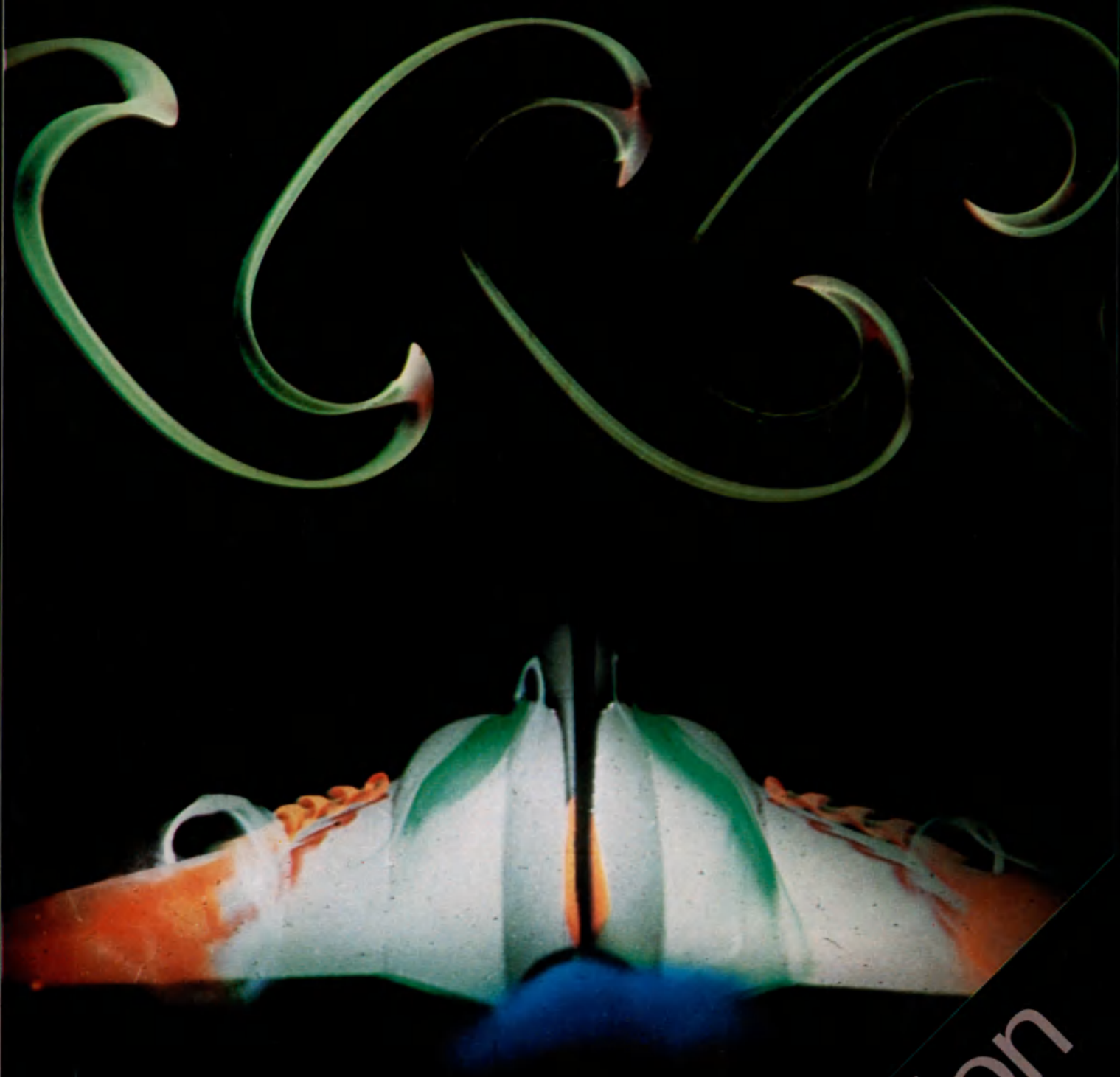


The Unesco Courier

A window
open on the world

April 1978 (31st year) 3.50 French francs



aviation
at age 75



Musée Bonnet, Bayonne, France — Photo © Bulloz, Paris

**TREASURES
OF
WORLD ART**

130

**Germany
(Fed. Rep.)**

On the wing

The German painter Albrecht Dürer (born in Nuremberg in 1471) had already won international renown by the beginning of the 16th century, when great Renaissance artists throughout Europe acclaimed his originality and genius. A prolific engraver and draughtsman, Dürer was also a passionate observer of the natural world. "Verily art is embedded in nature," he wrote, "and he who can extract it is an artist." This watercolour of a jay's wing is one of many studies that reveal Dürer's astonishing skill at turning nature into art.

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Cover

This issue, which marks the 30th anniversary of the International Civil Aviation Organization, is devoted to the development of aviation and highlights the shape of things to come. Tomorrow's aircraft are already being designed and laboratory-tested. The two brilliantly-coloured photos that comprise the cover were taken at the hydraulic test tunnel of France's aerospace research centre (ONERA) at Châtillon near Paris. Below, simulation of aerodynamic flow around an experimental delta-wing plane. Above, turbulence created by a thin obstacle.

Photos © ONERA, Châtillon, France

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Flight without frontiers

75 years after the Wright brothers,
the International Civil Aviation Organization
celebrates its 30th anniversary

by Yves Lambert

Secretary-General of the
International Civil Aviation Organization

ON 17 December 1903 in North Carolina, U.S.A., a frail structure of metal, wood and fabric struggled into the air and precariously managed to remain airborne for 260 metres. Thanks to the Wright brothers, Wilbur and Orville, man had succeeded for the first time in flying a heavier-than-air, engine-powered machine.

The date is generally considered Year I in the history of aviation. From the beginning, however, the conquest of the air was international and exploits were scored simultaneously all over the world.

YVES LAMBERT, French civil aviation engineer, has been Secretary-General of the International Civil Aviation Organization (ICAO) since 1976. He formerly represented France on the ICAO Council.

The Frenchman Clément Ader and the Brazilian Alberto Santos-Dumont were experimenting with flying machines at the same time as the Wright brothers. The first international flights were by the Frenchman Louis Blériot who crossed the Channel in 1909 and the Dutchman Wijnmalen who managed a Paris-Brussels round trip in 1910.

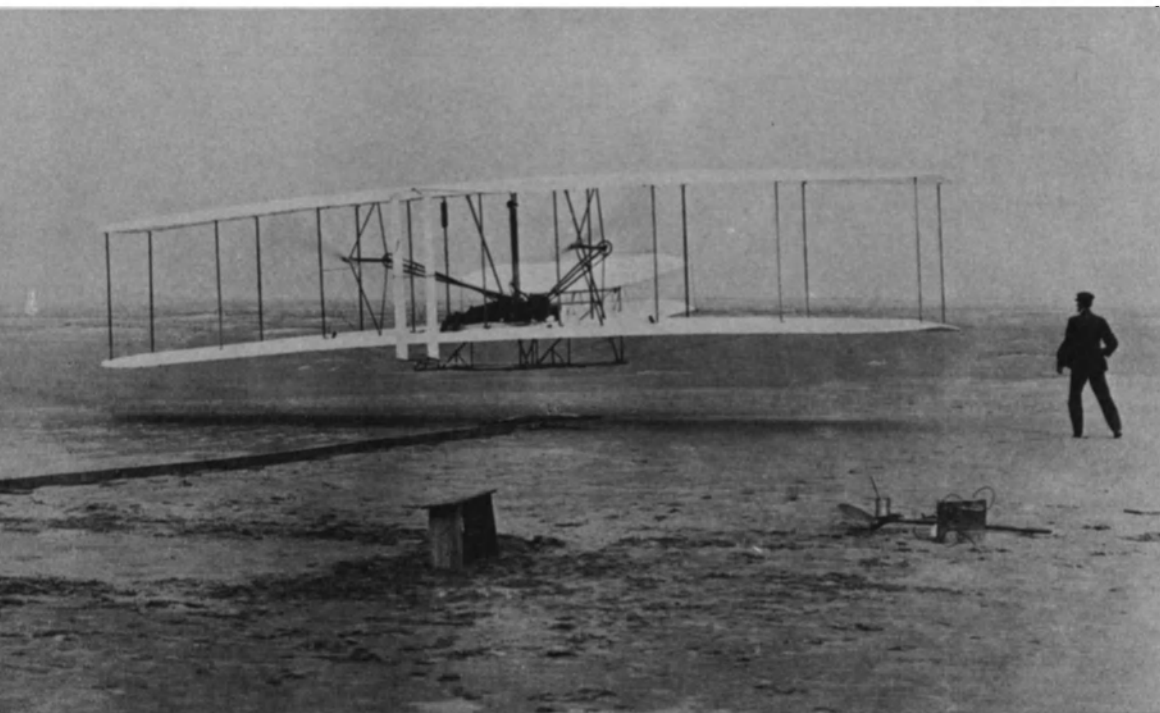
Their single seater planes flying at less than 100 km. per hour were the not-so-distant ancestors of today's jets which are so much a part of our daily life that they no longer evoke interest, much less wonder, on the part of the public.

During the last 30 years, the transatlantic flight has been cut from 17 to 3 hours, thanks to Concorde. The number of pas-

sengers using scheduled carriers has grown from 24,343,000 in 1947 to 620 million (including the U.S.S.R.) in 1977, without counting the millions of holiday-makers who travel all over the world on chartered flights.

The ocean liners which in 1947 still carried two-thirds of the passengers across the North Atlantic have virtually disappeared. Aviation has become one of the major means for international exchange, shattering man's concept of time and distance and causing him not only to reassess his concept of geography but also to re-evaluate his social traditions and cultural patterns. No other achievement of our century has made such a profound impact on the lives of peoples everywhere as aviation.

Yet travellers see only one facet of avia-▶



Historic photo (left) was taken on 17 December 1903 at Kitty Hawk, North Carolina (U.S.A.) when the Wright brothers, Wilbur and Orville, achieved the first powered, sustained and controlled flight of a heavier-than-air machine. (In the 1890s, the French engineer Clément Ader succeeded in making a short hop in a powered plane he had built, but the machine was not capable of sustained or controlled flight.) Orville, lying prone in the middle of the lower wing beside the 12 HP engine, is at the controls of the plane which the Wrights designed and built after experimenting with kites and gliders. Wilbur has just released the wing. The first flight lasted 12 seconds. On the 4th, the machine was airborne for 59 secs. Today, 75 years later, civil aviation is a vast industry employing over 10 million persons. Right, bird's eye view from a modern airliner over South America.



Photo © Bibliothèque Nationale, Paris



1906 On 12 November in Paris, the Brazilian Alberto Santos-Dumont became the first holder of a world air speed record: 41 km. per hour. Three years later, Santos-Dumont produced his famous series of "Demoiselle" or "Grasshopper" monoplanes (above). These lightweight craft (wing span 5.10 m.; length 8 m.) were among the first to be used for pleasure flying.

Photo © Roi, Musée de l'Air, Paris



1909 Above, children hail the first-ever oversea plane flight as Louis Blériot's tiny monoplane (wingspan and length 8 m.) crosses the English coast near the end of its 37-minute Channel crossing on 25 July. A rival French aviator, Hubert Latham, had attempted a crossing 6 days before but engine trouble forced him down in mid-Channel. Below, two eras of travel and transport caught by a photographer on 27 July 1909 as Latham made a second gallant but unsuccessful attempt to fly the Channel.

Photo © Photothèque Hachette, Paris



tion and hardly notice all those who work behind the scenes to make their flight possible. They can hardly imagine the complex co-ordination required to make the international airline network operate efficiently. An essential link in this chain is the International Civil Aviation Organization (ICAO), a United Nations specialized agency with headquarters in Montreal (Canada), which has just celebrated its 30th anniversary.

In spite of setbacks at the beginning of the jet age and the changing economic situation, remarkable progress has been made, far exceeding the hopes of those who more than 30 years ago drafted the 1944 Chicago Convention to ensure the "safe and orderly" growth of international civil aviation.

The Convention, the birth certificate of ICAO, has now been ratified by 141 governments, and is the legal basis which made possible the multilateral agreements governing international air transport. The rapid development of international air transport, the opening of new routes, the search for new structures by carriers, charterers, airports and, of course, national administrations are the living and constantly renewed embodiments of the Chicago Convention.

ICAO is also a technical organization. Aviation requires international standardization, for international flights would be unthinkable if flight procedures and equipment were not the same throughout the world. ICAO acts as the international regulatory agency which sets the Standards and Recommended Practices for the precise and detailed characteristics and performances of both airborne and ground equipment.

To be effective, these Standards and Recommended Practices must be implemented. This is why ICAO establishes regional air navigation plans which define all the essential international air navigation facilities and services in the various regions of the world.

Thus, when taking a plane, whether for the longest scheduled non-stop flight—10,876 km. from Tokyo to New York—or for one of the shortest hops—27 km. between Copenhagen and Malmo—the passenger boards an aircraft which has a certificate of airworthiness issued in accordance with ICAO regulations.

During the flight the aircraft crew successively contacts various area control centres, using ICAO radio procedures. Finally, the aircraft will be guided by an ICAO instrument landing system, whether touching down in London or Bujumbura in the heart of Africa.

The aeroplane has overcome many natural obstacles, such as mountains, oceans and deserts. In recent years, however, air passengers have become concerned about

a new threat. Faced with the rising number of unlawful seizures of aircraft and with acts of terrorism against passengers, aircraft and aviation facilities, the international community has reacted in two ways. A complete international legal system has been worked out in the form of three conventions signed in Tokyo, The Hague and Montreal. ICAO has strengthened these legal instruments with technical measures that have been circulated to all contracting states. (See page 22).

ICAO is not only concerned with the interests of air transport users. For some years now, it has also been active in the field of environment by introducing measures to limit aircraft noise. In 1971, the ICAO Council adopted a set of standards on aircraft noise which were incorporated in Annex 16 of the Chicago Convention. These standards are becoming progressively more stringent for the latest aircraft. (See page 9).

Today the world is also concerned with pollution caused by exhaust fumes from cars, trucks and aircraft. Although it is generally agreed that aircraft are little to blame, it is nevertheless essential to establish the facts.

A first step in this direction involves drawing up international specifications for measuring polluting agents from all sources, including aviation. For this purpose ICAO is co-operating with other international organizations, such as the World Health Organization and the World Meteorological Organization.

Air law is a new branch of international law compared with maritime law, which enjoys a long tradition. ICAO's task is to codify international air law, taking into account different legal concepts and systems of jurisprudence, to draft conventions on various aspects of international air law, and to try to obtain their ratification.

So far, ICAO has prepared eight conventions covering such widely different areas as international recognition of the right of ownership of aircraft, damage caused to third parties on the ground, the liability of the air carrier towards passengers, offences committed on board aircraft and acts of unlawful interference with civil aviation.

While ICAO does not set fares and does not apportion air routes to the different airlines, its role is nevertheless essential in the development of air transport.

There has been much talk about disorder in the air transport market and about unbridled competition on certain air routes. However, this market is governed by bilateral agreements and the price of tickets is fixed by the airline tariff conferences, subject to government approval. ICAO's role with regard to the economic aspects of air transport has so far been limited to collecting and publishing statistical information and economic studies which can be used

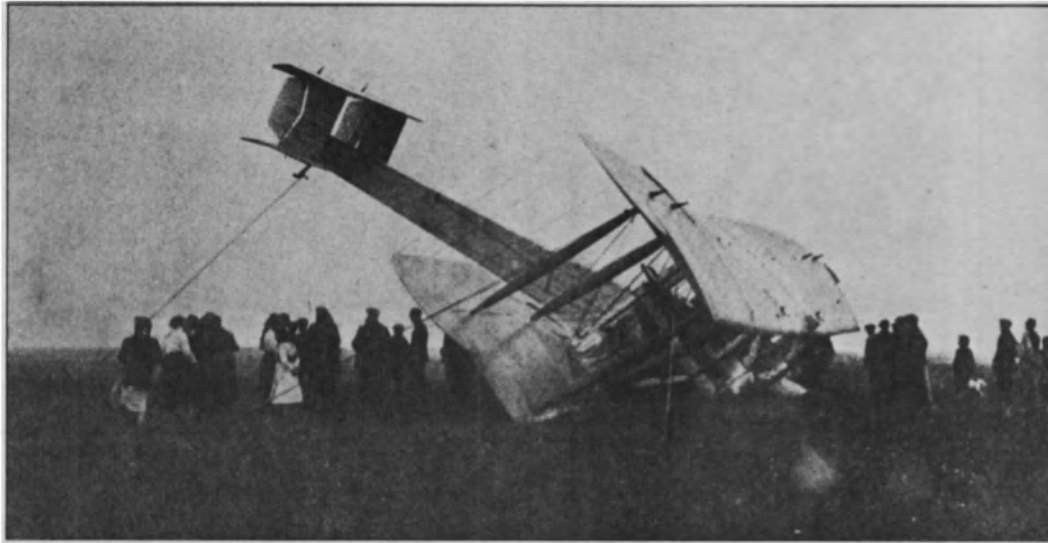


Photo © USIS, Paris

1919 An era of pioneering long-distance flights began on 15 June when British aviators John Alcock and Arthur Whitten Brown landed in Ireland (above) after the first nonstop transatlantic flight (16 hours 27 minutes from St. John's, Newfoundland). Later that year the world community showed its concern to promote international co-operation in civil aviation: the International Air Traffic Association (IATA) was founded at The Hague; the League of Nations took steps to draw up regulations for air traffic; and on 19 October the first international convention on air navigation met in Paris.



Photo © Photothèque Hachette, Paris

1927 The president of Japan's Imperial Aviation Company, Gen. Nagaoka, welcomes French aviators Costes and Le Brix to Tokyo during the round-the-world trip (10 October 1927-14 April 1928) on which they made the first nonstop flight across the South Atlantic. In the same year (1927) the American Charles Lindbergh made his epic solo flight from New York to Paris (in a machine only a little larger than the Wrights' first plane). Aviation continued to make rapid advances during the next decade, which saw many pioneering exploits including (in June 1937) the first nonstop flight over the North Pole from the U.S.S.R. to the United States. Soviet pilot Valeri Chkalov did the 9,130-km. trip in 63 hours aboard a single-engine Tupolev aircraft.



1

Photos © Eric Baschet Editions, Paris



2



Photo © Keystone, Paris

High-flying women 3

Some of the most legendary figures of the "heroic age" of flight in the 1920s and 1930s were women pilots who amazed the world with their flying skills and endurance. First great performance by a woman aviator was due to Adrienne Bolland of France (1) shown here in the single-engine craft in which she crossed the Andes on 1 April 1921 in spite of strong adverse winds and bitter cold. Many men in more powerful machines had failed to perform this feat. Amelia Earhart of the U.S.A. (2) was the first woman to fly the Atlantic, both as a passenger (1928) and as a solo pilot (on 20-21 May 1932). She played an active part in efforts to open aviation to women before disappearing in the Pacific in 1937 while attempting a round-the-world flight. (3) 24-year-old New Zealander Jean Batten at Calcutta during her record-breaking England-Australia flight (14 days 23 1/2 hours) in May 1934. (4) Soviet aviator V. Grizodubova (centre) and her team beneath the ANT-37 in which they flew almost 6,000 km. nonstop in 1938, breaking the long-distance record for an all-woman crew.

4



Photo © Soviet Information Bureau, Paris

by Member States for the preparation of development plans.

These activities, as well as the role of ICAO in co-ordinating air policies among its Contracting States, are far from negligible. They may have an even greater impact as the result of a special Air Transport Conference held in April 1977, the first such gathering in more than 30 years: ICAO is now entrusted with new tasks concerning the application of rates and fares, policy on chartered or non-scheduled flights, the regulation of capacity on international flights and the machinery for fixing international air tariffs. (1)

ICAO is active in many other fields, including aviation medicine, telecommunications, search and rescue, training films and manuals, and smoothing out cumbersome customs, immigration and public health formalities which impeded the movement of people and goods.

But among the many activities of ICAO, technical assistance to developing countries has a particularly important place. (See page 12). A recent study carried out in Africa by ICAO and the United Nations Development Programme (UNDP) has shown how aviation can contribute to economic development in the Third World, bringing an inflow of foreign currency, creating new jobs and opening up export markets.

In a world of increasingly rapid change, aviation is destined to become the key form of medium- and long-range transport. And as aviation expands, its problems too are bound to multiply. ICAO has already amply proved its determination to solve them.

■ Yves Lambert

(1) As an intergovernmental organization, ICAO works closely with a number of non-governmental bodies representing various interests in international civil aviation. Among these is the International Air Transport Association (IATA), with headquarters both in Montreal and Geneva, which groups 109 scheduled airlines. Besides dealing with uniformity in fares, ticketing, handling of baggage and freight, and with technical and legal matters, IATA represents the scheduled airlines at ICAO meetings. A major feature of IATA's work is its clearing house which permits member airlines to settle payments made all over the world in different currencies.

Symbolic photo of a child jumping in the air as a plane roars by overhead won second prize (amateur category) in the international photo competition organized in 1974 by Photokina of Cologne, Germany (Fed. Rep.). The theme of the competition, "A World for All", was chosen by the United Nations for World Population Year.



Photo © Masayuki Takahashi, Japan

THERE is nothing like noise to make a noise. While most people don't care a decibel about aircraft nuisances as long as they are not bothered themselves, the roar of planes at many airports is real enough for those living close by. Distant echoes are also heard by airline executives and international aviation bodies concerned with safe and efficient air transport.

Consider these facts :

- Not long ago, stores, office buildings, schools and homes around Los Angeles International Airport occupied what is now a large swathe of open space laid bare as if by a giant lawn mower. These 2,800 buildings have been destroyed in the most drastic step yet taken in the United States to deal with the thunder and whine of jets. ▶

Down with decibels!

by Eugene Sochor

EUGENE SOCHOR, head of the Office of Public Information at the International Civil Aviation Organization (ICAO) in Montreal, was for 12 years a staff member of Unesco's press division.

In response to public outcry, many airports have had to cut operations at night as part of a growing pattern of resistance to aircraft noise. Wellington Airport in New Zealand is a good example. It is closed to traffic from 11 P.M. to 6 A.M. except for emergencies, delayed international flights and meteorological conditions.

A list of major cities with some sort of night curfews includes: West Berlin, Bremen, Cologne, Dusseldorf, Frankfurt, Geneva, Hamburg, Hong Kong, London, Manchester, Malmo, Montreal (Dorval), Munich, Nice, Oslo, Paris (Orly), Sydney, Stockholm, Tokyo, Toronto and Zurich.

Internationally, the growth of local shut-downs has caused air carriers to alter flight plans and schedules, with resulting traffic peaks and strain on air traffic control, and on airport and customs facilities immediately before or after curfews. Some international airports must handle as many as 500 flights and 70,000 or more travellers a day.

The chain reaction is also felt on stop-overs. Bombay International Airport, for instance, is completely saturated with traffic at night and deserted during the day. The reason is Bombay's strategic location between Europe and Tokyo. Most international flights arrive at night since they take off comparatively early to avoid the curfews on departure in Europe and at their destination points. It has been pointed out that if a night curfew were imposed at John F. Kennedy International Airport in New York and the summer night curfew at London Airport were made year round, jets would have only 3 hours a day to cross the Atlantic.

The noise issue has also affected the development of new airports. As an executive of the Airport Operators Council International noted recently: "No new major airport has been started in the U.S. since

1970. Even relatively minor projects like runway extensions are being delayed, often for years, as citizens fight to ward off more noise".

ICAO experts who have been working on the problem of airport curfews in relation to traffic peaks think that the most that may be expected is some easing of the situation through prudent, well considered and workable measures. These measures should be applied both nationally and internationally and will require a co-ordinated international approach.

Action taken at airports in one country may affect operations half-way round the world. A variety of differing and inconsistent restrictions applied at random at different airports in the network may prove disruptive to airlines and their passengers, to air traffic control, and to airport operations generally.

Responding to public concern, the last ICAO Assembly clearly recognized its responsibility and that of member governments to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of the human environment.

It noted that with most jets now in service exceeding the noise limits set by ICAO for new aircraft, the noise problem in certain areas, including many busy international airports, had led to curfews and generated strong opposition to the expansion of existing airports or the construction of new ones. The Assembly called on all states to recognize the role of ICAO in "aggressively pursuing a comprehensive programme" to reduce aircraft noise at its source and to develop effective noise abatement strategies.

The whole question of aviation and environment is in fact one of ICAO's major con-

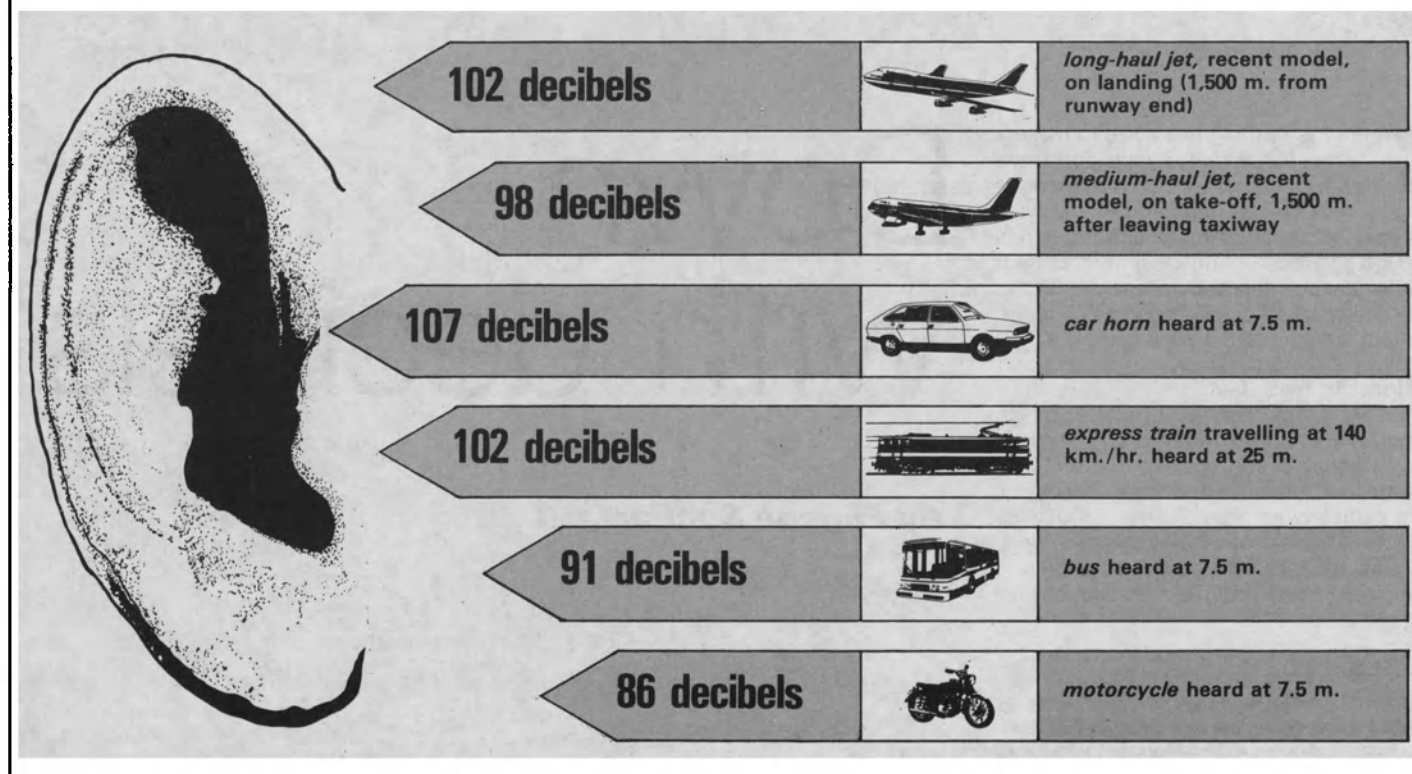
▶ Since it was impossible to move the airport, city officials decided—after more than \$4 billion in damage suits over aircraft noise—to move the people instead at a cost of \$300 million.

- A survey of U.S. airports conducted recently by the Airport Operators Council International found \$245 million in pending noise-related lawsuits filed against airport authorities in the U.S. In addition, over the past five years, airports have spent some \$200 million in land acquisition programmes because of noise.

- In some schools, jets disrupt teaching. One junior high school near Los Angeles Airport had to be closed because of constant interruption. The Airport agreed to pay \$21 million to five local school districts for sound proofing.

- Usual complaints of residents near airports are interrupted sleep, bad television reception and houses that shudder every few minutes. A survey indicates that people living close to airports suffer a higher incidence of nervous breakdowns than people living further away.

Reckoning with noise



cerns. It is resulting in ever-tightening noise limitations on aircraft, which, according to the ICAO Constitution, are binding on all contracting states. These standards (which are part of Annex 16 of the Chicago Convention on International Civil Aviation) aim at reducing the noise at source through certification of the aircraft, starting with future subsonic jets through production of current jets, propeller-driven planes, supersonic transport planes and STOL (short take-off and landing) aeroplanes.

ICAO is also studying noise reduction requirements for existing first generation subsonic jets which do not meet the Annex 16 requirements. It must, however, be recognized that the cost of "hushing" or "retrofitting" such jets—the noisiest in the world's aircraft fleet—would be exorbitant for most airlines.

Airline executives also question the usefulness of modifying engines with sound absorbing material when in fact these older jets are due to be replaced by the newer wide-body jets which *do* meet ICAO noise standards. Also, the cost of "retrofitting" the older planes would be passed on inevitably to the travelling public.

Airlines have readily co-operated in working out procedures and route patterns which generate the minimum noise disturbance and meet the needs of a particular airport. Some approach and landing procedures to ease the noise over residential areas are being steadfastly opposed by pilot organizations as being too dangerous. Instead, the International Federation of Air Line Pilots' Associations (IFALPA) has always maintained that aircraft noise abatement should be achieved by control of noise at its source, rather than by modifying aircraft operating procedures which may impinge on safety of operations.

The ICAO Assembly is also concerned with another aspect of the situation: better airport planning and zoning. Land in many countries has become a rare commodity keenly disputed by people and planes. A dramatic case in point is what a newspaper called: "The carrot patch standing in the way of Tokyo's shiny new airport". This massive airport at Narita was built to ease congestion at Haneda airport. Its opening has been postponed 12 times since 1972 by the violent opposition of squatters, including a farmer who refused to move his carrot patch from under the shadow of the control tower.

Quite a different story is the new Nagasaki Airport on Kyushu Island, the first "floating" airport in the world. It resembles a huge aircraft carrier. Japanese officials are so enthusiastic about this novel approach that they are also planning to locate the new Osaka Airport off the mainland in the bay of Osaka. Few countries, however, can be as fortunate in selecting a site and financing its airports as the sparsely-settled and oil-rich United Arab Emirates, which boast four international airports within short distances of one another. Even so, a new airport is under construction in Abu Dhabi.

Land requirements for older airports took into account only the needs of the airline operators to move people the fastest, safest and most economical way. Few people lived around the airports anyway. People came to watch the new jets take off in a roar of excitement. But as traffic increased and housing developments moved closer to the airports, the novelty wore off and the problems piled up.

The land required for airport development has increased dramatically as a result of increased numbers of flights and passengers, volume of cargo and operating

requirements of aircraft. Whereas 1,600 hectares may have been adequate 20 years ago for a major international airport, some airports being constructed now require areas as large as 6,000 hectares merely to satisfy direct operational needs. Mirabel Airport servicing Montreal occupies the largest such area in the world—7,000 hectares in its final phase and a protective cocoon of 27,700 hectares. The price for such seclusion is distance—in this case 55 km. from the city.

The farther away the airport from the city centre, as common sense would dictate, the louder the outcry of travellers who stand to lose the time gained in air travel. Hence the need for fast and improved city to airport transportation, if necessary by rail or even helicopter.

The location, size and configuration of the airport must be co-ordinated with the patterns of residential development and other major land uses in the area. An ICAO Airport Master Planning Manual states that in long-range planning of airports, including the expansion of existing airports, planners should assess the impact on the airport's surrounding community. This necessarily involves a close relationship with the authorities that control the land around the airport.

Like so many of man's other machines, the aircraft is both a blessing and a curse. Its nuisances cannot be wished away. Perhaps the patient outlook of the writer and flyer Antoine de Saint-Exupéry is to the point. If, as he wrote, we feel that the machine is destroying man, it is that we lack the hindsight to assess all the sudden changes which it has brought about.

■ Eugene Sochor

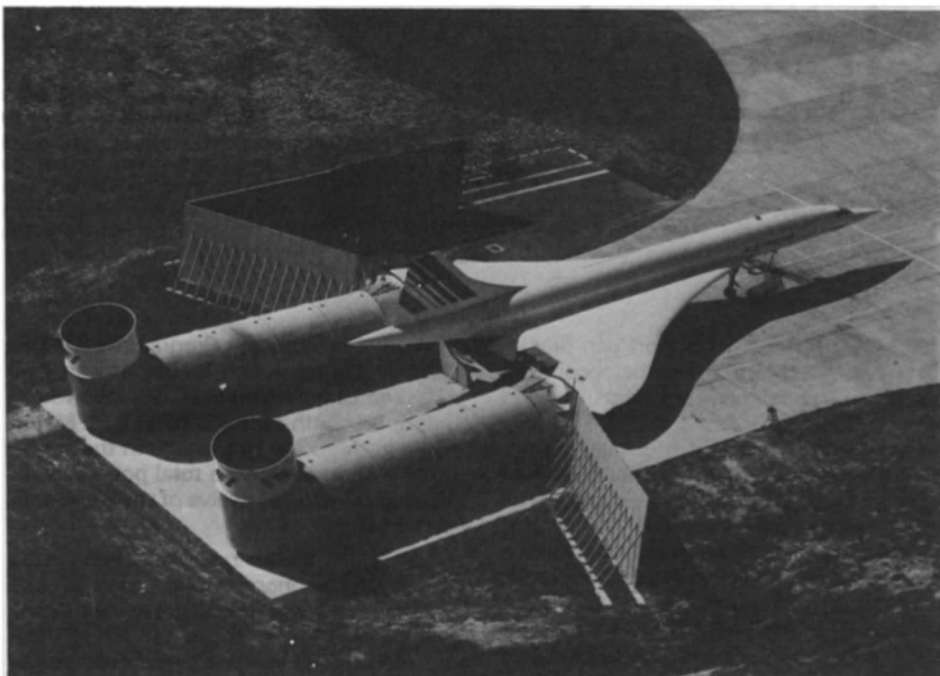


Photo © Jean J. Moreau, Paris

This presentation of the noise levels caused by various means of transport was prepared on the basis of a diagram published by the ICAO *Bulletin*, the technical monthly of the International Civil Aviation Organization, in February 1975. Above, giant silencers at Charles de Gaulle airport, Paris. The enormous tubes are designed to muffle the noise of jets being tested after overhaul.



Photo © Keystone, Paris

Destination development

by Luis Cabral

MODERN air transport can dramatically improve the economic development prospects of Third World countries.

Investment in aviation is usually considered a costly and risky business, but there is now abundant evidence to show that a well-organized national and international air transport system can substantially boost the foreign-exchange earnings of developing countries, as well as creating thousands of new jobs and millions of dollars of revenue.

These are the unexpected and welcome conclusions of a two-year International Civil Aviation Organization (ICAO) study of the contribution civil aviation can make to the economic development of African states. The study, funded by the United

Nations Development Programme (UNDP) following a resolution of the African Civil Aviation Commission (AFCAC) involved 37 countries south of the Sahara, from Mauritania in the north to Lesotho in the south. These countries have a total population of 250 million people; twelve of them are landlocked.

While countless studies have been made of African economies and many of civil aviation, this was the first attempt to link the two fields in a "cause and effect" relationship. ICAO worked closely with other U.N. agencies to cover a multitude of activities, but attention was focussed primarily on agriculture, industry, commerce and civil aviation itself. At first project members doubted whether aviation could make much of a contribution to economic

LUIS CABRAL is an Indian economist working with the Technical Assistance Bureau of ICAO in Montreal.

growth in Africa and provide anything more than luxury transport for the privileged few. After studying the question for two years, the governments involved are convinced that aviation is indeed a vital force in Africa.

Its contribution to exports is already significant: airlines carried over \$30 million worth of fresh horticultural products to Europe in 1974 and could carry much more, if production and marketing were better organized. While only seven of the 37 countries visited contributed to these exports, the study revealed that most of the others could create employment and earn valuable foreign exchange by growing fruit and vegetables for overseas markets. As a result, a recommendation was made to 27 governments that they request assistance from the Food and Agriculture Organization of the United Nations (FAO) so as to get a larger slice of this lucrative market.

Project members were often amazed by the opportunities civil aviation offers to increase Africa's earnings. Most of them were aware that cut flowers represent a potential export, but hardly imagined that the retail market for flowers in Western Europe is worth \$3 billion a year, and that African countries are so well-placed to take an increasing share of it. All states were, therefore, encouraged to become active in this area and at the same time to increase—wherever appropriate—their par-

ticipation in the export market for fresh fish.

Industry is still in an embryonic stage in Africa. Most activity is in light manufacturing, designed to reduce imports by providing local populations with foodstuffs, beverages, textiles, bicycles and the like. The study found, however, that better use could be made of the plentiful supply of low-cost labour to produce a wide range of goods, from fashion garments to electronic equipment. Many of these goods would still be competitive even with the added cost of air transport.

While tourism is highly developed in a few African countries, many others would like to enter the field. Tourism in Africa is almost entirely dependent on aviation, but here the experts expressed caution. Though the continent as a whole is rich in tourist attractions, few countries have enough to offer individually to draw significant numbers of visitors.

The study warned that tourism can be a risky venture, with no assurance that returns will cover the large investments required. In order to avoid costly errors, governments were advised to seek expert advice before launching tourist development programmes.

Though it can bring high financial returns in a short period, tourism does little to stabilize national economies, and there is little doubt that in the long run air com-

merce geared to the exporting of perishable merchandise represents a sounder investment for most African states.

A rapid survey of the actual and potential markets for perishable goods reveals that handsome profits could be made by African countries willing to make a modest investment and to exploit the available capacity of air-transport carriers to Europe.

During the winter of 1975-76 Western Europe imported 105,000 tonnes of fruit and vegetables from Africa south of the Sahara, but only 20,000 tonnes were carried by air. Given normal rates of expansion, the latter figure should double by 1980.

But if further efforts are made along the lines suggested by the ICAO study, there is no reason why air exports should not reach 60,000 tonnes, worth \$90 million or more by 1980.

The possibilities offered by the cut flower market are even more impressive. In 1974, flower imports to Europe, worth \$45 million in all, were dominated by Israel, Colombia and South Africa. Only two African countries (Kenya and the Ivory Coast) had a share in this market (to the tune of \$3.3 million), and yet the climate and soil throughout most of Africa are ideal for growing flowers and aircraft are available to transport them.

Experts predict that European flower imports will treble by 1980 to \$135 million, and provided a sufficient number of states respond to the challenge, Africa could well capture half of this market.

Another export field where rewards are high is that of fresh fish. Shipped by air, fresh fish command very high prices and bring exporters between 50 per cent and 100 per cent profit. But Africa has done almost nothing to capitalize on this opportunity. Only 1,300 tonnes of fish (worth \$4.5 million) were air-freighted to Europe from Africa in 1975, yet Africa's exports could easily total \$25 million in two years' time.

One tangible proof that the ICAO survey results are being taken seriously is the recent purchase by a group of West African states of ten turbo-prop cargo planes from the U.K.'s Royal Air Force. The planes, which can carry a maximum payload of 35 tonnes, are designed for both long- and short-haul operations from the most difficult terrain and do not need sophisticated ground support equipment.

As this example shows, developing countries are already making decisions in the field of air transport which are bound to affect their rate of economic growth. Not all of these choices concern the development of exports; many have to do with regional and internal problems and prospects.

Preliminary findings of ICAO studies in five East Asian countries show that while the level of aviation development is more advanced there than in Africa, the potential of air transport is not fully utilized and should be better integrated into the social and economic growth of the region. This group of countries, which includes Indonesia and the Philippines, consists of more than 10,000 island archipelagos. It would

Aviation can contribute to the economic development of Third World countries by providing speedy transport for perishable goods and by opening up hitherto inaccessible regions. Above left, cattle flown over the Andes from the Pacific coast are unloaded at Tingo Maria (Peru). As part of its livestock improvement programme, Peru has airlifted thousands of cattle to breeding centres in its Amazon region. Right, 100-tonne cargo of grapes was flown from Nicosia (Cyprus) to London, arriving 10 days ahead of grapes sent by sea and fetching premium prices on the British market.



Photo © Lockheed-Georgia Co., Georgia

be a big and costly process to develop surface transport to link up the isolated communities living in this difficult terrain.

Another preliminary study indicates that better air transport between the islands in the South Pacific (including Fiji, Papua-New-Guinea and Western Samoa) and Australia, New Zealand, Japan and the U.S.A. might benefit tourism, light industry, agriculture and trade.

In Latin America, air transport is already playing an important role in the development of several countries. It is not generally known, for example, that Brazil has the world's largest general aviation fleet, after Canada and the U.S.A. The development of Brazil's interior provinces in the last 20 years would have been much slower without the intensive and intelligent use of aircraft. The same goes for the rest of South America.

Brazil uses aircraft in numerous development programmes, including construction of the Trans-Amazon Highway, while Venezuela has pressed them into service to prospect for oil and mineral resources in Amazonia. In Peru, the Ministry of Fishery employs C-130 cargo-planes to airlift 20-tonne loads of frozen fish from Lima to Ayacucho in the interior. The aircraft crosses the Andes in one hour, while a truck with only a 4-tonne load takes 22 hours to circle the mountains.

Taking advantage of airfreight development, Peru is now building freezer plants in the towns of the Andes to improve the local diet. It has also flown in thousands of pure-bred cattle from Brazil, Argentina, Costa Rica, Guatemala and Panama.

Across the Andes, Argentina uses a large cargo fleet to airlift machinery, vehicles, fruit, meat and other products to various countries in Latin America and even to Africa. Bolivia too is now using two new C-130 Hercules to airlift farm produce from its Amazon basin area to La Paz. The aircraft will also be used to promote exports and to prospect for oil and gas.

Mineral prospecting and oil and gas exploration can be made easier and quicker with the help of a well-organized air transport system. Inaccessibility is no longer the obstacle it was, thanks to shuttle services capable of airlifting personnel and equip-

ment to a desired location in a matter of hours.

In Alaska's North Slope, for example, aircraft ranging from heavyweights to light helicopters are used to prospect for oil, moving men and supplies in a quick and efficient manner.

Again, if a preliminary geological survey shows that a region contains enough minerals and ore to justify exploitation, vehicles and equipment can be airlifted to the site either by conventional air-transport or by specially adapted STOL (short take-off and landing) aircraft. These aircraft can then make the return journey with a cargo of ore refined on the spot. This might prove a solution, for instance, to Egypt's difficulties in exploiting the inaccessible, yet ore-rich regions between the Nile and the Red Sea.

These specialized uses of air transport offer new hope to countries unable to exploit their natural resources because of the exorbitant cost of constructing related road or rail networks. But the most immediately productive use of aircraft in Third World countries, at least in Africa, is for exporting perishable goods to overseas markets.

Europe and the United States are the traditional markets for such goods, but there is also a growing demand for rare fruits and exotic seafood in the oil-rich countries of the Middle East, where shrimps from Ghana, Brazilian limes, and Senegalese beans are beginning to make their appearance.

The term "perishables", however, covers a whole range of commodities other than food and cut flowers, which developing countries can export by air. Such items include fashion garments, short-life radioactive substances, gold, gems, banknotes and valuables of all kinds, antiques, newspapers and magazines.

In the highly competitive world of modern business, developing countries can reap enormous benefits from air-freighting perishable goods. Contrary to general belief, air freight is no longer a means of transport to be used only in emergencies or when cost is not a prime factor. In many cases, air freight is the most economical way of shipping and marketing goods.

According to an IATA (International Air Transport Association) study, the comparison between air and surface costs only makes sense as part of an overall export drive. In terms of packing and crating, insurance premiums, transport charges, transit warehousing and wharfage and interest on capital invested in shipments en route, air freight comes out better. There are also the invisible benefits such as speed, punctuality, dependability and flexibility in adapting to changing market demand—all of which help to ensure the overall success of the operation.

At the national level, any developing country must sooner or later face the question: what form of transport is the most productive investment? Compared to road transport, transport by air is relatively cheap to develop, but somewhat expensive to run.

This leads to the surprising conclusion that in a majority of cases the least expensive and most satisfactory way of developing a national transport system seems to be to start with air transport, then construct railways, and finally to build roads to link outlying villages with the railway stations.

■ Luis Cabral

Aviation holds out great potential for Africa's developing economies by boosting exports and foreign exchange earnings and by creating new jobs. Right, coffee being loaded on to a cargo plane at Tippi (Ethiopia).



Photo © U.S. International Communication Agency, Washington, D.C.

Top of the props

In this remarkable photo, three giant Australian cargo planes flying nose to tail with only a hazardous 8 metres between them look for all the world like a 12-engined airborne monster with three sets of wings. Today's heavy-duty workhorses of the air transport a wide range of bulk cargoes, from road-building machinery to life-saving supplies.



Photo Bruce Adams © Parnage, Paris

The sky's the limit

The endless possibilities
of special purpose flying

by *Patrick Finn*

THE modern traveller usually thinks of aviation in terms of airline transport, and perhaps of military applications. But the myriad uses of planes that come under the heading "general aviation" are often less known.

Yet they range from tasks that affect our everyday life, such as cargo flights, to esoteric scientific experiments such as flying a set of clocks around the world to test Einstein's theory of relativity, or climbing above the clouds to get a better look at an eclipse of the sun.

PATRICK FINN is a Canadian journalist specializing in aviation and air transport news. He is a former president of the Canadian Science Writers' Association and a member of the Aviation Space Writers' Association.



Farmer...

Flying farmers in many parts of the world use crop dusters or spray planes to spray fields with liquid plant food or insecticide. Light aircraft are also used for bombarding forests with nitrogen pellets to speed growth. Left, aerial forest-spraying depicted on a Polish stamp.



Photo © Parimaos, Paris

...Doctor...

Far from the nearest coast, a doctor is winched down on to a supertanker to examine a casualty.

The aeroplane, along with other types of aircraft such as the helicopter, the glider and lighter-than-air craft, have become tools of economic development, sources of recreation, and special aids to communication and humanitarian effort throughout the world.

In the field of air cargo, for example, aircraft such as the L-100 Hercules now travel the skies like the "tramp ships" of an earlier era, picking up and dropping off loads of cattle, drilling equipment, road-building machinery and life-saving supplies.

Large cargo aircraft have played a vital role in such major projects as the Trans-Amazon highway in Brazil, the Trans-Gabon railway in Africa, and the Alaskan oil pipeline.

Other "general aviation" aircraft of various sizes and designs are used throughout the world in such tasks as hurricane hunting, the location of dangerous icebergs, and forest fire fighting.

But these spectacular uses are only part of the story. General aviation in all of its forms now contributes thousands of interesting and highly skilled jobs to the economies of the nations, with a growing number of small airports providing new trade and communication networks.

One of the major roles of general aviation is in business and commuter-type flying. In fact, business flying has become one of the world's fastest growing industries in recent years.

Forecasters say that business flying will continue to grow despite the energy and fuel shortages in many areas. On a seat-mile basis, small aircraft use less fuel than big airliners. And as airlines continue to cut back on flights to smaller communities because of light and uneconomic loads,

businessmen will continue to turn to company planes to get them to the right place at the right time.

In many countries, business planes are no longer used only for top company officials. They now transport managers, engineers, accountants and other specialists who must be constantly on the move.

Busy people are also becoming used to the idea of hiring planes or taking small commuter aircraft to get them to their destination quickly. In fact, such services frequently connect with the major airlines. The result is a complex network of air communications similar to that which developed in earlier eras in land and sea transport.

Personal transportation is probably the most high profile category of general aviation. It means flying for fun, learning new skills, and perhaps the opportunity to move into the professional side of the aviation world.

In the broad category of special purpose flying, there are so many uses of general aviation that it would be impossible to list them all. However, some of the more diverse uses include:

- **Flying health services.** In Australia, there is a flying doctor service, which is designed to provide quick aid to persons living in lonely, isolated areas of the "out-back"
- **Forest and crop spraying.** In Canada and the U.S., aircraft are used regularly to spray forests in the northeast where spruce budworm is infesting thousands of acres of conifers. For crops, special low-flying aircraft have been developed for spraying, and farmers are now also seeding their fields from the air.
- **Disease control.** In the Volta River basin in West Africa, the World Health Organization is involved in a major spray programme

to kill the larvae of the blackfly, which transmit the blinding disease of onchocerciasis.

- **Livestock airlifts.** In Peru, cargo aircraft were used to transport 35,000 head of purebred cattle over the Andes to Amazon villages in the interior.

- **Forest fire fighting.** Both planes and helicopters have proved successful in keeping these outbreaks under control. So-called "water-bombers" drop both water and special fire-fighting chemicals on hot spots in the forests.

- **Plant airlifts.** In the Philippine islands, cargo aircraft were pressed into duty to move seedlings and plants as part of the government's green revolution programme.

- **Pipeline and utility line patrol.** Helicopters and light aircraft are used all over the world to fly up and down pipeline routes and remote power and telephone lines to check for possible problems.

- **Aerial photography.** Map makers use aerial photos that can be employed with special viewing equipment to produce three-dimensional effects.

- **Aerial archaeology.** Aerial photography has become widely used by archaeologists in recent years as a means of discovering hidden or partly destroyed ancient sites that could not be found on the ground. Aerial photos also help archaeologists to plan digs by providing an overall view of sites and their topography.

- **Urban planning.** Air photos can provide developers and city officials with an up-to-date look at urban growth or creeping blight.

- **Environmental and wildlife protection.** Helicopters and light aircraft can be particularly effective in tracking down the sources of water and air pollution. Conservationists in many countries use aircraft to



Photo © Keystone, Paris

...Fireman...

Aircraft have proved their worth many times over as versatile fire-fighting machines. Above, a helicopter aims a hose during a fire in Chicago. Below, a plane specially designed for fighting forest fires drops its load of water:

(see also photos pages 18-19)



Photo Donnezan © Rapho, Paris

take inventories and assess the state of wildlife.

- **Aerial logging.** Planes can be used to identify patches of valuable types of wood. In the western part of the U.S., helicopters are used to fly deep into forest areas and remove small logs for the roof shingle market.

- **Search and Rescue.** This is one of the better known uses of general aviation. Many a hiker, mountain climber or wilderness traveller owes his life to airborne rescue teams and spotters.

- **Cargo drops.** Cargo can sometimes be dropped by parachute in areas where there are no airfields. Non-fragile supplies can be allowed to free fall from a low altitude, if necessary. During severe winters or drought, an aeroplane or helicopter can be used to drop hay and other forage to keep animals alive until the weather improves.

- **Mail delivery.** This is no doubt the oldest form of general aviation. Early airline passenger routes were pioneered by the pilots who flew the mail.

- **Prospecting for natural resources.** Mining firms use aircraft to carry special detection instruments over land that has good mining prospects. Water resources can also be surveyed easily by aircraft.

- **Disaster relief.** Following major floods and earthquakes, the aircraft is usually the quickest way to bring clothing, food, medicine and blood into a disaster area, as well as to evacuate the injured.

- **Recreation.** Perhaps the most fascinating development in sport aviation in recent years is the increased interest in gliding, manpowered flight and the most basic type of flight of all—hang gliding.

The recent development of the short take-off and landing aircraft (STOL) has been a boon to general aviation. It paves

the way to flights to many areas that have only makeshift or short runways.

Another general aviation trend is the renewed interest in lighter-than-air craft. Experiments have already been conducted in North America on the use of balloons for logging; several firms have plans to build a new generation of lighter-than-air craft.

But spectacular as these experiments and sports may be, it is in the area of business and special purpose aviation that general aviation will make its economic impact during the next few decades.

The aircraft has joined the computer as one of the great new tools of our time. And both can be of benefit to developed and developing countries.

The small community with an industrial airport can now compete on a more equal basis with big cities in bidding to attract industries. In fact, some observers see the growth of general aviation as a handmaid of industrial decentralization.

Companies can be attracted to smaller population centres by their proximity to raw materials, by their lower land and operating costs, and by better living conditions for employees. General aviation makes remote communities accessible to the larger market centres.

If the past is any guide, men will continue to find new special uses for the aeroplane.

■ Patrick Finn

Art restorer...

Equestrian statue being carried directly from the foundry to its base in Cracow (Poland) in 1976. It now crowns the reconstructed monument to King Ladislas Jagello, destroyed in World War II.

Photo © Keystone, Paris



Photo © Keystone, Paris



Photo © Agence France-Presse, Paris

...Wildlife protector...

Dancing on air, a young elephant is airlifted to its new home in Rwanda's Akagera National Park as part of a programme to remove herds of elephants that were roaming wild across vitally needed farmland.

House mover...

Metal hangar heads for an oil well in an otherwise inaccessible spot in Alaska. Drilling equipment was also airlifted.

...Rescuer...

Passenger being hauled to safety in 1976 from a cable car that stalled above the city of Grenoble in the French Alps.

...Archaeologist...

Many archaeological sites have been spotted and identified from the air. Outline of the foundations of a Gallo-Roman villa at Biarre (France) is clearly visible on aerial photo at right. Small white blob in front of the main rectangular building indicates the site of a fountain.

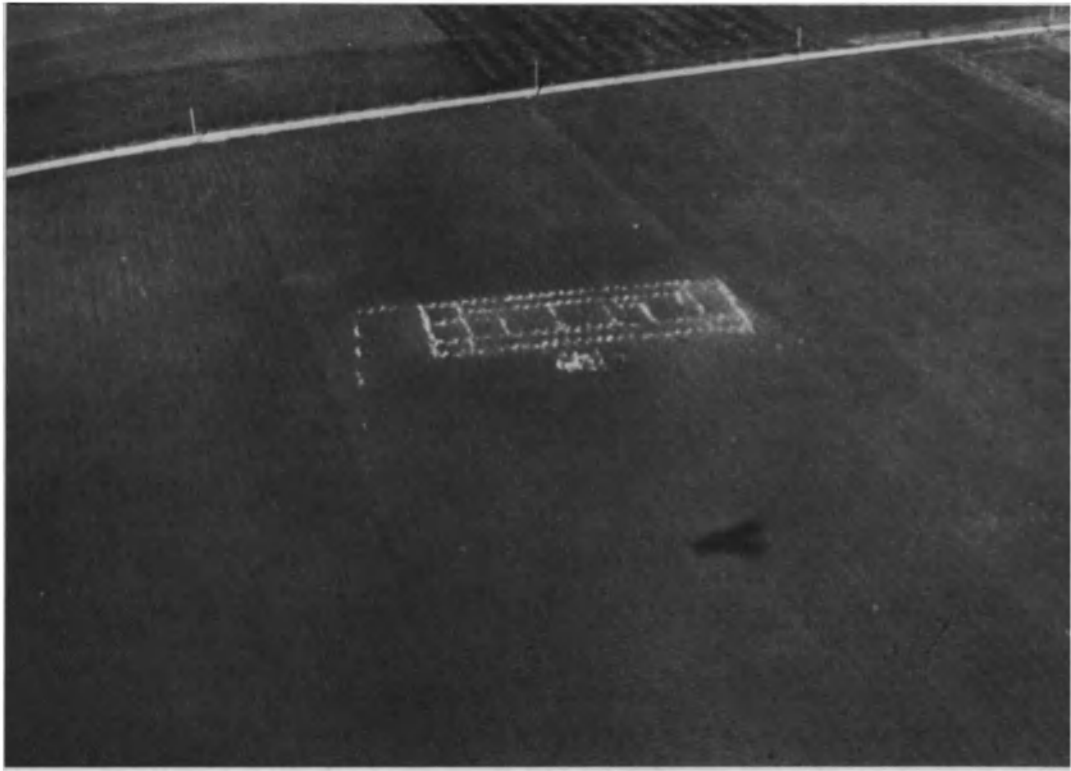


Photo © Parrmage, Paris

Photo © Roger Agache, Service des Fouilles, Abbeville, France

...Carrier...

Like some giant insect clasping its prey, a heavy-duty helicopter takes a bus for a ride.



Photo © Europix, London



Safety first in the air

Birds and aircraft sometimes find themselves competing for the same airspace. When they do the encounter often causes damage and can be fatal. The cost of repairing planes after impact with birds runs into millions of dollars yearly. Special maps for navigators show bird migration routes. Top photo: flying ornithologists in the U.S. join a flock of Canadian geese to study their migration habits.

by Olof Fritsch

O human race, born to fly upward, wherefore at a little wind dost thou so fall?"

Wind shear was not exactly what Dante had in mind in his poetic outburst 600 years ago. Yet he couldn't have been more to the point about this weather hazard which, along with birds and wake vortices, the ICAO Council has called one of the three major technical problems facing aviation today.

Wind shear—the sudden change in wind with height and distance—is not the worst thing in an aviator's atmosphere, but it rates high because of the element of surprise. Under certain circumstances it can turn a smooth take-off or a final approach into a sickening roll if not a dive at the end of the runway.

For over 10 years, ICAO has been trying to establish requirements for measuring low-level wind shears and turbulence at international airports, and to develop international procedures for warning pilots about them. It recently studied replies from 42 states and three international organizations to three inquiries on the subject and especially on the kind of information needed to avoid these dangers.

These replies show that less than half of the ICAO states are studying wind shear. Several of them mentioned that studies were difficult because of the complexity of the problem and the need for sophisticated equipment and facilities.

A few states, however, are carrying out studies using instrument towers, experimental ground-based measuring devices and data obtained by aircraft. Some of these studies concentrate on wind data provided by masts or towers in the vicinity of aerodromes or, as in the United States, on a variety of aspects, including manned flight simulation, wind shear hazard definitions and digital simulation, wind shear forecasts and the development of airborne and ground-based detection and measuring systems.

The United States reply noted that since five of the last six air carrier wind shear accidents in the U.S. were associated with

thunderstorms, a major portion of their research deals with measures to prevent thunderstorm-related wind shear accidents.

ICAO is cautiously optimistic about the progress of studies now under way. Some useful results may be expected within one to two years, mainly in respect of wind shear effects on aircraft, aircraft instrumentation and pilot training. The development of effective ground-based wind shear measuring equipment, however, is likely to take longer.

The increasing use of wide-bodied jets has highlighted a phenomenon which exists to a certain extent with all aeroplanes but which has now become a matter of great importance. This is wake turbulence.

It is a simple enough phenomenon but one with serious implications for aircraft operations and airports. Every aeroplane in flight generates wake vortices, pairs of counter-rotating masses of air extending backwards from the aircraft's wing tips and flaps when extended.

The violent, fast-spinning but invisible air masses trail for several kilometres behind the aircraft. The greater the lift being produced by the wing and the bigger the aeroplane, the more violent and long-lived the vortices and the greater the danger for any light aircraft which follow too closely behind during take-off or landing.

The U.S. National Transportation Safety Board has cited wake vortices as a contributory factor in 147 accidents in the United States between 1963 and 1974. While most involved light aircraft, one fatal accident involved a DC-9 behind a DC-10. In the United Kingdom, where the proportion of light aircraft is small, especially at busy airports, there has so far been no accident caused by wake vortices, but a number of near accidents have been reported.

Vortex encounters occur most frequently when aircraft are approaching an airport since it is in this phase of flight that successive aircraft are most likely to follow similar flight paths. These types of encounters are especially hazardous since the aircraft may be close to the ground and the crew's workload is high in this phase of flight.

At the time the B-747 entered service, authorities in the U.K. imposed a distance of 10 nautical miles or four minutes be-

tween it and any following smaller aircraft as a precaution during landing. This separation was later reduced to five nautical miles or two minutes on the basis of results of trials in the United Kingdom and the United States. In the U.K., the five-minute separation was maintained for small aircraft following big planes, including Concorde. In the U.S., the five-minute separation was applied behind aircraft having a take-off weight in excess of 135 tonnes. This includes the heavier B-707's, DC-8's and VC-10's.

Extensive theoretical and experimental research on wake vortices has been carried out in recent years by private industry and government agencies in the U.S. and the U.K. In May 1974, a joint agreement between the U.S. Department of Transportation and the British Civil Aviation Authority established a test site at Heathrow International Airport in London which recorded 12,950 landings through June 1975.

A vortex test site is also in operation at John F. Kennedy International Airport in New York while a joint U.S.-Canadian programme to collect data on departing aircraft has been set up at Toronto International Airport.

It is hoped that further developments in ground sensors and comprehensive data collection will enable experts to find ways to reduce and dissipate the vortices. Meanwhile, separation standards remain the best possible way of coping with the problem.

While man gets craftier, birds also become smarter. Scaring them away from aircraft is not an easy task even if modern techniques are better than the farmer's scarecrow.

There exists no "Convention on Air Traffic Control" to regulate whether birds or aircraft have the right of way. Although most people in aviation are aware of a "bird problem", few realize its magnitude. As reported in the ICAO Bulletin, eight aircraft crashes have been attributed to birds since 1973. In 1976, two executive jets were downed by birds. It is estimated that each year there are 2,400 significant bird strikes to civil aircraft, and repairs to damaged aircraft were said to run into millions of dollars.

Since civil jet aircraft spend most of their flying time at altitudes not normally occupied by birds, the hazard exists mainly at, and near, airports. It is during the critical take-off and landing phases that aircraft and birds occupy the same airspace. Simply stated, the bird strike prevention programme aims at keeping birds from coming to the airport, driving away those that do come, and reporting on those that stay too long.

Birds may live at an airport, but, just as often, they may only be visitors and, like any visitor, look for a place to eat, drink or

OLOF FRITSCH, Swedish pilot, is Chief of the ICAO's Accident Investigation and Prevention Section. He is also Vice-President of the Canadian Society of Air Safety Investigators.

rest. The airport can be made unattractive to them by draining wet areas and cutting down trees. Other countermeasures, such as changing the ground cover or exterminating earthworms, are more complex. Each airport requires its own study and improvement plan.

However, these measures will not eliminate all birds from an airport. Like any tourist, different birds are looking for different things. What may be unattractive to one may be inviting to another. Airports offer large areas which, except for aircraft, are relatively undisturbed by man.

In one reported case birds had built a nest in the engine intake of a turbo-prop plane in only one and a half hours while the aircraft was idle on the ground. Another report noted that a group of jackdaws had hidden 72 pieces of metal in a plane while it was in a hangar. The largest piece was a wrench. With resourcefulness like this, the only solution is to remove all birds to other nesting places far away from the airport.

The most common techniques currently being used to drive birds away are loud noises produced by shells or gas explosions, flashes of light, flares and recorded bird distress calls. These calls, played back through sound systems, have been found most effective.

Many airports now employ patrol teams equipped with vehicles and dispersal equipment. The noise of guns usually keeps the birds away for a short while, but they may soon come back or be replaced by newcomers. It doesn't take a bird long to figure out that the noise below is produced by man.

It is also important, therefore, to have a reporting system that will inform pilots when they may expect competition for the same airspace. The control tower, assisted by ground staff, can provide such information.

Radar is also used to detect flocks of birds flying in the vicinity of airports. This is particularly useful during bird migration periods when extremely hazardous conditions may occur. Besides reporting on birds near airports, charts have been published that show the migration routes of birds.

Improvements in aircraft design have not been ignored. Agreement has been reached in ICAO that aircraft structures should be designed so that aircraft can continue to fly safely after impact with a 1.81-kilogramme bird.

■ Olof Fritsch

by John Marrett

ACTS of unlawful interference today pose a serious threat to civil aviation. Like other major forms of transportation in the past, aviation has in recent years become a target for criminal acts. The media usually describe this new form of crime as "hijacking" or "air piracy", using terms which evoke similar offences on land and on the high seas.

All states must deal inexorably with crime, and to protect their national interests must take steps to combat these acts of unlawful interference.

The President of the Council of ICAO, Dr Assad Kotaite, drew attention to this issue on 15 September 1977 during his address to the 22nd session of the ICAO Assembly: "Unfortunately, acts of unlawful interference with international civil aviation and its facilities continue to have a serious adverse effect on the safety, regularity and efficiency of international air transport. It is imperative that all states take measures to safeguard international civil air transport.

"The number of parties to the three Conventions—Tokyo (1963), The Hague (1970) and Montreal (1971)—is steadily increasing. Our aim at ICAO is to achieve universal acceptance of these instruments and their full application to prevent the occurrence of any acts endangering the safety of international civil aviation."

The international community has expressed its concern about this form of crime through a number of resolutions of the United Nations, the most recent of which was adopted on 3 November 1977, and through resolutions adopted by other international organizations.

The Aviation Security Programme sponsored by ICAO was drawn up in response to this concern. It may be divided into two complementary parts, legal and technical.

Three conventions dealing with the legal aspects of the problem have been adopted so far.

The Tokyo Convention, adopted as early as 1963, was the first concrete action by

World against

the international community to draw up legislation on the unlawful seizure of aircraft. It deals with offences committed on board aircraft registered in a Contracting State while that aircraft is in flight. At present, 88 states are parties to the Tokyo Convention.

The Convention of The Hague, signed on 16 December 1970, defines the act of unlawful seizure of an aircraft. It contains detailed provisions on states' jurisdiction over an offence, on taking offenders into custody, and on questions of prosecution and extradition. The Convention has so far been ratified by 79 states.

A year later, in September 1971, another conference convened at Montreal under the auspices of ICAO adopted a Convention for the "suppression of unlawful acts against the safety of civil aviation." The Montreal Convention defines a wide spectrum of unlawful acts and is concerned, broadly speaking, with acts of sabotage. The Contracting States have undertaken to make these offences punishable by severe penalties. So far, 75 states have become parties to this Convention.

On the technical side, the primary goal of the ICAO aviation security programme is the prevention of unlawful acts, but it also deals extensively with measures to be taken if preventive action fails. To help states implement their own security programmes, ICAO convenes informal regional seminars, and in 1971 published a manual on aviation security. The manual, which provides detailed procedures and guidance, is kept up to date by regularly issued amendments.

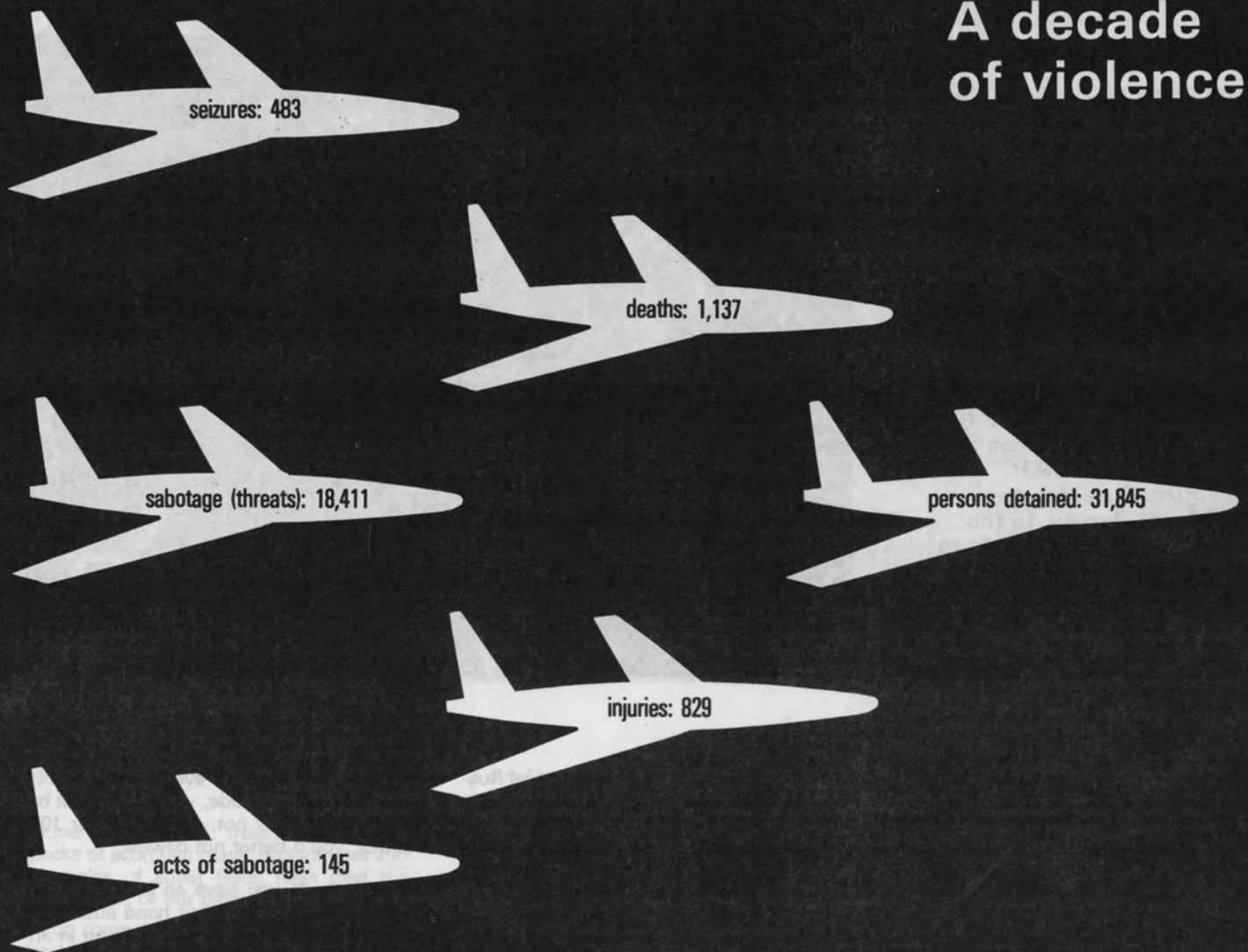
Some states that have requested more detailed technical assistance have been provided with the services of an itinerant aviation security expert. Funds have been provided for this by the United Nations Development Programme (UNDP).

Other aviation security programmes have been developed by such international organizations as the International Criminal Police Organization (ICPO-Interpol); the Universal Postal Union (UPU); the International Air Transport Association (IATA); the Airport Association Co-ordinating Council (AACCC); and the International Federation of Air Line Pilots' Associations (IFALPA).

The travelling public may therefore be assured that the resources of the entire world community have been and still are being mobilized to promote the safe, orderly and efficient development and use of civil aviation in the interests of all the peoples of the world.

JOHN MARRETT of Jamaica joined the International Civil Aviation Organization in 1970 to prepare its Security Manual and is now the Organization's Aviation Security Officer.

alert hijacking



Record of almost ten years of violence (Jan. 1969 to Feb. 1978) to passengers and crews of civil aircraft is shown here. The figures in this diagram were compiled by the International Civil Aviation Organization from news reports and other sources but they have no official status. According to the same sources, such illegal acts affected no less than 41 airlines and 49 different countries in 1977 alone.

Flying for thrills

by Oleg K. Antonov

Several types of Soviet aircraft flying with internal and international airlines bear the markings "A N", indicating that they were designed by Oleg Konstantinovich Antonov, the noted Soviet aeronautical engineer. The designer and constructor of aircraft ranging from small Red Cross planes to a big 80-tonne transport, Antonov is a Member of the Ukrainian Academy of Sciences, a Hero of Soviet Labour, and a Lenin Prize-winner. Since 1946 he has been head of a major U.S.S.R. Aeronautical Research and Development Bureau. In the following text, an extract from his memoirs *Ten Times Over* ("Desiat' raz snachala"), he looks back to the year 1932 when he was beginning his career as a glider constructor.

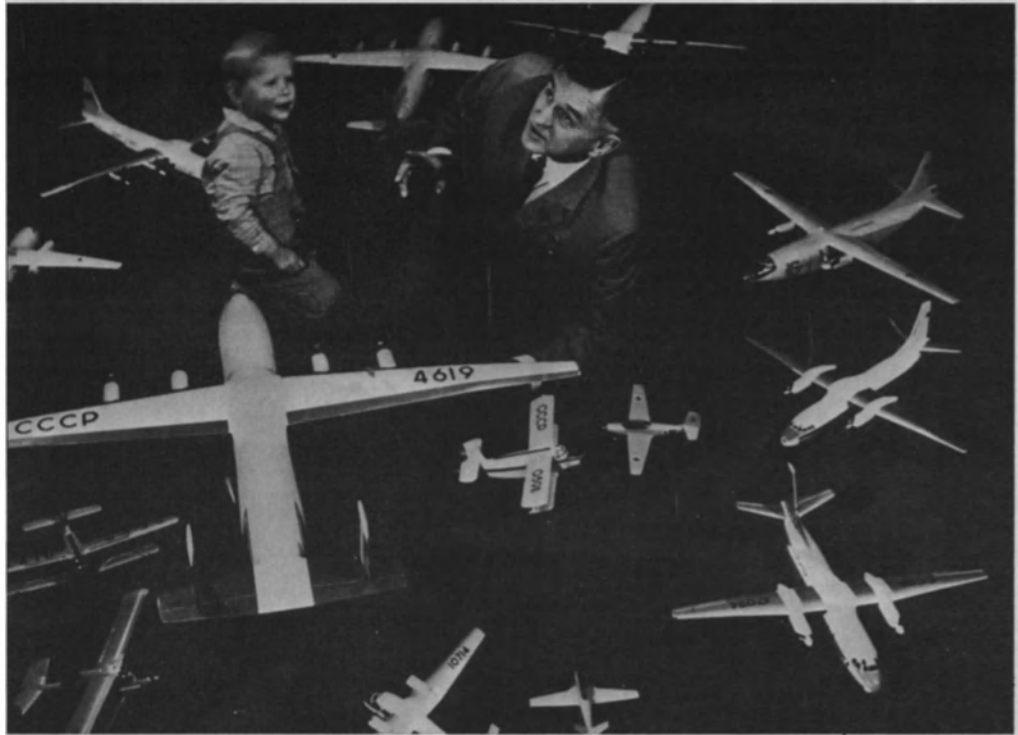


Photo © APN, Moscow

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I am sitting in the cockpit at the controls of my glider, my beloved brain-child, as it lurches forward, throbbing and humming under the quivering tension of the shock-cord—a rubber-stranded rope stretched out by the ground crew to launch the aircraft. Everything has been thought through, everything calculated. Every pin, every bolt has been driven in place to function properly; every rivet locked in the hole made for it; every lever stamped, bent, welded, and there you have it—that remarkable and yet simple apparatus—the glider.

So simple, in fact, that in medieval Russia and in ancient Greece and even earlier, in ancient India, craftsmen and materials could have been found to build a glider capable of flying hundreds of kilometres and soaring for hours aloft. But there was just one little thing missing—the know-how.

It would take man two or three thousand years to solve an apparently simple problem: fitting together pieces of wood, fabric and a few metal elements to fashion what goes nowadays by the unassuming name of glider.

For a glider pilot there is no such thing as an engine. He accustoms himself to the discipline of gliding from the very first jerk on the shock-cord.

The glider pilot has a golden rule which he must never forget: "keep up speed." There is no engine, no propeller thrust, so forget about stepping on the gas and pulling the stick back to gain height. Keep going, forward and down; forward and down. If you lose concentration you lose speed and down you go. A good glider will

go into a half-spin, or even a spin, and if there's enough altitude, you'll come out of it. But if there's not, say just 50 or 100 metres, you'd better not dawdle.

The minute you have an inkling you're losing gliding speed, your hand automatically eases the stick. If you're flying in an open cockpit, you feel the speed with your whole being. With your face, with your eyebrows, with your ears, from the slope angle of the glider, from the pressure on the stick, from the singing of the struts, from the hissing of the air stream, from the vibration of the cabin. Forward and down, forward and down...

...But today the instructor is taking me up in an engine-powered plane to do some aerobatics in order to improve my skills.

The motor idles. The instructor and I climb into the cabin. No parachutes. In 1932 parachute jumping was just getting started as a popular sport. You flew without a parachute—in gliders, in small aircraft, too. Why bother with a parachute? Safety belts were also frowned upon.



Photo I. Sapozhnikov © TASS, Moscow

We climb into the cockpit. A short run, and we're airborne.

Emerald tufts of trees, pale yellow specks of scorched grass, quadrangles and rectangles of sunlit fields flash past the green wings of our biplane.

I do some vertical turns. The cowling of the plane swings along the horizon. I'm pressed back in my seat. A bay looms up, then a lilac chain of cliffs, the steppe, mountains, sea, steppe, mountains, sea—everything is spinning in a sparkling iridescent whirlwind. The ailerons yaw, increasing the pull on the stick. I am holding it with both hands.

We come out of the turn...

The plane, as obedient as a good-natured bumpkin, shifts into level flight. Altitude: 800 metres.

"Well, how about a loop now!" shouts the instructor. "Let's dive!"

I ease the stick away from me, the plane's nose dips more, and still more, we're accelerating... 120, 140, 160 km. an hour.

"Pull the stick back."

I do. I'm pressed hard back against my seat. The plane's nose rises, the horizon tears by us, disappearing below.

"Stick full back!" the instructor yells.

As we climb, the speed slackens, and there we are, flying wheels up, upside-down. The noise of the engine subsides as the instructor throttles back. We dive, we come out of it... From behind, the horizon below, bathed in the light of the sea, passes us by.

My companion opens the throttle. Great!

"Again!"

"I do another Nesterov loop." (*)

"Now for a wing-over!"

Once again we gather speed. I come out on the horizon, stick full back, with my left foot pushing the rudder bar to the limit. I'm forced back against my seat as we bank to the left. The plane, rolling over, is travelling wheels up. But here the irrepressible conditioned reflex of the glider pilot takes over. My hand, responding to an involuntary impulse, shifts the stick into neutral. I feel myself coming away from my seat, and...

At that instant, the only part of the plane that I am conscious of, the only thing that connects me with the plane, is the twine-wrapped end of the control stick. And at that very instant, the stick springs back against me. I'm thrust against my seat.

The instructor has yanked back his stick, changing the curved-line flight trajectory that I had broken and restoring the centrifugal force that retrieved us and kept us in our seats.

And not a moment too soon. Had his attention wandered for a fraction of a second, our submissive little biplane would have dumped us and left us floating through space with no parachutes, just a few hundred metres above a craggy slope, alone with our thoughts about how useful safety belts can be.

■ Oleg K. Antonov

(*) Piotr N. Nesterov, Russian engineer and aviator (1887-1914), significantly improved the manoeuvrability of aircraft. One of the pioneers of aerobatics, he executed a loop in 1913 subsequently known as the "Nesterov loop"



Photo © ONERA, Châtillon, France

WHAT shall we see in civil aviation after the turn of the century? Thousand-tonne flying wings carrying 1,000 or more passengers? Hypersonic transports with unlimited range? Spacecraft regularly winging their way to and from Earth orbital missions?

Some of these craft will be operational early in the 21st century; others may not reach fruition before the year 2025; yet others may never see service at all. But they all exist today, either as concepts in the minds of aircraft designers and engineers or at some stage of development. A few are already with us as experimental vehicles.

The problem with crystal-balling in the aviation field, as in others, is that major technological advances do not always occur when the world is ready for them. During the period between the conception of an experimental aircraft and its successful demonstration, non-technical obstacles may crop up to prevent the normal progression from testing and evaluation to operational use. The opposite may also happen: prototypes at an advanced stage of development may become obsolete because of a major technological breakthrough.

The consensus today in the civil aviation industry is that between now and the year 2000 there will be no major design changes in the world's commercial aircraft. Both the airframe manufacturers and the airlines

The shape of things to come

by Charles D. LaFond

CHARLES D. LAFOND has been editor-in-chief of the ICAO Bulletin, the monthly technical journal of the International Civil Aviation Organization, since 1971. Previously, he was for 20 years an aerospace-magazine writer in the United States.

Tomorrow's aircraft are already on the drawing board and in some cases models are being tested in wind or hydraulic tunnels where various flying conditions are simulated. Special optical instruments are used to record the movement of air or water as they flow around the model, sometimes producing surprising visual effects. Turbulent flow round a cylindrical fuselage (left) in hydraulic test tunnel at Châtillon (France) shows up as a haunting owl-eyed mask. Below, model of a supersonic commercial transport developed in high-speed wind tunnels at a research centre in Virginia (U.S.A.). Multiple exposure photo shows wings outstretched for take-off and landing, folded halfway back for medium speeds and almost flush with fuselage during supersonic flight.

Photo © USIS, Paris

expect new aircraft during the next few decades to be derivatives of today's designs. They will be shortened or stretched. They will have more or fewer engines, and passenger craft will be modified so that they can be more easily converted to carry freight. Engines will be quieter and produce less pollutants. Range may be extended, and take-off and landing runs may be shortened. But for those of us on the ground, the narrow-body transports will look about the same as today's. So will the large, wide-body aircraft, though they may possibly be bigger.

The reasons for this are largely economic. The cost of new aircraft continues to escalate. The air transport industry is still growing, but at a much slower rate than anticipated. The cost of fuel is still mounting as available world supplies diminish.

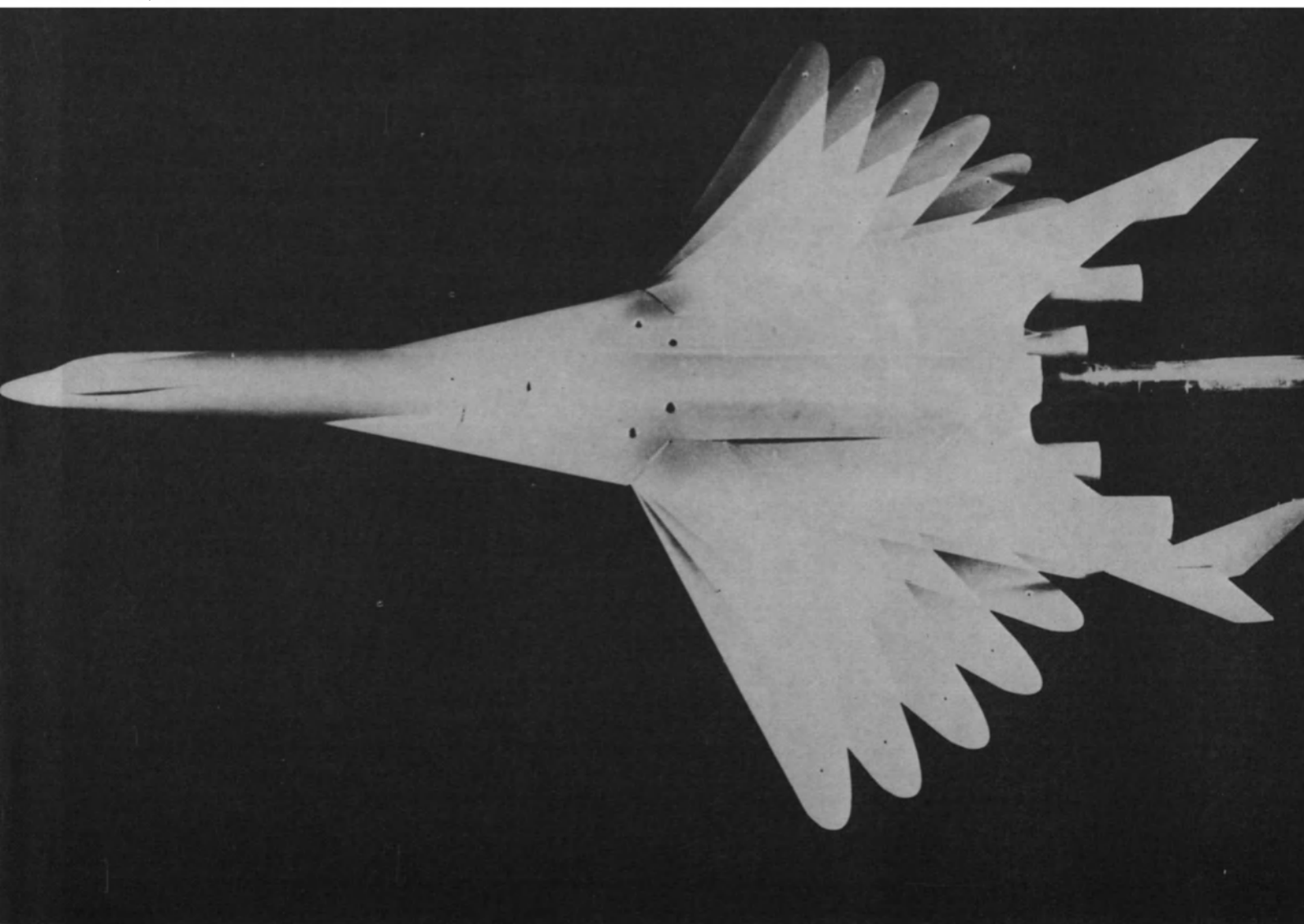
In the longer term, however, the picture may not be so bleak. In all the industrialized countries, intensive research has been going on for years in key areas that would permit radical changes in aircraft design.

Research into advanced materials alone

is already producing structures which combine enormously increased strength with significant reductions in weight. New engine designs, backed up by sophisticated research in acoustics, may prove so effective in the not-too-distant future that the next major step in reducing aircraft noise will have to come from the airframe itself.

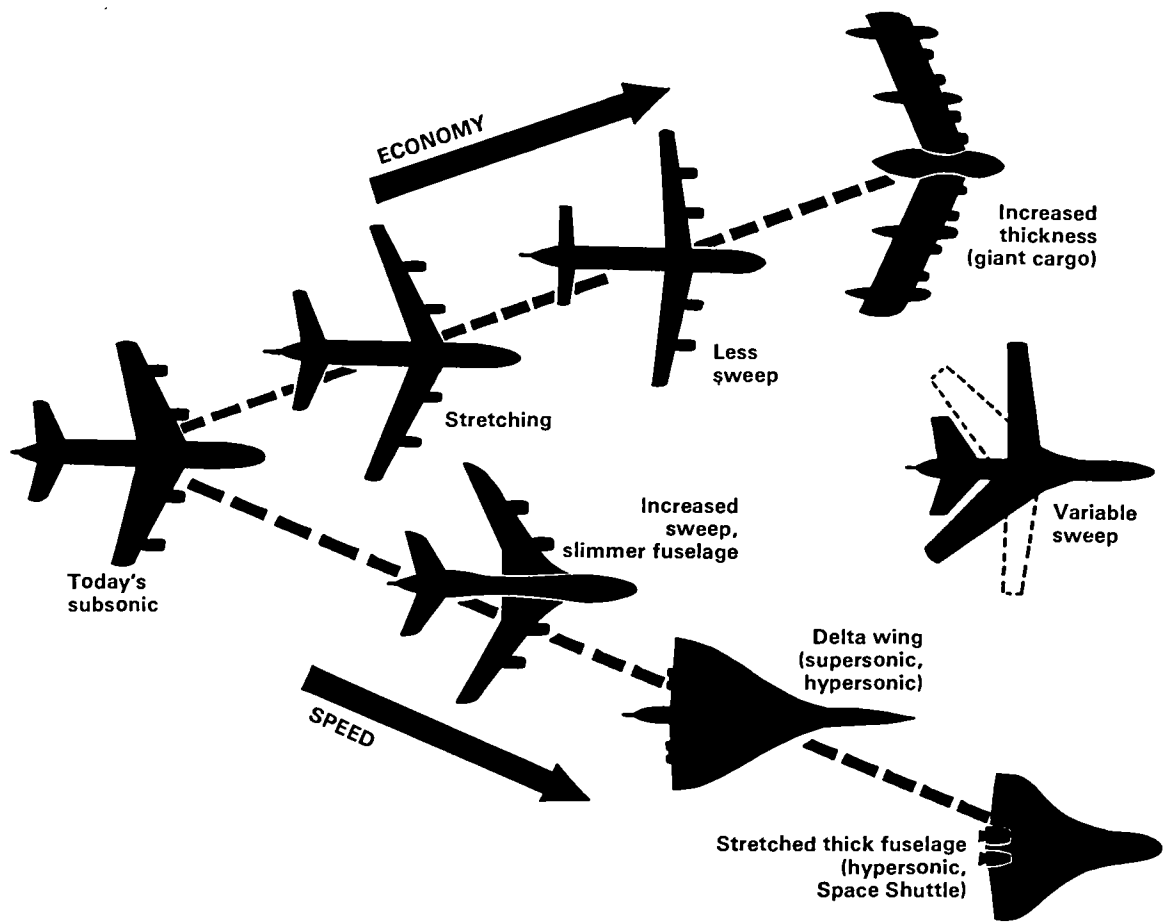
Fuel research is introducing an entirely new factor into the equation. Synthetic fossil fuels, liquid hydrogen and nuclear power are all being studied today as potential power alternatives. However, given today's technology and the lack of international commitment, the practical use of either liquid hydrogen or nuclear energy for aircraft propulsion is a long way off.

Advanced wing configuration is another area of research that is already paying off. Some models, now in an advanced stage of development, have been shown to combine enormous lift for heavy payloads with short take-off and landing (STOL) capabilities. As a result, we may see vastly different wing structures coming into use in the next century, as well as the possibility of a



New silhouettes in the air

There are two major trends in aeronautical research today. One is the result of a quest for higher speed; the other stems from a search for greater economy. Designs for future high-speed planes incorporate wings that are smaller and increasingly tucked into the fuselage. The search for economy, on the other hand, produces wings that are stretched, have less sweep and are thicker. The fuselage tends to disappear. Drawings, right, show these two trends in aircraft design.



Drawing J.M. Troillard © Science et Vie, Paris

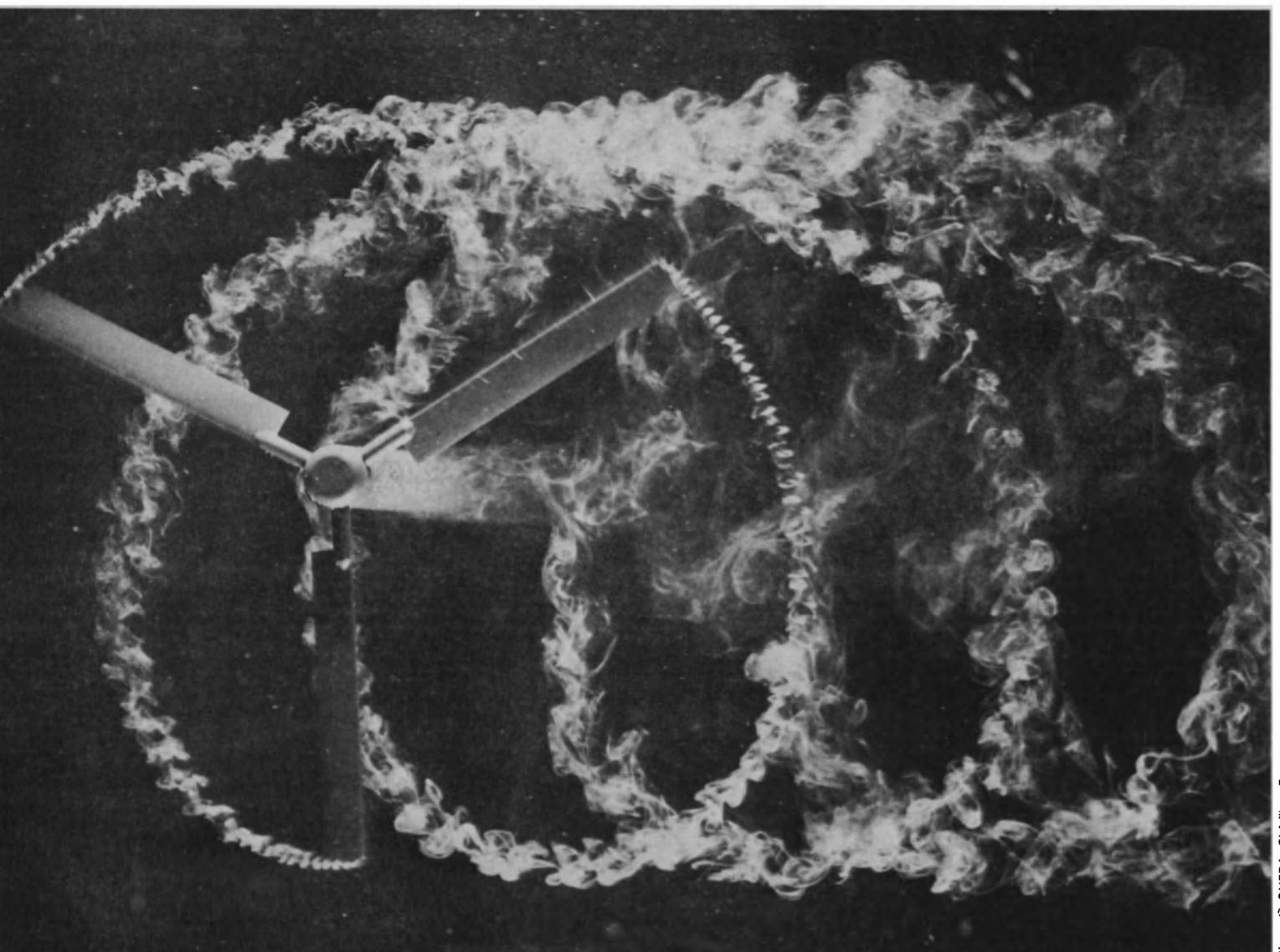


Photo © ONERA, Châtillon, France

▶ transonic transport operating at slightly over the speed of sound.

Let us look at some of the research now in progress.

The use of composite materials for the manufacture of aircraft structural parts is a relatively recent field, although the development of bonded glass fibre began as far back as 1940. This technology consists of producing structures of virtually any shape by stacking and moulding layers of differently oriented fibres contained in a plastic base.

The so-called advanced reinforced composites which emerged in the mid-1960s incorporate boron filaments whose strength and high performance instantly appealed to aeronautic engineers. Today composites are replacing more and more metal structures because of the weight and cost savings and greater fuel economy that can be achieved.

The really important thing about composites is that the selection of fibre material and the lamination of layers with fibres running in different directions for each layer permit an end product that fits specific structural needs. For example, composites can guarantee good bending strength for one piece and keep costs down in another which is only subjected to low stress. It has been estimated that, compared with metals, advanced composites can bring energy savings of up to 33 per cent and

weight savings approaching 30 per cent.

A relatively new material has been produced by what is called "whisker" technology, in which nearly perfect crystalline structures of carbon provide a specific strength approximately 50 times that of steel.

One major U.S. airframe manufacturer estimates that up to 75 per cent of an aircraft could be made from composites, primarily graphite epoxy, and that the overall cost would be 21 per cent less than that of its metal counterpart. As the airframe would be much lighter, fuel consumption would be reduced by about 30 per cent. With today's technology, such an aircraft could be built by the 1980s or early 1990s, and operational soon after.

What kind of fuel will be used in the early 2000s? Most experts believe that conventional kerosene jet fuel will be the basic civil aviation source well into the next century. As we approach the year 2000, however, alternative fuels may have to be introduced.

Synthetic kerosene, obtained from coal and shale, could be mixed directly with petroleum-based fuels, giving an end-product whose properties would be similar to those of today's jet fuel. Coal and shale supplies appear to be large, and such a fuel would require few changes in storage and ground handling and could readily be used in conventional aircraft. However, some

specialists feel strongly that a major commitment should now be made to developing the use of liquid methane or liquid hydrogen as a fuel. In either case, a new aircraft design would be required.

For the same weight of fuel, liquid methane can provide 20 per cent more heat than kerosene. Its density is about half and its cost about the same as kerosene fuels. But liquid methane only exists at very low temperatures (-161°C at atmospheric pressure), like liquid hydrogen (-253°C), and thus creates storage and handling problems. Although its higher heating value reduces the total fuel needed to carry a load over a given distance, the improvement is only modest. Because it is lighter, bigger fuel tanks are required.

More interest has been shown in an aircraft fuelled by liquid hydrogen because of its even higher heating value: 280 per cent that of kerosene for the same weight of fuel. The trouble is that its density is only one-twelfth that of kerosene. Thus the liquid hydrogen needed to produce the same energy as kerosene fuel, while weighing only 35 per cent as much, requires a volume four times as great.

Obviously, then, an aircraft using liquid hydrogen would require a larger, heavier fuselage with greater aerodynamic drag and consequently reduced efficiency. At the same time it would have a lower gross weight at take-off, thus requiring less ▶

Windmill effect

▶ Photo taken during experiment in a hydraulic test tunnel shows simulated airflow patterns created by the rotor blades of a helicopter.

Materials under the microscope

Research into advanced materials which combine increased strength with reduced weight has led to the development of new alloys. Right, a nickel and niobium carbonate alloy seen through a microscope.

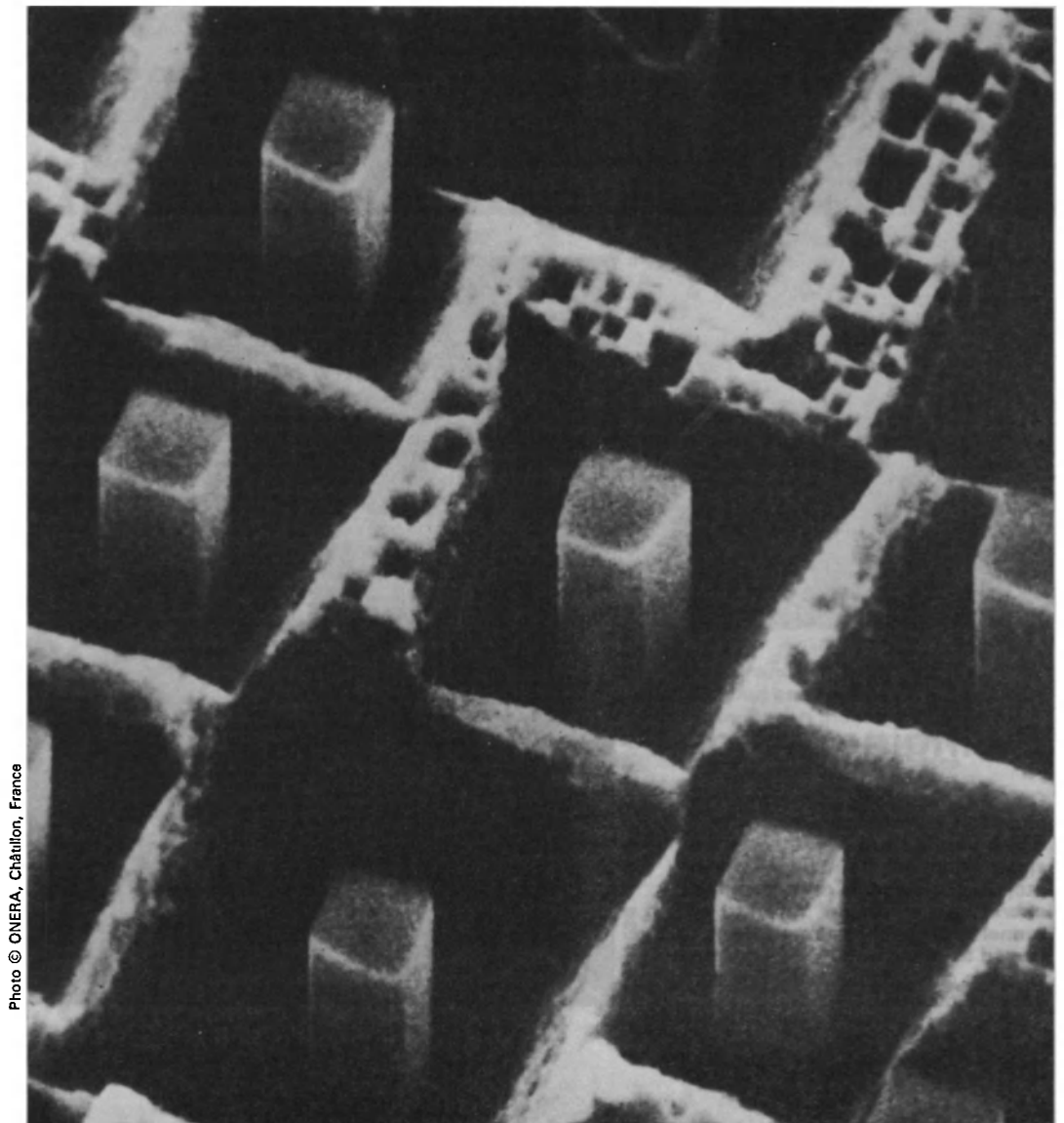


Photo © ONERA, Châtillon, France

Fuel of the future?

Liquid hydrogen is a possible fuel for aircraft of the future. However, it would require a new aircraft design incorporating giant fuel tanks (right).

Drawing J.M. Troillard © Science et Vie, Paris

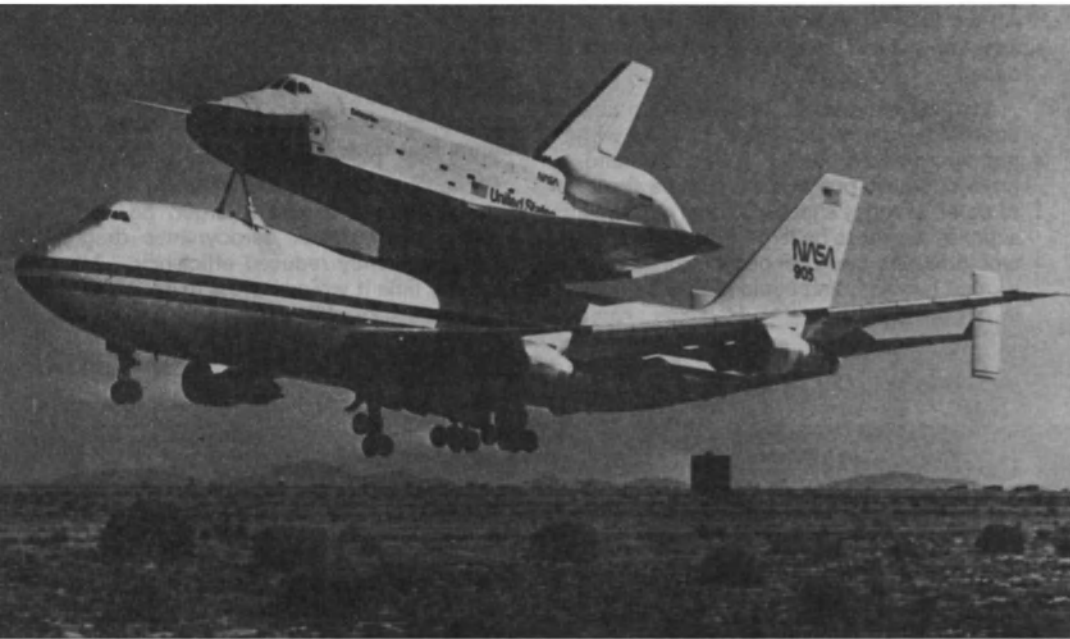
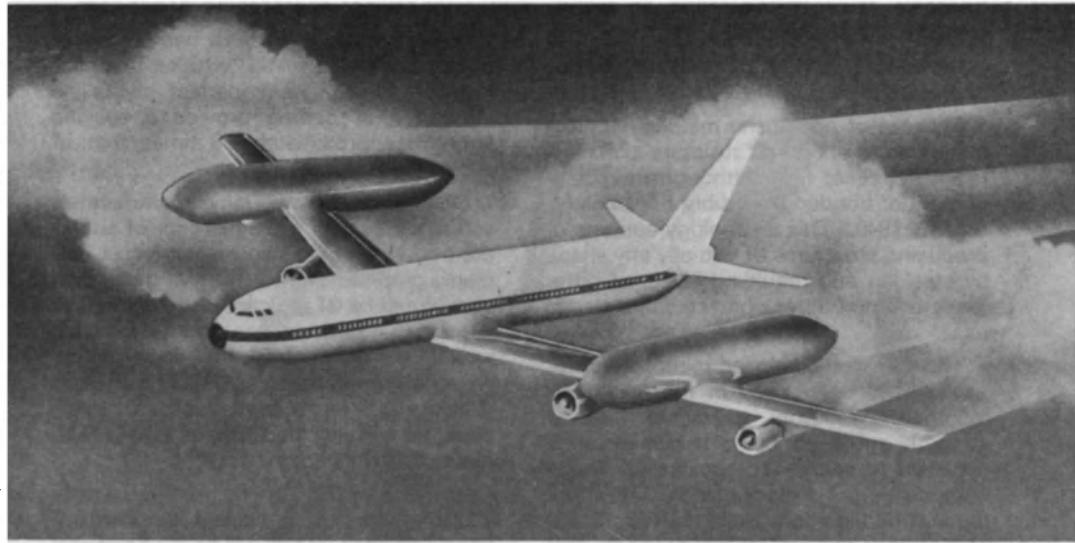


Photo © USIS, Paris

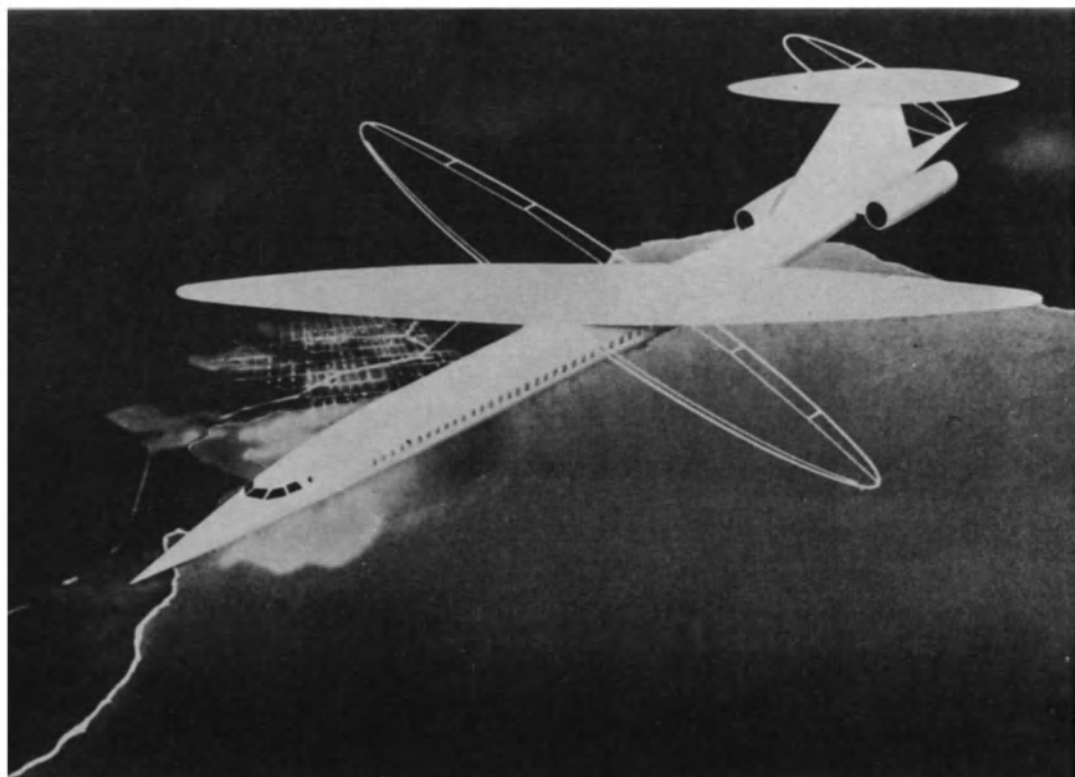
Space Shuttle on piggyback

The U.S. Space Shuttle has already made its first free flight after being launched from a specially adapted carrier (here shown taking off). When fully operational it will leave Earth powered by its twin rockets, go into orbit, perform a space mission and then return and land like a glider. After refuelling it will be ready for its next flight.

Swinging wings

One proposed design for tomorrow's aircraft is the oblique-wing plane which would fly at slightly over the speed of sound. The wing, located atop the fuselage, is rotated as the aircraft gathers speed. (In wind tunnel testing it has already been turned as much as 50°.) If maximum speed is carefully controlled no sonic boom is created.

Photo © USIS, Paris



energy per kilometre than conventional aircraft. On a long flight the energy economy would be significant. Nevertheless, cost is a serious hurdle.

Another problem that cannot be taken lightly is the storage and handling of liquid hydrogen. One expert estimates that the complex required at a major international airport for the storage and handling of liquid hydrogen for wide-body jets would be 30 times the size of the gigantic U.S. Apollo Space Programme installations near New Orleans.

The proponents of liquid hydrogen, however, stress a number of advantages of this fuel. There would be a dramatic reduction in the noxious exhaust fumes from commercial transport aircraft. The major exhaust product of liquid hydrogen is water vapour, with minute amounts of oxides of hydrogen. With careful design, they assert, the latter could be reduced far below that of equivalent kerosene-fuelled jet engines.

Furthermore, hydrogen-fuelled supersonic transport aircraft of the future would generate a lighter supersonic boom, and these second- or third-generation supersonic transports will require 40 per cent less energy than if synthetic jet fuel is used.

As we near the end of the century, new aircraft, particularly those operating in the subsonic and transonic ranges, may benefit from current developments in wing aerodynamics and even from entirely new concepts in the use of wing structures.

Some of these changes may not even be noticed by the casual observer. For example, by increasing wing thickness or reducing sweep, we may significantly reduce the weight of wings and greatly improve aerodynamic efficiency. The result would be lower fuel consumption or much smaller engine sizes to carry the same payload over a given distance. Another by-product could be reduced noise on the approach to airports.

Other, even more sophisticated changes in wing design involve controlling the airflow around the wings in order to reduce turbulent flow and thereby reduce drag. This could result in fuel savings of as much as 50 per cent.

An even stranger-looking design is the proposed oblique-wing aircraft, which would fly at speeds slightly over that of sound. A relatively long, narrow, straight wing is located atop the fuselage, forming a shape which turns out to be ideal for both low-speed and high-speed flight. As the

aircraft picks up speed, the wing is rotated. In wind-tunnel testing it has been turned as much as 50°. The remarkable thing is that at low supersonic speeds (up to Mach 1.5) in the wind tunnel such asymmetrical models have been found to be more stable than models of conventional aircraft. Also, if the maximum speed is carefully controlled, no sonic boom is created.

Because of new developments in shielding nuclear reactors and successful tests which have shown that there would be no release of radioactive material in the event of a crash, we may see nuclear power coming to the fore for aircraft propulsion.

The temperatures generated are sufficient to drive a turbofan engine suitable for powering subsonic transports. However, because of the concentrated weight of the reactor and its shielding, very large aircraft would be required, probably weighing in at 500 tonnes or more. A nuclear-powered transport aircraft could provide a range equal to some 10,000 continuous flight hours without refuelling.

In the same weight range or larger is the "flying wing" that many designers have dreamed of for years. Some feel that the flying wing, unencumbered as it is with the long body structure of conventional air-

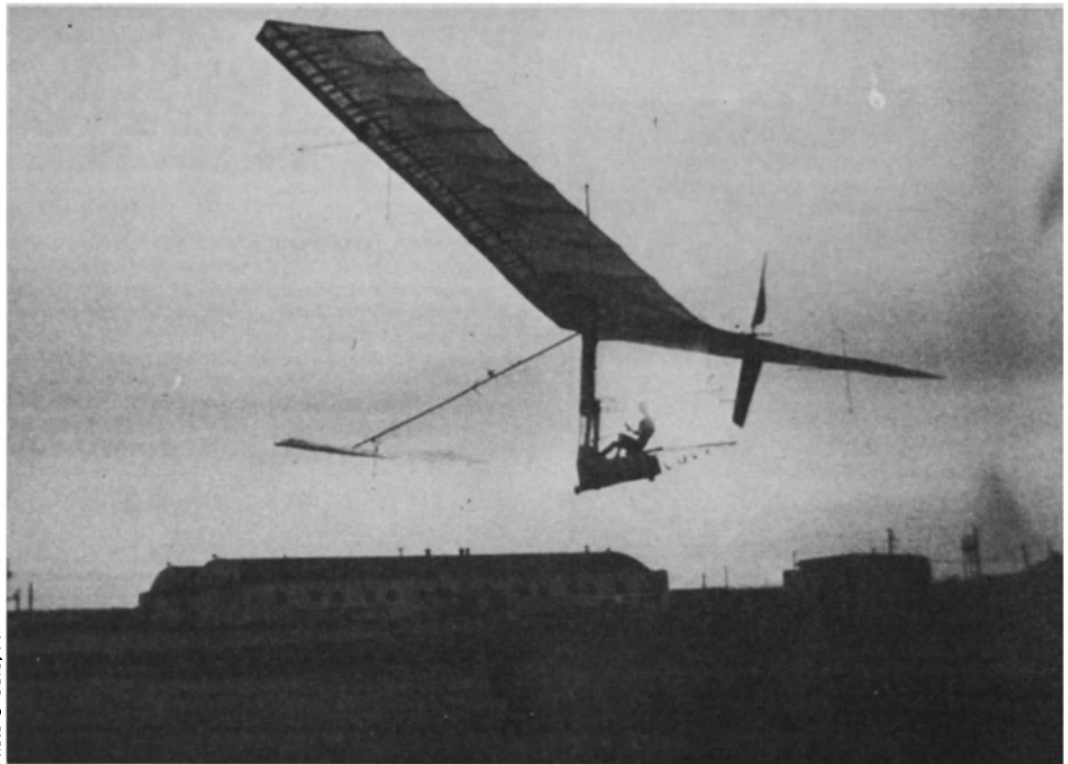


Photo © USIS, Paris

Pedalling on air

On 23 August 1977 the first successful man-powered flight took place in California (U.S.A.). At the controls of the flimsy-looking *Gossamer Condor* was a young hang-glider pilot and bicycle racer, Bryan Allen, who triumphantly walked off with an \$86,000 prize awarded by British industrialist Henry Kremer. Competitors had been trying to win it for 18 years. Propelling the craft with a bicycle-pedal mechanism, he flew the figure-eight course around two pylons 800 metres apart in seven minutes. The craft, designed by aeronautical engineer Paul MacCready, was made of piano wires, aluminium tubing and see-through plastic. With a wingspan of 28 metres, it weighed only 32 kilos.

craft, is the most efficient design obtainable. Others believe it to be inherently unstable.

The wing required for take-off and landing would have to be deep enough to provide lift, and would thus have enough room for the payload—possibly 1,500 to 2,000 passengers and 300 tonnes of cargo—which could be distributed over the entire span. A first-generation vehicle could use conventional engines, while second-generation flying wings might have a fusion reactor. The later version would have an unlimited range; its cruising speed would be some 1,000 km. per hour.

Looking further ahead, we may eventually see an even more revolutionary aircraft, capable of travelling at Mach 6—i.e. six times the speed of sound. The fuel, liquid hydrogen, would also be used to cool the aircraft's skin, compensating for the enormous heat generated at such a high speed. Researchers look on the Mach 6 hypersonic transport as the logical successor of the March 3-4 class supersonic transports of the nearer future, which will probably also be powered by liquid hydrogen.

Why Mach 6? The answer is that this seems to be the upper speed limit that fits the practical journey times for long-range flights of from 8,000 to 10,000 km. Such a hypersonic plane, carrying between 300 and 400 passengers and looking not much different from today's Anglo-French delta-wing Concorde, except in size, would make the non-stop trip from Los Angeles to Paris in less than three hours.

Although there seems little doubt in the minds of many scientists today that such a craft could be built some time early in the 21st century, there certainly is some doubt as to its practicality. Nevertheless, experimental versions of ramjet engines necessary for powering the hypersonic transport are already in research and development.

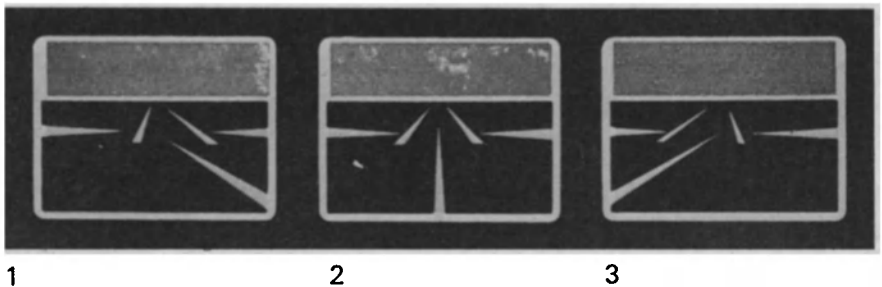
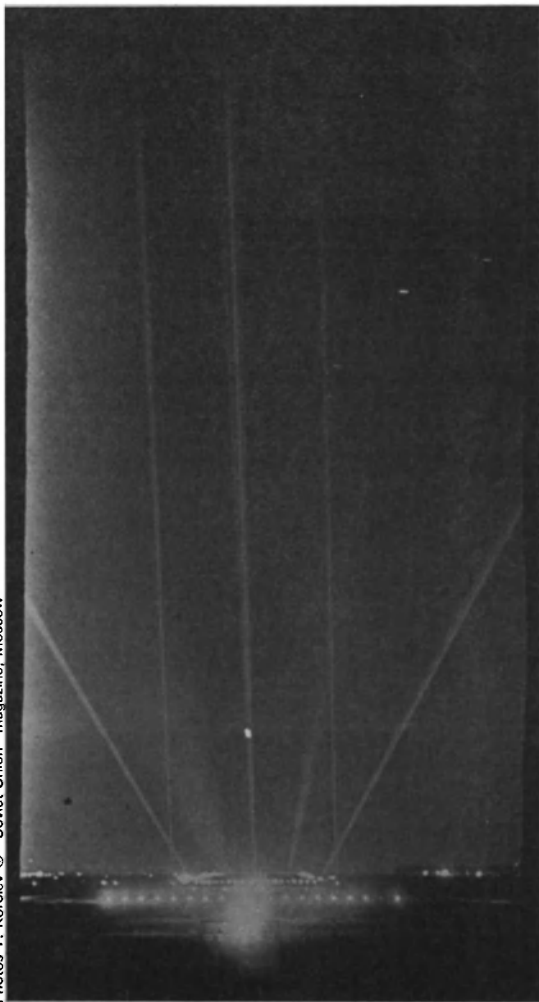
Much closer on the horizon, however, is a vehicle that represents an equally radical departure from the norm: the U.S. Space Shuttle. It is the first offspring of the marriage between aerodynamics (it is a glider) and space technology (it uses rocket control when in space). This large aerospace transport vehicle is now well ahead in development.

The first re-usable space transport system, the shuttle will leave Earth boosted by immense twin solid propellant rockets, go into orbit, manoeuvre in space as required to perform its mission, then return and land without power—something like a conventional jet transport aircraft, except that the pilot will have to control it like a glider during a lengthy landing approach. After refuelling, it should be ready for its next flight and could be used for hundreds of missions.

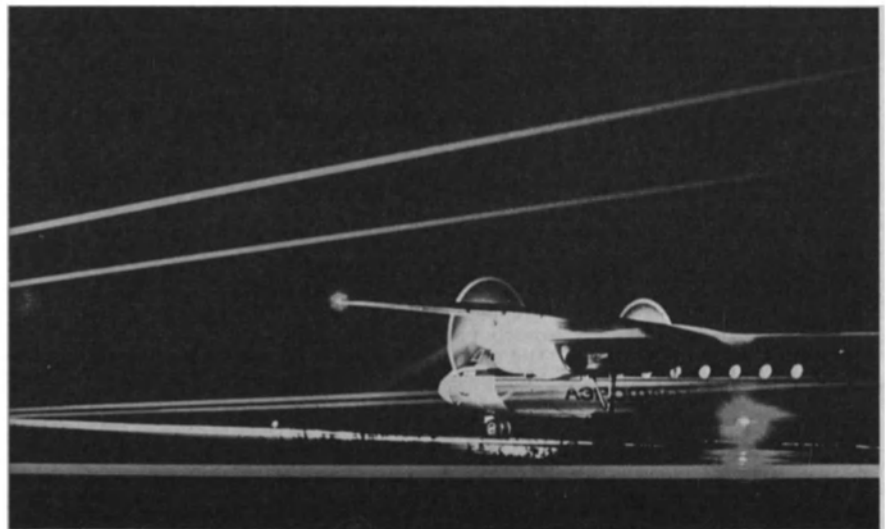
The first fully operational flight of the Space Shuttle is expected in 1980, and the life of the programme as presently conceived could carry it up to the turn of the century. And if these missions are successful, one can expect that at some point during the next 20 years a follow-up programme for an even more versatile Shuttle might evolve. For this is just the beginning.

■ Charles D. LaFond

Landing on laser beams



A new landing system using laser beams was perfected in late 1977 by Soviet scientist Igor Berezhnoi. Known as Glissada, the system reduces the pilot's reliance on his instrument panel in conditions of poor visibility or at night. Five powerful red beams (left), which present no danger to vision, are visible 20 km. away. Three of them indicate the edges and centre line of the runway; the other two show the glide path. Schematic representations above show what the pilot sees on his glide path as he comes in to land: 1.) plane is left of course; 2.) on course; 3.) right of course. Shown below, plane touching down at night with the aid of Glissada. The new system is already being patented in sixteen countries including the U.S.A., the U.K., the Fed. Rep. of Germany and France.



Bookshelf

RECENT UNESCO BOOKS

- **The Image of the Buddha**, edited by David L. Snellgrove. A major study of the many forms in which the ideal of Buddhahood has found artistic expression over some 2,500 years. 58 colour plates and 310 black and white illustrations. 1978, 482 pp., Co-published with Kodansha International Ltd., Tokyo, who are exclusive distributors for the U.S.A. Other exclusive distributors: Serindia Publications for the U.K. and Vikas publishers for India. (220 F).
- **Maori Art of New Zealand**, by Terence Barrow. Co-published with A.H. and W. Reed, Australia and New Zealand. 1978, 108 pp. illus. (28 F).
- **Population Education: a Contemporary Concern**. 1978, 120 pp. (No. 28 in Unesco's "Educational Studies and Documents" series) (14 F).
- **Aspects of Algerian Cultural Policy**, by Sid-Ahmed Baghli. 1978, 57 pp. (10 F).
- **Communication Policies in Japan**, by Hidetoshi Kato. 1978, 57 pp. (12 F).
- **Growing up in Cities**, edited by Kevin Lynch. Studies of the environment of adolescents in Cracow, Melbourne, Mexico City, Salta (Argentina), Toluca (Mexico) and Warsaw. 1977, 177 pp. illus. Co-published with the MIT Press, Cambridge, Mass., U.S.A. and London, U.K., who have exclusive sales rights in U.S.A. and U.K. (48 F).
- **Namibia: the Effects of Apartheid on Culture and Education**, by Marion O'Callaghan. 1977, 169 pp. (35 F).
- **Race and Class in Post-Colonial Society**. A study of ethnic group relations in the English-speaking Caribbean, Bolivia, Chile and Mexico. 1977, 458 pp. (65 F).
- **Ecosocial Systems and Ecopolitics**, Edited by Karl W. Deutsch. A reader on human and social implications of environmental management in developing countries. 1977, 368 pp. (70 F).
- **Handbook on the International Exchange of Publications**, edited by Frans Vanwijngarden. 1978, 165 pp. (38 F).
- **Statistics of Educational Attainment and Illiteracy 1945-1974**. A report covering 202 countries and territories, prepared with the co-operation of the U.N. Statistical Office. (No. 22 in Unesco's "Statistical Reports and Studies" series) 1977, 233 pp. (26 F).
- **Directory of Documentation, Libraries and Archives Services in Africa**, by Dominique Zidouemba (revised and enlarged by Eric de Grolier). 1977, 311 pp. (60 F).

Thai airport plan takes off

With the help of the United Nations Development Programme (UNDP) Thailand has launched an airport development plan to bring its domestic air services into the jet age. A master plan will be drawn up incorporating the development needs of the country's 31 domestic airports, many of them in remote areas which can only be reached by air.

Apartheid and sickness

On the occasion of the International Day for the Elimination of Racial Discrimination (21 March 1978), which coincided with the launching of International Anti-Apartheid Year, Dr. Halfdan Mahler, Director-General of the World Health Organization, reaffirmed WHO's condemnation of apartheid in these terms: "The destructive invasion of apartheid into all spheres of human existence has not spared one of the most cherished human values: health. There is an enormous gap between the state of health of the white minority and that of the black majority. The patterns and levels of nutrition, sickness and mortality of whites and blacks are so different that it would be difficult to believe that they refer to populations which have been living within the same country for centuries."

Cape Verde— Unesco's 144th Member State

The Republic of Cape Verde signed the constitution of Unesco on 15 February 1978, bringing the total number of Unesco Member States to 144. The Cape Verde Islands (capital Praia on Santiago island), a former Portuguese colony situated in the Atlantic 500 km. from the African coast, is a major stopping-off point for transatlantic shipping.

Blind dolphins of the Indus

In 1974 only 50-odd fresh-water dolphins were alive in the Indus river, and this rare species faced extinction. Today numbers have risen (198, including some 30 babies, were recently counted) thanks to conservation measures taken by the Pakistani authorities with the aid of the World Wildlife Fund based in Morges (Switzerland). The Indus dolphin, which lives in muddy waters, has lost the use of its eyes and relies on a highly developed sonar system to move about and find food.

Clean air for the Acropolis

For the first time since the World Health Organization (WHO) began its environmental pollution control project in Athens there has been a dramatic drop (50% for the period mid-Nov. 1977 to mid-Jan. 1978) in the level of sulphur dioxide which causes much of the Greek capital's air pollution. A regulation issued by the Greek government, on the recommendation of WHO, has prohibited the use of heavy high sulphur oils for heating in the Athens area. This measure, which has not only improved health conditions in Athens but also removed a major cause of the deterioration of the Acropolis monuments, follows a series of studies carried out with the aid of Unesco specialists.

New Unesco records

Two new titles have been released in the Unesco-sponsored "Musical Atlas" record collection (Odeon/EMI): Music of the Baka Pygmies of Cameroon (3C 064-18265) and Traditional Arab Music from Morocco (3C 064-18264). Forthcoming recordings in the Unesco-sponsored "Musical Sources" collection (Philips) include Australian Aboriginal Music, Religious Songs from Corsica, and Osawa Daiko Japanese Drums. (The Unesco record collections are edited for the International Music Council by the International Institute for Comparative Music Studies.) *Please do not send orders to Unesco. Order through your local record dealer.*

Drought and hunger in the Sahel

The food situation in the African Sahel following last year's drought is worse than at first expected, reports Mr. Edouard Saouma, Director-General of the Food and Agriculture Organization of the United Nations (FAO). Upper Volta, Mali and Chad have joined Mauritania, Senegal and Gambia on the list of stricken countries. Aid operations, co-ordinated by the World Food Programme, have been going on since the beginning of the crisis in September 1977.

Cultural co-operation in Europe

A new plan for cultural co-operation involving 22 European countries has been adopted by the Council of Europe in Strasbourg. The plan includes six major projects on the following themes: secondary education and preparation for life; innovations in higher education; the development of adult education; modern languages teaching; cultural development policies; and culture and the media.

Human Rights: signed but not yet ratified

In our November 1977 issue, we indicated in footnotes (pages 29 and 32) that 69 Member States had ratified or acceded to the International Covenant on Economic, Social and Cultural Rights, and that 68 States had ratified or acceded to the International Covenant on Civil and Political Rights. We also listed 28 countries as having ratified or acceded to the Optional Protocol relating to the Covenant on Civil and Political Rights. In point of fact, these figures did not represent ratifications or accessions to the Covenants and to the Protocol but more broadly to the number of States which had merely signed them. Not all the States which have signed these instruments have formally ratified or acceded to them. We ask readers to excuse this confusion of terms which do not have the same legal weight. As of April 1978 49 States had ratified or acceded to the first of these Covenants, 47 the second, and 18 the Protocol.

Letters to the editor

A YOUTHFUL VOICE ON WORLD PROBLEMS

Sir,

Several critical problems face the world today and increasingly menace its future. The main problem is overpopulation, mainly in the poor countries where there is a need for education and information. Population is increasing at an immense rate, and feeding all these people is becoming a big problem.

For the moment, the U.S.A., the U.S.S.R. and Europe have enough surplus food to supply the poor countries. But instead of doing this we live on a mountain of products that we can hardly consume. We waste and eat far too much rich and fat food, and in so doing we threaten our own health.

Why is this waste and over-consumption so dangerous? Consumption needs production, and production needs energy, lots of energy, and energy comes mostly from oil, which will be used up by 1995-2000. It is the poor countries that need oil in order to develop technologically advanced agriculture to supply their starving people.

Why is nuclear energy not a solution? Nuclear energy needs uranium and plutonium—and they will be used up in about 50 years.

The fact that \$43 million are spent every hour on military purposes throughout the world, day and night, does not make the situation easier. Isn't it ridiculous to spend so much money on weapons that are only used to kill? All the weapons in the world today could kill the Earth's population about 20 times over.

Pollution in water, air and soil have ecological effects and bring about climatic changes. These effects could destroy agriculture and drastically cut down the production of food.

I could go on listing problems for ever, but these are the most important. They are probably too big for an individual to cope with but they are certainly not insoluble if we all work together. For many people who are not young and do not have their whole lives in front of them find it hard to see what they could do.

Educating and informing your children and grandchildren is very, very important, giving them love and respect so that they will go out into the world with high moral values and a determination to solve problems.

For young people it is best to choose to educate yourselves as much as possible and choose a job that can help the world; for example as doctors, engineers, agricultural economists, politicians, missionaries, etc.

I hope that we can together make a decent future for ourselves and for posterity, although the future is full of big problems.

Hakan Björkman
16 years old
Brussels

SHOULD HUMAN RIGHTS BE COMPULSORY?

Sir,

I should like to draw your attention to article 26 (1) of the Universal Declaration of Human Rights, the full text of which you published in your November 1977 issue.

This article declares that everyone has the right to education and that in the elementary and fundamental stages it shall be free. No one could quarrel with this. Why then does the article continue by saying that "elementary education shall be compulsory"? Is the Declaration excluding the rights of children

(or their parents) not to be compelled if they so choose?

I know the argument that where education is not compulsory poor communities have no choice but to put their children to work rather than sending them to school, but who is to say that they are wrong in so doing? I think a clause insisting on compulsion has no place in a document dealing with human rights.

Sheila M.S. Thomson
London, U.K.

Editor's note. Prof. K. Vasak, Director of Unesco's Division of Human Rights and Peace, replies:

The problem of negative human rights is a formidable one. If we have the right to live, should we not also have the right to die? If we have the right to marry, do we not also have the right not to marry?

But if we all have the right to freedom and personal security, we certainly do not have the right to renounce this right and opt for slavery.

What this boils down to is that the international community, rightly or wrongly, considers that certain human rights involve not only individuals but also the society at large. Consequently, the international community insists that such rights be exercised (or not be exercised) in a certain way. The right to education is one of these. The international community is convinced that, to be a human being worthy of the name, a person must benefit from primary education: hence primary education should be compulsory. The problem is similar to that posed above with respect to freedom and security of the person, and their negation—slavery.

Obviously, one does not have to agree with the international community. In disagreeing, Miss Thomson is exercising her human right to freedom of opinion and expression.

Sadriddin Ayni A great Central Asian poet of freedom

APRIL 1978 marks the centenary of the birth of Sadriddin Ayni, a great and original writer who wrote in two languages—Tadzhik and Uzbek—both of which are spoken in his native region of Bukhara (in what is today Soviet Central Asia). The works of Sadriddin Ayni, who died in 1954, are widely read in the U.S.S.R., where they have been translated into 36 languages. But even outside the U.S.S.R., there had been 300 publications of his works by 1970.

The son of a craftsman, he was orphaned at 11 years of age, and in order to continue his studies in a *madrasah* (a Muslim religious school) he worked as a street sweeper and a porter, and took a number of other jobs. When he was 18, he began to write poems, many of which were inspired by popular festivals and fairs.

An educator as well as a poet, Sadriddin Ayni developed a critical attitude towards the feudal regime in Bukhara which altered the course of his life. In 1905 he headed a pioneering school in Bukhara which practised new teaching methods, and when the school was closed down by the clergy, he and his supporters organized clandestine

lessons for illiterate adults. Ten years later he was forced to flee from his native city because of his opposition to the regime.

On his return to Bukhara in Spring 1917, he was arrested, brutally beaten and

thrown into jail where he stayed until his release by the soldiers of the Revolution. But it was only after 1920 and the fall of the Emir of Bukhara that Sadriddin began to express himself fully and freely as a writer and an educator, taking an active part in the creation of the country's first Soviet schools and writing a number of handbooks for teachers.

But although Sadriddin Ayni was a poet, he was above all a writer of prose. His rich experience of life, his profound knowledge of the customs and traditions of Tadzhikistan and Uzbekistan and his constant striving for freedom permeate all his work, from the stories in *The Hangman of Bukhara* (1922) to his epic novel *Slaves* (1934-1935) and his four volumes of *Memoirs* (1948-1954).

A humanist of encyclopaedic range Sadriddin Ayni unflinchingly pursued his work as an educator and writer until the end of his life. The first President of the Tadzhikistan S.S.R.'s Academy of Sciences, founded in 1951, he was also an honorary member of the Uzbekistan Academy of Sciences.



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Sadriddin Ayni in 1925

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your seat belts!



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In 1911, when this group posed on a French Farman plane for a souvenir photo, only eight years had elapsed since the first powered plane flight, but aviation had already made great progress. In that year, more than 1,350 planes were built around the world; pioneering airmail services began in Europe, the United States and India; and the Frenchman Louis Bréguet broke a record by piloting no less than 10 passengers! In 1911, 12,000 passengers took to the air (more than twice as many as in 1910). In the last three decades (1947-1977) civil aircraft have carried almost 6 billion passengers — one and a half times the world's population.