE, the Advisory Council for Aeronautics Research in Europe, gives objectives for future aircraft delivered around 2020 and for which JTI "Clean Sky" initiative is proposed within FP7. The scientific community must work to resolve the remaining uncertainties about the industry's impact in terms of noise, local air quality and climate change (e.g. contrails). There will then be certainty in terms of measurement of ATM impacts, which will ensure transparent decision making that accounts for all likely sustainability outcomes.

CLEAR-CUT GOALS

Aviation is expected to become a carbon neutral industry, through its inclusion in a global emissions trading scheme. The inclusion of CO_2 costs will increase the cost of air travel per passenger km; ATM will have to deliver more efficient direct routes and vertical profiles to ensure that the industry as a whole can reduce costs and make air transport affordable to the society that demands its services. The harmonised implementation of the flexible use of airspace in the whole ECAC area will enable more direct routes.

ATM will also provide harmonised implementation of advanced low noise routings and techniques (with local flexibility in implementation) as a method of reducing the impact of noise on communities to the greatest extent possible. These low noise routings will have to be designed with the trade-off between noise and emissions and will have to be supported by an effective and consistent land use planning system that is fully integrated with airport development policies.

Despite growth in air traffic, the number of people exposed to aircraft noise is expected to decrease. The aviation industry, through active participation in ICAO CAEP, has challenged itself to take more strident measures in limiting noise, reflecting aviation external environmental regulation and noise/emission technology achievements, including specific ATM aspects, bearing in mind that in addition focused R&D will accelerate reduction of aircraft/engine noise and emission 'at the source'.

SESAR is working with a 2020 vision. All ATM stakeholders will implement an environmental management system. The market demand for air transport will grow and ATM, through SESAR implementation (and globally), will deliver corresponding service enhancement in response. Key ATM decisions will be subject to transparent impact assessment to select the most suitable option. ■

11 Key Performance Areas for the SESAR ATM target concept

- Environmental sustainability
- Participation by the ATM community
- Predictability
- Safety
- Security
- Cost-effectiveness
- Efficiency
- Environment
- Flexibility
- Global interoperability

SESAR Consortium

SESAR brings together the aviation players from all fields of activities: civil and military, legislators, industry, operators, users, ground and airborne, as well as significant expertise from EUROCONTROL. AEA (Association of European Airlines), Aéroports de Paris (ADP), AENA (Aeropuertos Espanoles y Navegacion Aérea), AIRBUS, Air France, Air Traffic Alliance E.I.G / G.I.E, Amsterdam Airport SCHIPHOL, Austro Control GmbH, BAA (UK Airport Group), BAE Systems, Deutsche Flugsicherung GmbH (DFS), Deutsche Lufthansa AG, DSNA (Direction des Services de la Navigation Aérienne), EADS, ENAV, ERA (European Regions Airline Association), FRAPORT, IAOPA (International Council of Aircraft Owner and Pilot Associations), IATA (International Air Transport Association), Iberia, INDRA, KLM, LFV (Luftfartsverket), LVNL (Air Traffic Control The Netherlands), Munich International Airport, NATS, NAV Portugal, SELEX Sistemi Integrati, THALES ATM, THALES AVIONICS.

Associated Partners are: ATC EUC, Boeing, CAA UK, ECA, ETF, EURAMID, IFATCA, IFATSEA, Honeywell, Rockwell-Collins, Dassault (representing ELFAA, European Low Fare Airlines Association).

Contributing Research Centres: AENA, DFS, DLR, DSNA, INECO, ISDEFE, NLR, SICTA, SOFREAVIA.

Jean-Jacques Korsia,
Program Executive,
SNECMA

SNECMA: Achieving Targets for 2020

Jean-Jacques Korsia,
Program Executive,
SNECMA

At about the time the Kyoto Protocol on the reduction of greenhouse gases came into effect in 2005, Snecma and its European partners launched a four-year research program dubbed "VITAL", the aim of which is to significantly reduce engine noise, fuel consumption and emissions.

VITAL is a collaborative FP6 research programme running over four years with a total budget of 91M€, including 51M€ in funding from the EC. Snecma leads a consortium of 53 partners including all major European engine manufacturers – Rolls-Royce Plc, MTU, AVIO SPA, Volvo Aero Corporation, Techspace Aero, ITP, Rolls-Royce Deutschland and Airbus.

VITAL aims to contribute the achievement of extremely challenging ACARE targets for 2020 by developing innovative engine technologies at affordable cost, to achieve a:

- 6dB reduction in noise emissions per aircraft operation point
- 7% reduction in CO_2 emissions and fuel consumption

The objectives of VITAL and ACARE 2020, however, cannot be achieved simply by improving existing proven technologies. Breakthroughs in engine design and the technologies used are needed.

NEXT GENERATION

One way of simultaneously reducing noise and CO_2 emissions consists of significantly increasing the engine by-pass ratio. For a fixed thrust engine, this means increasing the engine secondary mass airflow. The consequence of such a technology is a trend towards increased engine diameters.

The challenge for VITAL is to develop a new set of technologies for producing a very high by-pass ratio engine while at the same time avoiding or minimising the drawbacks of engine drag and weight associated with low specific thrust engines.

The technologies are tested and validated throughout the project lifetime using major aerodynamic, acoustic and mechanical rig tests. They provide a validated set of engine technologies and an integrated research infrastructure supported by a validated operating plan for the use of these technologies in next-generation low-noise, cost-efficient engines.

The work of VITAL is organised around 6 technical sub-projects addressing the components or modules of the low-pressure engine core. Another transversal sub-project defines the component requirements and assesses at complete engine level the benefits resulting from the module and installation studies. This ensures smooth integration of the components.

The complete engine assessment is performed on 3 main candidate engine architectures for large noise and emission reductions: Direct Drive Turbofan (DDTF), Geared Turbofan (GTF) and Contra-Rotating Turbofan (CRTF) architectures.

> "Breakthroughs in engine design and the technologies used are needed."

Airbus has provided two airplane specifications to cover short range (A320 type, 30000lbs) and long-range (A330 type, 70000lbs) applications. Six engines have been derived from these two specifications covering a wide range of architectures: DDTF, CRTF and GTF.

Concerning the fan, the DDTF focuses on lightweight material to reduce fan weight by 30%; The CRTF, a highly ambitious and promising alternative solution, allows rotational speed to be decreased by about 30% under the same aerodynamic loads, which should bring a significant reduction in noise.

For the remaining low-pressure components, lightweight or high-load materials are being developed for the Booster, the hot and cold structures, the shaft and low-pressure turbine as well as the engine installation and the thrust reverser.

The VITAL program is now at the midway point. Results are already very positive. In addition to the primary research and technology aspects, the partners have formed a very fruitful relationship, and have clearly demonstrated the value of cross-border teamwork. ■

The **objectives of VITAL and ACARE 2020** cannot be achieved simply by improving existing proven technologies

Hermann Sheugenpflug,
Director Technology Management at MTU Aero Engines

MTU: Building Perspectives with Innovation

Hermann Scheugenpflug,
Director Technology Management at MTU Aero Engines

With a forecasted growth of air traffic for the next 20 years, Europe's aviation industry faces the challenge to satisfy the demand whilst ensuring cost effective, safe and environmentally friendly air travel. Continuous research on alternative engine configurations is therefore needed to explore technological breakthroughs.

CHALLENGE

The Advisory Council of Aeronautical Research in Europe (ACARE) identified the research needs for the aeronautics industry for 2020; regarding the engine a 20% reduction in CO_2 emissions per passenger-kilometre and a significant reduction of the NOX emissions in order to achieve the 80% reduction.

The existing programmes have already identified concepts and technologies to meet these goals; NEWAC (New aero engines core concepts) is a new European-level program in which – under the leadership of MTU Aero Engines – major European engine manufacturers, assisted by universities and research institutes (40 partner in all) focus on new core engine concepts. It will close the gap in enabling technologies and will develop fully validated novel core engine technologies based on the results of past EC projects.

A €71 million European-level programme, NEWAC will provide technological breakthroughs.

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NEWAC is a €71 million programme of which €40 million is funded by the EC. Through its research programme, it will provide technological breakthroughs for the field of aero engines efficiency and emissions.

INNOVATIONS

NEWAC targets a broad range of innovations that include:

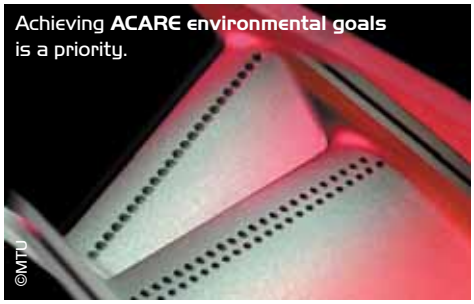
• Intercooled Recuperative Aero Engine (IRA) which includes optimisation of the recuperator arrangement, innovative duct design and a radial compressor in a new design area.

• Intercooled core with compact and efficient intercoolers, aggressive ducting and advanced compressor capable of performing at the extremely demanding conditions of the intercooled cycle and with improved transient behaviour for intercooler integration. The intercooler is also a critical technology for the IRA concept.

• Active core with active heat management systems like active cooling air cooling, active rotor venting system, smart compressor casing and active compressor flow control

• Flow controlled core with outer flow-path control technology from casing air aspiration applied on blades and vanes, new advanced 3D aerodynamic compressor design and robust rotor/stator tight clearance management.

• Innovative combustors with Lean Premixed Prevaporized technology applied for low OPR (Overall Pressure Ratio) engines (intercooled recuperative core) with Partially Evaporated Rapid Mixing technology for low to medium OPR engines (active and flow controlled core) and Lean Direct Injection technology for medium to high OPR engines (intercooled core).



Achieving **ACARE environmental goals** is a priority.

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EXPECTED RESULTS

NEWAC main result will be fully validated novel technologies enabling a 6% reduction in CO_2 emissions and a further 16% reduction in NO_x. Most importantly, the project will address the particular challenges involved in delivering these benefits simultaneously contributing to the attainment of the ACARE targets.

All new configurations investigated in NEWAC will be compared, assessed and ranked regarding their benefits and contributions to the global project targets. Detailed specifications will be provided for all innovative core configurations.

As a result, NEWAC will further refine the technology routes to environmentally friendly and economic propulsion solutions. The developed components will further result in optimised engine designs based on the NEWAC technologies but also in combination with the results of the EEFAE, SILENCER and VITAL programmes. ■

> **"The developed components will further result in optimised engine designs."**

> "We will be able to test all stages of the development in a virtual environment."

Torbjörn Kvist,
VERDI Project Manager
at Volvo Aero

VOLVO AERO:
"Team Work" for the Environment

Torbjörn Kvist,
VERDI Project Manager at Volvo Aero

Volvo is committed to shaping the future of modern aircraft engines design with a priority for environmental concerns.

VERDI: VIRTUAL MANUFACTURING

With the launch of the EU's VERDI project, 16 leading European engine manufacturers, institutes and universities will collaborate on the virtual simulation of the manufacturing process.

VERDI stands for Virtual Engineering for Robust Manufacturing with Design Integration. The aim of VERDI is to develop a new generation of engineering technologies which enable the simulation of the combined effects of all manufacturing processes during the design phase.

"We will be able to test all stages of the development in a virtual environment," says Torbjörn Kvist, VERDI Project Manager at Volvo Aero.

Volvo Aero has used advanced weld simulations since the beginning of the 1990s. This will now be integrated with the 15 partners' expertise in other areas, such as simulated milling or sheet metal pressing, to create a fully-functional simulation tool. Components will be manufactured virtually in different ways while such things as durability are calculated. It will be possible to see, as early as the concept phase, what happens to the final component once it is manufactured.

But VERDI goes even further than that. Because it creates a digital model of the components, the engineers can see in what stage it fails, if it fails, from the information gathered on of how the material is affected by the different manufacturing stages.

VERDI was initiated in 2005 and brings together contributions from the EU Commission and from industrial partners for a total budget of €6.4 million.

This project is being coordinated by Volvo Aero Corporation. VERDI's partners are Rolls-Royce, MTU Aeroengines, Aachen University of Technology, Universität Karlsruhe, ITP, CIMNE, Luleå University of Technology, Trollhättan/Uddevalla University, Avio, EnginSoft, Politecnico di Torino, CENAERO, Techspace Aero, The University of Nottingham and AICIA.

AIDA: SMART AERODYNAMICS

AIDA is an EU research project that will develop an alternative design for an intermediate casing in order to reduce weight and thereby carbon dioxide emissions. The engine is secured to the aircraft partly via the intermediate casing, one of the components in Volvo Aero's product specialization. Reshaping of the flow channels will help to reduce engine weight.

AIDA is focusing development efforts on flow channels in the intermediate casing and turbine section of the engine. A 20% increase in the deflection of air flows will help cut emissions of carbon dioxide by 2% with a more aggressive, shorter duct leading to a shorter and lighter engine structure.

The project is being managed by Volvo Aero. It started in 2004 and will end in 2008. The project manager is Stéphane Baralon. AIDA is worth €8.2 million, with the EU contributing €5.6 million.

16 participants are contributing, including the University of Cambridge, Rolls-Royce and Chalmers University of Technology. Most of them are also VERDI partners.

So far the milestones set for the project have been met. The critical assessment at the mid term review was successfully passed.

An outstanding opportunity for European co-operation, VERDI and AIDA highlight the efforts by engine manufacturers to tackle the challenges of technologies adaptation needed to continuously improve environmental performances.

Sharing new technologies will provide combined solutions to European manufacturers. ■

Sharing technologies will provide combined solutions to European manufacturers.

Photo Volvo

Alternative Fuels: Promising Options

Francis Couillard,
Vice-President Environment Policies, European Affairs Directorate SAFRAN

In order to further reduce greenhouse gases emissions, new solutions that are complementary to engine and aircraft technological improvements are required. Optimization of fuel characteristics to reduce the contribution to greenhouse effect and/or alternatives fuels to lower CO_2 net production is considered.

Alternative fuels could answer several concerns raised by the use of fossil resources:
- Provide environmental benefits if alternative fuel production is clean;
- Reduce the fuel supply dependency;
- Possibly, offer a lower price.

For obvious safety reasons, aviation fuel has to match very stringent specifications, such as heating values, thermal stability, critical temperatures, spray, viscosity capacities, etc… It must also be chemically compatible with fuel system materials at aircraft and engine level.

LOOKING FORWARD

The current market proposes a first generation of bio-fuels like ethanol or FAME. The 2nd generation of alternative fuels is produced by synthesis and aim at delivering a fuel with similar specifications to kerosene. Coal to liquid (CTL) or natural gas to liquid can be an option for kerosene replacement. Coal to liquid based kerosene is under production in South Africa and demonstrates the capability of the chemical industry to produce and validate an alternative fuel at acceptable economical conditions.

Biomass to liquid could better meet the environmental concern, and although not yet industrially developed, it is the most promising alternative to kerosene. It will benefit from the experience gained on the CTL process. Current concern could be the availability of biomass.

A complete substantiation on engines will be needed.

Other alternative fuels, such as hydrogen, cannot be considered as a substitute to kerosene due to concerns about safety, storage, and life cycle analysis assessment.

The introduction of an alternative fuel will obviously request a full coordination between fuel companies, aircraft and engine manufacturers, research labs, and authorities. ■

Francis Couillard, Vice-President Environment Policies, European Affairs Directorate, SAFRAN

> “Alternative fuels could answer several concerns raised by the use of fossil resources.”

Finding **alternatives to kerosene** would require close co-operation

Philippe de Saint Aulaire
Vice President
Environmental Affairs,
Airbus

> "Economic efficiency and environmental performance are intrinsically bound together."

Why Emission Reduction Matters

Philippe de Saint Aulaire,
Vice President Environmental Affairs, Airbus

Aviation is now being asked to act for nothing less than an environmentally-sustainable flying future, in response to a growing demand for air transport and growing environmental concerns. This may just appear as having to solve a paradox of a world that wants mobility… and a clean future.

It is no paradox however; it is aviation's commitment. And it is our commitment at Airbus to design and support safe and profitable aircraft that will meet increasing environmental stringencies. It is a life-long commitment to our customers and, if I may say so, non-stop innovation smoothes the way.

Reducing aircraft emissions is a priority high on our agenda. The reason is simple: Economic performance and environmental performance are intrinsically bound together, embedded into fuel efficiency.

ADVANCED DESIGN

CO_2 engine emissions are proportional to the amount of fuel being burnt and fuel burn has a significant share in Direct Operating Costs, which has been on a rise. Alternative CO_2-free fuels are not for the near future and when it comes to reducing CO_2 emissions, the equation is straightforward: this will be achieved through lower fuel consumption that per se is the core business of aircraft and engine manufacturers. Fuel consumption mitigation has always been one of the fundamentals of making of an aircraft. Typically, over an optimum range, the lower fuel required, the higher the passenger and/or cargo payload.

Advanced aircraft design saves weight and innovation makes a difference. One major strand of our research investment is progressively introducing advanced materials, lightweight systems, and new processes, along with optimised configurations and aerodynamics. This achieves substantial weight reductions that make it possible to burn less fuel and in turn to reduce emissions.

Let me highlight the environmental performance of the A380: with a much higher percentage of new materials in its structure, the aircraft has a very low fuel burn of just 2.9 litres per passenger per 100 kilometres and generates as little as 80 g of CO_2 per passenger kilometre.

Design impacts all the parameters making up the overall environmental performance of the aircraft. Therefore, environmental objectives are an integral part of the definition of any new aircraft developed by Airbus, as well as when improving existing products.

SOUND OPERATIONS

Product performance is also about operations performance and sound aircraft operations (flight operations and maintenance alike) are key to fuel efficiency.
Airbus and its suppliers support the airlines in deploying methods and software tools for aerodynamically clean aircraft, well-maintained engines and good flight planning, which will lead to cuts in costs and… emissions.

We do not say it often enough: Aircraft operations are 20% more fuel-efficient than 10 years ago and aircraft entering today's fleet are 70% more fuel-efficient than 40 years ago!

WAYS FORWARD

When it comes to climate change, environmental performance is not just in the hands of one or the other players in the industry. Everyone has a share.

We believe in a global solution that will encompass technological improvements, operating procedures, optimised air traffic management and flight efficiency, away from excessive regulation.

This is why Airbus supports and will keep supporting the work and role of ICAO. It is also why Airbus aligns its vast research programme on the 2020 vision of the Advisory Council for Aeronautics

AIRBUS: COMMITTED TO ENVIRONMENTAL PERFORMANCE

Airbus is committed to building aircraft that are part of the solution, not part of the problem.

To this end, Airbus has established an innovative assessment methodology to map, better understand and minimise the 'eco-footprint' an aircraft may have over its lifecycle, from design to dismantling. The methodology is at the core of Airbus' innovative lifecycle approach and Sites & Products Environmental Management System (EMS).

In January 2007, Airbus became the first and only aerospace company in the world to receive ISO 14001 environmental certification at corporate level, which covers the company's production sites and products throughout their life cycle. This is proof of the robustness of Airbus Sites & Products EMS that has been deployed Company-wide to systematically and continuously explore new ways to improve our environmental performance.

➜ Airbus Environment, Social and Economic Report is available at www.airbus.com

(ACARE), targeting a 50% cut in CO_2 emissions per passenger km an 80% cut in NOx emissions. This is also why the Company has joined the industry-driven CleanSky initiative that will bring technologies to maturity and the step changes required within the next seven years.

Constructive ways forward require dialogue and synergies with all the stakeholders - customers, engine manufacturers, suppliers, air navigation providers, airports, scientific research and regulators.

I believe environment is a field where we all have much to say and much to contribute. ■

The Airbus A80 has a remarkable noise performance, showing unprecedented certified noise levels with a 17-EPNdB cumulative margin to ICAO Chapter 4 noise limits. It also meets the night noise requirements of the most stringent international airports, being QC/2 for departure and QC/0.5 for arrival at London Heathrow. The A380 also features a programmable automatic noise-over-ground Flight Management System to minimise noise exposure underthe flight path for a further 2 to 4 decibels in perceived noise reduction.

AIRBUS A380: CLEANER, QUIETER, GREENER, SMARTER

The A380 provides a new way to cope with air traffic growth in major markets worldwide, carrying more people and freight further while burning less fuel and releasing fewer emissions.

The aircraft has a very low fuel burn of just 2.9 litres per passenger per 100 kilometres – the same as for a mid-sized European diesel car.

The aircraft generates lower CO_2 emission levels, as low as 80 g per passenger kilometre – the car industry will aim at 140 g of CO_2 g per km in 2009 and 120g in 2012.

The A380 has a higher percentage of new materials in its structure, with some manufactured using the latest carbon fibre composites and laminates. Its carbon fibre-reinforced plastic composite centre wing box allows a weight saving of up to 1.5 tonnes versus the most advanced aluminium alloys.

Mike Ambrose,
CEFA Chairman

> "Emissions trading is not the solution, it is only one element."

Aviation and the Environment

An interview with
Mike Ambrose,
Chairman of The Committee for Environmentally Friendly Aviation

Q.: *CEFA stands for Europe's Committee for Environmentally Friendly Aviation. Can you tell us about the mission of your organization?*

Mike Ambrose: When we were formed in 1996, our original purpose was to try to coordinate the promotion of all the efforts that are to be made by all the different stakeholders within air transport to try to build an improved public perception.
That original mission is still important today but in the last half decade, CEFA has transformed into a vital committee through which the principal Air Transport Industry Associations coordinate their views on environmental policies. And that we believe is not just helpful for the air transport industry, it is also helpful for regulators and the politicians, because it encourages the establishment of a strong, clear policy from the unified industries rather than having ten or fifteen individual organizations, each pushing their own particular concern.
So, we are looking at questions of air transport and the environment from the highest level that we possibly can and our mission is to help guide regulators and politicians on environmental policy.

Q.: *So, the challenge is to make Aviation and the Environment compatible?*

Mike Ambrose: No, and I am going to challenge that question because aviation and the environment are already compatible. The principal challenge is to ensure a higher level of understanding of aviation's environmental performances amongst politicians, the media, and regulators; and the role that air transport plays in Europe.
We have an effect on the environment, we cannot deny that. We cannot move people from one place to another without burning energy and burning energy produces various forms of pollution. But what we have been doing in the last fifteen years is consistently improving our environmental performance through self-funding investment in the air transport industry and we have many reasons to be very proud in Europe. People from SNECMA, Rolls Royce, ATR, and Airbus have focused on successive products to get continuous improvement in environmental performance. So what we have to do is to change the public perception.
If we look at the EU Commission's own figures on the amount of carbon dioxide that is produced by the different segments of industry, last year air transport was quoted as being 3%. However, and this didn't get very much publicity, because it is not politically acceptable to do so, very quietly during the autumn of last year, the EU Commission revised this figure and it revised air transport contribution downward to 1.5%(1). If you look at all of the environment publications and media coverage, it would be very easy to get the impression that air transport is responsible for climate change. It is not. We in fact contribute a very little to pollution.

PROFILE

Appointed Director General of the European Regions Airline Association in 1987, Mike Ambrose is an active leader in Europe's aviation industry. He participates in major specialist bodies such as the global Flight Safety Foundation and Europe's Committee for Environmentally Friendly Aviation (CEFA).
A frequent speaker on subjects affecting regional aviation, he received a Regional Airline World Lifetime Achievement Award in 2004 for 'devotion to the regional airline industry and for championing many of the initiatives and policies associated with the safety and profitability of regional airlines.'
Mike has been a Board member of the Flight Safety Foundation since 1997 and Vice Chairman International since June 2003. He is also a member of the Foundation's Executive Committee. He is a Fellow of the Royal Society, Royal Aeronautical Society and Royal Institute of Navigation.

Q.: *Can we speak about an environmental responsibility and a culture of commitment?*

Mike Ambrose: We have had a commitment expressed in the best possible form through massive investments in new equipment and operating procedures. That commitment has been made by airlines, airports, aircraft and engine manufacturers for decades. What we have to do now is to make that commitment and the advances that we have demonstrated far more obvious. We can do that in a number of ways.

There is a campaign currently being run by the Air Transport Action Group to try to make the public more aware of the contribution of air transport in reducing pollution. Significant improvements have been made. Aircraft engines in today's fleets are 20 decibels[2] lower than aircraft forty years ago. If we look at the EU Commission's statements about the number of people affected by aircraft noise, it has been reduced by more than 90%[2]. Engines in today's fleets are 70% more fuel efficient than they were forty years ago[2]. All these improvements come from a commitment at the highest possible level.

Q.: *What do European airlines expect from aircraft manufacturers regarding emissions reduction?*

Mike Ambrose: First of all, we expect them to remain our partners. No stakeholders within air transport can survive by themselves. We have a wonderful history of co-operation between aircraft, engine manufacturers and airlines. We expect them to continue investing in the support of the environmental performance improvements. We are seeing the benefits of this effort already: the next generation of engines is to be quieter and consume less fuel. We are seeing aeroplanes that are far more fuel efficient in terms of aerodynamics design, because they are using composites materials that make them lighter.

We also want to see that funding going on to improve products and we want to see that funding is done and partially supported by EU funds. Aircraft and air transport industries are important for Europe's positioning in the world and there is no reason why EU funding should not continue to support further environmental performance and improvement of technologies.

Q.: *What are the views of the European airlines on the proposal of the Commission to include aviation into the EU ETS?*

Mike Ambrose: We have certainly looked at all of the options being considered. Of all the financial options, emissions trading seems to offer the most constructive solution and that is why the European air operators are supporting emissions trading as a concept. Obviously, there are some sensitive elements in the process that we want to ensure are feasible, such as the carriers to which emissions trading are applied, the data that we have to collect, and the amount of carbon considered. These are issues on which we have to get further clarification but as a concept, yes, we support it. The important point is that no politician or regulative authority should see emissions trading as the solution. It is only one element.

The other element is investment. We also have the opportunity of making further improvements to flight procedures. And the one very real and significant improvement that could be made in a relatively short term and that doesn't require new technology is to overcome the political hurdles that are holding up the implementation of the single European sky because that would reduce fuel consumption by more than 12%.

Q.: *From your position what will be the future challenges?*

Mike Ambrose: The coming challenge is that we have to change the public, media and political perception. It is to make sure that we communicate on environmental performance more effectively, and to recognise that environmental issues need to be at the forefront of all our business and communications strategies, whether we are an airline, airport, aircraft manufacturer or a company which provides products or services to the industry. We have to make sure that environmental policies are sensible and moderate, based on the true facts about aviation's environmental impact and taking into account its contribution to social cohesion and the economy. Finally, it is in the interests of all organisations throughout the industry to work together to ensure that the above goals are reached. ■

1 Source: European Pollutant Release & Transfer Register
2 Air Transport Action Group: www.atag.org

CEFA

The Committee for Environmentally Friendly Aviation (CEFA) was formed in 1996, following a meeting with the EC and the air transport industry, when the European Civil Aviation Conference, Directors General Civil Aviation (DGCA) predicted that environmental concerns would probably be the greatest constraint on the development of civil air transport in the future.

The Membership is open to any European association representing the interests of civil air transport. Current membership comprises: AEA, ACI (Europe), ASD, EBAA, EEA, ERA, ELFAA, IACA. Additionally, a representative of Eurocontrol's Environmental Focal Point attends CEFA meetings as an observer.

In order to promote civil air transport's good environmental performance and to achieve secure conditions for its future development and growth, the constituent members of CEFA will:

- Develop common positions on environment-related issues and policies whenever possible;
- Share knowledge, information and views;
- Put forward the CEFA position to bodies such as the European Commission (EC) and the European Parliament (EP);
- Seek to inform decision-makers, opinion-formers and the general public in order to avoid misconceptions concerning air transport's environmental performance;
- Promote public and political recognition of the economic and social contributions made by air transport in Europe's regions;
- Ensure that the industry is properly represented that data and facts which allow its performance to be measured.

Added thrust through innovative technologies!

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Expertise in the commercial engine business: MTU Aero Engines has it. For decades, Germany's leading engine manufacturer has been a reliable partner of all the big players in the industry.

The route into the future is staked out: Two new engines – the GP7000 for the Airbus A380 mega-transport and the PW6000 for the Airbus A318 narrowbody – come with the finest in MTU technology. That helps them burn less fuel and make less noise, and cuts life cycle costs. In the years ahead, the two new programs are going to provide new lift for global air traffic. www.mtu.de

MTU Aero Engines

> "The JTIs are now indispensable and will certainly become more and more important in the future."

Philippe Busquin
MEP

Building the Aircraft of the Future

An interview with
Philippe Busquin,
Member of the European Parliament and former EU Commissioner for Research (1999-2004).

Q.: *When you were in charge of Research at the European Commission, you took several initiatives aimed at making a better connection between Research and the Environment. What was your purpose?*

Philippe Busquin: Sustainable development and protection of the environment are two essential objectives that became priorities during my tenure at the European Commission. My purpose was to avoid an over concentration on issues without actively engaging in the effort to solve them. Only through significant research programmes, can better methods, new mechanisms and concrete results become possible.
Directly concerning aviation, we set up the first technological platform necessary to meet the objectives of the programme "Vision 2020." This Vision was the direct result of the work done by The Group of Personalities, a group that I initiated and chaired. With Vision 2020, the environment received special attention, in particular we addressed key issues like noise and emissions reduction.
Aircraft manufacturers, airlines and ANSPs, with strong backing from the Commission, defined this Vision. The commitments were clearly identified, each fitting well within the overall goal of contributing to the protection of the environment. Among these commitments were a 50% reduction in CO_2 emissions, a 80% reduction in NOx emissions and a 50% reduction in noise. This programme benefits from a high level of collaboration between public and private sectors as well as between European and national research programmes. Accordingly, the Group has then been able to define the different stages of a strategic agenda that will enable us to build the plane of the future.

Q.: *In particularly, what is your opinion on the Clean Sky Joint Technology Initiative?*

P.B.: The Joint Technology Initiative Clean Sky is an indispensable step towards achieving the technological platform necessary to achieve "Vision 2020." A JTI runs for seven years, which means in practise that it is possible to accommodate the long development cycles within aerospace. It also means that it will be possible for the Clean Sky consortium to set up the technology demonstrators which will allow the research on Greener Aviation to go beyond the mere definition of research actions. The JTI aims at achieving better common funding of research and development programmes. The JTI's are now indispensable and will certainly become more and more important in the future.

Q.: *As a Member of the European Parliament do you have a specific agenda regarding aviation and the environment?*

P.B.: As President of the Sky and Space Intergroup I regularly organise meetings with the purpose of disseminating information to the Members of the European Parliament in order to obtain their support. It is important that Members of Parliament understand that it is through specific programmes such as the Clean Sky that we can anticipate, lead and manage future developments.

Q.: *Looking to the future, what are your views on the evolution of air transport over the next 30 to 40 years?*

P.B.: It is true that 9/11 affected our industries in a negative way. The huge impact this event had on air transport highlights to what extent geopolitical factors, which are outside our control, directly affect us. It is important that we keep the changing geopolitical structures in mind when we look at the industry developments. Air transport is a driving force for economic growth and social benefits, not only in terms of technology but also in employment. In Europe today, the integration of the enlarged Union depends on air transport.

Q.: *From your point of view, what role will aircraft manufacturers play in this development?*

P.B.: As manufacturers you already play a crucial role with your efforts to design and build the aircraft of tomorrow. These aircraft must be safe, clean, quiet and cost effective. Beyond that the ongoing change of airports and air traffic management operations will play a crucial role, as they contribute significantly to any environmental improvements.

Q.: *What are the messages or recommendations you would like to share with all the air transport stakeholders?*

P.B.: My message is that aviation should continue to play its part in mitigating any impact on the environment. I see, in particular, that programmes and initiatives like SESAR and Clean Sky will be instrumental in achieving the high targets we are setting together with the industry. Besides the environment, I also think that safety must remain a high priority. The aviation industry has an outstanding capacity to combine these critical developments. Time has come to think, act and move forward together on the road towards progress. ■

Getting Ready for REACH

Bruno Costes,
Chairman of Environment and Sustainable Development Commission, GIFAS
Director Environmental Affairs Industrial Coordination, AIRBUS

WHAT IS REACH?

Recognising the improvements needed to be brought to the previously existing system to evaluate the properties and dangerousness of chemicals (5% have been screened since 1981 over more than 100 000 substances used in Europe), the EU has recently adopted a new regulation called REACH, published on 30/12/2006 with an Entry into Force scheduled for the 1st of June 2007.

REACH means Registration, Evaluation and Authorisation of Chemicals. It aims at replacing or supplementing all previously existing regulations on substances and it intends to significantly improve the protection of human health and the environment. REACH is based on the precautionary principle; the burden of proof for demonstrating the safe use of chemicals is, according to REACH, now transferred from Member States to industry.

REACH applies to all substances, preparations (a combination of substances) and articles being manufactured, imported, or used in Europe, unless they are already covered by a similar process (as for biocides…). REACH is perhaps the largest piece of EU Regulation ever produced: nearly 1000 pages of legislative text, with 17 implementation guidelines (RIPs: Reach Implementation Projects) currently being prepared that will complete the legislation.

R FOR REGISTRATION

REACH obliges producers and importers to provide information about the properties of the chemicals they produce or import into the EU in quantities greater than 1 tonne per year. These data, communicated through a formal registration process, should be sufficient to further evaluate the risk of the intended use of the substance, and the producer must provide information regarding the corresponding safe use. This information will follow the substance from the manufacturer/importer to downstream users throughout the supply chain.

Should a pre-registration be made (between June/November 2008), the registration could then be spread over a period of 11 years; it would concern about 30.000 substances in use today. A substance not registered according to REACH obligations can no longer be put on the market. Each registrant will be part of a forum of exchange to further share the existing data of the concerned substance and jointly perform further evaluations.

A FOR AUTHORISATION

Under REACH, the use of certain dangerous chemicals is acceptable as long as appropriate risk control measures are implemented. If these measures are not sufficient to keep the risks for human health and environment acceptable, REACH foresees limitations or even the banning of substances for certain uses (for instance in consumer products).

However, the most dangerous substances (those of very high concern) will be subject to time limited authorisation, thereby putting the burden on the applicant to show that the risks are adequately controlled or that the socio-economic benefits from the use outweigh the risks. All the non-authorised uses of substances will be then prohibited. The substances of very high concern are subject to particular attention and must be tracked, as their presence in articles must be notified to the European Chemical Agency if their concentration exceeds 0.1% weight/weight of the article and their volume exceeds 1T aggregating all articles produced in a year.

WHERE DOES ASD STAND REGARDING REACH?

ASD Companies are supportive of the aims of REACH and are fully conscious of the expected positive long-term effects of REACH on human health and the environment.

However, we expect that the implementation of REACH will affect our sector due in particular to its safety obligations, which cannot be compromised. We will do our best to anticipate and resolve any issue.

ASD companies are using a large number of chemicals. The ASD products are complex, with a great number of parts interacting with each other and often manufactured in different countries.

ASD companies mostly operate as Downstream Users, according to REACH, then buy substances or preparations within the EU to integrate them into the manufacturing process; they can also act as importers of these substances, preparations and/or articles. All the ASD sectors are concerned, as REACH applies to each substance but also to each use of substances from production to disposal, used as their own but also in preparations (sealants, paints, resins…) or articles. Even though exemptions exist for substances used where necessary in the interest of defence, the manufacturing

of defence products often uses the same production line/substances as the civil products which are under the scope of REACH.

Our sector will do its utmost to resolve situations resulting from the discrepancy in duration between the 11 year period for the REACH Implementation compared to the long life cycle of our products (25-40 years for an aircraft). However, we expect that substances/products manufactured in small volume will be withdrawn from the market due to unaffordable costs for the producer to continue production. The direct expected consequences of such situations will be supply chain disruptions leading to research & development and re-qualifications of a wide number of alternative options with the subsequent compliance costs for adapting our processes/installations/products.

Further contacts with our supply chain as well as preliminary inventories of substances used within our companies have confirmed our analysis: for some particular substances portfolios, more than 70% of the corresponding uses will be affected by REACH.

HOW CAN ASD COMPANIES PREPARE THEMSELVES?

ASD companies should actively prepare internally and start discussions with their suppliers to ensure that all the supply chain is aware of these new obligations, their corresponding schedule and anticipate the consequences.

The first action to be undertaken should be to get an understanding of the REACH provisions together with their implications on the supply chain. In this perspective, ASD has launched several initiatives in close co-operation with national associations (GIFAS, SBAC, BDLI, etc…), other concerned sectors such as the mechanical industry and major companies. Some information toolkits are being produced, such as a "REACH implementation guide" aiming at providing our sector with summaries/explanations of the various provisions and the main actions to undertake in order to ensure an appropriate compliance. Each company should set up an appropriate multi-skills structure to address REACH in the most efficient manner.

The key challenge our sector is facing is the management of the data to be exchanged between the supply chain and authorities including the European Chemical Agency; these exchanges are necessary to ensure compliance and should be as standardised and consistent as possible if we want to limit the duplication of our efforts and subsequently our costs. Important actions should be devoted to achieving this objective.

In parallel, participation of our sector to the REACH Implementation Projects (RIP's) has been organised to ensure that our specificities are appropriately considered in the development of the relevant guidance and IT-tools of the Agency. The European Commission coordinates activities closely with the stakeholders i.e. Member States, Industry, NGOs and sectorial associations such as ASD.

The following interview will give you insights on what is happening in these RIPs, and practical recommendations to best prepare for a smooth REACH Implementation. ■

MORE INFORMATION IS AVAILABLE ON THE FOLLOWING WEBSITES:

http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm
http://ec.europa.eu/enterprise/reach/index_en.htm
http://ecb.jrc.it/reach/rip/
http://www.gifas.asso.fr/en/
http://www.sbac.co.uk/
http://www.bdli.de/
http://www.asd-europe.org

REACH and RIPS
What Did We Learn?

Ragnhild Bruhn, *from Volvo AB and* **Jack de Bruijn** *from the European Commission/Joint Research Centre provide ASD Focus with some guidelines to better understand REACH.*

A downstream user has, as all other actors, an important function and must identify his role in REACH, says Ragnhild Bruhn. Downstream users, she continues, are practically all companies that use chemicals.

Ragnhild Bruhn is an Industrial Hygienist at Volvo Technology Corporation and one of the many users involved in the work with the REACH Implementation Projects, RIP.

Within REACH, there are several types of chemical users and roles in the chemical supply chain: manufacturer, importer (from non-EU states), formulator (one kind of downstream user), and end downstream user. A company can have several roles and subsequently have different tasks and obligations to respect.

Yes, agrees Jack de Bruijn and he goes on to stress that a key issue for any downstream user is to check that their key substances will be pre-registered in order not to cause a possible stop in their manufacturing processes. Jack de Bruijn is coordinating the RIP 3 and 4 projects at the European Chemicals Bureau (ECB) of the European Commission Joint Research Centre and he emphasizes the absolute importance for all users – whatever their role in the supply chain – to prepare themselves and act now.

Within the European Community organi-

sation, the ECB, together with DG Enterprise and Environment, has been responsible for developing the REACH Implementation Projects and since the beginning of the development work it has taken the opportunity to involve the future users of these guidances.

From the JRC point of view, this co-operation was a very valuable way of working, says Jack de Bruijn. The JRC immediately got a better understanding from the users of what we were trying to achieve. The JRC also received important input from the future users in a way that it would not have received during a "normal" consultation process.

ON PRE-REGISTRATION PROCESS

Today, one of the key issues is to prepare for the pre-registration process. As REACH will come into force on June 1 2007. In order not to loose commercial momentum, i.e. to enable users to continue to use the necessary chemical substance while they have not yet registered, the pre-registration process will start on June 1 2008 and will run for six months. All pre-registered substances, depending on their tonnage and property, will benefit from a staged registration period, i.e. a period of 3, 6 or 11 years. time window for the producer/importer to comply with the registration obligations.

Ragnhild Bruhn,
Volvo AB

"The REACH Regulation reinforces the notion of risk management."

Any producer/importer of substances will of course have the opportunity to register their chemical products after REACH has entered into force, says Jack de Bruijn. However, we do recommend every producer/importer to start the process as soon as possible, as non pre-registered substances will have to be registered before being used.

ON RISK MANAGEMENT SCENARIOS

Ragnhild Bruhn agrees and says that there are certain results from the REACH Implementation Project that are particularly interesting. The REACH Regulation reinforces the notion of risk management (already present in some Community legislation) when using chemical substances compared to an approach based on hazard. The implementation of risk management measures is enabled by exposure scenario. i.e. the set of conditions that describe how the substance is manufactured or used during its life-cycle and how the manufacturer or importer controls, or recommends downstream users to control, exposures of humans and the environment. In practise, this means that in every Safety Data Sheet for a chemical substance or preparation it will be clearly identified how a substance must be handled in a safe way. This is a reinforcement compared to the previous legal situation.

The second major result that Ragnhild Bruhn stresses is the possibility to participate in the case studies on exposure scenarios that currently are being developed in collaboration between the JRC and the REACH users. By participating in the various case studies, downstream users can learn how the system of exposure scenarios will work in practice and can gain experience on how the REACH regulation can affect a company.

Both Jack and Ragnhild have the impression that this co-operation process has also led to an understanding within the concerned companies that Environment, Health and Safety staff should be heavily involved in the preparation for REACH. Equally, it is also important to involve the procurement and commercial staff, e.g. purchasers. The purchasers can pressure the provider to start the pre-registration as soon as possible.

On the question of whether REACH might have a commercial value in the same way ISO 9001, the interviewees both agree that this could be the case. Raghnhild Bruhn also points out that if a provider cannot prove that he complies with REACH this might mean that they will lose business.

Jack de Bruijn,
European Commission/Joint Research Centre

"All users must prepare themselves and act now."

A CALL FOR ACTION

On the question of which role ASD can play in this process, Ragnhild Bruhn points out that since this work must be discussed on an European basis, the European associations of ASD's type certainly have a role to play in ensuring that their specificities are effectively considered through the remaining work currently being undertaken in the RIPs, in order to track any relevant initiatives and promote a consistent implementation within the sector for the benefit of all. In any case, it is up to the companies to actively act now in order to anticipate and comply with the newly adopted REACH Regulation. ■

The assessment and advice given in this document is the opinion of the writers and is not a guarantee of regulatory compliance.

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> "Space budgets raised by 25 % during the past ten years, except in Europe."

Alain Gaubert,
ASD Director Space,
Secretary General
EUROSPACE

Space Policy: the Turning Point

Alain Gaubert,
ASD Director Space,
Secretary General EUROSPACE

The Commission of the EU and ESA have recently adopted the European Space Policy, a jointly elaborated document. It is certainly not up to the Space Industry to act in the place of politicians and say what Europe has to do in Space. On the other hand, and because European Space Industry holds the know-how in this field, it has the imperative duty to beware those in charge of setting the orientations and inform them on the scope and consequences of their decisions.

European Space Industry splits its activity between institutional and commercial programmes mainly using the same technologies. Institutional programmes represent approximately 60 % of its turn-over but in the last ten years, the volume has stagnated. Commercial programmes, essentially in the field of telecommunications, have suffered from a strong economic recession due to an important market slump even though their performance remained quite satisfactory. Despite the excellent penetration of ARIANE, the launching services market is facing commercial risks as it profits only exceptionally from European preference and faces fierce competition with launchers of countries the economy of which is not comparable to ours.

Thus, Space Industry has lost 20 % of its workforce during the past five years and employs presently only some 28.000 people, mainly specialised engineers. The immediate consequence of this situation is that this industry faces problems in maintaining its competence. Competitivity and the capacity to satisfy European requirements are at stake and consequently the aptitude of Europe to preserve its sovereignty.

TRANSLATION INTO ACTIONS

Space Industry thus faces a deep crisis. Its situation is unique in the world. Everywhere else, in the U.S. or in Russia and singularly in all the emerging countries, the institutional space funds are increasing. Space budgets have been raised by 25 % during the past ten years, except in Europe. The U.S. devotes 3 to 4 times more than the Europeans for civil space and about 15 to 20 times in the military field thus, strongly supporting the concept of 'space dominance'. Without similar ambitions, Europe will remain largely behind American industry that benefits substantially from this advantage.

Reports on this alarming situation are not lacking. But it does not seem to produce any reaction from the European political world.

However, the publication of the European Space Policy remains a major event. Such policy, anticipated by everybody for over ten years, should give Europe a common axis around which all actors should federate and work together. It remains to be seen whether this policy will be sufficiently ambitious to allow industry to survive. It can already be feared that the chapter on Defence may passed over in silence. It also remains to be seen what Member States would do concretely concerning its implementation in terms of organisation and funding.

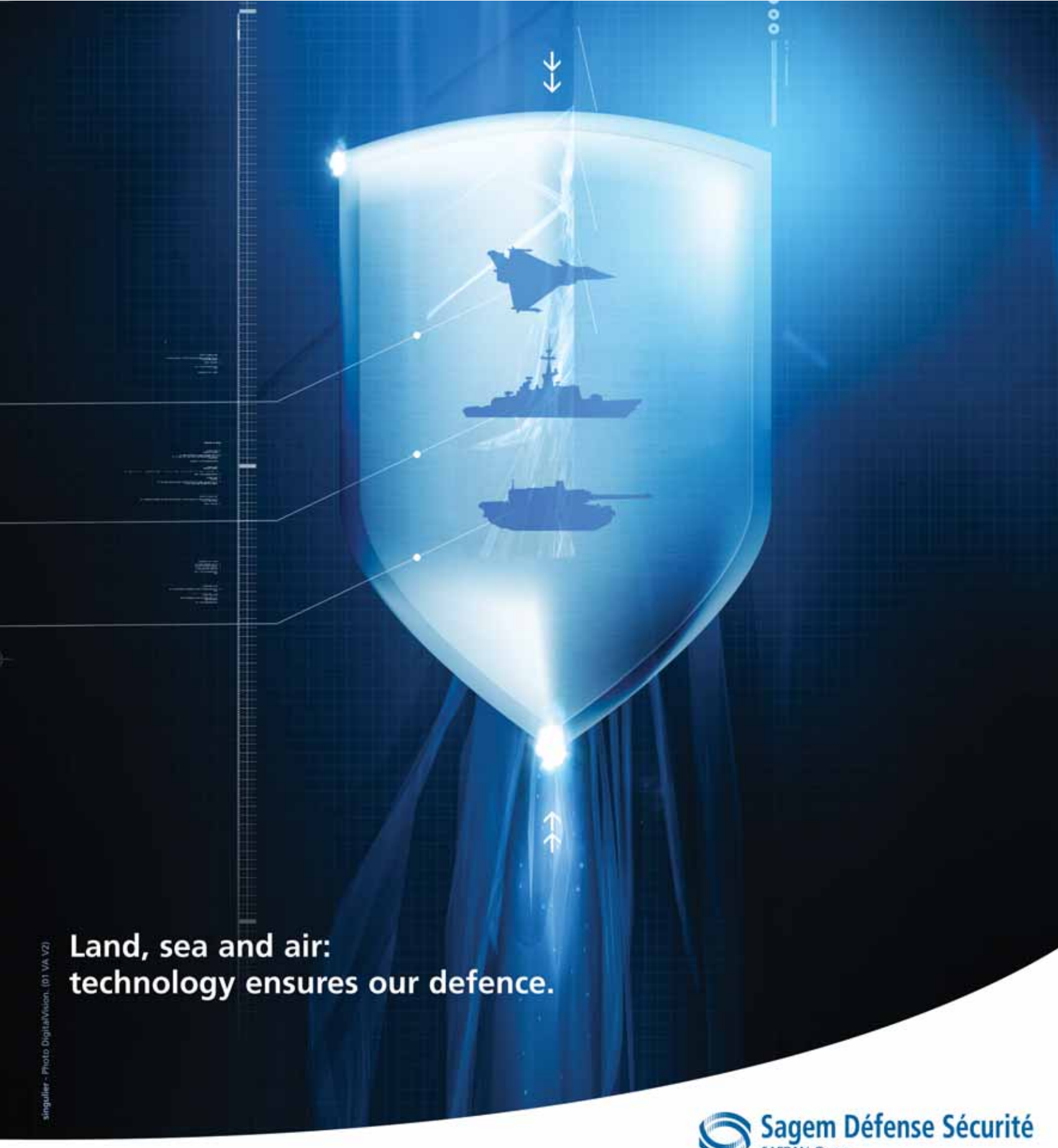
Space programmes are implemented over a specific time scale: Galileo was initiated more than 10 years ago and its operational satellites are not yet in orbit. GMES has also been developed for more than ten years and the structures allowing its development are not even set up. Even sustained by a significant commercial market, industry cannot survive without a sufficient institutional market.

Space Industry is committed to achieving the European **strategic autonomy**. (Fires in Portugal and Spain).

Photo ESA

We enter today a new era: that of words translated into actions. The decisions of engaging programmes have to be taken rapidly and the funding, at the same level of ambitions must be secured. The objection can be raised that space is not the sole priority of the European citizen and that health, security, employment, etc…. also deserve a special endeavour. This is true, but the decision on which choices should be taken now and the result will be irreversible as far as Space is concerned.

Europe, with the help of Space Agencies and in the first place ESA, has built up an industry at the service of its citizen and its ambition. It would be prejudicial to Europe if it was to become unable to preserve the independence of a number of its tools of knowledge, appreciation and action. ■



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> "The work of ASD-STAN will expand towards global co-operation."

Gunter Lessmann,
ASD-STAN Director

Shaping Standards from Industry for Industry

Gunter Lessmann,
ASD-STAN Director

ASD-STAN, previously known as AECMA-STAN, establishes, develops and maintains standards requested by the European Aerospace and Defence Industry for worldwide use and application.

ASD-STAN is registered as a non-profit Association under Belgian law and acts as an "Associated Body" to CEN, Comité Européen de Normalisation, the European Standardization Organization established by the European Commission. ASD-STAN acts as the "Sole Provider of Aerospace Standards" to CEN. ASD-STAN cooperates with ECSS, European Co-operation for Space Standardization, to which it has delegated the establishment of Space related standards.

ASD-STAN establishes prEN pre-Standards according to industrial needs which subsequently are transformed into EN European Standards following CEN rules for subsequent publication as national Stan-dards within all 30 CEN member countries. Additionally ASD-STAN establishes TR Technical Reports and currently prepares for a new type of European Industrial Standard EA.

ASD-STAN activities are self-financed through membership fees from its member states Germany, France, United Kingdom, Italy, Spain, Sweden and Belgium and by the sale of prEN and TR. It is also sub-contracted by SBAC Society of British Aerospace Companies for the sale of SBAC Technical Specifications. ASD also mandated ASD-STAN for the sale of their documents ASD-STE100 Simplified Technical English and S2000M: International Specification for Material Management -Integrated data processing for military equipment.

A STREAMLINE PROCESS

In 2006 ASD-STAN has started 40 new work items and has completed the establishment of 100 new and revised standards. From its stock of prEN and from new standard developments, ASD-STAN has published 242 EN via CEN in 2006. The current stock on standards maintained by ASD-STAN is 1163 prEN and 253 TR. 88 new standards and standard revisions are currently in process.

ASD-STAN acts as Standards Management Leader for the International Aerospace Quality Group IAQG, i.e. ASD-STAN coordinates the worldwide publication of Aerospace Quality Standards.

ASD-STAN cooperates with the American Aerospace Industries Association AIA and with the American Society of Automotive Engineers SAE for common standardization activities. Further intensification and expansion towards global co-operation is foreseen in the near future. ■

@ FOR FURTHER INFORMATION PLEASE SEE
http://www.asd-stan.org

The working structure of ASD-STAN is part of the organizational environment of its member associations and their member companies. The current ASD-STAN working structure comprises the following Domains and Sectors throughout 7 European countries:

D1 Engineering Procedures LOTAR **LO**ng **T**erm **A**rchiving and **R**etrieval of digital technical product documentation MOAA **M**odular and **O**pen **A**vionics **A**rchitecture ICE Ideal **C**abin **E**nvironment	**D4 Metallic** Aluminium, Titanium, Heat resisting alloys, Steels, Test methods, Welding / Brazing
D2 Electrical General, Cables, Connectors, Relays, Protection Devices, Lamps, Batteries, Harnesses Components, Data Bus, Optical	**D5 Non-Metallic** Elastomers / Sealants, Thermoplastics, Adhesives / Honeycomb, Paints / Varnishes, Surface treatments, Composite Material, Textiles, Ceramics
D3 Mechanical Parts of mechanical systems, Fasteners, Hydraulics	**D6 Quality** European Aerospace Quality Group

If you are interested in participating in one or more of these working groups, please do not hesitate to contact us by email: **contact@asd-stan.org**