The Convention on
International Civil Aviation

Annexes 1 to 18

International Civil Aviation Organization

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ANNEX 1
to the Convention on
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Personnel Licensing

As long as air travel cannot do without pilots and other air and ground personnel, their competence, skills and training will remain the essential guarantee for efficient and safe operations. Adequate personnel training and licensing also instill confidence between States, leading to international recognition and acceptance of personnel qualifications and licences and greater trust in aviation on the part of the traveller.

Standards and Recommended Practices for the licensing of flight crew members (pilots, flight engineers and flight navigators), air traffic controllers, aeronautical station operators, maintenance technicians and flight dispatchers, are provided by Annex 1 to the Convention on International Civil Aviation. Related training manuals provide guidance to States for the scope and depth of training curricula which will ensure that the confidence in safe air navigation, as intended by the Convention and Annex 1, is maintained. These training manuals also provide guidance for the training of other aviation personnel such as aerodrome emergency crews, flight operations officers, radio operators and individuals involved in other related disciplines.

Today's aircraft operations are so diverse and complex that protection must be provided against the possibility, however remote, of total system breakdown due to either human error or failure of a system component.

The human being is the vital link in the chain of aircraft operations but is also by nature the most flexible and variable. Proper training is necessary so as to minimize human error and provide able, skilful, proficient and competent personnel. Annex 1 and ICAO training manuals describe the skills necessary to build proficiency at various jobs, thereby contributing to occupational competency. The medical standards of the Annex, in requiring periodic health examinations, serve as an early warning for possible incapacitating medical conditions and contribute to the general health of flight crews and controllers.

The Human Factors programme addresses known human capabilities and limitations, providing States with basic information on this vital subject as well as the material necessary to design proper training programmes. ICAO's objective is to improve safety in aviation by making States more aware of, and responsive to, the importance of human factors in civil aviation operations.

Licensing is the act of authorizing defined activities which should otherwise be prohibited due to the potentially serious results of such activities being performed improperly. An applicant for a licence must meet certain stated requirements proportional to the complexities of the task to be performed. The licensing examination serves as a regular test of physical fitness and performance ensuring independent control. As such, training and licensing together are critical for the achievement of overall competency.

One of ICAO’s main tasks in the field of personnel licensing is to foster the resolution of differences in licensing requirements and to ensure that international licensing standards are kept in line with current practices and probable future developments. This is ever more crucial as the flight crew will be exposed to increasing traffic density and airspace congestion, highly complicated terminal area patterns and more sophisticated equipment. To accomplish this task, Annex I is regularly amended to reflect the rapidly changing environment.

ANNEX 2
to the Convention on
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Rules of the Air

Air travel must be safe and efficient; this requires, among other things, a set of internationally agreed rules of the air. The rules developed by ICAO - which consist of general rules, visual flight rules and instrument flight rules contained in Annex 2 - apply without exception over the high seas, and over national territories to the extent that they do not conflict with the rules of the State being overflown. The pilot-in-command of an aircraft is responsible for compliance with the rules of the air.

An aircraft must be flown in accordance with the general rules and either the visual flight rules (VFR) or the instrument flight rules (IFR). Flight in accordance with visual flight rules is permitted if a flight crew is able to remain clear of clouds by a distance of at least 1 500 m horizontally and at least 300 m (1 000 ft) vertically and to maintain a forward visibility of at least 8 km. For flights in some portions of the airspace and at low altitudes, and for helicopters, the requirements are less stringent. An aircraft cannot be flown under VFR at night or above 6 100 m (20 000 ft) except by special permission. Balloons are classified as aircraft, but unmanned free balloons can be flown only under specified conditions detailed in the Annex.

Instrument flight rules must be complied with in weather conditions other than those mentioned above. A State may also require that they be applied in designated airspaces regardless of weather conditions, or a pilot may choose to apply them even if the weather is good.

Most airliners fly under IFR at all times. Depending upon the type of airspace, these aircraft are provided with air traffic control service, air traffic advisory service or flight information service regardless of weather conditions. To fly under IFR, an aircraft must be equipped with suitable instruments and navigation equipment appropriate to the route to be flown. When operating under air traffic control the aircraft must maintain precisely the route and altitude that have been assigned to it and keep air traffic control informed about its position.

A flight plan must be filed with air traffic services units for all flights that will cross international borders, and for most other flights that are engaged in commercial operations. The flight plan provides information on the aircraft's identity and equipment, the point and time of departure, the route and altitude to be flown, the destination and estimated time of arrival, and the alternate airport to be used should landing at destination be impossible. The flight plan must also specify whether the flight will be carried out under visual or instrument flight rules.

Regardless of the type of flight plan, the pilots are responsible for avoiding collisions when in visual flight conditions, in accordance with the principle of see-and-avoid. However, flights operating under IFR are either kept separated by air traffic control units or provided with collision hazard information.

Right-of-way rules in the air are similar to those on the surface, but, as aircraft operate in three dimensions, some additional rules are required. When two aircraft are converging at approximately the same level, the aircraft on the right has the right of way except that aeroplanes must give way to airships, gliders and balloons, and to aircraft which are towing objects. An aircraft which is being overtaken has the right of way and the overtaking aircraft must remain clear by altering heading to the right. When two aircraft are approaching each other head on they must both alter heading to the right.

As interceptions of civil aircraft are, in all cases, potentially hazardous, the Council of ICAO has formulated special recommendations in Annex 2 which States are urged to implement through appropriate regulatory and administrative action. These special recommendations are contained in Attachment A to the Annex

All these rules, when complied with by all concerned, help make for safe and efficient flight.

ANNEX 3
to the Convention on
International Civil Aviation

Meteorological Service for International Air Navigation

Pilots need to be informed about meteorological conditions along the routes to be flown and at their destination aerodromes.

The object of the meteorological service outlined in Annex 3 is to contribute to the safety, efficiency and regularity of air navigation. This is achieved by providing necessary meteorological information to operators, flight crew members, air traffic services units, search and rescue units, airport management and others concerned with aviation. Close liaison is essential between those supplying meteorological information and those using it.

At international aerodromes the meteorological information is normally supplied to aeronautical users by a meteorological office. Suitable telecommunications facilities are made available by States to permit those aerodrome meteorological offices to supply information to air traffic services and search and rescue services. Telecommunications between the meteorological office and control towers or approach control offices should be such that the required points may normally be contacted within 15 seconds.

Aerodrome reports and forecasts are required by aeronautical users to carry out their functions. Aerodrome reports include surface wind, visibility, runway visual range, present weather, cloud, air and dew-point temperature and atmospheric pressure, and are issued either half-hourly or hourly. These reports are complemented by special reports whenever any parameter changes beyond pre-fixed limits of operational significance. Aerodrome forecasts include surface wind, visibility, weather, cloud and temperature, and are issued every three or six hours for a validity period of 9 to 24 hours. Aerodrome forecasts are kept under continuous review and amended by the meteorological office concerned, as necessary.

Landing forecasts are prepared for some international aerodromes to meet requirements of landing aircraft. They are appended to the aerodrome reports and have a validity of two hours. Landing forecasts contain expected conditions over the runway complex in regard to surface wind, visibility, weather and cloud.

To assist pilots with their flight planning, most States provide meteorological briefings which are increasingly carried out using automated systems. Briefings comprise details of en-route weather, upper winds and upper-air temperatures, often given in the form of meteorological charts, warnings related to hazardous phenomena en-route, and reports and forecasts for the destination aerodrome and its alternates.

To provide aircraft in flight with information about significant changes in weather, meteorological watch offices are maintained. They prepare warnings of hazardous weather conditions, including thunderstorms, tropical cyclones, severe squall lines, heavy hail, severe turbulence, severe icing, mountain waves, sandstorms, duststorms and volcanic ash clouds. Moreover, these offices issue aerodrome warnings of meteorological conditions that could adversely affect aircraft or facilities on the ground: for example, warnings of expected snowstorms. They also issue warnings for wind shear for the climb-out and approach paths. Furthermore, aircraft in flight are required to report severe weather phenomena encountered en route. These reports are disseminated by the air traffic services units to all aircraft concerned.

On most international routes routine observations are made by aircraft of upper winds and temperatures. They are transmitted by aircraft in flight to provide observational data that can be used in the development of forecasts. These aircraft observations of winds and temperatures are being automated using the air-ground data link communications.

As far as route forecasts are concerned, all flights require advance and accurate meteorological information so as to chart a course that will permit them to make use of the most favourable winds and conserve fuel. With rising fuel costs, this

has become increasingly important. Therefore, ICAO has implemented the World Area Forecast System (WAFS). The purpose of this system is to provide States and aviation users with standardized and high-quality forecasts on upper-air temperature, humidity and winds and on significant weather. The WAFS is based on two world area forecast centres which use the most up-to-date computers and satellite telecommunications (ISCS and SADIS) to prepare and disseminate global forecasts in digital form directly to States and users.

During the past few years a number of incidents have occurred due to aircraft encounters with volcanic ash clouds following volcanic eruptions. In order to provide for the observation and reporting of volcanic ash clouds and the issuance of warnings to pilots and airlines, ICAO, with the assistance of other international organizations, has established an international airways volcano watch (IAVW). The corner stones of the IAVW are nine volcanic ash advisory centres which issue advisory information on volcanic ash globally, both to aviation users and meteorological offices concerned.

Automated observing systems are becoming increasingly useful at aerodromes and currently are considered to meet the aeronautical requirements as far as the observation of the surface wind, visibility, runway visual range and height of the cloud base, air and dew-point temperature and atmospheric pressure are concerned. In view of the improved performance of fully automated systems, they may now be used, without any human intervention, during non-operational hours of the aerodrome.

ANNEX 4
to the Convention on
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Aeronautical Charts

The world of aviation, which by its very nature knows no geographical or political boundaries, requires maps that are unlike those used in ground transportation. For the safe performance of air operations it is essential that a current, comprehensive and authoritative source of navigation information be made available at all times, and aeronautical charts provide a convenient medium for supplying this information in a manageable, condensed and coordinated manner. It is often said that a picture is worth a thousand words, however, today's often complex aeronautical charts may be worth much more. Aeronautical charts not only provide the two dimensional information common in most maps, but also often portray three dimensional air traffic service systems. Almost all ICAO States produce aeronautical charts and most segments of aviation make reference to them for planning, air traffic control and navigation purposes. Without the global standardization of aeronautical charts it would be difficult for pilots and other chart users to effectively find and interpret important navigation information. The safe and efficient flow of air traffic is facilitated by aeronautical charts drawn to accepted ICAO Standards.

The Standards, Recommended Practices and explanatory notes contained in Annex 4 define the obligations of States to make available certain ICAO aeronautical chart types, and specify chart coverage, format, identification and content including standardized symbology and colour use. The goal is to satisfy the need for uniformity and consistency in the provision of aeronautical charts that contain appropriate information of a defined quality. When a published aeronautical chart contains "ICAO" in its title, this indicates that the chart producer has conformed to both general Annex 4 Standards and those pertaining to a particular ICAO chart type.

The ICAO Council first adopted the original Standards and Recommended Practices in 1948. Annex 4 has its origins in "Annex J - Aeronautical Maps and Charts" of the Draft Technical Annexes adopted by the International Civil Aviation Conference in Chicago in 1944. Since the adoption of the first edition which provided specifications for seven ICAO chart types, there have been fifty-three amendments to update the Annex to accommodate the rapid advances in air navigation and cartographic technology. The ICAO series of aeronautical charts now consists of twenty-one types, each intended to serve specialized purposes. They range from detailed charts for individual aerodromes/heliports to small-scale charts for flight planning purposes and include electronic aeronautical charts for cockpit display.

There are three series of charts available for planning and visual navigation, each with a different scale. The *Aeronautical Navigation Chart — ICAO Small Scale* charts cover the largest area for a given amount of paper; they provide a general purpose chart series suitable for long-range flight planning. The *World Aeronautical Chart — ICAO 1 : 1 000 000* charts provide complete world coverage with uniform presentation of data at a constant scale, and are used in the production of other charts. The *Aeronautical Chart — ICAO 1:500 000* series supplies more detail and provides a suitable medium for pilot and navigation training. This series is most suitable for use by low-speed, short- or medium-range aircraft operating at low and intermediate altitudes.

The vast majority of scheduled flights take place along routes defined by radio and electronic navigation systems that make visual reference to the ground unnecessary. This type of navigation is conducted under instrument flight rules and the flight is required to comply with air traffic control services procedures.The *Enroute Chart — ICAO* portrays the air traffic service system, radio navigation aids and other aeronautical information essential to en-route navigation under instrument flight rules. It is designed for easy handling in the crowded space of an aircraft flight deck, and the presentation of information is such that it can easily be read in varying conditions of natural and artificial light. Where flights cross extensive oceanic and sparsely settled areas, the *Plotting Chart — ICAO* provides a means of maintaining a continuous flight record of aircraft position and is sometimes produced to complement the more complex enroute charts.

As a flight approaches its destination, more detail is required about the area around the aerodrome of intended landing.

The *Area Chart — ICAO* provides pilots with information to facilitate the transition from en-route phase to final approach phase, as well as from take-off to en-route phases of the flight. The charts are designed to enable pilots to comply with departure and arrival procedures and holding pattern procedures, all of which are coordinated with the information on the instrument approach charts. Frequently, air traffic services routes or position reporting requirements are different for arrivals and for departures and these cannot be shown with sufficient clarity on the area chart. Under these conditions a separate *Standard Departure Chart — Instrument (SID) — ICAO* and *Standard Arrival Chart — Instrument (STAR) — ICAO* are produced. The area chart may also be supplemented by a *Radar Minimum Altitude Chart — ICAO* which is designed to provide the information to enable flight crews to monitor and cross-check altitudes assigned while under radar control.

The *Instrument Approach Chart — ICAO* provides the pilot with a graphic presentation of instrument approach procedures, and missed approach procedures to be followed should the crew be unable to carry out a landing. This chart type contains a plan and profile view of the approach with full details of associated radio navigation aids and necessary aerodrome and topographical information. When a visual-type approach is flown, the pilot may refer to a *Visual Approach Chart — ICAO* which illustrates the basic aerodrome layout and surrounding features easily recognizable from the air. As well as providing orientation, these charts are designed to highlight potential dangers such as obstacles, high terrain and areas of hazardous airspace.

The *Aerodrome/Heliport Chart — ICAO* provides an illustration of the aerodrome or heliport which allows the pilot to recognize significant features, rapidly clear the runway or heliport touchdown area after landing and follow taxiing instructions. The charts show aerodrome/heliport movement areas, visual indicator locations, taxiing guidance aids, aerodrome/heliport lighting, hangars, terminal buildings and aircraft/heliport stands, various reference points required for the setting and checking of navigation systems and operational information such as pavement strengths and radio communication facility frequencies. At large aerodromes where all the aircraft taxiing and parking information cannot be clearly shown on the *Aerodrome/Heliport Chart — ICAO,* details are provided by the supplementary *Aerodrome Ground Movement Chart — ICAO* and the *Aircraft Parking/Docking Chart — ICAO*.

The heights of obstacles around airports are of critical importance to aircraft operations. Information about these are given in detail on the *Aerodrome Obstacle Charts — ICAO*, Types A, B, and C. These charts are intended to assist aircraft operators in making the complex take-off mass, distance and performance calculations required, including those covering emergency situations such as engine failure during takeoff. Aerodrome obstacle charts show the runways in plan and profile, take-off flight path areas and the distances available for take-off run and accelerate-stop, taking obstacles into account; this data is provided for each runway which has significant obstacles in the take-off area. The detailed topographical information provided by some aerodrome obstacle charts includes coverage of areas as far as 45 km away from the aerodrome itself.

Recent developments associated with “glass cockpit technologies”, the availability and exchange of electronic aeronautical information, and the increased implementation of navigation systems with high positional accuracies and continuous position fixing, have created an environment well suited to the rapid development of viable electronic charts for display in the cockpit. A fully developed electronic aeronautical chart display has the potential for functionality that extends well beyond paper charts and could offer significant benefits such as continuous plotting of the aircraft’s position and customization of the chart display depending on the phase of flight and other operational considerations. Annex 4, Chapter 20 *Electronic Aeronautical Chart Display — ICAO* provides basic requirements aimed at standardizing electronic aeronautical chart displays while not unduly limiting the development of this new cartographic technology.

Annex 4 provisions have evolved considerably from the seven original ICAO chart types adopted in 1948. To ensure that aeronautical charts meet the technological and other requirements of modern aviation operations, ICAO is constantly monitoring, improving and updating aeronautical chart specifications.

ANNEX *5*
to the Convention on
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Units of Measurement to be Used in Air and Ground Operations

The question of the units of measurement to be used in international civil aviation goes back as far as the origin of ICAO itself. At the International Civil Aviation Conference held at Chicago in 1944, the importance of a common system of measurements was realized and a resolution was adopted calling on States to make use of the metric system as the primary international standard.

A special committee was established to look into the question and as a result the First Assembly of ICAO in 1947 adopted a resolution (A1-35) recommending a system of units to be issued as an ICAO Standard as soon as possible. Stemming from this resolution, the first edition of Annex 5 was adopted in 1948. This contained an ICAO table of units based essentially on the metric system, but it also contained four additional interim tables of units for use by those States unable to use the primary table. It was evident from the beginning that the achievement of standardization in units of measurement would not be easy, and Annex 5 was initially applicable only to those units used in communications between aircraft and ground stations.

Many attempts to improve the level of standardization were made in the following years and a number of amendments to Annex 5 were introduced. By 1961 the number of tables of units in the Annex had been reduced to two, which remained until Amendment 13 was adopted in March 1979. Amendment 13 extended considerably the scope of ICAO's role in standardizing units of measurements to cover all aspects of air and ground operations and not just air-ground communications. It also introduced the International System of Units, known as SI from the "Système International d'Unités", as the basic standardized system to be used in civil aviation.

In addition to the SI units the amendment recognized a number of non-SI units which may be used permanently in conjunction with SI units in aviation. These include the litre, the degree Celsius, the degree for measuring plane angle, etc. The amendment also recognized, as do the relevant ICAO Assembly Resolutions, that there are some non-SI units which have a special place in aviation and which will have to be retained, at least temporarily. These are the nautical mile and the knot, as well as the foot when it is used in the measurement of altitude, elevation or height only. Some practical problems arise in the termination of the use of these units and it has not yet been possible to fix a termination date.

Amendment 13 to Annex 5 represented a major step forward in the difficult process of standardizing units of measurement in international civil aviation. Although complete standardization is still some time away, the foundation has been laid for resolving a problem which has been recognized by ICAO since its inception. With this amendment a very large degree of standardization has been achieved between civil aviation and other scientific and engineering communities.

Amendments 14 and 15 to Annex 5 introduced a new definition of the metre, and references to temporary non-SI units were deleted.

ANNEX 6
to the Convention on
International Civil Aviation

Operation of Aircraft
(Parts I, II and III)

The essence of Annex 6, simply put, is that the operation of aircraft engaged in international air transport must be as standardized as possible to ensure the highest levels of safety and efficiency.

In 1948 the Council first adopted Standards and Recommended Practices for the operation of aircraft engaged in international commercial air transport. They were based on recommendations of States attending the first session of the Operations Divisional Meeting held in 1946, and are the basis of Part I of Annex 6.

In order to keep pace with a new and vital industry, the original provisions have been and are being constantly reviewed. For instance, a second part to Annex 6, dealing exclusively with international general aviation, became applicable in September 1969. Similarly, a third part to Annex 6, dealing with all international helicopter operations, became applicable in November 1986. Part III originally addressed only helicopter flight recorders, but an amendment completing the coverage of helicopter operations in the same comprehensive manner as aeroplane operations covered in Parts I and II was adopted for applicability in November 1990.

It would be impractical to provide one international set of operational rules and regulations for the wide variety of aircraft which exist today. Aircraft range from commercial airliners to the one-seat glider, all of which cross national boundaries into adjacent States. In the course of a single operation, a long-range jet may fly over many international borders. Each aircraft has unique handling characteristics relative to its type and, under varying environmental conditions, may have specific operational limitations. The very international nature of commercial aviation, and of general aviation to a lesser degree, requires pilots and operators to conform to a wide variety of national rules and regulations.

The purpose of Annex 6 is to contribute to the safety of international air navigation by providing criteria for safe operating practices, and to contribute to the efficiency and regularity of international air navigation by encouraging ICAO's Contracting States to facilitate the passage over their territories of commercial aircraft belonging to other countries that operate in conformity with these criteria.

ICAO Standards do not preclude the development of national standards which may be more stringent than those contained in the Annex. In all phases of aircraft operations, minimum standards are the most acceptable compromise as they make commercial and general aviation viable without prejudicing safety. The Standards accepted by all Contracting States cover such areas as aircraft operations, performance, communications and navigation equipment, maintenance, flight documents, responsibilities of flight personnel and the security of the aircraft.

The advent of the turbine engine and associated high performance aircraft designs necessitated a new approach to civil aircraft operation. Aircraft performance criteria, flight instruments, navigation equipment and many other operational aspects required new techniques, and they in turn created the need for international regulations to provide for safety and efficiency.

The introduction of high-speed, long- and short-range aircraft, for example, created problems associated with endurance at relatively low altitudes, where fuel consumption becomes a major factor. The fuel policies of many of the international civil aviation carriers are required to take into account the need for possible diversions to an alternate aerodrome when adverse weather is forecast at the intended destination.

Clearly defined International Standards and Recommended Practices exist in respect of operating minima based on the aircraft and the environmental factors found at each aerodrome. Subject to the State of the Operator's approval, the aircraft operator has to take into account the type of aeroplane or helicopter, the degree of sophistication of equipment carried on the aircraft, the characteristics of the approach and runway aids and the operating skill of the crew in carrying out procedures involved in operations in all weather conditions.

Another development has been the introduction of provisions (generally referred to as ETOPS) to ensure safe operations by twin-engined aeroplanes operating over extended ranges, often over water. This type of operation has arisen because of the attractive economics of the large twin-engined aeroplanes now available.

The human factor is an essential component for the safe and efficient conduct of aircraft operations. Annex 6 spells out the responsibilities of States in supervising their operators, particularly in respect of flight crew. The main provision requires the establishment of a method of supervising flight operations to ensure a continuing level of safety. It calls for the provision of an operations manual for each aircraft type, and places the onus on each operator to ensure that all operations personnel are properly instructed in their duties and responsibilities, and in the relationship of such duties to the airline operation as a whole.

The pilot-in-command has the final responsibility to make sure that flight preparation is complete and conforms to all requirements, and is required to certify flight preparation forms when satisfied that the aircraft is airworthy, and that other criteria are met in respect to instruments, maintenance, mass and load distribution (and the securing of the loads), and operating limitations of the aircraft.

Another important aspect covered in Annex 6 is the requirement for operators to establish rules limiting the flight time and flight duty periods for flight crew members. The same Standard also calls for the operator to provide adequate rest periods so that fatigue occurring either on a flight, or successive flights over a period of time, does not endanger the safety of a flight. An alert flight crew must be capable of dealing not only with any technical emergencies but with other crew members and must react correctly and efficiently in case of an evacuation of the aircraft. Rules such as this must be included in the operations manual.

Critical to safe aircraft operations is the knowledge of the operating limits of each particular type of aircraft. The Annexsets out minimum performance operating limitations, with respect to aircraft in use today. These Standards take into account a significant number of factors which can affect the performance of a wide range of aircraft: mass of the aircraft, elevation, temperature, weather conditions and runway conditions, and include take-off and landing speeds under conditions which involve the failure of one or more power-units.

A detailed example is included in Attachment C to Annex 6, Part I, in which a level of performance has been calculated and found to apply over a wide range of aeroplane characteristics and atmospheric conditions.
ICAO is actively engaged in efforts to foresee the requirements of future operations such as the recent acceptance of a new set of procedures which revise the obstacle clearance requirements and instrument approach procedures for all categories of international civil commercial aviation.

Hijacking of civil aircraft has placed an additional burden on the pilot-in command. The various safety precautions that such acts necessitate, in addition to precautions of a purely technical nature, have been studied by ICAO and made to cover as many emergency situations as possible.

Part II of Annex 6 deals with aeroplanes in international general aviation. International commercial in transport operations and general aviation operations in helicopters is covered in Part III. Some international general aviation operations may be performed by crews less experienced and less skilled than commercial civil aviation personnel. eEquipment installed in some general aviation aircraft may not meet the same standard as in commercial in transport aircraft, and general aviation operations are subject to less rigorous standards and conducted with a greater degree of freedom than is found in commercial air transport operations.

Because of this, ICAO recognizes that international general aviation pilots and their passengers may not necessarily enjoy the same level of safety as the farepaying passenger in commercial air transport. Part II of the Annex, however, was designed specifically to ensure an acceptable level of safety to third parties (persons on the ground and persons in the air in other aircraft). Thus, operations involving commercial and general aviation aircraft in a common environment are required to adhere to the minimum safety standards.

ANNEX 7
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Aircraft Nationality and Registration Marks

How are aircraft classified and identified, and how can you tell aircraft nationality?

These are but two of the questions answered in the briefest ICAO Annex, which deals with aircraft nationality and registration marks, and, in a separate table, classifies aircraft by how they maintain sustained flight in the air.

The Annex is based on Articles 17 to 20 of the Chicago Convention. The ICAO Council adopted the first Standards concerning this issue in February 1949, based on recommendations from the first and second sessions of the Airworthiness Division, held in 1946 and 1947 respectively. Since then only four amendments have been made to the Annex. The latest edition is the fifth one, issued in 2003.

The first amendment introduced the definition of a "rotorcraft", and modified requirements related to the location of nationality and registration marks on wings. The second amendment redefined the word "aircraft", the use of which became effective in 1968; it also implemented a decision that all air-cushion-type vehicles, such as hovercraft and other ground-effect machines, should not be classified as aircraft.

Since Article 77 of the Convention permits joint operating organizations, Amendment 3 was introduced to define "Common Mark", "Common Mark Registering Authority" and "International Operating Agency", to enable aircraft of international operating agencies to be registered on other than a national basis. The determining principle of the related provisions is that each international operating agency must be assigned a distinctive common mark by ICAO, this being selected from a series of symbols included in the radio call signs allocated by the International Telecommunication Union (ITU).

The fourth amendment, adopted in 1981, introduces provisions related to registration and nationality marks for unmanned free balloons.

The fifth amendment, adopted in 2003, introduces a new requirement for the Certificate of Registration to carry an English translation if issued in a language other than English.

The Annex sets out procedures for selection by ICAO Contracting States of nationality marks from the nationality symbols included in the radio call signs allocated to the States of Registry by the ITU.

It sets standards for the use of letters, numbers and other graphic symbols to be used in the nationality and registration marks, and spells out where these characters will be located on different types of airborne vehicles, such as lighter-than-air aircraft and heavier-than-air aircraft.

This Annex also calls for the registration of the aircraft, and provides a sample of this certificate for use by ICAO Contracting States. This certificate must be carried in the aircraft at all times, and an identification plate, bearing at least the aircraft's nationality, or common mark and registration mark, must be affixed in a prominent position to the main entrance.

Years of considerable effort permit the classification of aircraft to be as simple as possible, and yet encompass as many types of flying machines as the human mind can devise.

ANNEX 8
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Airworthiness of Aircraft

In the interest of safety, an aircraft must be designed, constructed and operated in compliance with the appropriate airworthiness requirements of the State of Registry of the aircraft. Consequently, the aircraft is issued with a Certificate of Airworthiness declaring that the aircraft is fit to fly.

To facilitate the import and export of aircraft, as well as the exchange of aircraft for lease, charter or interchange, and to facilitate operations of aircraft in international air navigation, Article 33 of the Convention on International Civil Aviation places the burden on the State of Registry to recognize and render valid an airworthiness certificate issued by another Contracting State, subject to the condition that the airworthiness requirements under which such a certificate is issued or rendered valid are equal to or above the minimum standards which may be established by ICAO from time to time pursuant to the Convention. These minimum standards are contained in Annex 8, the first edition of which was adopted by the Council on 1 March 1949.

Annex 8 includes broad standards which define, for application by the national airworthiness authorities, the minimum basis for the recognition by States of Certificates of Airworthiness for the purpose of flight of aircraft of other States into and over their territories, thereby achieving, among other things, protection of other aircraft, third parties and property. It is recognized that ICAO Standards would not replace national regulations and that national codes of airworthiness containing the full scope and extent of detail considered necessary by individual States would be required as the basis for the certification of individual aircraft. Each State is free to develop its own comprehensive and detailed code of airworthiness or to select, adopt or accept a comprehensive and detailed code established by another Contracting State. The level of airworthiness required to be maintained by a national code is indicated by the broad standards of Annex 8 supplemented, where necessary, by guidance material provided in ICAO's *Airworthiness Technical Manual* (Doc 9760).

Annex 8 is divided into four parts. Part I includes definitions; Part II deals with procedures for certification and continuing airworthiness of aircraft; Part III includes technical requirements for the certification of new large aeroplane designs; Part IV deals with helicopters.

One of the supporting clauses in the definitions used in the Annex defines the environment in which an aircraft is expected to perform as "anticipated operating conditions". These are conditions which are known from experience or which can be reasonably envisaged to occur during the operational life of the aircraft, taking into account the operations for which the aircraft is made eligible. They also include conditions relative to the weather, terrain surrounding the aerodromes from which the aircraft is expected to operate, functioning of the aircraft, efficiency of personnel and other factors affecting safety in flight. Anticipated operating conditions do not include those extremes which can be effectively avoided by operating procedures and those extremes which occur so infrequently that higher levels of airworthiness to meet them would render aircraft operations impracticable.

Under the provisions related to continuing airworthiness of aircraft, the State of Registry must inform the State of Design when it first enters in its register an aircraft of the type certified by the latter. This is to enable the State of Design to transmit to the State of Registry any generally applicable information it has found necessary for the continuing airworthiness and for the safe operation of the aircraft. The State of Registry must also transmit to the State of Design all continuing airworthiness information originated by it for transmission, as necessary, to other Contracting States known to have on their registers the same type of aircraft.

To assist States in establishing contact with appropriate national airworthiness authorities, necessary information has been provided in an ICAO circular (Circ 95) which is available on the ICAO-Net.

The technical standards dealing with certification of aeroplanes are limited at present to multi-engined aeroplanes of over 5 700 kg maximum certificated takeoff mass. These standards include requirements related to performance, flying qualities, structural design and construction, engine and propeller design and installation, systems and equipment design and installation, and operating

limitations including procedures and general information to be provided in the aeroplane flight manual, crashworthiness of aircraft and cabin safety, operating environment and human factors and security in aircraft design.

The performance standards require that the aeroplane shall be capable of accomplishing the minimum performance specified in the Annex at all phases of flight, in the event that the critical power-unit has failed and the remaining power-units are operated within their take-off power limitations, be capable of safely continuing or abandoning its take-off. After the initial take-off phase, the aeroplane must be capable of continuing climb up to a height at which the aeroplane can continue safe flight and landing, while the remaining power-units are operating within their continuous power limitations.

The aeroplane must be controllable and stable under all anticipated operating conditions without exceptional skill, alertness or strength on the part of the pilot, even in the event of failure of any power-unit. Furthermore, the stall characteristics of the aeroplane must be such as to give the pilot clear warning, and it should be possible for the pilot to maintain full control of the aeroplane without altering engine power.

Requirements for detailed design and construction provide for a reasonable assurance that all aeroplane parts will function reliably and effectively. Functioning of all moving parts essential to safe operation must be demonstrated by suitable tests, and all materials used must conform to approved specifications. Methods of fabrication and assembly must produce a consistently sound structure which must be protected against deterioration or loss of strength due to weathering, corrosion, abrasion or other causes, which could pass unnoticed. Means must be provided which will automatically prevent emergencies or enable the crew to deal with them effectively, and design should minimize the possibility of in-flight fires, cabin depressurization and toxic gases in the aeroplane and the aircraft against lightning and static electricity.

Special consideration is given to requirements dealing with design features which affect the ability of the flight crew to maintain controlled flight. The layout of the flight crew compartment must be such as to minimize the possibility of incorrect operation of controls due to confusion, fatigue or interference. It should allow a sufficiently clear, extensive and undistorted field of vision for the safe operation of the aeroplane.

Aeroplane design features also provide for the safety, health and well being of occupants by providing an adequate cabin environment during the anticipated flight and ground and water operating conditions, the means for rapid and safe evacuation in emergency landings and the equipment necessary for the survival of the occupants following an emergency landing in the expected external environment for a reasonable time-span.

Requirements for the certification of engines and accessories are designed to ensure that they function reliably under the anticipated operating conditions. An engine of the type must be tested to establish its power or thrust from characteristics, to ensure that operating parameters are satisfactory and to demonstrate adequate margins of freedom from detonation, surge or other detrimental conditions. Tests must be of sufficient duration and must be conducted at such power and other operating conditions as are necessary to demonstrate the reliability and durability of the engine.

Following the recent events of highjacking and terrorist acts on board aircraft, special security features have been included in aircraft design to improve the protection of the aircraft. These include special features in aircraft systems, identification of a least-risk bomb location, and strengthening of the cockpit door, ceilings and floors of the cabin crew compartment.

ANNEXE 9
to the Convention on
International Civil Aviation

Facilitation

The Standards and Recommended Practices (SARPs) on Facilitation (FAL) are derived from several provisions of the Chicago Convention. *Article 37* obliges ICAO to adopt and amend from time to time international standards and recommended practices and procedures dealing with, *inter alia*, customs and immigration procedures. *Article 22* obliges each Contracting State to adopt all practicable measures to facilitate and expedite navigation by aircraft between the territories of Contracting States, and to prevent unnecessary delays to aircraft, crews, passengers, and cargo, especially in the administration of the laws relating to immigration, quarantine, customs and clearance. *Article 23* of the Convention expresses the undertaking of each Contracting State to establish customs and immigration procedures affecting international air navigation in accordance with the practices established or recommended pursuant to the Convention.

A number of other articles have special pertinence to the provisions of the FAL Annex and have been taken into account in its preparation. These include: *Article 10*, which requires all aircraft entering the territory of a Contracting State to land at, and depart from, an airport designated by that State for customs and other examination; *Article 13*, which require compliance of a Contracting State's entry, clearance, immigration, passports, customs and quarantine laws and regulations, by or on behalf of passengers, crew or cargo; *Article 14*, which obliges each Contracting State to take effective measures to prevent the spread by means of air navigation of communicable diseases; and *Article 24* (customs duty), *Article 29* (documents carried in aircraft) and *Article 35* (cargo restrictions).

These provisions of the Convention find practical expression in the SARPs of Annex 9, the first edition of which was adopted in 1949. The SARPs pertain specifically to facilitation of landside formalities for clearance of aircraft and commercial traffic through the requirements of customs, immigration, public health and agriculture authorities. The Annex is a wide-ranging document which reflects the flexibility of ICAO in keeping pace with international civil aviation. ICAO is recognized as being the first international body to make a real start on facilitation by developing Standards which bind its Contracting States.

The Annex provides a frame of reference for planners and managers of international airport operations, describing maximum limits on obligations of industry and minimum facilities to be provided by governments. In addition, Annex 9 specifies methods and procedures for carrying out clearance operations in such a manner as to meet the twin objectives of effective compliance with the laws of States and productivity for the operators, airports and government inspection agencies involved.

Initially, the main thrust of the Annex consisted of efforts to reduce paperwork, standardize internationally the documents that were to accompany traffic between States, and simplify the procedures required to clear aircraft, passengers and cargo. It was—as it still is—recognized that delays due to cumbersome formalities must be reduced, not just because they are unpleasant but, in practical terms, because they are costly to all of the "customer groups" in the community and because they interfere with the success of everyone.

Over the years, traffic volumes grew. States' resources for inspection regimes could not keep pace. The facilitation of landside clearance formalities became a much more complex issue. The focus of Annex 9 therefore changed. In its 11th edition (2002), the Annex 9 retained its original strategies, carried forward in all editions since the first, of reducing paperwork, standardizing documentation and simplifying procedures. However, it shifted its focus to inspection techniques based on risk management, with the objectives to increase efficiency, reduce congestion in airports and enhance security; to control abuses such as narcotics trafficking and travel document fraud; and to support the growth of international trade and tourism. In addition, new SARPs and guidance material were introduced to address certain high-profile issues of public interest such as the treatment of persons with disabilities.

More recently, the face of facilitation has been further shaped by major developments in the civil aviation environment which have occurred during the last ten years (the mid-1990s and beyond). These phenomena include: technological

progress, with the universal proliferation of the use of computers and electronic data interchange systems; massive increases in illegal migration which have become worldwide immigration and national security problems, with civil aviation the transport mode of choice and passport fraud a frequent tactic; and ongoing political and social upheaval, which has given rise to increased use of terrorism, in which unlawful interference with civil aviation is still a powerful technique for pursuing an objective.

These topics formed the basis of the agenda of the 12th Session of the Facilitation Division that was held in Cairo in early 2004 with the theme, "Managing Security Challenges to Facilitate Air Transport Operations." Discussions on the essential role that facilitation measures play in the improvement of security led to the Division making recommendations on the security of travel documents and border control formalities, on modernized provisions for facilitation and security in air cargo service operations, on controlling travel document fraud and illegal migration and on international health regulations and hygiene and sanitation in aviation.

The consequent 12th edition of Annex 9 (expected publication: 2005) reflects ICAO's contemporary FAL strategy. This is to advocate and support action by Contracting States in three principal areas: the standardization of travel documents, the rationalization of border clearance systems and procedures, and international cooperation to tackle security problems related to passengers and cargo. While the primary motivation of Annex 9 will continue to carry out the mandate in Article 22 of the Chicago Convention, "...to prevent unnecessary delays to aircraft, passengers and cargo....", numerous provisions, developed with the intent to increase efficiency in control processes, support also the objective to raise the level of general security.

Enhancing the security of travel documents and tackling illegal migration are among the major changes introduced into Annex 9 through its 12th edition. Most of the existing Chapters and Appendices of the Annex remain more-or-less unchanged from the 11th edition. Two Chapters, in particular, have been substantially amended to reflect new international realities.

Chapter 3, which deals with the entry and departure of persons and baggage, now contains a Standard obliging Contracting States to regularly update security features in new versions of their travel documents, to guard against their misuse and to facilitate detection of cases where such documents have been unlawfully altered, replicated or issued. Another Standard requires States to establish controls on the lawful creation and issuance of travel documents. States are also now obliged to issue separate passports to all persons, regardless of age, and to issue them in machine readable form, in accordance with ICAO's specifications. States and airlines are required to collaborate in combatting travel document fraud. As for crew members, States are obliged to place adequate controls on the issuance of crew member certificates and other official crew identity documents.

Finally, an entirely new Chapter 5 is devoted to the growing problem of inadmissible persons and deportees. The SARPs of this Chapter set out in clear terms the obligations of States and airlines *vis-à-vis* transport of potentially illegal migrants and similar "problem" cases that the international air transport industry comes across in ever greater numbers daily. Strict adherence by Contracting States of the obligations to remove from circulation fraudulent travel documents or genuine documents used fraudulently will greatly help to constrict the flow of illegal migrants the world over.

ANNEX 10
to the Convention on
International Civil Aviation

Aeronautical Telecommunications
(Volumes I, II, III, IV and V)

Three of the most complex and essential elements of international civil aviation are aeronautical communications, navigation and surveillance. These elements are covered by Annex 10 to the Convention.

Annex 10 is divided into five volumes:

Volume I — Radio Navigation Aids
Volume II — Communications Procedures including those with PANS status
Volume III — Communication Systems
Part 1 — Digital Data Communication Systems
Part 2 — Voice Communication Systems
Volume IV — Surveillance Radar and Collision Avoidance Systems
Volume V — Aeronautical Radio Frequency Spectrum Utilization

The five volumes of this Annex contain Standards and Recommended Practices (SARPs), Procedures for Air Navigation Services (PANS) and guidance material on aeronautical communication, navigation and surveillance systems.

Volume I of Annex 10 is a technical document which defines for international aircraft operations the systems necessary to provide radio navigation aids used by aircraft in all phases of flight. The SARPs and guidance material of this volume list essential parameter specifications for radio navigation aids such as the global navigation satellite system (GNSS), instrument landing system (ILS), microwave landing system (MLS), very high frequency (VHF) omnidirectional radio range (VOR), non-directional radio beacon (NDB) and distance measuring equipment (DME). The information contained in this volume includes aspects of power requirements, frequency, modulation, signal characteristics and monitoring needed to ensure that suitably equipped aircraft will be able to receive navigation signals in all parts of the world with the requisite degree of reliability.

Volumes II and III cover two general categories of voice and data communications that serve international civil aviation. They are the ground-ground communication between points on the ground and the air-ground communication between aircraft and points on the ground. The air-ground communication provides aircraft with all necessary information to conduct flights in safety, using both voice and data. An important element of the ground-ground communication is the aeronautical fixed telecommunications network (AFTN), a worldwide network organized to meet the specific requirements of international civil aviation. Within the AFTN category, all significant ground points, which include airports, air traffic control centres, meteorological offices and the like, are joined by appropriate links designed to serve aircraft throughout all phases of flight. Messages originated at any point on the network are routed as a matter of routine to all points required for the safe conduct of flight.

In Volume II of Annex 10, general, administrative and operational procedures pertaining to aeronautical fixed and mobile communications are presented.

Volume III of Annex 10 contains SARPs and guidance material for various air-ground and ground-ground voice and data communication systems, including aeronautical telecommunication network (ATN), aeronautical mobile-satellite service (AMSS), secondary surveillance radar (SSR) Mode S air-ground data link, very high frequency (VHF) air-

ground digital link (VDL), aeronautical fixed telecommunication network (AFTN), aircraft addressing system, high frequency data link (HFDL), aeronautical mobile service, selective calling system (SELCAL), aeronautical speech circuits and emergency locator transmitter (ELT).

Volume IV of Annex 10 contains SARPs and guidance material for secondary surveillance radar (SSR) and airborne collision avoidance systems (ACAS), including SARPs for SSR Mode A, Mode C and Mode S, and the technical characteristics of ACAS.

In Volume V of Annex 10, SARPs and guidance material on the utilization of aeronautical frequencies are defined. The International Telecommunication Union (ITU) has set up a framework in which the demands for radio spectrum from individual States are balanced with the interests of different radio service users to produce a planned radio environment incorporating interference-free, effective and efficient radio spectrum use. Volume V contains information on the assignment planning of individual aeronautical radio stations operating or planned to operate in different frequency bands.

ANNEX 11
to the Convention on
International Civil Aviation

Air Traffic Services

Control of air traffic was almost unknown in 1944. Today, air traffic control, flight information and alerting services, which together comprise air traffic services, rank high among the indispensable ground support facilities which ensure the safety and efficient operation of air traffic throughout the world. Annex 11 to the Chicago Convention defines air traffic services and specifies the world-wide Standards and Recommended Practices applicable in the provision of these services.

The world's airspace is divided into a series of contiguous flight information regions (FIRs) within which air traffic services are provided. In some cases, the flight information regions cover large oceanic areas with relatively low air traffic density, within which only flight information service and alerting service are provided. In other flight information regions, large portions of the airspace are controlled airspace within which air traffic control service is provided in addition to flight information and alerting services.

The prime objective of air traffic services, as defined in the Annex, is to prevent collisions between aircraft, whether taxiing on the manoeuvring area, taking off, landing, en route or in the holding pattern at the destination aerodrome. The Annex also deals with ways of expediting and maintaining an orderly flow of air traffic and of providing advice and information for the safe and efficient conduct of flights and alerting service for aircraft in distress. To meet these objectives, ICAO provisions call for the establishment of flight information centres and air traffic control units.

All aircraft fly in accordance with either instrument flight rules (IFR) or visual flight rules (VFR). Under IFR, the aircraft fly from one radio aid to the next or by reference to self-contained airborne navigation equipment from which the pilot can determine the aircraft's position at all times. IFR flights are conducted through all but the severest of weather conditions, while aircraft flying under VFR must remain clear of cloud and operate in visibility conditions which will permit the pilot to see and avoid other aircraft. Chapter 3 specifies the types of service to be provided to these flights - for example, IFR flights are provided with air traffic control service when operating in controlled airspace. When operating in uncontrolled airspace, flight information service, which includes known traffic information, is provided and the pilot is responsible for arranging the flight to avoid other traffic. Control service is normally not provided to VFR flights, unless in specific areas, in which case VFR flights are separated from IFR flights but no separation service is provided between VFR flights, unless specifically required by the ATC authority. However, not all aircraft are provided with air traffic services. If an aircraft is operating entirely outside of controlled airspace in an area where a flight plan is not required, the flight may not even be known to air traffic services.

Safety is the overriding concern of international civil aviation and air traffic management contributes substantially to safety in aviation. Annex 11 contains an important requirement for States to implement systematic and appropriate air traffic services (ATS) safety management programmes to ensure that safety is maintained in the provision of ATS within airspaces and at aerodromes. Safety management systems and programmes will serve as an important contribution toward ensuring safety in international civil aviation.

Air traffic control service consists of clearances and information issued by air traffic control units to achieve longitudinal, vertical or lateral separation between aircraft, in accordance with the provisions set out in Chapter 3 of the Annex. This chapter also deals with the contents of clearances, their coordination between ATC units and the co-ordination of transfer of responsibility for control as a flight progresses from the area of one control unit to another. An orderly transfer process requires that an aircraft must be under the control of only one air traffic control unit at any one time.

Air traffic control units are sometimes faced with a traffic demand beyond the capacity of a particular location or area, as occurs at busy aerodromes during peak periods.

Annex 11 provides for ATC units to specify restrictions to the traffic flow, when required, for the purpose of avoiding excessive delays to aircraft in flight.

Annex 11 also specifies the requirements for coordination between the civil air traffic control units and military authorities or other agencies responsible for activities that may affect flights of civil aircraft. Military units are provided with flight plan and other data

concerning flights of civil aircraft to assist in establishing identification in the event that a civil aircraft approaches or enters a restricted area.

Flight information service is provided to aircraft operating in controlled airspace and to others known to the air traffic services units. The information includes significant meteorological (SIGMET) information, changes in the serviceability of navigation aids and in the condition of aerodromes and associated facilities and any other information likely to affect safety. IFR flights receive, in addition, information on weather conditions at departure, destination and alternate aerodromes, collision hazards to aircraft operating outside of control areas and control zones and, for flight over water, available information on surface vessels. VFR flights also receive information on weather conditions which would make visual flight impractical. Annex 11 also contains specifications for operational flight information service (OFIS) broadcasts, including automated terminal information service (ATIS) broadcasts.

Chapter 5 of Annex 11 is concerned with the alerting service, which provides for the alerting of rescue coordination centres when an aircraft is believed or known to be in a state of emergency, when it fails to communicate or to arrive on time or when information is received that a forced landing has been made or is imminent. Alerting service is automatically provided to all aircraft receiving air traffic control service and, as far as is practicable, to all other aircraft whose pilots have filed a flight plan or are otherwise known to air traffic services. It is also provided to aircraft known or believed to be subject to unlawful interference. The effect of the alerting service is to set in motion all appropriate rescue and emergency organizations which can provide assistance when and where required.

Subsequent chapters of the Annex cover ATS requirements for air-ground communications and for communications between ATS units and between those units and other essential offices. These chapters also specify the information required to be supplied to each type of air traffic services unit. Air-ground communications should permit direct, rapid and continuous static-free two-way radiotelephony communication, whenever practicable, while those between ATS units should permit exchange of printed messages and, in the case of air traffic control units, direct voice communications between controllers. Because of the importance of the information transmitted over air-ground radio channels and that received from other units and offices, Annex 11 recommends that such communications should be recorded.

An Appendix to the Annex spells out the principles governing the identification of air traffic services routes to allow both pilots and ATS to make unmistakable reference to any route without resorting to geographical references. Another Appendix specifies the requirements for designators for significant points marked by a radio aid as well as those not marked by a radio aid. Annex 11 also contains a series of attachments with guidance material on a variety of subjects, from airspace organization to ATS requirements for air-ground channels to the establishment and naming of standard arrival and departure routes.

Contingency planning is an important responsibility of all States that provide air navigation services. An Attachment to Annex 11 contains concise guidance to assist States in providing for the safe and orderly flow of international air traffic in the event of disruptions of air traffic services and related supporting services and in preserving the availability of major world air routes in the event of disruptions.

The sky may be limitless but not for air traffic. As more aircraft fill the crowded air routes, air traffic control concepts, procedures, equipment and rules will continue to evolve as will the provisions of this Annex.

ANNEX 12
to the Convention on
International Civil Aviation

Search and Rescue

Search and rescue services are organized to respond to persons apparently in distress and in need of help. Prompted by the need to rapidly locate and rescue survivors of aircraft accidents, a set of internationally agreed Standards and Recommended Practices has been incorporated in ICAO's Annex 12 - *Search and Rescue* (SAR).

The Annex, which is complemented by a three-part *Search and Rescue Manual* dealing with SAR organization, management and procedures, sets forth the provisions for the establishment, maintenance and operation of search and rescue services by ICAO Contracting States in their territories and over the high seas. Proposals for Annex 12 were originally made in 1946. By 1951**,** the proposals had been reviewed and revised to meet international civil aviation requirements, and were embodied as Standards and Recommended Practices in the first edition of Annex 12.

Containing five chapters, the Annex details the organization and cooperative principles appropriate to effective SAR operations, outlines required necessary preparatory measures and sets forth proper operating procedures for SAR services in actual emergencies.

One of the first aspects addressed in the organizational chapter is the requirement for States to provide SAR services within their territories and over those portions of the high seas or areas of undetermined sovereignty as determined in regional air navigation agreements and approved by the Council of ICAO. This chapter also deals with the establishment of mobile SAR units, the means of communication for these units and the designation of other elements of public or private services suitable for search and rescue activity.

Provisions concerning equipment requirements of rescue units reflect the need to give adequate assistance at the scene of accidents, due regard being given to the number of passengers involved.

Cooperation between the SAR services of neighbouring States is essential to the efficient conduct of SAR operations. This important aspect is covered in depth in Chapter 3, which requires ICAO Contracting States to publish and disseminate all information needed for the expeditious entry into their territories of rescue units of other States. It is also recommended that persons qualified in the conduct of aircraft accident investigation accompany rescue units in order to facilitate accident investigation.

Chapter 4, which deals with preparatory measures, sets forth the requirements for collation and publication of information needed by SAR services. It specifies that detailed plans of operation must be prepared for the conduct of SAR operations and indicates the necessary information for inclusion in the plans.

Preparatory measures required to be undertaken by rescue units, training requirements and removal of aircraft wreckage are also covered. A search and rescue operation is a dynamic activity requiring uniformly comprehensive operating procedures that are sufficiently flexible to meet extraordinary needs. Beginning with the requirement to identify and categorize the emergency situation, Chapter 5 details action to be taken for each category of event.

Three distinct phases categorize emergency situations. The first is the "Uncertainty Phase" which is commonly declared when radio contact has been lost with an aircraft and cannot be re-established or when an aircraft fails to arrive at its destination. During this phase the Rescue Coordination Centre (RCC) concerned may be activated. The RCC collects and evaluates reports and data pertaining to the subject aircraft.

Depending on the situation, the uncertainty phase may develop into an "Alert Phase", at which time the RCC alerts appropriate SAR units and initiates further action.

The "Distress Phase" is declared when there is reasonable certainty that an aircraft is in distress. In this phase, the RCC is responsible for taking action to assist the aircraft and to determine its location as rapidly as possible. In compliance with a predetermined set of procedures, the aircraft operator, State of Registry, air traffic services units concerned, adjacent RCCs and appropriate accident investigation authorities are informed; a plan for the conduct of the search and rescue operation is drawn up and its execution is coordinated.

Procedures are detailed in Chapter 5 for SAR operations involving two or more RCCs, for authorities in the field and for terminating or suspending SAR operations. Other procedures deal with actions to be taken at the scene of an accident and by a pilot-in-command intercepting a distress transmission.

An Appendix to the Annex provides three sets of signals, the first of which are signals for use by aircraft and surface craft during the conduct of a SAR operation. The second and third sets consist of ground-to-air visual signals for use by survivor and ground rescue units.

ANNEX 13
to the Convention on
International Civil Aviation

Aircraft Accident and Incident Investigation

The causes of an aircraft accident or serious incident must be identified in order to prevent repeated occurrences. The identification of causal factors is best accomplished through a properly conducted investigation. To emphasise this point, Annex 13 states that the objective of the investigation of an accident or incident is prevention.

Annex 13 provides the international requirements for the investigation of aircraft accidents and incidents. It has been written in a way that can be understood by all participants in an investigation. As such, it serves as a reference document for people around the world who may be called on, often without any lead time, to deal with the many aspects involved in the investigation of an aircraft accident or serious incident. As an example, the Annex spells out which States may participate in an investigation, such as the States of Occurrence, Registry, Operator, Design and Manufacture. It also defines the rights and responsibilities of such States.

The ninth edition of Annex 13 consists of eight chapters, an appendix and four attachments. The first three chapters cover definitions, applicability and general information. Chapter 3 includes the protection of evidence and the responsibility of the State of Occurrence for the custody and removal of the aircraft. It also defines how that State must handle requests for participation in the investigation from other States.

All States that may be involved in an investigation must be promptly notified of the occurrence. Procedures for this notification process are contained in Chapter 4. The same chapter outlines the responsibilities for conducting an investigation depending on the location of the occurrence, eg. in the territory of an ICAO Contracting State, in the territory of a non-contracting State, or outside the territory of any ICAO State. Following the formal notification of the investigation to the appropriate authorities, Chapter 5 addresses the investigation process.

Responsibility for an investigation belongs to the State in which the accident or incident occurred. That State usually conducts the investigation, but it may delegate all or part of the investigation to another State. If the occurrence takes place outside the territory of any State, the State of Registry has the responsibility to conduct the investigation.

States of Registry, Operator, Design and Manufacture who participate in an investigation are entitled to appoint an accredited representative to take part in the investigation. Advisers may also be appointed to assist accredited representatives. The State conducting the investigation may call on the best technical expertise available from any source to assist with the investigation.

The investigation process includes the gathering, recording and analysis of all relevant information; the determination of the causes; formulating appropriate safety recommendations and the completion of the final report.

Chapter 5 also includes provisions regarding: the investigator-in-charge, flight recorders, autopsy examinations, coordination with judicial authorities, informing aviation security authorities, disclosure of records, and re-opening of an investigation. States whose citizens have suffered fatalities in an accident are also entitled to appoint an expert to participate in the investigation.

Chapter 6 contains the Standards and recommended practices dealing with the development and publication of the final report of an investigation. The recommended format for the final report is contained in an Appendix to the Annex.

Computerized databases greatly facilitate the storing and analysing of information on accidents and incidents. The

sharing of such safety information is regarded as vital to accident prevention. ICAO operates a computerized database known as the Accident/Incident Data Reporting (ADREP) system, which facilitates the exchange of safety information among Contracting States. Chapter 7 of Annex 13 addresses the reporting requirements of the ADREP system which is by means of Preliminary and Accident/Incident Data Reports.

Chapter 8 of Annex 13 deals with accident prevention measures. The provisions in this chapter cover incident reporting systems, both mandatory and voluntary, and the necessity for a non-punitive environment for the voluntary reporting of safety hazards. This chapter then addresses database systems and a means to analyse the safety data contained in such databases in order to determine any preventive actions required. Finally, it recommends that States promote the establishment of safety information sharing networks to facilitate the free exchange of information on actual and potential safety deficiencies. The processes outlined in this chapter form part of a safety management system aimed at reducing the number of accidents and serious incidents worldwide.

ANNEX 14
to the Convention on
International Civil Aviation

Aerodromes
(Volumes I and II)

A distinction of Annex 14 is the broad range of subjects it contains. It extends from the planning of airports and heliports to such details as switch-over times for secondary power supply; from civil engineering to illumination engineering; from provision of sophisticated rescue and fire fighting equipment to simple requirements for keeping airports clear of birds. The impact of these numerous subjects on the Annex is compounded by the rapidly changing industry which airports must support. New aircraft models, increased aircraft operations, operations in lower visibilities and technological advances in airport equipment combine to make Annex 14 one of the most rapidly changing Annexes. In 1990, after 39 amendments the Annex was split into two volumes, Volume I dealing with aerodrome design and operations and Volume II dealing with heliport design.

Annex 14, Volume I, is also unique: it is applicable to all airports open to public use in accordance with the requirements of Article 15 of the Convention. Historically, it came to life in 1951 with 61 pages of Standards and Recommended Practices and 13 additional pages on guidance for their implementation. That edition included specifications for water aerodromes and aerodromes without runways; specifications that no longer appear. Today over 180 pages of specifications and additional pages of guidance material set forth the requirements for international airports around the world.

The contents of Volume I reflect, to varying extents, the planning and design, as well as operation and maintenance, of aerodromes.

The heart of the airport is the vast movement area extending from the runway, along the taxiways and onto the apron. Today's large modern aircraft require *a* more exacting design of these facilities. Specifications on their physical characteristics, i.e. width, surface slope and separation distances from other facilities, form a principal part of this Annex. Specifications for new facilities, unheard of at the beginning of ICAO, such as runway end safety areas, clearways and stopways, are all set forth. These facilities are the building blocks for airports which define its over-all shape and size and permit engineers to lay out the skeleton that forms the airport's basic structure.

Along with defining the ground environment of an airport, specifications are also required to define its airspace requirements. Airports must have airspace free from obstacles in order for aircraft to approach and depart safely from the airport. It is also important that th*e* volume of this space be defined so that it may be protected to ensure the continued growth and existence of the airport or, as stated in the Annex, ". . . to prevent the aerodromes from becoming unusable by the growth of obstacles . . . by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace". The requirements to provide a particular obstacle limitation surface and the dimensions of the surfaces are classified in the Annex by runway type. Six different types of runway are recognized: non-instrument approach runways, non-precision approach runways, precision approach runways categories I, II and III, and takeoff runways.

A striking feature of airports at night are the hundreds, sometimes thousands of lights used to guide and control aircraft movements. In contrast to flight, where guidance and control are done through radio aids, movements on the ground are primarily guided and controlled through visual aids. Annex 14, Volume I, defines in detail numerous systems for use under various types of meteorological conditions and other circumstances.

As these visual aids must be immediately understandable by pilots from all over the world, standardization of their location and light characteristics is highly important. Recent advances in lighting technology have led to great increases

in the intensity of lights. Also in recent years, the development of small light sources has facilitated the installation of lights in the surface of pavements that can be run over by aircraft. Modern high intensity lights are effective for both day and night operations and, in some day conditions, simple markings may be highly effective. Their uses are defined in the Annex as well. Airport signs are a third type of visual aid. At large airports and airports with heavy traffic it is important that guidance be provided to pilots to permit them to find their way about the movement area.

The objective of most specifications is to improve the safety of aviation. One section of Annex 14, Volume I, is devoted to improving the safety of equipment installed at airports. Particularly noteworthy are specifications concerning the construction and siting of equipment near runways. This is to reduce the hazard such equipment might pose to aircraft operations. Requirements for secondary power supply are also specified, along with the characteristics of light circuit design and the need to monitor the operation of visual aids.

In recent years more attention has been given to the operation of airports. The current edition of Annex 14, Volume I, includes specifications on maintenance of airports. Particular emphasis is given to pavement areas and visual aids. Attention is also given to eliminating features of airports which may be attractive to birds that endanger aircraft operation.

Of critical importance to the operation of any airport is the rescue and fire fighting service which, according to Annex 14, all international airports are required to have. The Annex sets forth the agents to be used, their amounts and the time limits in which they must be delivered to the scene of an aircraft accident.

To take off and land safely and routinely today's aircraft require accurate information on the condition of facilities at airports. Annex 14, Volume I, sets forth: what information is to be provided; how it is to be determined; how it is to be reported; and to whom it is to be reported. (Specifications for the transmittal of this information through AIPs and NOTAMs are set out in Annex 15 — *Aeronautical Information Services*.) Typical of the type of information to be reported are elevation of different parts of the airport, strength of pavements, condition of runway surfaces and the level of airport rescue and fire fighting services.

Provisions for heliports are included in Volume II of Annex 14. These specifications complement those in Volume I which, in some cases, are also applicable to heliports. The provisions address the physical characteristics and obstacle limitation surfaces required for helicopter operations from surface level and elevated on-shore heliports and helidecks, under both visual and instrument meteorological conditions. Material dealing with the marking and lighting of heliports, as well as rescue and fire fighting requirements for heliports, also have been included in Volume II. Although specifications on marking and lighting of heliports are only applicable to operations in visual meteorological conditions, work is under way on the development of appropriate visual aids for helicopter operations in instrument meteorological conditions.

ANNEX 15
to the Convention on
International Civil Aviation

Aeronautical Information Services

One of the least known and most vital roles in support of international civil aviation is filled by the aeronautical information service (AIS). The object of the aeronautical information service is to ensure the flow of information necessary for the safety, regularity and efficiency of international air navigation.

Annex 15 defines how an aeronautical information service shall receive and/or originate, collate or assemble, edit, format, publish/store and distribute specified aeronautical information/data. The goal is to satisfy the need for uniformity and consistency in the provision of aeronautical information/data that is required for the operational use by international civil aviation.

The ICAO Council first adopted the original Standards and Recommended Practices in 1953. Annex 15 has its origins in Article 37 of the Chicago Convention. The first requirements for the Annex were developed by the ICAO Air Navigation Committee (now the Air Navigation Commission), following recommendations from regional air navigation meetings, and were published by the authority of the Council as *Procedures for International Notices to Airmen* back in 1947.

"International notices to airmen" is a phrase which led to the birth of an early aeronautical acronym: NOTAM. In 1949, a special NOTAM meeting reviewed and proposed amendments to these procedures, which were later issued as *Procedures for Air Navigation Services* that became applicable in 1951. A total of 33 amendments updated Annex 15 over the years to meet the rapid changes brought about by air travel and associated information technology. In recent years, Annex 15 amendments have reflected the increased need for the timely provision of quality aeronautical information/data and terrain data as they have become critical components of data-dependant on-board navigation systems. The Annex now contains many provisions aimed at preventing corrupt or erroneous aeronautical information/data which can potentially affect the safety of air navigation.

The operator of any type of aircraft, be it small private aircraft or large transport aircraft, must have available a variety of information concerning the air navigation facilities and services that may be expected to be used. For example, the operator must know the regulations concerning entry into and transit of the airspace of each State in which operations will be carried out, as well as what aerodromes, heliports, navigation aids, meteorological services, communication services and air traffic services are available and the procedures and regulations associated with them. The operator must also be informed, often on very short notice, of any change affecting the operation of these facilities and services and must know of any airspace restrictions or hazards likely to affect flights. While this information can nearly always be provided before take-off, it must, in some instances, be provided during flight.

The philosophy underlying Annex 15, which stems from Article 28 of the Convention on International Civil Aviation, is that each State is responsible for making available to civil aviation interests any and all information which is pertinent to and required for the operation of aircraft engaged in international civil aviation within its territory, as well as in areas outside its territory in which the State has air traffic control or other responsibilities.

The information handled by an AIS may vary widely in terms of the duration of its applicability. For example, information related to airports and its facilities may remain valid for many years while changes in the availability of those facilities (for instance, due to construction or repair) will only be valid for a relatively short period of time. Information may be valid for as short a time as days or hours.

The urgency attached to information may also vary, as well as the extent of its applicability in terms of the number of operators or types of operations affected. Information may be lengthy or concise or include graphics.

Therefore, aeronautical information is handled differently depending on its urgency, operational significance, scope, volume and the length of time it will remain valid and relevant to users. Annex 15 specifies that aeronautical information be published as an integrated aeronautical information package. It is composed of the following elements: the *Aeronautical Information Publication* (AIP), including amendment service, AIP supplements, NOTAM, pre-flight information bulletins (PIB), aeronautical information circulars (AIC), checklists and lists of valid NOTAM. Each

element is used to distribute specific types of aeronautical information.

Information concerning changes in facilities, services or procedures, in most cases, requires amendments to be made to airline operations manuals or other documents and databases produced by various aviation agencies. The organizations responsible for maintaining these publications usually work to a pre-arranged production programme. If aeronautical information were published indiscriminately with a variety of effective dates, it would be impossible to keep the manuals and other documents and databases up to date. Since many of the changes to facilities, services and procedures can be anticipated, Annex 15 provides for the use of a regulated system, termed AIRAC (aeronautical information regulation and control), which requires significant changes to become effective and information to be distributed in accordance with a predetermined schedule of effective dates, unless operational considerations make it impracticable.

Annex 15 also specifies that pre-flight information must be made available at each aerodrome/heliport normally used for international operations and sets the content of aeronautical information provided for pre-flight planning purposes as well as requirements for the provision of that information through automated aeronautical information systems. Additionally, there are requirements to ensure that important post-flight information provided by aircrews (for example, the presence of a bird hazard) are relayed to the AIS for distribution as the circumstances necessitate.

The need, role and importance of aeronautical information/data have changed significantly with the evolution of the Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) systems. The implementation of area navigation (RNAV), required navigation performance (RNP) and airborne computer-based navigation systems has brought about exacting requirements for the quality (accuracy, resolution and integrity) of aeronautical information/data and terrain data .

The users' dependence on the quality of certain aeronautical information/data is evident from Annex 15, paragraph 3.2.8 a) which, when describing critical data, states: "There is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe".

Since corrupt or erroneous aeronautical information/data can potentially affect the safety of air navigation because of the direct dependence upon it by both airborne and ground-based systems, it is imperative that each State ensure that users (aviation industry, air traffic services, etc.) receive timely and quality aeronautical information/data for the period of its intended use.

To achieve this, and to demonstrate to users the required information/data quality, Annex 15 provides that States must establish a quality system and put in place quality management procedures at all stages (receiving and/or originating, collating or assembling, editing, formatting, publishing, storing and distributing) of the aeronautical information/data process. The quality system must be documented and demonstrable for each function stage, ensuring that the organizational structure, procedures, processes and resources are in place in order to detect and remedy any information/data anomalies during the phases of production, maintenance and operational use. Explicit in such a quality management regime is the ability to trace all information/data from any point, back through the proceeding processes, to its origin.

Of all the activities in international civil aviation, the provision and sustaining of aeronautical information services may not rank among the most glamourous and indeed the complexity of AIS information supplying data-dependant on-board navigation systems may be transparent to the user, but without this service a pilot would be flying into the unknown.

ANNEX 16
to the Convention on
International Civil Aviation

Environmental Protection
(Volumes I and II)

Annex 16 (Volumes I and II) deals with the protection of the environment from the effect of aircraft noise and aircraft engine emissions - two topics hardly thought about when the Chicago Convention was signed.

Aircraft noise was already of concern during the formative years of ICAO, but it was then limited to the noise caused by propellers whose tips rotated at speeds approaching that of sound. This concern increased with the introduction of the first generation jet aeroplanes in the early 1960s and accelerated with the growth in the number of jet aircraft in international operations.

Aircraft noise is a function, among other things, of the power of the engines that propel aeroplanes through the atmosphere. Reduce the power and you reduce noise, but at the same time you may affect the safety characteristics of the jet aircraft.

In 1968, the ICAO Assembly adopted a resolution which conceded the seriousness of noise in the vicinity of airports, and instructed the ICAO Council to establish international specifications and associated guidance material to control aircraft noise. In 1971, the Assembly adopted another resolution recognizing the adverse environmental impact that may be related to aircraft activity. This resolution placed on ICAO the responsibility to guide the development of international civil aviation in such a manner as to benefit the people of the world and to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of the human environment.

Annex 16 dealing with various aspects of aircraft noise problems was adopted in 1971 on the basis of recommendations of the 1969 Special Meeting on Aircraft Noise in the Vicinity of Aerodromes. These aspects included: procedures for describing and measuring aircraft noise; human tolerance to aircraft noise; aircraft noise certification; criteria for establishment of aircraft noise abatement procedures; land use control; and ground run-up noise abatement procedures.

Shortly after this meeting, the Committee on Aircraft Noise (CAN) was established to assist ICAO in the development of noise certification requirements for different classes of aircraft.

The first meeting of this committee developed the first amendment to Annex 16, which became applicable in 1973 and included noise certification of future production and derived versions of subsonic jet aeroplanes.

During subsequent meetings, the Committee on Aircraft Noise developed noise certification standards for future subsonic jet aeroplanes and propeller-driven aeroplanes, and for future production of existing supersonic transport aeroplane types and helicopters. It also developed guidelines for noise certification of future supersonic and propeller-driven STOL (short take-off and landing) aeroplanes as well as installed APUs (auxiliary power-units) and associated aircraft systems when operating on the ground.

A resolution adopted by the ICAO Assembly in 1971 led to specific action on the question of engine emissions and detailed proposals for ICAO Standards for the control of engine emissions from certain types of aircraft engines. The Committee on Aircraft Engine Emissions (CAEE) was subsequently established with a view to develop specific Standards for aircraft engine emissions.

These Standards, adopted in 1981, set limits for the emission of smoke and certain gaseous pollutants for large turbo-jet and turbofan engines to be produced in the future; they also prohibit the venting of raw fuels. The scope of the existing Annex 16 was widened to include engine emission provisions and the document was retitled *Environmental Protection*. Volume I of the reorganized Annex 16 contains provisions related to aircraft noise while Volume II contains provisions related to aircraft engine emissions.

In Volume I, different aircraft classifications form the basis of noise certification. These classifications include subsonic jet aeroplanes for which application for the certification of the prototype was accepted before 6 October 1977; for those accepted on or after that date; for propeller-driven aeroplanes over 5 700 kg; for those not exceeding this mass; for supersonic aeroplanes for which application for certification of the prototype was accepted before 1 January 1975; and for helicopters for which the application for certification of the prototype was accepted on or after 1 January 1980.

For each classification of aircraft type, a noise evaluation measure has been standardized. Except for propeller-driven aeroplanes not exceeding 5 700 kg maximum certificated take-off mass, the noise evaluation measure is the effective perceived noise level, expressed in EPNdB. The EPNdB is a single number indicator of the subjective effects of aircraft noise on people, taking into account the instantaneous perceived noise level and duration.

Various measurement points, maximum noise levels at lateral, approach and flyover noise measurement points, along with flight test procedures, have been designated for these types of aircraft.

Noise certification is granted by the State of Registry of an aircraft on the basis of satisfactory evidence that the aircraft complies with the requirements which are at least equal to the applicable Standards set out in this Annex.

In Volume II of Annex 16, there are Standards which prohibit the intentional venting of raw fuel to the atmosphere from all turbine engine powered aircraft manufactured after 18 February 1982.

There are also Standards which limit the emission of smoke from turbo-jet and turbofan engines intended for propulsion at subsonic speeds and manufactured after 1 January 1983. For engines intended for supersonic propulsion, similar limitations apply to engines manufactured after 18 February 1982.

Also included are Standards which limit the emission of carbon monoxide, unburned hydrocarbons and oxides of nitrogen from large turbo-jet and turbofan engines intended for subsonic propulsion and manufactured after 1 January 1986. These Standards are based on an aircraft's landing and take-off (LTO) cycle. In addition to these Standards, Volume II contains detailed measurement procedures and instrument specifications and details the statistical methods to be used in assessing test results.

In 1983, the CAN and CAEE committees were amalgamated to form the Committee on Aviation Environment Protection (CAEP), as a Technical Committee of the ICAO Council. Since its establishment, CAEP has further developed the Standards in Annex 16 for both aircraft noise and aircraft engine emissions.

Concerning aircraft noise, on the basis of recommendations by CAEP, the Council of ICAO in 2001 adopted a new Chapter 4 noise standard, more stringent than that contained in Chapter 3. Commencing on 1 January 2006, the new standard will apply to newly certificated aeroplanes and to Chapter 3 aeroplanes for which re-certification to Chapter 4 is requested.

This new Standard was adopted at about the same time as the ICAO Assembly endorsed the concept of a "balanced approach to noise management" developed by CAEP that is comprised of four elements, namely reduction of noise at source, land-use planning, operational measures, and operation restrictions. For further details, see the *Consolidated statement of continuing ICAO policies and practices related to environmental protection.*

Concerning aircraft engine emissions, there has been a change in the focus of the Organization's work. While it was initially based on concerns regarding air quality in the vicinity of airports, in the 1990s it was expanded to include global atmospheric problems to which aircraft engine emissions contribute, such as climate change. As a result, consideration is being given to further development of the ICAO emissions Standards to take account of emissions not only in the LTO cycle, but also during the cruise phase of operations.

In both 1993 and 1999, on the basis of CAEP recommendations, the Council of ICAO adopted more stringent Standards defining the emission limits for oxides of nitrogen. At the time of writing, a third revision of these limits was under consideration by the Council.

Environmental protection has become one of the biggest challenges to civil aviation in the twenty-first century. Since

it was first adopted, Annex 16 has been further developed to meet new environmental concerns and to accommodate new technology. The Organization will continue to keep the Annex under review, consistent with its aim of achieving maximum compatibility between the safe and orderly development of civil aviation and the quality of the environment.

Annex 17
to the Convention on
International Civil Aviation

Security - Safeguarding International Civil Aviation against Acts of Unlawful Interference

The dramatic increase in crimes of violence which adversely affected the safety of civil aviation during the late 1960's, resulted in an Extraordinary Session of the ICAO Assembly in June 1970. One of the resolutions of that Assembly called for specifications in existing or new Annexes to the Chicago Convention to specifically deal with the problem of unlawful interference, in particular with unlawful seizure of aircraft. Following the work of the Air Navigation Commission, the Air Transport Committee, and the Committee on Unlawful Interference, Standards and Recommended Practices on Security were adopted by the Council on 22 March 1974 and designated as Annex 17 – Security. This Annex sets out the basis for the ICAO civil aviation security programme and seeks to safeguard civil aviation and its facilities against acts of unlawful interference. Of critical importance to the future of civil aviation and to the international community at large are the measures taken by ICAO to prevent and suppress all acts of unlawful interference against civil aviation throughout the world.

Annex 17 is primarily concerned with administrative and co-ordination aspects, as well as with technical measures for the protection of the security of international air transport, requiring each Contracting State to establish its own civil aviation security programme with such additional security measures as may be proposed by other appropriate bodies.

Annex 17 also seeks to co-ordinate the activities of those involved in security programmes. It is recognized that airline operators themselves have a primary responsibility for protecting their passengers, assets and revenues, and therefore States must ensure that the carriers develop and implement effective complementary security programmes compatible with those of the airports out of which they operate.

Some of the specifications in Annex 17 and the other Annexes recognize that it is not possible to achieve absolute security. States must ensure, nevertheless, that the safety of passengers, crew, ground personnel and the general public is a primary consideration in the safeguarding action which they initiate. States are also urged to adopt measures for the safety of the passengers and crew of unlawfully diverted aircraft until their journey can be continued.

The Annex is maintained under constant review to ensure that the specifications are current and effective. Because this document sets minimum standards for aviation security worldwide, it is subjected to careful scrutiny before undergoing any changes, additions or deletions. Since its publication, Annex 17 has been amended ten times in response to needs identified by States and is kept under review by the Aviation Security (AVSEC) Panel. This group of experts appointed by the Council includes representatives from Argentina, Australia, Belgium, Brazil, Canada, Ethiopia, France, Germany, Greece, India, Italy, Japan, Jordan, Mexico, Nigeria, the Russian Federation, Senegal, Spain, Switzerland, the United Kingdom and the United States, as well as international organizations such as the Airports Council International (ACI), the International Air Transport Association (IATA), the International Federation of Airlines Pilots Association (IFALPA) and the International Criminal Police Organization (ICPO-INTERPOL).

Prior to 1985, the significant threat to civil aviation was seen as the hijacking. As a result, the Standards and Recommended Practices tended to focus on hijacking rather than sabotage, in-flight attack or facility attack. By modifying existing technology and applying agreed upon specifications and procedures, the worldwide aviation community established a reasonably effective screening system for passengers and their carry-on luggage.

Following the three-year cycle for Annex amendments, additional changes to Annex 17 were developed in 1988 which included specifications to further assist in fighting sabotage.

Some of the changes included in Amendment 7 to Annex 17 adopted in June 1989, provide for a further clarification of the Standards dealing with reconciliation of baggage with passengers, controls over items left behind on the aircraft by disembarking passengers, security controls for commercial courier services and controls over cargo and mail under certain situations.

The latest Amendment 10 to Annex 17 was adopted by the ICAO Council on 7 December 2001 in order to address challenges posed to civil aviation by the events of 11 September 2001. It became applicable on 1 July 2002. The amendment includes various definitions and new provisions in relation to the applicability of this Annex to domestic operations; international cooperation relating to threat information; national quality control; access control; measures related to passengers and their cabin and hold baggage; in-

flight security personnel and protection of the cockpit; code-sharing/collaborative arrangements; human factors; and management of response to acts of unlawful interference.

The Attachment to Annex 17 provides officials of States responsible for implementing national programmes with a verbatim extract of all relevant specifications appearing in the other Annexes as well as the related procedures appearing in the PANS documents (Procedures for Air Navigation Services - Rules of the Air and Air Traffic Services, and Procedures for Air Navigation Services - Aircraft Operations). This material provides officials with a summary of all security-related Standards, Recommended Practices and procedures in a single document.

The aviation security specifications in Annex 17 and the other Annexes are amplified by detailed guidance material contained in the *Security Manual for Safeguarding Civil Aviation Against Acts of Unlawful Interference* which was first published in 1971. This restricted document provides details of how States can comply with the various Standards and Recommended Practices contained in Annex 17. The Manual has since been developed for the purpose of assisting States to promote safety and security in civil aviation through the development of the legal framework, practices, procedures and material, technical and human resources to prevent and, where necessary, respond to acts of unlawful interference.

The very existence of these documents highlights the intensive vigilance that the Contracting States of ICAO maintain to preserve the safety of international civil aviation from a threat which is non-operational in character or origin.

Although ICAO deals primarily in multilateral arrangements to establish an international framework, much has been done to encourage States to assist each other on a bilateral basis. Annex 17 encourages States to have a security clause in their air transport agreements and a model clause has been made available.

Commencing in late 2002, ICAO's Universal Security Audit Programme is auditing the implementation of Annex 17 provisions by Contracting States. In addition to helping States improve their aviation security systems by identifying deficiencies and providing suitable recommendations, the audits are expected to provide useful feedback concerning the provisions in Annex 17.

ICAO and its Council continue to treat the subject of aviation security as a matter of the highest priority. However, acts of unlawful interference continue to pose a serious threat to the safety and regularity of civil aviation. The Organization has developed and continues to update legal and technical regulations and procedures to prevent and suppress acts of unlawful interference. Since Annex 17 is the principal document giving direction on the establishment of security measures, its uniform and consistent application is paramount if the aviation security system is to be successful.

ANNEX 18
to the Convention on
International Civil Aviation

The Safe Transport of Dangerous Goods by Air

More than half of the cargo carried by all modes of transport in the world is dangerous cargo – explosive, corrosive, flammable, toxic and even radioactive. These dangerous goods are essential for a wide variety of global industrial, commercial, medical and research requirements and processes. Because of the advantages of air transport, a great deal of this dangerous cargo is carried by aircraft.

ICAO recognizes the importance of this type of cargo and has taken steps to ensure that such cargo can be carried safely. This has been done by adopting Annex 18, together with the associated document *Technical Instructions for the Safe Transport of Dangerous Goods by Air*. Other codes have existed for regulating the carriage of dangerous goods by air, but these did not apply internationally or were difficult to enforce internationally and, moreover, were not compatible with the corresponding rules of other transport modes.

Annex 18 specifies the broad Standards and Recommended Practices to be followed to enable dangerous goods to be carried safely. The Annex contains fairly stable material requiring only infrequent amendment using the normal Annex amendment process. The Annex also makes binding upon Contracting States the provisions of the Technical Instructions, which contain the very detailed and numerous instructions necessary for the correct handling of dangerous cargo. These require frequent updating as developments occur in the chemical, manufacturing and packaging industries, and a special procedure has been established by the Council to allow the Technical Instructions to be revised and reissued regularly to keep up with new products and advances in technology.

The ICAO requirements for dangerous goods have been largely developed by a panel of experts which was established in 1976. This panel continues to meet and recommends the necessary revisions to the Technical Instructions. As far as possible the Technical Instructions are kept aligned with the recommendations of the United Nations Committee of Experts on the Transport of Dangerous Goods and with the regulations of the International Atomic Energy Agency. The use of these common bases by all forms of transport allows cargo to be transferred safely and smoothly between air, sea, rail and road modes.

The ICAO requirements for the safe handling of dangerous goods firstly identify a limited list of those substances which are unsafe to carry in any circumstances and then show how other potentially dangerous articles or substances can be transported safely.

The nine hazard classes are those determined by the United Nations Committee of Experts and are used for all modes of transport. Class 1 includes explosives of all kinds, such as sporting ammunition, fireworks and signal flares. Class 2 comprises compressed or liquefied gases which may also be toxic or flammable; examples are cylinders of oxygen and refrigerated liquid nitrogen. Class 3 substances are flammable liquids including gasoline, lacquers, paint thinners, etc. Class 4 covers flammable solids, spontaneously combustible materials and materials which, when in contact with water, exit flammable gases (examples are some powdered metals, cellulose type film and charcoal). Class 5 covers oxidizing material, including bromates, chlorates or nitrates; this class also covers organic peroxides which are both oxygen carriers and very combustible. Poisonous or toxic substances, such as pesticides, mercury compounds, etc., comprise Class 6, together with infectious substances which must sometimes be shipped for diagnostic or preventative purposes. Radioactive materials are in Class 7; these are mainly radioactive isotopes needed for medical or research purposes but are sometimes contained in manufactured articles such as heart pacemakers or smoke detectors. Corrosive substances which may be dangerous to human tissue or which pose a hazard to the structure of an aircraft are dealt with in Class 8 (for example, caustic soda, battery fluid, paint remover). Finally, Class 9 is a miscellaneous category for other materials which are potentially hazardous in air transport, such as magnetized materials which could affect the aircraft's navigational systems.

Annex 18 and the Technical Instructions became effective on 1 January 1983 and applicable on I January 1984 when all of the Contracting States of ICAO were expected to conform to the ICAO requirements and to give them legislative recognition.