



- **Based on the previously assembled basic scenario structures, this step aims at interpreting and rendering more precise the year 2050 for aviation and its emissions.**

<i>Descriptor</i>	<i>SCENARIO A 2050</i>
<p>INFLUENCE AREA MACRO-ECONOMY</p> <p>3. <u>Economic centres</u></p>	<p><u>Dispersion of economic centres all over the world</u></p> <p>The generation of new centres goes hand in hand with regionalisation. Some of these centres produce what they need and have closed loop economies. The interaction of these economies is reduced to a necessary level.</p>

<i>Descriptor</i>	<i>SCENARIO A 2050</i>
<p>INFLUENCE AREA ECOLOGY</p> <p>4. <u>Climate</u></p>	<p><u>Significant change</u></p> <p>The climate has dramatically changed over the last decades. What started at the end of the last century with the accumulation of storms, flooding and slight warming is now evident all over the globe: the green-house effect with significant warming, destruction of arable land, the depletion of the ozone layer - also over the northern hemisphere - have led to more severe natural catastrophes. Part of the arable land of the year 2000 has turned into desert, the melting of the poles and the icebergs led to flooding of many coastal areas in North America, Europe and Asia. The blue planet is threatened by a dramatic decrease in bio diversity of flora and fauna, new dermatological diseases, immune deficiencies and new viruses, etc.</p>

<i>Descriptor</i>	<i>SCENARIO A 2050</i>
<p>INFLUENCE AREA DEMOGRAPHY</p> <p>7. <u>Education</u></p>	<p><u>High level education only for the better off</u></p> <p>Education is expensive and only affordable for the rich. In many countries the economy has only jobs for few highly qualified people; the majority is needed for simple jobs with lower education (e.g. in the personal service sector). Local or tribal knowledge and competence (in agriculture, medicine, biology, spirituality, language, art, culture) gain in importance and are highly demanded in some regions; spiritual education versus professional education.</p>

<i>Descriptor</i>	SCENARIO A 2050
<p>INFLUENCE AREA REGULATIONS</p> <p>14. <u>Regulations on air traffic operation</u></p> <p>15. <u>Regulations on the kind of demand</u></p> <p>16. <u>Regulations on emissions</u></p>	<p><u>Voluntary reduction supported by restriction – but different according to the regions</u> Air transport has been blamed as being one of the worst polluting industries over the last decades. Science has proven that air traffic has negative effects on air quality, ozone layer, immune deficiency diseases, respiratory and allergic diseases. Air traffic is subject to limited permissions granted by the authorities. Strict criteria for ecology have to be fulfilled by the type of aircraft, its emissions and ATM has to assume the least-polluting routing possible.</p> <p><u>Only “useful and irreplaceable air transport” is wanted</u> Authorities have strict guidelines regarding the kind of air traffic they allow. Leisure flights are the absolute exception and only possible under specific weather conditions; furthermore they are extremely expensive. For all kinds of business trips people need good reasons and a lot of money to get on board.</p> <p><u>Severe restrictions on all kinds of traffic</u> Science has clearly proven that traffic emissions harm the environment. Therefore air and other traffic is subject to severe restrictions and only trips with extremely well founded reasons get a slot. There is no doubt about their negative consequences for all life on earth.</p>

<i>Descriptor</i>	SCENARIO A 2050
<p>INFLUENCE AREA ENERGY</p> <p>17. <u>Energy availability</u></p> <p>18. <u>Energy resources for aviation</u></p> <p>19. <u>(Raw) materials</u></p>	<p><u>Energy is based on renewable resources – but no significant breakthrough</u></p> <p>Wind, solar, water, biomass, fuel cells are the main energy sources according the sustainability criteria of the society. Mainly the energy sources of 2000 have been abandoned. The remaining energies are scarce and are used according to the importance for the society.</p> <p><u>Energy for aviation is very limited</u></p> <p>Hospitals, schools, agriculture and basic public services have the highest priority in energy allocation. Aviation has a low priority.</p> <p><u>Bottlenecks</u></p> <p>Materials’ replacements are expensive and limited due to strict recycling requirements. High-energy prices make the price/availability bottleneck even more narrow.</p>

<i>Descriptor</i>	SCENARIO A 2050
<p>INFLUENCE AREA TECHNOLOGY</p> <p>20. <u>Information/Communication technology</u></p> <p>21. <u>E-commerce</u></p> <p>22. <u>Virtual reality</u></p>	<p><u>Complete ICT failure</u></p> <p>Technology does not deliver what is expected of it. Too many problems with the complexity of ICT have reduced research and application. The demand for high sophisticated ICT in a spiritual and face-to-face-society slows down.</p> <p><u>e-commerce is one of many channels</u></p> <p>e- + m-commerce in its original sense was too virtual and didn't fulfil the people's need for polysensuality such as feeling, tasting, smelling: Therefore it's an add-on but not a replacement for physical events. High transport costs for logistics and lack of data security keep e- + m-commerce low key.</p> <p><u>Virtual reality has been replaced by new conscience levels</u></p> <p>Virtual reality seems to be a toy of technology driven minds of the last century. New means of reality, on a higher level of consciousness are accepted if they match the sustainable society's needs.</p>

<i>Descriptor</i>	<i>SCENARIO A 2050</i>
<p>INFLUENCE AREA TECHNOLOGY</p> <p>23. <u>Biosciences</u></p> <p>24. <u>Robotics</u></p>	<p><u>Not everything which is technically feasible is ethically acceptable</u></p> <p>Biosciences are accepted as far as they help nature and human beings to achieve a better quality of life without endangering other people, species and nature. Human cloning is prohibited in many regions. Side effects and uncontrolled systemic consequences are not yet well managed.</p> <p><u>Moderate growth</u></p> <p>Labour, ethics and other problems have led to the situation that robotics are used in a limited way and under control of human beings. Robotics will not replace the value of human work and creativity.</p>

<i>Descriptor</i>	<i>SCENARIO A 2050</i>
<p>INFLUENCE AREA AT SUPPLY SIDE</p> <p>25. <u>Infrastructure</u></p> <p>26. <u>Aircraft</u></p>	<p><u>Many constraints</u></p> <p>Strict government regulations on emissions reduce all kind of traffic and discourage infrastructure investors. This promotes “stay local” for the vast majority.</p> <p><u>Freezing of AC technology</u></p> <p>As air transport is on a steep downturn, the industry disinvests of this sector and engages in other sustainable, prospering sectors. No improvements regarding noise; the lack of investment lead to long-term safety fears.</p>

<i>Descriptor</i>	<i>SCENARIO A 2050</i>
INFLUENCE AREA TRANSPORT 30. <u>Modal split</u>	<u>Green modal split concepts for interregional traffic</u> The remaining traffic is organised according to sustainability criteria. There is no optimised transfer to other modes , just a transfer with unattractive transfer time.

<i>Descriptor</i>	SCENARIO A 2050
<p>INFLUENCE AREA AT TECHNOLOGY</p> <p>31. <u>Airframe/engine technology</u></p> <p>32. <u>CNS/ATM</u></p> <p>33. <u>Airport design</u></p>	<p><u>System change aiming at less pollution – but no blockbuster innovation</u></p> <p>Airframe/engine technology is not the focus of the industry: It is perceived as an old technology from the last century, which has no future. Therefore no investment at all. The research undertaken in the first decades of the century did not show the expected success; new fuel concepts and supersonic projects were abandoned.</p> <p><u>Only green ATM procedures</u></p> <p>Due to constraints and lack of demand the ATM equipment and service providers invest only in sustainable aspects required by the government. CNS/ATM is stagnating or has fragmented systems. Free flight is granted for green fleets.</p> <p><u>Airport design is classical</u></p> <p>Lack of demand, high prices and strict regulations have led to disinvestments in airports all over Europe. Only a few regional ones with classic design are in operation, but with less traffic than 50 years ago.</p>

<i>Descriptor</i>	<i>SCENARIO A 2050</i>
<p>INFLUENCE AREA AT TECHNOLOGY</p> <p>34. <u>Alternative transport modes</u></p>	<p><u>Ecologically correct transportation modes for the remaining traffic</u></p> <p>Slow, but ecologically correct transportation modes are highly accepted means of regional encounters.</p>

<i>Descriptor</i>	SCENARIO A 2050
<p>INFLUENCE AREA AT EFFECTS ON ECOLOGY</p> <p>35. <u>Noise effects on health</u></p> <p>36. <u>Exhaust gas emissions at cruise altitudes (subsonic, tropospheric)</u></p> <p>37. <u>Exhaust gas emissions at cruise altitudes (supersonic, stratospheric)</u></p> <p>38. <u>Local air quality related emissions</u></p>	<p><u>Noise is still a problem</u></p> <p>The only way to fight noise is air traffic reduction, as no technological solutions are in sight (lack of investment).</p> <p><u>Subsonic emissions are still a problem</u></p> <p>Supranational actions regarding these emissions have been taken too late; most of the damages are irreparable. As no technical solutions are available a ban is the only way to deal with the further destruction of the atmosphere. The only way to escape this is an emissions permit trading.</p> <p><u>No problem any more</u></p> <p>Supersonic flights were terminated in 2005 without any successor technology.</p> <p><u>Serious health problems</u></p> <p>Science has proven that air transport emissions have serious health damaging effects such as new immune deficiency, respiratory diseases and allergies. A lot of these diseases seem to be incurable.</p>

<i>Descriptor</i>	<i>SCENARIO A 2050</i>
<p>INFLUENCE AREA SPECIAL SYSTEM EFFECTS</p> <p>39. <u>Safety</u></p>	<p><u>Safety problems persist</u></p> <p>The few investments made in air traffic were dedicated to health and ecology protection, not to safety. The accident rate per passenger mile is significantly higher than at the beginning of the century. This is not a major concern in society: those who fly despite all health and ecology damaging aspects have to pay a high price for it – and sometimes it costs their lives.</p>

<i>Descriptor</i>	SCENARIO D 2050
<p>INFLUENCE AREA MACRO-ECONOMY</p> <p>1. <u>GDP worldwide</u></p> <p>2. <u>Globalisation</u></p>	<p><u>Impressive GDP growth world-wide but with regional differences</u></p> <p>The spread of new technologies, education, globalisation and new business models helped the threshold countries to catch up with the leading economies. North America, Europe and Asia (China, India, South East Asia) are competing for the world economic leadership. They are the incubators for new sciences such as biosciences, nano-technology, smart materials, smart traffic systems and all kinds of IT-multimedia technologies. Thanks to new and renewable energy sources, energy will not be a limiting factor for the development of humanity any more.</p> <p><u>Globalisation seems to be the success model of the 21st century</u></p> <p>Projects around the globe integrating the best possible labour force convinced the ever sceptics and globalisation opponents. Even poorer countries have got their chance to benefit from higher salaries, social security and access to any kind of IT-communication. New agreements between countries and economic blocs have led to a more equal distribution of wealth.</p>

<i>Descriptor</i>	<i>SCENARIO D 2050</i>
<p>INFLUENCES AREA MACRO-ECONOMY</p> <p>3. <u>Economic centres</u></p>	<p><u>The Y€-regions (YEN, EURO, \$) dominate the economic affairs in the world</u></p> <p>There are a few dominant centres in Europe, America and Asia.. These centres concentrate the world’s top industries, the best R&D centres and high profile jobs. As they are in constant competition with regard to the world leadership, there is a lot of exchange between them (exchange of information, people and concepts). Despite their competition in the early 20s they agreed on a common money called “clicks” because it is a virtual money and all financial transactions are done by a click – not a mouse, but an eyeball click.</p>

<i>Descriptor</i>	<i>SCENARIO D 2050</i>
<p>INFLUENCE AREA ECOLOGY</p> <p>4. <u>Climate</u></p>	<p><u>Little change</u></p> <p>Thanks to many actions undertaken at the beginning of the century the catastrophic scenarios did not come true: Governments, industry, agriculture and households all over the world took action in order to reduce climate damages and to preserve the natural environment. Ecological sciences are together with biosciences a booming business with many new ventures and business models.</p>

<i>Descriptor</i>	<i>SCENARIO D 2050</i>
<p>INFLUENCE AREA DEMOGRAPHY</p> <p>7. <u>Education</u></p>	<p><u>High level education for everybody</u></p> <p>The free access to any kind of high level education is one of the new basic human rights. A great effort has been made to give any human being on earth free access to education via Supernet, the powerful Internet successor system. This is one of the most valuable achievements of the 21st century.</p>

<i>Descriptor</i>	SCENARIO D 2050
<p>INFLUENCE AREA SOCIAL TRENDS</p> <p>8. <u>Mobility needs</u></p> <p>9. <u>Quality of life</u></p> <p>10. <u>Working patterns</u></p>	<p><u>Virtual mobility is Nr.1</u></p> <p>The new society lives, moves and behaves in four dimensions: virtuality crosses borders including time limitations and opens up new means of working, understanding, education and consciousness. We move our knowledge, feelings, data and money in virtual spaces. Besides these fantastic experiences we have to travel around the globe for our international businesses; we work, communicate and deal in other cultures with efficiency and elegance and need high speed comfortable means of transportation.</p> <p><u>Hedonism takes the lead: fun and consumption of everything is the new leitmotif</u></p> <p>“Success feeds wealth and wealth has to be shown” are the credos of this new society. Enjoy whatever money can buy. The ultimate birthday gift is an interplanetary trip with a birthday party in orbit.</p> <p><u>Work, business and life is global</u></p> <p>On time, on-line and absolutely interactive wherever you are – even in a space craft. Time is money and we make best use of our time. Super IT at our fingertip makes virtual dreams come true.</p>

<i>Descriptor</i>	SCENARIO D 2050
<p>INFLUENCE AREA SOCIAL TRENDS 11. <u>Leisure behaviour</u></p> <p>12. <u>Business behaviour</u></p> <p>13. <u>Social structure</u></p>	<p><u>A shrinking world allows whatever you dream of</u></p> <p>Travelling virtually and physically, around the globe and in orbit is the “in-fun” of this generation. Stress-relieving activities with the 5th generation mind machines are also en vogue. Whatever refreshes body and soul, mind and spirit in the most sophisticated way is highly welcomed.</p> <p><u>There is no business like global business</u></p> <p>A very tough world-wide competition requires a permanent fight for the most innovative solution 24 hours, 7 days and within nanoseconds. The high performance people jet around the world by doing many jobs at a time simultaneously. There is no way to survive in a small local niche; whatever you do it will be on a global benchmark. The winner takes it all and there is no pity, no social or any other bonus or excuse.</p> <p><u>Fragmented society in the €and \$-region</u></p> <p>The old family model is dead (not in the Yen-region!); what we live nowadays is an opportunistic project partnership model. Any relationship – between hetero- and homosexual partners and even between children and parents is regarded as a project with a clear start and end and an intensive trial phase. Families are evaluated according to their values and benefit to the individual, even children have the right to choose their family.</p>

<i>Descriptor</i>	SCENARIO D 2050
<p>INFLUENCE AREA REGULATIONS</p> <p>14. <u>Regulations on air traffic operation</u></p> <p>15. <u>Regulations on the kind of demand</u></p> <p>16. <u>Regulations on emissions</u></p>	<p><u>Legislation follows what is economically needed</u></p> <p>Economic boom, world-wide exchange of goods and people require a favourable regulation policy. There are no limits for air traffic except physical, safety and technical ones.</p> <p><u>Above the clouds – freedom is unlimited</u></p> <p>Whatever kind of air transport you need is available if it is an attractive market. Politics follows the liberalisation principles in order to stimulate industry , new busines and unlimited mobility.</p> <p><u>Legislation follows technology</u></p> <p>Air engine industry abolished its threatening emissions due to new engines, fuel technologies and new aerodynamic principles. The legislator works hand in hand with the emission defining industries like engine, airframe and the fuel industry.</p>

<i>Descriptor</i>	SCENARIO D 2050
<p>INFLUENCE AREA ENERGY</p> <p>17. <u>Energy availability</u></p> <p>18. <u>Energy resources for aviation</u></p> <p>19. <u>(Raw) materials</u></p>	<p><u>A wide range of energy sources is available</u></p> <p>One of the most significant advances of the last years have been made in the energy sector. Now a range of various energy sources is available such as renewable energies (water, wind, solar, bio-mass...), nuclear fusion, fuel cells, hydrocarbons... Any place of the world has the energy it needs at a reasonable price. Many countries abandoned the centralised utilities' principle and invested in decentralised power stations in every house, public or industrial building.</p> <p><u>Energy is available</u></p> <p>Aviation gets the energy it needs at a reasonable price. The newest aircraft generation flies with new, less polluting energies such as hydrogen and others.</p> <p><u>Raw materials and new smart designer materials are available</u></p> <p>Material sciences have made large progress and developed new materials which replace old raw materials which are no longer available and have the properties needed by the user. New materials have properties such as shock absorbing, transformation from solid to soft and vice versa, communication devices and sensors integrated in their surface for transportation modes. A large part of CNS capacity is now found in the aircraft body itself called the smart navigating materials.</p>

<i>Descriptor</i>	<i>SCENARIO D 2050</i>
<p>INFLUENCE AREA TECHNOLOGY</p> <p>20. <u>Information/ ommuni-cation technology</u></p> <p>21. <u>E-commerce</u></p>	<p><u>ICT has revolutionised the world over the last 50 years</u></p> <p>ICT is found in every aspect of life, work and art. Nobody can imagine how life has been before without ICT. Communication and all kinds of exchanges around the globe are possible in a fast, easy, elegant way. Instant communication, solutions provided without a nanosecond delay is the motto of this highly competitive world. The fusion of ICT with bio-sciences has given IT a new dynamic boost (super fast ,self-learning bio-chips which model the human brain in a seamless way). On the other hand ICT has substituted a lot of traffic and particularly air traffic: 5th generation ICT systems allow real communications even on the net by the aid of cultural filters, virtual personalities and even the transmission of feelings and emotions. Despite these substitution effects there is still a high air traffic density generated by globalisation and fun travel.</p> <p><u>The winner e- + m-commerce takes it all</u></p> <p>The famous citation of the last century "In some years you are e-business or out of business" has come true. Business is based on electronic, mobile and new means of stimulation. Even virtual food, taste and vitamins exist. The former security and logistics problems have been solved with the help of new high-performing, self-risk-adaptable security tools, wireless nano-technology and virtual reality.</p>

<i>Descriptor</i>	SCENARIO D 2050
<p>INFLUENCE AREA TECHNOLOGY</p> <p>22. <u>Virtual reality</u></p> <p>23. <u>Biosciences</u></p>	<p><u>If it is not virtual it is not real</u></p> <p>The brave new world of virtuality has changed our life styles, working, thinking and feeling. Sometimes virtual and real things are mixed up in a way that people cannot differentiate what is virtual and what is real. Virtual worlds help to train people for real world tasks/ problems and to simulate difficult situations; after the virtual trials we decide which one is the best and that becomes the real one. The creation of virtual personalities or e-clones which have the same capacities as the real ones allows to be at two places at the same time.</p> <p><u>Biosciences are the new engine of the world economy</u></p> <p>The merger of IT and biosciences have boosted both to new growth dimensions. All kinds of genetic prevention, repair and genetic improvement are possible. Ethic and moral issues are now in the hands of citizen’s surveillance and approval organisations. The great success in healing formerly incurable diseases and the tremendous improvements in quality of life are more convincing than any ethic concern people had before. Some researchers are pushing the limits of science and the tolerance of society. Cloned human organs are accepted, mainly as a material resource for repair. The human body contains not only biological material, but even IT and new artificial materials which are more resistant against attrition than natural bio-material.</p>

<i>Descriptor</i>	<i>SCENARIO D 2050</i>
<p>INFLUENCE AREA TECHNOLOGY</p> <p>24. <u>Robotics</u></p>	<p><u>Robots are the masters of industrial production</u></p> <p>Most kinds of hard or monotone or very complicated physical work have been delegated to robots. They are everywhere from household management, logistics to industrial production and transportation. Robots are smart self-learning machines and can also have human characteristics and spleens.</p>

<i>Descriptor</i>	<i>SCENARIO D 2050</i>
<p>INFLUENCE AREA AT SUPPLY SIDE</p> <p>25. <u>Infrastructure</u></p> <p>26. <u>Aircraft</u></p>	<p><u>New efficient, high performance airports</u></p> <p>The new generation of airports enlarged and built between 2020 and 2050 are the new mega-centers for business, communication, education and entertainment. Fast, silent and 0-emission trains and mass-car-transport system connect airports directly with cities in the surrounding 500 km. The transfer from one transportation mode to the next is either extremely fast in moving tubes or - if transfer time allows it - a phase of relaxation, business or fun in one of the numerous airport facilities. The mega-hubs are able to operate very large and very specialised aircraft, airships, wingships and the new generation of supersonics. ATM has also made tremendous progress: high traffic density en route and at approach and departure, pilot-less flights, space-based navigation and surveillance with high precision.</p> <p><u>New generations of supersonic, VLA, airships and orbit shuttles</u></p> <p>The aircraft demand curve has reached its plateau: after years where ICT and air traffic had the same growth rate the ICT substituting effects become now more evident. Air traffic according the 2000 principles is no more manageable. The new aircraft generation has convinced society and politics that they really work with new sustainable concepts . New generations of supersonic, VLA, airships and orbit shuttles satisfy the high demand for air traffic.</p>

<i>Descriptor</i>	SCENARIO D 2050
INFLUENCE AREA TRANSPORT 27. <u>Travel time</u> 28. <u>Travel cost</u> 29. <u>Infrastructure (demand)</u>	<u>2 opposite ideas: the faster the better or the more entertaining the better</u> The rainmakers of the new global economy pay high prices for the fastest possible travelling time (time is money!). Those who are not in a hurry enjoy travelling like the former cruise ship travellers. Travel time is up to the customer’s individual situation: airlines and technology have a solution for any need. As the market stagnates the price battles start. <u>Attractive prices</u> There is a tariff for any income: in airline auctions and on virtual market places you can buy the cheapest tickets. For the super speed and super service trips people have to pay a premium. <u>High demand for safety, attractiveness and intermodality</u> All partners in transportation ask for high safety, easy access, interconnectivity and strategic alliances.

<i>Descriptor</i>	<i>SCENARIO D 2050</i>
INFLUENCE AREA TRANSPORT 30. <u>Modal split</u>	<u>Balanced modal split with high intermodality</u> The modal split combines all relevant modes according to the customer's needs; e.g. HSGT and specific types of air transport. If the customer's priority is the fastest possible way from A to B, then the modal split comprises supersonic aircraft with HSGT and new tube transport. If the customer's priority is the cheapest price then it means ship, airship and lorry as transport mode.

<i>Descriptor</i>	SCENARIO D 2050
<p>INFLUENCE AREA AT TECHNOLOGY</p> <p>33. <u>Airport design</u></p> <p>34. <u>Alternative transport modes</u></p>	<p><u>New airport design according to the need of high demand and new ac concepts</u></p> <p>New aircraft concepts require new infrastructure: special gates and terminals for supersonic, VLA and airships. Therefore we find different airports with different specifications.</p> <p><u>Competition in sustainable transport mode is high</u></p> <p>High demand for air transport has stimulated not only the aircraft industry but also the substituting transportation modes such as HSGT, fast tubes for goods and ICT, virtual travelling as substitute for physical travel.</p>

<i>Descriptor</i>	<i>SCENARIO D 2050</i>
<p>INFLUENCE AREA AT EFFECTS ON ECOLOGY</p> <p>37. <u>Exhaust gas emissions at cruise altitudes (supersonic, stratospheric)</u></p> <p>38. <u>Local air quality related emissions</u></p>	<p><u>Supersonic emissions reduced</u></p> <p>After the grounding of the last Concorde in 2005, Boeing and Airbus Industries decided to give the supersonic concept a new kiss of life supported by a huge supersonic fund of private investors. These private investors came from the old “Concorde fan club” and from the Nouveaux Riches of the e+ m-economy. Instead of shares they got future ticket vouchers and so the future customers of Concorde II were already there before the first plane took off the ground.</p> <p>But the emission-indices for critical emissions of the new supersonics are so low, that there will be no major problems with respect to climate aspects.</p> <p><u>Local air quality is not effected anymore</u></p> <p>Thanks to NGO pressure, governmental initiatives and industry investment in new fuels and engine types local air quality now is excellent.</p>

<i>Descriptor</i>	SCENARIO D 2050
INLUENCE AREA SPECIAL SYSTEM EFFECTS 39. <u>Safety</u>	<u>Safety is a nr. 1 issue</u> All efforts in automation, improvement of ATM, engine and aircraft reliability aim at sustainability and safety. New fourfold redundant electronic , hydraulic and other technical systems are made available. An air crash is a disaster for airlines and airframers. Insurance costs are tremendous. In the very rare case of an air crash of a VLA the responsible company – either the aircraft producer or the airline - are in deep trouble. Security failures are unforgivable and not tolerated.

<i>Descriptor</i>	<i>SCENARIO B 2050</i>
	<p data-bbox="192 363 1189 480"><u>STEP 5:</u> SCENARIO INTERPRETATION</p> <p data-bbox="192 579 2024 660">➤ Based on the previously assembled basic scenario structures, this step aims at interpreting and rendering more precise the year 2050 for aviation and its emissions.</p>

<i>Descriptor</i>	<i>SCENARIO B 2050</i>
INFLUENCE AREA MACRO-ECONOMY 3. <u>Economic centres</u>	<u>Dispersion of economic centres all over the world</u> The generation of new centres goes hand in hand with regionalisation. Some of these centres produce what they need and have closed loop economies. Others try to catch up with the leading economies and do not care about ecology. The exchanges of these economies follow the economic and in some regions more the ecological needs.

<i>Descriptor</i>	<i>SCENARIO B 2050</i>
INFLUENCE AREA ECOLOGY 4. <u>Climate</u>	<u>Some alarming but no catastrophic change</u> The climate has changed over the last decades, but with different seriousness and consequences in the various regions.. What started at the end of the last century with the accumulation of storms, flooding and slight warming continues and cumulates incidents. But the effects are not felt in the same way all over the globe. Some developed regions are very conscious even with regard to minor changes, whereas developing countries are more concerned with their economic situation than with an endangered or polluted environment. The world is not only split in areas with two different economic speeds but also in “ecology carers and non-carers”. Some highly developed regions grant development aid only if the developing country accepts stricter ecological standards.

<i>Descriptor</i>	SCENARIO B 2050
INFLUENCE AREA DEMOGRAPHY 5. <u>Fertility</u> 6. <u>Mortality</u>	<p><u>Lower fertility rate but not enough to make a significant change</u></p> <p>Despite a lower fertility rate the world population is still growing. According to the educational and economic situation fertility decreases with different rates in the various regions. There are still some cultures in the world where many children assure social security and prosperity based on religious, social and tribal values.</p> <p><u>Slightly decreasing all over the world</u></p> <p>Health Care is not yet a social right for everybody in the world. The rich countries can afford whatever the new high tech medicine provides including its gene modifying and gene repair therapies: their life expectancy climbs up to 130 years – and this in beauty and excellent shape. All the others have to take what they get for a lower price or from charity organisations. The developed countries have to find acceptable solutions for an ageing society; the financial burden of many retired people (more than 50% of the population in developed countries) becomes unbearable for the active part of the society. Elder people who are still in good shape have to work, mainly in the social sector on a voluntary basis as long as they are able to do so.</p>

<i>Descriptor</i>	<i>SCENARIO B 2050</i>
INFLUENCE AREA DEMOGRAPHY 7. <u>Education</u>	<u>High level education only for the rich</u> Education is expensive and only affordable for the rich people in the poorer countries and for a larger population in the rich countries. In developing countries the economy has only jobs for few highly qualified people; the majority is needed for simple jobs with lower education (e.g. in the personal service sector).

<i>Descriptor</i>	<i>SCENARIO B 2050</i>
<p>INFLUENCE AREA SOCIAL TRENDS</p> <p>8. <u>Mobility needs</u></p> <p>9. <u>Quality of life</u></p>	<p><u>Physical mobility in accordance with ecology needs</u></p> <p>Physical mobility increases with regard to long distance travel , but decreases on a short distance level. Mobility is accepted as far as it does not harm the environment. Renewable energies such as wind, solar, bio-mass, fuel cells, etc are highly welcomed and provide a good feeling of having contributed to the sake of the ecology. If somebody else pays high mobility and energy prices people adopt a sustainable lifestyle. But if the question boils down to paying more from their own pocket, then money counts more than the protection of ecology. Sustainable behaviour, protection of ecology, quality of life for all living beings (humans, animals and plants) are the values of those who can afford it.</p> <p><u>Down to earth and facing the realities</u></p> <p>Quality of life in this society means to do what you can afford in accordance with your own economic necessities and environmental needs. What you do for the environment has to be reasonable in an economic/monetary sense. Feeling all our senses (poly-sensual perception), respecting nature, but not without modern life style values, are the new mainstream trends..</p>

<i>Descriptor</i>	SCENARIO B 2050
<p>INFLUENCE AREA SOCIAL TRENDS</p> <p>10. <u>Working patterns</u></p> <p>11. <u>Leisure behaviour</u> (air transport related)</p>	<p><u>Regional and global labour structures do not interfere</u></p> <p>Regional and global labour is possible according to the motto “chacun à son gout”. Some people have to travel from region to region whereas others prefer to stay in the region but with an ICT connection with the whole world. We find a pluralism of working lifestyles satisfying the individual values: this ranges from the extreme ecologist and prosumerism lifestyle to the most global one. But even the globetrotter has to respect ecological needs and values..</p> <p><u>Leisure behaviour follows the working patterns</u></p> <p>What we discover in the working world is what we want to explore as a private person or just the contrary: those who travel a lot want to spend their vacation in the region with a lot of wellness services. Others who work in a region the whole year want to discover the rest of the world during their vacation. But there is always one criterion which has to be respected: you can do whatever you want if it does not harm the natural environment. Polluting or endangering the environment is regarded as a crime against nature and the future generations.</p>

<i>Descriptor</i>	SCENARIO B 2050
<p>INFLUENCE AREA REGULATIONS</p> <p>14. <u>Regulations on air traffic operation</u></p> <p>15. <u>Regulations on the kind of demand</u></p> <p>16. <u>Regulations on emissions</u></p>	<p><u>Some restrictions – but different according to the regions</u></p> <p>Air and other transport have been blamed as being one of the most polluting sectors. Therefore the high emission aircraft have been grounded, whereas the green fleets have almost no traffic restrictions. Different ecology criteria have to be fulfilled by the type of aircraft and its emissions. ATM has to assume the least-polluting routing possible.</p> <p><u>Only “useful and irreplaceable air transport ” is wanted</u></p> <p>Authorities have their guidelines regarding the kind of air traffic and the pollution they allow. All flights need transparent economic and traffic reasons in order to get a permission. Many regions make leisure flights subject to permission and you pay a high price.</p> <p><u>Restrictions on extremely polluting traffic</u></p> <p>Science has clearly proven that traffic emissions harm the environment. Therefore air and other traffic is subject to restrictions and only trips with clean energy get a preferred slot or a driving permission. Non-clean transport is permitted as an exception , but at an extremely high price (green taxes).</p>

<i>Descriptor</i>	SCENARIO B 2050
<p>INFLUENCE AREA ENERGY</p> <p>17. <u>Energy availability</u></p> <p>18. <u>Energy resources for aviation</u></p> <p>19. <u>(Raw) materials</u></p>	<p><u>Energy is available – but at a high price</u></p> <p>High energy prices drive the research for new energy sources, new application systems and alternatives. Renewable energies such as wind, solar, water, bio-mass are used in the renewable energy belt. Fuel cells are exploited together with the sources of 2000. Research has to follow the economic and ecological criteria.</p> <p><u>Energy for aviation is very limited</u></p> <p>Only hospitals, schools, and vital public services have the highest priority in cheap energy allocation. Hydrocarbons are used for aviation, but at a higher price.</p> <p><u>More research to overcome the bottlenecks</u></p> <p>Raw material is getting scarce and material replacements are expensive; this boosts the research for new ecological and cheap materials. High-energy prices make the price/availability bottleneck even more narrow.</p>

<i>Descriptor</i>	SCENARIO B 2050
<p>INFLUENCE AREA TECHNOLOGY</p> <p>20. <u>Information/Communication technology</u></p> <p>21. <u>E-commerce</u></p> <p>22. <u>Virtual reality</u></p>	<p><u>Evolutionary ICT development</u></p> <p>Old ICT is still going ahead, not in quantum leaps but in smooth improvements and in evolutionary cycles. It belongs to daily life but has lost its glamour of the early 21st century when everybody was on an ICT hype.</p> <p><u>e-commerce and m-commerce on a regional basis</u></p> <p>e- + m-commerce in its original sense was too virtual and didn't fulfil the people's need for polysensuality such as feeling, tasting, smelling. Therefore it's an add-on, not on a global, but on a more regional basis. Local shops still operate for goods where feeling, smelling, tasting and personal encounters play a major role.</p> <p><u>Virtual reality for the poor and actual reality for the rich</u></p> <p>Virtual reality becomes the "panem et circensem" of modern times for the poor. Virtual reality trips are cheaper than real trips; virtual reality games, movies etc. help the poor to face the daily misery. Only the rich can afford real service, real trips and they enjoy it as their privilege and luxury.</p>

<i>Descriptor</i>	<i>SCENARIO B 2050</i>
<p>INFLUENCE AREA TECHNOLOGY</p> <p>23. <u>Biosciences</u></p> <p>24. <u>Robotics</u></p>	<p><u>Not everything which is technically feasible can be successfully commercialised</u></p> <p>Biosciences are still expensive because they cannot be marketed on a large scale; therefore they belong to the luxury in rich men's life. The poorer people have to take what they get at a cheaper price: either traditional therapy or alternative medicine.</p> <p><u>Moderate growth</u></p> <p>Labour, ethics and other problems have led to the situation that robotics are used in a limited way and under control of human beings. Robotics will never replace the value of human work and creativity.</p>

<i>Descriptor</i>	<i>SCENARIO B 2050</i>
<p>INFLUENCE AREA AT SUPPLY SIDE</p> <p>25. <u>Infrastructure</u></p> <p>26. <u>Aircraft</u></p>	<p><u>Airport constraints for environmental reasons</u></p> <p>Government regulations on emissions reduce infrastructure projects and discourage infrastructure investors.</p> <p><u>Switch to ecological AC technology</u></p> <p>AC technology is green or not existing with dramatically reduced or 0 NOX and less noise production. Governments and airlines aim at the same objectives: the less polluting the aircraft the better the slot frequencies. AC industry has abandoned the concept of bigger is better: what has the highest demand now is inter-regional clean transport vessels with small to mid-size silent aircraft.</p>

<i>Descriptor</i>	SCENARIO B 2050
INFLUENCE AREA TRANSPORT 27. <u>Travel time</u> 28. <u>Travel cost</u>	<u>Travel time is less important</u> <p>What counts for people is a kind of travel efficiency, for both leisure and business. According to the personal values efficiency can be interpreted in different ways: for some a green efficiency has the highest priority and they choose their means of transport according to the lowest pollution regardless travelling time. Others try to balance ecological and time efficiency and a third group is only interested in travel time optimisation – of course at a high price. In general time is less important for short distances in ground transport. In air traffic ecological aspects have a strong impact on timing and routing.</p> <u>High costs for polluters</u> <p>Financial constraints are based on regulation, charges and taxes. The polluter (airline, engine manufacturer, airframer...) pay charges according to their pollution rate. Every player in air transport is interested in keeping the pollution rate as low as possible in order to gain a competitive edge. Ecology becomes a new key success factor in transport. This policy which distorts the competition is highly welcomed by the supporters of a sustainable economy and society.</p>

<i>Descriptor</i>	SCENARIO B 2050
<p>INFLUENCE AREA AT TECHNOLOGY</p> <p>31. <u>Airframe/engine technology</u></p> <p>32. <u>CNS/ATM</u></p> <p>33. <u>Airport design</u></p>	<p><u>System change according to demand change</u></p> <p>Regulation which incorporates more sustainable policies and changed demand patterns (less, but non-polluting flights, no short range flights..) has a strong impact on AC technology. New whispering and clean engines and new materials which respect the environment from production via the whole operating cycle to the final disposal are the innovation flagships of the AC industry.</p> <p><u>Accent on safety and ecology</u></p> <p>A constant improvement, but no revolutionary blockbuster: better management according to safety and ecological criteria. Reduced holding patterns, improved routings, slot preference for green fleets and collision avoidance systems are in place.</p> <p><u>Airport design changes according to demand pattern</u></p> <p>The new airports switch from the “hub-and-spoke”-principle to the “point-to-point”-service. As most of the short and mid-range flights have been abandoned there is less feeder-traffic. Point-to point fulfils also sustainable policy criteria.</p>

<i>Descriptor</i>	SCENARIO B 2050
<p>INFLUENCE AREA AT TECHNOLOGY</p> <p>34. <u>Alternative transport modes</u></p>	<p><u>Ecologically correct has also to be economically justified</u></p> <p>Alternative modes have a perfect market chance if they fulfil both aspects: it has to save the environment and people's wallet.</p>

<i>Descriptor</i>	SCENARIO B 2050
<p>INFLUENCE AREA AT EFFECTS ON ECOLOGY</p> <p>35. <u>Noise effects on health</u></p> <p>36. <u>Exhaust gas emissions at cruise altitudes (subsonic, tropospheric)</u></p> <p>37. <u>Exhaust gas emissions at cruise altitudes (supersonic, stratospheric)</u></p> <p>38. <u>Local air quality related emissions</u></p>	<p><u>Noise is only a minor problem</u></p> <p>Noise pollution has significantly reduced due to less air traffic and a slight improvement in technology (whispering aircraft)</p> <p><u>Subsonic limited</u></p> <p>As no technical solutions are available subsonic flights are banned from the stratosphere.</p> <p><u>Only limited permission</u></p> <p>Very few supersonic flights which fulfil strict emission and noise criteria are permitted.</p> <p><u>Sensitivity increases</u></p> <p>The total burden of air pollution declines, but the society's sensitivity to pollution in general increases. People are better informed about the links between pollution and health problems as new immune deficiency, respiratory diseases and allergies increase in all social groups.</p>

<i>Descriptor</i>	<i>SCENARIO B 2050</i>
INFLUENCE AREA SPECIAL SYSTEM EFFECTS 39. <u>Safety</u>	<u>Safety problems are not eliminated</u> The slogan in air traffic is now “practice what you preach”. Passengers and airport neighbours do not make any compromise in terms of safety. Safety is as important as ecology.

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA MACRO-ECONOMY</p> <p>1. <u>GDP world-wide</u></p> <p>2. <u>Globalisation</u></p>	<p><u>Impressive GDP growth world-wide but with regional differences</u></p> <p>The spread of new technologies, education, globalisation and new business models helped the threshold countries to catch up with the leading economies. North America and Europe are again the leading economies in the world. Asia (China, India, South East Asia) has significant growth rates based on the application of new technologies and a better birth control. They challenge US and Europe in the global competition. But US and Europe defend their leading position in all important science and technology fields such as biosciences, nano-technology, smart materials, smart traffic systems and all kinds of IT-multimedia technologies.</p> <p><u>Globalisation is a win-win-model for all regions world-wide</u></p> <p>Projects around the globe integrating the best possible labour force convinced the ever sceptics and globalisation opponents. All regions world-wide have got their chance to benefit from higher salaries, social security, a more equal distribution of wealth and access to any kind of IT-communication. Globalisation has pushed the world into one single world currency which operates on a virtual and real basis.</p>

<i>Descriptor</i>	<i>SCENARIO C 2050</i>
<p>INFLUENCES AREA MACRO-ECONOMY</p> <p>3. <u>Economic centres</u></p>	<p><u>New centres dominate the economic affairs in the world</u></p> <p>There are some dominant centres in Europe, in the Americas, and in Asia. These centres concentrate the world's top industries, the best R&D centres and high profile jobs. The global players "govern" these centres and take over more and more the rule making role of the former nation states or political blocs. These centres are in constant competition with regard to the world leadership and there is a lot of exchange between them (exchange of information, know how, people and concepts).</p>

<i>Descriptor</i>	<i>SCENARIO C 2050</i>
INFLUENCE AREA ECOLOGY 4. <u>Climate</u>	<u>Little change – but no catastrophies</u> Thanks to many actions undertaken at the beginning of the century the catastrophic scenarios did not come true: Governments, industry, agriculture and households all over the world took action in order to reduce climate damages and to preserve the natural environment. Ecological sciences are together with biosciences a booming business with many new ventures and business models.

<i>Descriptor</i>	<i>SCENARIO C 2050</i>
<p>INFLUENCE AREA DEMOGRAPHY</p> <p>5. <u>Fertility</u></p> <p>6. <u>Mortality</u></p>	<p><u>Fertility has decreased significantly and particularly in countries with former high fertility</u></p> <p>Abolishment of illiteracy, better information of women in poorer countries, new easy, fast and cheap means of birth control and higher incomes have helped to decrease the fertility rate. The leading economic blocs North America and Europe who suffer from an over-aging in their original population need high qualified labour force for development and commercialisation of high tech. This offers a good opportunity for young people from the former third world to immigrate to their countries. The young smart Asians are highly welcomed as indispensable human resource ; the xenophobia of the early millennium has completely disappeared.</p> <p><u>We get older but stay young</u></p> <p>It seems that mankind has beaten illness and death. Advances in medicine, hygiene and the manipulation of the genetic code made it happen: Life expectancy has reached the 'magic number' of 130 years. The problem now is not illness or mortality, but longevity and its social consequences. Rich old people consume a lot of money, health care efforts and therefore are in permanent conflicts with younger generations and their needs. This is one of the major social problems in 2050. Ethic commissions start discussions regarding an expiry date for human beings as for perishable goods.</p>

<i>Descriptor</i>	<i>SCENARIO C 2050</i>
<p>INFLUENCE AREA DEMOGRAPHY</p> <p>7. <u>Education</u></p>	<p><u>High level education for everybody</u></p> <p>The free access to any kind of high level education is one of the new basic human rights. A great effort has been made to give any human being on earth free access to education via Supernet, the powerful Internet successor system. This is one of the most valuable achievements of the 21st century.</p>

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA SOCIAL TRENDS</p> <p>11. <u>Leisure behaviour</u></p> <p>12. <u>Business behaviour</u></p> <p>13. <u>Social structure</u></p>	<p><u>A shrinking world allows whatever you dream of</u></p> <p>Travelling virtually and physically, around the globe is the “in-fun” of this generation. Stress-relieving activities with the 5th generation mind machines are also en vogue. Whatever refreshes mind, body and soul in the most balanced way is highly welcomed.</p> <p><u>There is no business like global business</u></p> <p>A very tough world-wide competition requires a permanent fight for the most innovative solution 24 hours, 7 days and within nanoseconds. The high performance people jet around the world by doing their job and balancing their body and mind at the same time. Whatever you do it will be on a global benchmark. The young economies are eager to catch up with the world leaders US and Europe and therefore they try everything to challenge them.</p> <p><u>Fragmented society</u></p> <p>The old family model is dead; what we live nowadays is an balanced partnership model. Any relationship is evaluated in terms of benefit and balance for each partner, with a maximum of flexibility: these patchwork families are on a constant change – always on the search for a higher balance.</p>

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA REGULATIONS</p> <p>14. <u>Regulations on air traffic operation</u></p> <p>15. <u>Regulations on the kind of demand</u></p> <p>16. <u>Regulations on emissions</u></p>	<p><u>Legislation follows economic and ecological needs</u></p> <p>Economic boom, globalisation on a win-win-basis and world-wide exchange of goods and people require a favourable regulation policy.</p> <p><u>Above the clouds – freedom is not unlimited</u></p> <p>The sky is limited and freedom for aviation is not unlimited. Whatever kind of air transport you need is available if it is an attractive market, green and safe. Politics incorporates as well the balance principle and tries to make it a win-win game for both economy and ecology on a world-wide scale.</p> <p><u>Legislation follows technology</u></p> <p>It has taken some decades until the air engine industry has abolished its threatening emissions due to new engines, fuel technologies and new aerodynamic principles. The legislator works hand in hand with the emission defining industries like engine, airframe and the fuel industry, but makes clear that economic interests can not overrule ecological claims.</p>

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA ENERGY</p> <p>17. <u>Energy availability</u></p> <p>18. <u>Energy resources for aviation</u></p> <p>19. <u>(Raw) materials</u></p>	<p><u>Energy resources are limited and have their price</u></p> <p>A booming world economy needs a lot of energy: therefore the energy sources get scarce. This puts pressure on R&D and the energy exploring industries: A lot of investment is now made in the energy sector. Some companies intensify their research in renewable energies (water, wind, solar, bio-mass...), others work on nuclear fusion, fuel cells, hydrocarbons.</p> <p><u>Kerosene is available</u></p> <p>Aviation gets the energy it needs, but at a high price. The newer aircraft generation flies with renewable energies.</p> <p><u>Raw materials and new smart designer materials are available</u></p> <p>Material sciences have made large progress and developed new ones which replace old raw materials and have properties such as shock absorbing, transformation from solid to soft and vice versa, communication devices and sensors integrated in their surface for transportation modes. A large part of CNS capacity is now found in the aircraft body itself and is called the smart navigating materials.</p>

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA TECHNOLOGY</p> <p>20. <u>Information/communication technology</u></p> <p>21. <u>E-commerce</u></p>	<p><u>ICT has revolutionised the world over the last 50 years</u></p> <p>ICT is found in every aspect of life, work and art. Nobody can imagine how life has been before without ICT. Communication and all kinds of exchanges around the globe are possible in a fast, easy, elegant way. Instant communication, solutions provided without a nanosecond delay is the motto of this highly competitive world. The fusion of ICT with biosciences has given IT a new dynamic boost (super fast ,self-learning bio-chips which model the human brain in a perfect way). On the other hand ICT has not substituted a lot of traffic and particularly air traffic. 5th generation ICT systems allow real communications even on the net by the aid of cultural filters, and even the transmission of feelings and emotions.</p> <p><u>The winner e- + m-commerce takes it all</u></p> <p>The famous citation of the last century ”In some years you are e-business or out of business” has come true. All business in all dimensions is based on electronic, mobile and new virtual concepts. The former security and logistics problems have been solved with the help of new high-performing, self-risk-adaptable security tools, wireless nano-technology and virtual reality. E-commerce boosts freight traffic around the world to a new peak.</p>

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA TECHNOLOGY</p> <p>22. <u>Virtual reality</u></p> <p>23. <u>Biosciences</u></p>	<p><u>Virtual reality is indispensable in all aspects of work, health and leisure</u></p> <p>Virtual reality has changed our life styles, working, thinking and feeling. Virtual worlds help to train people for real world tasks/ problems and to simulate difficult situations before they go for reality action. The entire education and training sector has been revolutionised by virtual reality.</p> <p><u>Biosciences are the new engine of the world economy</u></p> <p>The merger of IT and bio-sciences have boosted both to new growth dimensions. All kinds of genetic prevention, repair and genetic improvement are possible. Ethic and moral issues are now in the hands of citizen’s surveillance and approval organisations who take care that new scientific findings are not used against human rights, interests and personal well-feeling. The great success in healing formerly incurable diseases and the tremendous improvements in quality of life are convincing for an ageing population who suffers from multi-morbidity during the last 40 years of their life. Human clones are not accepted after humanity has seen some horror scenarios a few years ago. But cloned organs from their own cell material are accepted, mainly as a material resource for repair. The human body contains now more artificially improved biological material, more IT and some new artificial materials for organ replacement, which are more resistant against attrition than natural bio-material.</p>

<i>Descriptor</i>	<i>SCENARIO C 2050</i>
<p>INFLUENCE AREA TECHNOLOGY</p> <p>24. <u>Robotics</u></p>	<p><u>Robots are the masters of industrial production</u></p> <p>Most kinds of hard or monotone or very complicated physical work have been delegated to robots. They are everywhere from household management, logistics to industrial production and transportation. Robots are smart self-learning machines and can also have human characteristics and spleens.</p>

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA AT SUPPLY SIDE</p> <p>25. <u>Infrastructure</u></p> <p>26. <u>Aircraft</u></p>	<p><u>New efficient, high performance airports</u></p> <p>The new generation of airports enlarged and built between 2020 and 2050 are the new centres for business, communication, education and entertainment. Fast, low-emission trains and mass-car-transport system connect airports directly with cities in the surrounding area. The transfer from one transportation mode to the next is either extremely fast in moving tubes or - if transfer time allows it - a phase of relaxation, business, fun or balance for body, mind and soul in one of the numerous airport facilities. The airports are very efficient and able to operate very large aircraft, and the new generation of supersonics. ATM has also made tremendous progress: high traffic density en route and at approach and departure, space-based navigation and surveillance with high precision.</p> <p><u>New generations of supersonic, VLA, airships and orbit shuttles</u></p> <p>The aircraft demand curve has reached its plateau: Air traffic has already reached the highest point of saturation, more is not manageable. The new aircraft generation has increased seat pitch and convinced society and politics that they really work with new sustainable concepts. New generations of supersonic, VLA and airships satisfy the high demand for air traffic.</p>

<i>Descriptor</i>	<i>SCENARIO C 2050</i>
INFLUENCE AREA TRANSPORT 30. <u>Modal split</u>	<u>Capacity driven intermodality</u> High intermodality is what all customers want. The new modal split combines all relevant modes according to the customer's needs; e.g. HSGT and specific types of air transport. If the customer's priority is the fastest possible way from A to B, then the modal split developed by super-optimisation programs comprises supersonic aircraft with HSGT and new tube transport. If the customer's priority is the cheapest price then it means ship, airship and lorry as transport mode.

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA AT TECHNOLOGY</p> <p>33. <u>Airport design</u></p> <p>34. <u>Alternative transport modes</u></p>	<p><u>New airport design according to the need of high demand and new ac concepts</u></p> <p>New aircraft concepts require new infrastructure: special gates and terminals for supersonic, VLA and airships. The large airports try to offer all these different facilities, because it is a competitive factor. But there are some constraints with regard of vicinity safety and air quality.</p> <p><u>Competition in sustainable transport mode is high</u></p> <p>High demand for transport has stimulated not only the air traffic but also the substituting transportation modes such as HSGT and fast tubes for goods. But there are no substitution effects coming from ICT or virtual transport.</p>

<i>Descriptor</i>	SCENARIO C 2050
<p>INFLUENCE AREA AT EFFECTS ON ECOLOGY</p> <p>35. <u>Noise effects on health</u></p> <p>36. <u>Exhaust gas emissions at cruise altitudes (subsonic, tropospheric)</u></p>	<p><u>Noise is still a problem</u></p> <p>Despite protests against noise pollution in the vicinity of airports at the beginning of the century, the problem is not yet solved in a satisfying way for the airport neighbours. The noise reducing effects thanks to new silent engines of some aircraft (only evolutionary improvements in noise technology) is overruled by the density of air traffic. New airports far from agglomerations and better land use soften the problem, but do not solve it.</p> <p><u>Subsonic emissions reduced</u></p> <p>Optimum routes have led to a decrease in emissions, but this is not sufficient to guarantee a healthy environment. These efforts and the investments of energy industry have reduced the NOX by 50 % compared with 2000. One of the key success factors of air traffic was a significant reduction of subsonic emissions.</p>

<i>Descriptor</i>	<i>SCENARIO C 2050</i>
INLUENCE AREA SPECIAL SYSTEM EFFECTS 39. <u>Safety</u>	<u>Safety is a nr. 1 issue</u> All efforts in automation, improvement of ATM, engine and aircraft reliability aim at sustainability and safety. New fourfold redundant electronic, hydraulic and other technical systems are made available. If technology can not assure safety, then it results in constraints. An air crash is a disaster for airlines and airframers. Insurance costs are tremendous. In the very rare case of an air crash of a VLA the responsible company – either the aircraft producer or the airline - are in deep trouble. Security failures are unforgivable and not tolerated.

