Do you speak English?

In the early 20th century, France was the birthplace of aviation. The Wright brothers themselves went there to seek consecration. The First World War saw the birth of the French aeronautics industry. Once peace was restored, the romantic image of the hero was at the origin of a number of quixotic initiatives, which lacked any true industrial project compared with those launched in Germany and the United States.

After the Second World War, with the French, German and Japanese aeronautics industries in tatters, only the United Kingdom could timidly dispute American hegemony and the English language quite naturally became the language of aviation. It must be said also that the Americans have a genius for making up compound words to order, of which the best example is “fail-safe”, which cannot be translated into French other than by “procédé de construction tel que la rupture d’un des éléments ne compromet pas la solidité de l’ensemble” (process of construction by which the failure of one of the elements does not compromise the solidity of the ensemble).

It was at this point that the romantic side of French aviation experienced a rebirth: a multitude of prototypes were launched in which “sentiment prevailed over reason and imagination over critical analysis”. These innovative creations heralded a new future, enabling France to catch up, and even outdistance, its rivals. The first prototypes ended up, at best, in extremely limited series until the modest success of the Caravelle. Then it was the turn of Concorde, which established English and French as joint working languages and encouraged the American authorities to adopt the metric system. With Airbus the different national aeronautics industries took on a European dimension. Today almost all large-scale projects are carried out within the framework of European, even global cooperation, as witness EADS, Eurocopter and Dassault for civil aircraft. In this context, all documents are drawn up in English and it is the only language used in work meetings.

What conclusions can be drawn?

Firstly, the French language is not dead. Its qualities – clarity, precision and elegance – are still appreciated. The international success of the “Entretiens de Bichat” is proof of this: some foreign doctors learn French simply to be able to take part. Many foreign writers choose to publish in French. Indeed, the mathematician L. Lafforgue, after receiving the Fields medal, declared that: “only while the French mathematical school remains attached to French will it preserve its originality and its strength... Scientific creativity is rooted in culture in all its dimensions”.

Secondly, the French must acquire a proper command of the English language if they wish to make themselves heard, let alone chair meetings in which decisions are made. Although the language used in these meetings is not of course Oxford English but a pidgin that some call “Globish” - Global English.

The French suffer from a serious handicap in this field. The French system does not take account of two major factors: it is in the early years that the human brain is naturally open to learning languages and our ears receptive to all frequencies of the human voice. It is imperative therefore to begin foreign language learning as early as possible. The Scandinavian and the Dutch do just that, the result being that everyone has a command of several languages. The French wait until a child’s brain is less receptive and the ear finds it difficult to assimilate “the music” of a foreign language.

This short-sighted policy puts at risk the immediate safety of a vulnerable population: pilots.

European regulations, rightly judging it to be vital for the different players in the air traffic system to understand each other, ruled that pilots, in order to be authorised to fly in IFR (instrument flying), must follow the entire qualification course (theoretical course, hands-on training and examination) in English. France obtained an exemption which makes it possible to teach courses in French as long as students pass an exam in English; it is generally acknowledged however that this exam does not guarantee a sufficient command of operational English. The result is that many French pilots do not speak English well enough to be able work abroad and are unemployed at a time when airlines in the Middle and Far East are desperately seeking pilots due to a shortage in their own country.

Another unfortunate consequence is that French ab initio training schools cannot use English-speaking instructors because their qualifications, despite being in conformity with European regulations, are not recognised in France, although Airbus Training can employ them for their type rating. This is a handicap when trying to win foreign markets. Moreover, ab initio training is based on a particular culture and encourages pilots to prefer aircraft from that culture.

ICAO has just reinforced requirements in this field. Will this be enough to persuade France to give up these detrimental exemptions? This should in no way prevent it from defending its culture and its language.

Jean-Claude BÜCK
ANAE President
Vast future needs in the area of air transport have been identified in China and India, not least because of an inadequate ground infrastructure. In Europe and the United States freight transport will increasingly have to take to the skies for environmental reasons. And recent ecological disasters have revealed a huge need for humanitarian air transport, with worse to come unfortunately due to the vagaries of the ozone layer.

After a remarkable year in 2004, Airbus and Boeing have just beaten their own sales records with more than 2,000 new orders in 2005; more than 4,000 planes are on the order books of these two manufacturers alone.

All this is cause for celebration because a flourishing transport sector is – even more than a healthy construction industry – a sure sign of industrial dynamism.

However, there are serious problems to be tackled: first and foremost traffic congestion under the current organisation of airspace; then price, since the cost of oil might well double; and of course safety which, despite continuing to maintain its current excellent level, will nevertheless double its media impact.

This evolution was seen as inevitable by all participants in a colloquium organised in late 2005 by ANAE and AAAF on Aircraft and ATM Automation. After a filmed introduction by Dr. Assad Kotaïte and an opening speech by Stuart Matthews, Chairman of the Flight Safety Foundation, the colloquium gave rise to numerous proposals, ambitions and hopes for the future, based both on technical advances in the realms of computer sciences and automation and the need, but also the difficulty, of finding the necessary funding.

Our North-American friends displayed much dynamism and optimism, considering that “what must be done, will be done”. Overall, European speakers were more guarded (too cautious?), underlining our continent’s specific organisational and funding difficulties. Consensus was achieved on the phenomenal progress made on modern aircraft in terms of on-board communications, automation and 3D navigational precision. The possibility of using civil UAVs for freight transport was raised but speakers remained circumspect with regard to passenger transport.

The current slow rate of modernisation of air traffic control was the object of the majority of papers.

CONGESTION? PRICE? SAFETY?

These three issues can be resolved both in the sky and in the vicinity of airports.

In the sky

The sky is vast but very poorly managed. Obsolete navigation and communications systems result in the need for human control and fuzzy (soggy) logic, with excessive aircraft spacing and artificial crossroads turning inevitably into bottlenecks.

Navigation and communications systems have made fantastic progress and will continue to do so with the arrival of the long awaited Galileo system of navigation by satellites. Navigation computers have made similar advances and, properly programmed, can make an excellent job of piloting any aircraft entrusted to them. They are capable of calculating a flight of several hours to the minute according to an assigned trajectory and given weather forecast; they can adapt the flight to most external variations, communicate these predictions to the outside world, receive and immediately assess a request for modification and communicate their results; they can also hold an altitude accurately, taking into account the state and characteristics of the atmosphere.
All of this should make it possible to take more advantage of the three dimensions of the immensity of the sky and thus benefit from greater flexibility. With modern computers correlating all reliable information, it should be possible to reduce the incidence of factors giving rise to conflicts. In other words automated management, in which air traffic controllers would have to intervene only in the event of failure.

Improved management means enhanced flight time, better fuel consumption, and fewer collisions.

This of course presupposes a fleet with standardised equipment. We are not so far from this goal: even general aircraft are nowadays equipped with remarkably sophisticated GPS and FMS systems. At the current rate of fleet replacement, this problem will have more or less disappeared in 10 years’ time and a form of segregation – already largely in practice – will have become completely acceptable.

For instance it is perfectly possible to separate off freight traffic, which is less sensitive to turbulence and flight time than passenger traffic, by making it fly at a lower altitude. This would involve building mainly subsonic planes for freight transport, which would be optimised for intermediate levels, less pressurized, equipped with modular loadings (why not in the tips of straight, sturdy flying wings?). Airframe manufacturers are only waiting for the market to develop in order to set this in motion. This will in no way rule out the use of converted passenger aircraft: they already had to be comprehensively modified, a slight adaptation of their engines and their rate of pressurisation is all that would be required in addition!

In the vicinity of airports

The problem of congestion must also be tackled in the case of airports close to, or within the boundaries of sprawling, unwieldy cities. Such airports have great difficulties increasing their capacity. On the other hand, many airports already exist in the countryside (including abandoned army sites); in any case, it costs much less – in terms of real estate and equipment – to put up a new airport than to build motorways or railroads.

There is no reason not to move airports away from the cities as long as they are within striking distance of railways linking them to local markets: it would save both time and money when compared to taxi journeys during rush hours!

There is no reason either not to prioritise trains for short trips and create a real symbiosis between rail and air transport. Passengers would save time and money. This is just beginning to happen and it is becoming inconceivable to design a new airport without an adequate accompanying rail network. To travel from Paris-CDG to the other end of the world, it will soon be faster to take the TGV high speed train from Lille or Lyon. And when a high speed rail connection exists between Toulouse and Nice I will not hesitate to use it to go to Corsica instead of boarding a slow commuter aircraft, wasting hours wandering around Nice airport and paying too much in a overfull car park in Toulouse Blagnac (I can go to the Matabiau train station by metro).

Likewise, separating off freight traffic into properly equipped specialised terminals, with rapid transfer of containers onto rail coaches or trucks stationed near the tarmac, would save both time and money. To design such streamlined airports would surely not require an exceptional imagination.

Private aviation is already mainly separate, with a host of private aerodromes in France, many of which ought to be better equipped. This task should fall to regional authorities and would make it possible to divert most business traffic and even attract industrial implantations. Such aircraft seldom exceed level 200 in flight.

All this would bring only benefits to the customer and to society as a whole, thanks to the traffic increase made possible, the new investments and the mass of new services created: it must be done quickly.

What an extraordinarily stimulating perspective!

Let’s get to work!

As for ANAE, we should organise another such meeting in five years to take stock of the situation.
The proliferation of air transport since the mid 21st century has succeeded in meeting the travel needs of an increasingly mobile world: between 1950 and 2000, air traffic (measured in PKT or Passenger Kilometres Transported) increased a hundredfold. This extraordinary performance is due mainly to the advent of a remarkable means of transport: the subsonic jet aircraft. The use of cheap, efficient fuel refined from oil was the other main contributing factor.

If nothing were to come in the way of this development it should gather speed during the 21st century although certain obstacles such as airspace congestion, tackled at ANAE’s recent colloquium into “Aircraft and ATM Automation” (cf main article (p4-5) by Bernard Ziegler) could hold it back. Our concern is with an issue omnipresent in the early 21st century: the rapid depletion of energy resources. What might the consequences be of a scarcity of oil resources – and corresponding price increase – on the future development of air transport?

ANAE has decided to engage in this subject of crucial long-term global interest by organising an international conference aimed at gathering together the numerous players in this field and encouraging an exchange of ideas. To open the colloquium to as wide a public as possible, it is co-hosted by the Aeronautical Association and Astronautics of France and the French Academy of Technologies; Fedespace, which hosted a study day on the subject in 2005, is also taking part in the programme committee.

The colloquium will take place in Toulouse on 30th November and 1st December 2006; the aims of the conference as outlined in the pre-programme are recalled below:

“A progressive decline in global oil production, following a peak around 2010-2030, will result in a growing oil shortage and rising prices in the near future. Taxes on carbon emissions, designed to prevent climate change, might well push costs up even further. The future development of air transport will be radically affected, due initially to the impact of higher prices on traffic and later on to the consequences of the oil shortage; effects will be felt all the more acutely since for the moment no alternative is available to the use of kerosene produced from oil or synthetically.

The air transport system will thus be thrown into turmoil with limited possibilities for reaction because of the extreme inertia of the operating system: on the one hand, elaborating new concepts suited to this new situation will take time and on the other, aircraft currently on the drawing board will continue to operate into the second half of the 21st century.

The different studies, publications and events organised on this theme have shown that financial factors impact all aspects of this question and that any analysis must therefore be accompanied by an economic approach. The rise in fuel prices (whether oil or substitutes) will affect reserves, consumption, air transport operation costs and the evolution of air traffic. This dimension must therefore be borne in mind throughout the colloquium.

This objective is reflected in the structure of the colloquium, which comprises four sessions:

- the first: Air transportation issues in the 21st century aims to present the energy context (in terms of kerosene resources) facing the air transport system in the 21st century;
- the second: Which fuels and aircraft for the mid 21st century? will deal with the possibilities of continuing to operate present day aircraft on kerosene resources;
- the third: Which fuels and aircraft for the late 21st century? will tackle futuristic concepts for propulsion and aircraft design aimed at dealing with energy and environment problems;
- the fourth: Which air transportation system for the 21st century? will set out the viewpoints of both operators (airlines) and traffic controllers (in flight and on the ground).

A round table bringing the different parties together will draw some initial conclusions, which will be followed by the colloquium proceedings and by recommendations aimed at preparing the future air transportation system to deal with oil shortage and environmental issues.”
October 2007 will see the 50th anniversary celebrations of the launch of the first Earth satellite, Sputnik, which marked a revolution in geodetic and navigational techniques.

Soon after, the United States unveiled the Transit navigation system based on the Doppler effect. In February 1966 France launched the Diapason satellite followed, in 1967, by the Diademe satellites 1 and 2; dedicated to geodesy they were also based on the Doppler effect. Positioning by satellites had been born and Europe was an active player from the outset. Almost 50 years went by however before Europe succeeded in producing an operational system in the shape of Galileo.

Satellite navigation systems such as GPS and Galileo work by comparing reception times of radio electric signals given off by satellites with a precision of a few nanoseconds. The result is positioning to within a few meters and synchronisation to within a few nanoseconds.

This accuracy is obtained with the aid of onboard atomic clocks and sophisticated signal processing techniques and makes it possible, as long as certain elements are taken into account, to achieve useful, metric positioning for the user on the surface of the Earth, in the air or in orbit.

Since we are talking about satellites with ultra precise clocks orbiting within the gravitational field and receivers located on a rotating Earth, it is necessary to take into account relativistic effects and all that makes metric precision possible: space and time reference frames, a network of trajectory and synchronisation stations enabling precision orbitography, and tropospheric and ionospheric propagation. This has been developed in Europe via the various scientific space geodesy programmes launched since the D1 programme (Diapason and Diademe), which have recently attained centimetric precision with Doris, oceanic altimetry, etc.

The receiver will then need to be able to pass into local geodesic systems, as is currently the case with GPS, so as to establish position on a given chart.

In Europe, a community of researchers and engineers are interested in using navigation satellites such as Galileo, built and financed for applications, for scientific purposes. In order to make the most of the system, it would appear advisable to take a close look at its fundamental aspects in order to obtain a maximal level of precision and further information on the medium through which navigation signals pass.

**ANAE will hold an international colloquium in Toulouse, 2-4 October 2007, on fundamental aspects and scientific applications of Galileo.**

This colloquium, the Academy’s contribution to the 20th anniversary celebrations of the launch of Sputnik, will be oriented towards:

- **fundamental aspects of navigation by satellites and Galileo**: geodetic and temporal reference frames (and linkup to Glonass and GPS), onboard and ground clocks, relativistic correction, tropospheric and ionospheric correction, calibration, relations with international organisations (BIPM, IGS), radiative environment in orbit;
- **scientific applications** (metrological, geophysical) using either normal signals, differential measurements, phase measurements, occultations, in real or deferred time, with receivers placed either on scientific satellites or on the ground;
- **future systems**, particularly research and development on clocks, experiments in orbit on certain fundamental aspects (tested on board other satellites) like the equivalence principle, aspects of satellite navigation systems.

This colloquium will bring together leading members from the European scientific community who make use of satellite navigation systems such as GPS, GLONASS and Galileo. The involvement of scientists will have a positive effect on the ways in which Galileo and its later evolutions are used, and will help maximise its performance. The colloquium should be followed by other meetings in subsequent years.

A scientific committee is currently being set up to work out the detailed programme and select speakers.
Air transport, vital by nature, has reached a remarkable level of safety. In order to accomplish this, constant reflection was required on crew training, on ways of maintaining and monitoring skills, and especially of optimising team resources. A great deal of attention has also gone into aircraft design, manufacture, maintenance and operation.

It might seem surprising at first glance to compare what goes on in the mechanised universe of a cockpit - where the crew is in charge of hundreds of anonymous passengers - with that of an operating theatre in which a human being is dealt with in all their singularity.

And yet in both cases, the teams are made up of men and women with a solid knowledge base and skills consolidated by daily practice. Advanced technologies borrowed from aeronautics - robotics, electronic imagery and simulation - have penetrated operating theatres. One wonders whether certain methods used in aeronautics are transposable to the operating theatre.

In the course of this forum, organised by the French Air and Space Academy, experts who are also practitioners will exchange points of view on maintaining and monitoring skills, on concepts of teamwork, on upstream safety analysis needed to define procedures and checklists and on the feedback from experience that is an integral part of quality control.

The contribution of new technologies, which have already revolutionised daily practice in both worlds and will carry on opening up new prospects, will also be examined.