

AAE2001 – Introduction to Aircraft Design and Aviation Systems

Aviation System

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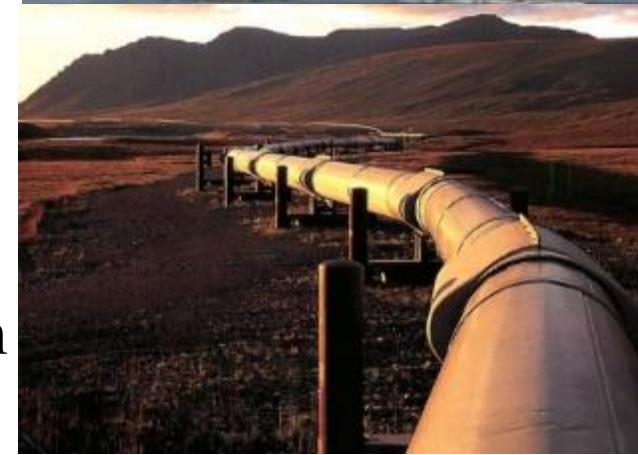


Transportation

No nation is self-sufficient. Each is involved at different levels in trade to sell what it produces and to acquire what it lacks. Trade is facilitated by transportation systems.

The modern day transportation industry includes many modes of transportation such as trucking, railroad, shipping, pipeline and by air.

By air, however, is the fastest mode of connecting people and business, and delivering goods and services. Air transport has become an essential economic and social instrument throughout the world.



Aviation

By definition, aviation is everything related to atmospheric flight. It includes the practical aspects of flying, the operation or simply the use and handling of aircraft, and also the design, development, production of air vehicles.

The aviation industry is all the business activities related to aviation. It includes:

1. Aviation and aerospace manufacturing (manufacturing of aviation and space related items for the civil, military and space related segments of the industry)
2. The airlines: major, national, regional and all cargo
3. General Aviation: All flying except that done by the military and by the scheduled airlines
4. Government aviation including the military and non-military segments. Non-military aviation in the government sector would include the operation of airports or the regulation of civil aviation
5. Airports and infrastructures



The Air Transport System

The International Civil Aviation Organization develops Standards and Recommended Practices for international civil aviation.

At a national level, the country's air transport system is governed and regulated by the national civil aviation authority, based on the SARPs of ICAO.

Civil air transport system is made by three key elements:

- **Infrastructure:** Airports, flight routes and networks
- **Vehicles:** Airlines, aircraft, Manufacturers
- **Operation:** Air traffic controllers and the people, e.g. flight and ground crew, management.



Vehicles



Operation

Air Transport Operation

From the operations' perspective, there are two categories of air transports:

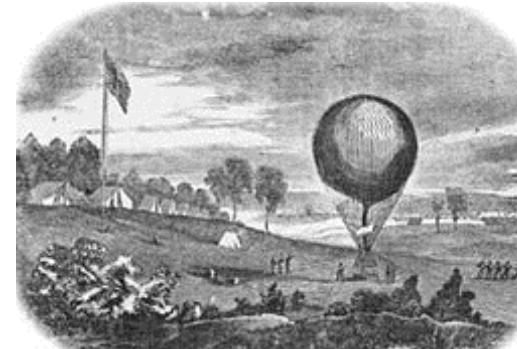
- Civil
- Military

Civil aviation includes all non-military flying, both general aviation and scheduled air transport aircraft, and private and commercial.



Military aviation is the use of air vehicles for the purpose of conducting and enabling warfare. Military aircraft includes bombers, fighters, transports, trainers, and reconnaissance aircraft. Even simple balloons were used as military surveillance air vehicles ~ in as early as the 18th century.

The variety allows for the completion of a wide variety of military objectives.



Aircraft Category and Purpose

Civil

General Aviation

- Business jets
- Trainers
- Homebuilt
- Aerobatic
- Gliders
- Firefighters
- Medical transports

**As of 2013,
360,000
aircraft
worldwide**

Military

Combat aircraft:

- Fighter, Bomber
- Electronic warfare aircraft
- Maritime patrol aircraft
- Multirole combat aircraft

Non-combat aircraft

- Military transport aircraft
- Reconnaissance, surveillance aircraft and UAV
- Experimental Aircraft

Transport

- Airliners
- Cargo aircraft
- Mail planes

Other Civil Aviation

aircraft:

- Sea plane
- Special purpose aircraft
- Rotorcraft
- UAV



Civil Aviation

Civil aviation is one of two major categories of flying, representing all non-military aviation, both private and commercial.

Civil aviation aircraft are distinguished by two categories:

- Non-scheduled general aviation: **including all non-scheduled civil flights, private or commercial**
- Scheduled air transport: **including all passenger and cargo flights operating on regularly schedules and routes**

Scheduled air transport is the larger operation in terms of passenger numbers, however, GA is larger in the number of flights.



Scheduled Air Transport



Scheduled air transport including all passenger and cargo flights operating on regularly published schedules and routes, in which services and flights are open to use by the public for a service fee. All airlines are in the scheduled air transport category.



Aircraft operating in this category have less flexibility with respect to choice of airports, hours of operation, load factors and similar operational characteristics than do non-scheduled category. Scheduled air transports must operate flights even if partially loaded, i.e. low load factor.



The common use of scheduled air transport includes:

- Scheduled air cargo and freight carriers
- Scheduled air passenger carriers
- Transport of passengers by air over regular routes and on regular schedules
- Renting of air-transport equipment with operator for the purpose of scheduled passenger transportation

Non-Scheduled Air Transport

Non-Scheduled Air Transport is also commonly referred to as **General Aviation**. GA includes:

- Private and recreation air transportation
- Ambulance Services
- Nonscheduled Chartered Passenger and Freight Air Transportation
- Scenic and Sightseeing Transportation, and Air taxi services
- **Air ambulance** provides the fastest method of transporting critically ill patients from one facility to another, medical rescue services for people in urgent and dangerous situations, or to bring critically ill patients closer to loved ones in the quickest possible way.
- **Air taxi** services companies provided short-haul, on-demand transportation. Air taxi are usually small airplanes or helicopters. Most air taxi service providers also utilized their fleets for sightseeing trips, or commutes between airports, chartered emergency medical transportation, and the delivery of workers and equipment to offshore oil well sites.
- **Charter air transportations** are hired air transportations, similar to car rental. Most chartered air service are on ad-hoc basis, however, it is not uncommon for airline companies to hire chartered airplanes on short term basis.





How does it work?

Countries of the world

The term "country" is used to refer to sovereign States. At present, there are 206 total sovereign States, 195 or so countries, with 193 States participating in the United Nations.

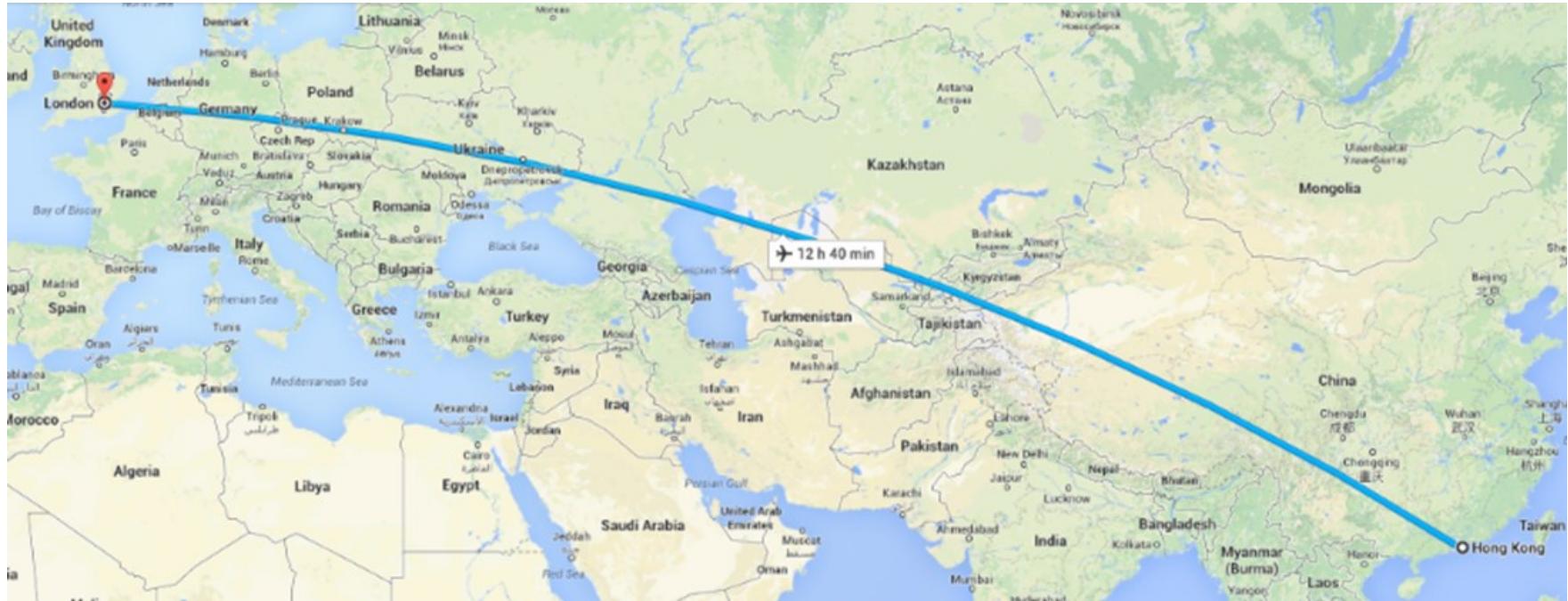


How does it work?

Hong Kong to London Example

The distance between London and Hong Kong is some 9641km. A flight from HKG to LHR passes through 7 different countries (sovereign States): China, Kazakhstan, Russia, Ukraine, Poland, Germany and the Netherlands, and enter and land in the territory of the UK.

Problem: Crossing the airspaces of sovereign States and landing in the UK require permissions of each State.



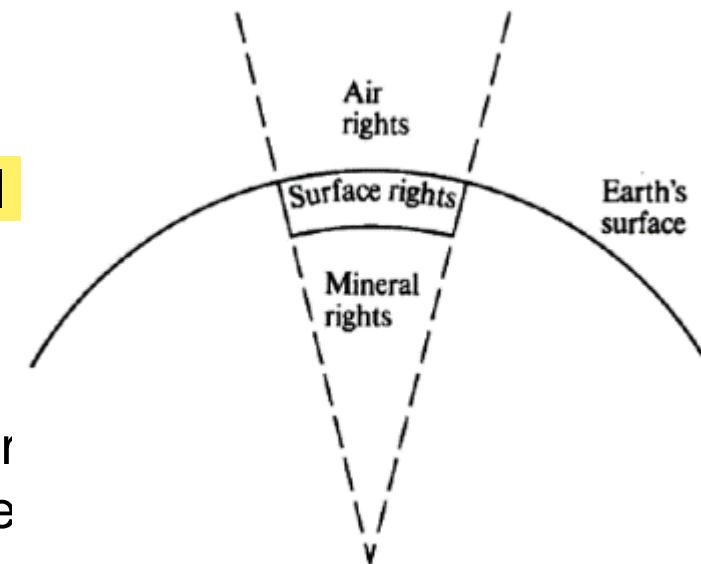
Airspace

Air sovereignty is the fundamental right of a sovereign State to regulate the use of its airspace, protect its territory and enforce its own aviation law - in extreme circumstance by the use of military fighter aircraft.

Airspace above the land and sea areas of a State generally forms part of the sovereign State area. Traditionally, flights by aircraft of one country into the airspace of another need prior permission.

Flights by some civil aircraft into the airspace of a UN member State does not need prior permission (Convention on International Civil Aviation).

Airspace means the portion of the atmosphere controlled by a country above its territory, including its territorial waters or, more generally, any specific three-dimensional portion of the atmosphere. It is not the same as aerospace, which is the general term for Earth's atmosphere and the outer space in its vicinity.



How does it work?

How did the aviation industry create boundary-free way of air travel that we take for granted today?

Freedoms of the Air

The freedoms of the air are the reason that we can enjoy a boundary-free way of air travel. The freedoms of the air is the fundamental building blocks of the international commercial aviation route network.

The freedoms of the air are a set of commercial aviation rights, agreed multilaterally, but some bilaterally, between two States, granting a country's airline the privilege to enter and land in another country's airspace, formulated as a result of agreements over the extent of aviation liberalization in the Convention on international Civil Aviation of 1944, known as the Chicago convention.

There are 9 freedoms of the air. The first five freedoms are officially Stated in the Chicago convention, and the remaining 4 freedoms have been agreed and in use, but not official instated.

9 Freedoms of the Air

1st Freedom of the Air: The right for an airline of one signatory State to fly and carry payload from its home country over the territory of another signatory State (land “A”) without landing.



Example: An American Airline flight from the US to somewhere in South America would be permitted to fly through Mexico’s airspace to get there.

2nd Freedom of the Air: The right for an airline of one signatory State to carry payload and fly from its home country and land in the territory of another signatory State (Land “A”) for technical operations/reasons such as refueling and repairs without enplaning or deplaning payloads, then continue its flight to the final destination.



Example: An Australian Airline flight from Melbourne to London could stop in Dubai to refuel but no passengers nor cargo could get on or off.

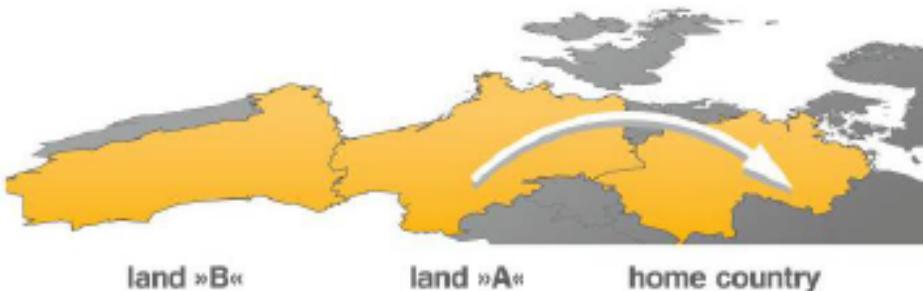
9 Freedoms of the Air – cont...

3rd Freedom of the Air: The right for an airline of one signatory State to carry payload and fly from its home country to land and deplane payloads in the territory of another signatory State (Land “A”).



Example: An HK Airline flight from HK to Malaysia could bring passengers originating in HK to Malaysia

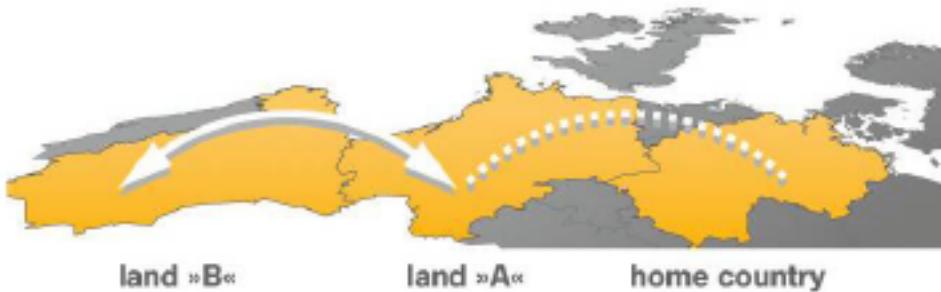
4th Freedom of the Air: The right for an airline of one signatory State to carry payload and fly from another signatory country and to deplane payloads in its home country.



Example: An HK Airline flight from Malaysia to HK could bring passengers originating in Malaysia to HK

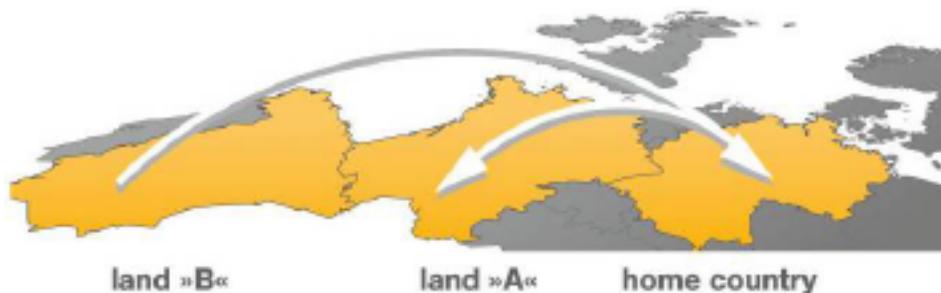
9 Freedoms of the Air – cont...

5th Freedom of the Air: The right for an airline of one signatory State to carry payload and fly between signatory State Land A and signatory State Land B given the flight is originated from or destined at its home country.



Example: An Australian Airline flight from Melbourne to London could stop in Dubai to enplane and deplane payload before continuing the flight to London.

6th Freedom of the Air: The right for an airline of one signatory State to carry payload and fly from one signatory State Land “B” to another signatory State Land “A” through/via its home country.



Example: A British airline flight from HK to Hamburg via London could pick up passengers from HK via a transit in London before deplaning passengers in Hamburg.

9 Freedoms of the Air – cont...

7th Freedom of the Air: The right for an airline of one signatory State to *carry payload* and fly between signatory State Land A and signatory State Land B while the flight need not originate from or destine at its home country.



Example: A Singapore Airline flight from Frankfurt to JFK could pick up payload in Frankfurt to flight and off load passengers in New York.

8th Freedom of the Air: The right for an airline of one signatory State to carry payload and fly between two destinations within a signatory country (Land "A") given the flight originates in its home country or a third country (Land "B").



Example: A Singapore Airline flight from Frankfurt to JFK to San Francisco could pick up passengers in New York and off load passengers in San Francisco.

9 Freedoms of the Air – cont...

9th Freedom of the Air: The right for an airline of one signatory State to carry payload and fly between two destinations within a signatory country (Land "A") without restriction.

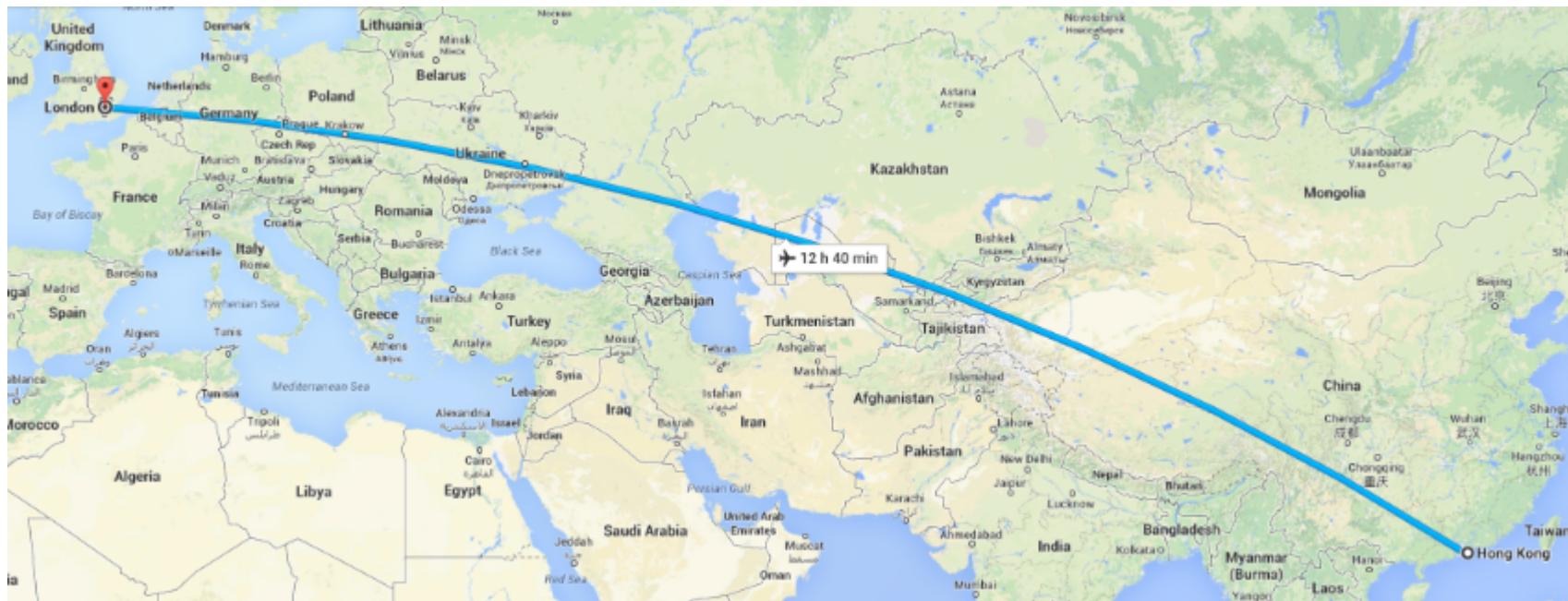


Example: Qantas Airways, an Australian airline, to carrying passengers and fly regular domestic flights and routes in New Zealand.

Further comments

- The 6th - 9th Freedom of the Air (inclusively) are not officially recognized under international treaties.
- Most signatory sovereign States exchange the first and second freedoms through the international air service Transit agreement.
- The other freedoms are usually established between States in bilateral or multilateral air service agreements.
- The third and fourth freedoms are always granted together.
- The eight and ninth freedoms have been exchanged by ICAO signatory States in the EU, and between AUS and NZ.

Hong Kong to London



A Hong Kong airline flight from HKG to LHR will pass through 7 different States, namely: China, Kazakhstan, Russia, Ukraine, Poland, Germany and the Netherlands.

Given all 9 States are signatory members of the Chicago Convention, the scheduled commercial flight from HKG can exercise the first Freedom of the air to fly over all 8 foreign States. The UK and HK governments must have a bilateral agreement in place to exercise the third Freedom of the air, in order for the flight to land and disembark at LHR.



INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO)

A United Nations specialized Agency



The International Civil Aviation Organization (ICAO) came into being in April 1947 as a result of agreements established at the **Convention on International Civil Aviation in Chicago** (Chicago Convention) in 1945. ICAO is a UN specialized agency since October 1947. The headquarter is located in Montreal, Canada.

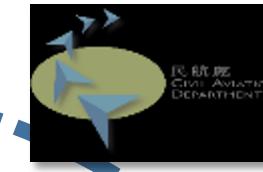
ICAO works with the Convention's current 193 Signatory States, global industry and aviation organizations to develop international Standards and Recommended Practices (SARPs) which are then used by States when they develop their legally-binding national civil aviation regulations.

There are currently over 10,000 SARPs reflected in the 19 Annexes to the Chicago Convention which ICAO oversees, and it is through these SARPs and ICAO's complementary policy, auditing and capacity-building efforts that today's global air transport network is able to operate over 100,000 daily flights, safely, efficiently and securely in every region of the world.



At an international level, the International Civil Aviation Organization oversees and facilitates the standardization, harmonization and cooperation of civil aviation of signatory states and national aviation authority.

International regulatory body



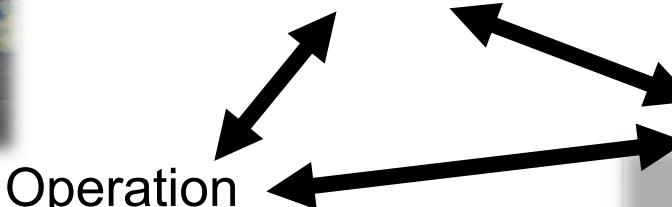
National Aviation Authority



Infrastructure

Operation

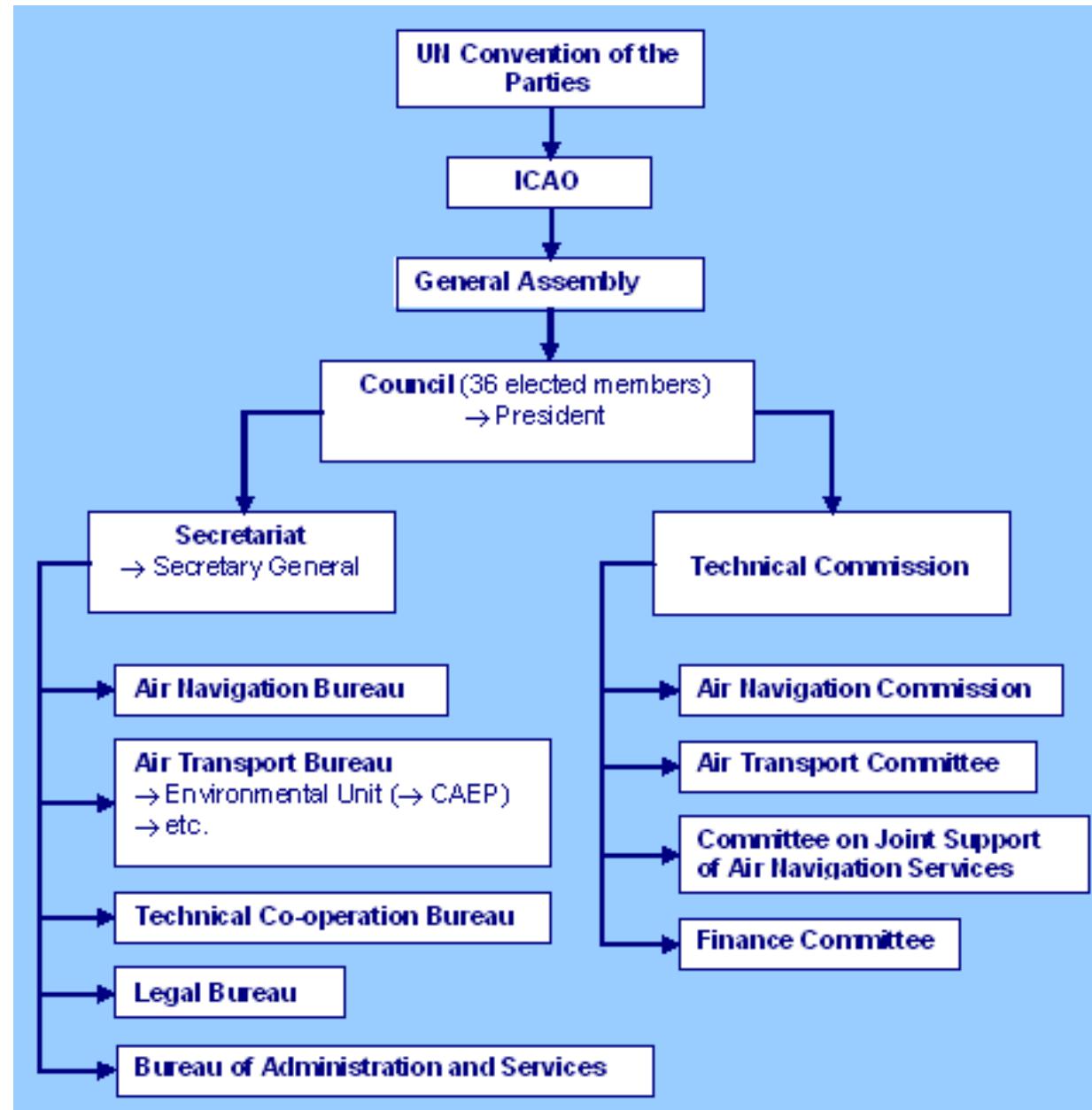
Vehicles



Organizational Structure

The constitution of ICAO is the Convention on International Civil Aviation, drawn up by a conference of International Civil Aviation in Chicago in December 1944, and to which each ICAO Signatory State is a party.

According to the terms of the Convention, the Organization is made up of an Assembly, a Council of limited membership with various subordinate bodies and a Secretariat. The chief officers are the President of the Council and the Secretary General.



The missions of ICAO

Eight strategic objectives of ICAO:

1. Foster the implementation of ICAO Standards and Recommended Practices (SARPs). 実施
2. Develop and adopt new or amended SARPS and associated documents in a timely manner.
3. Strengthen the legal framework governing international civil aviation.
4. Ensure the currency, coordination and implementation of regional air navigation plans and provide the framework for the efficient implementation of new air navigation systems and services.
5. Respond to major challenges to the safe, secure and efficient development and operation of civil aviation.
6. Ensure that guidance and information on the economic regulation of international air transport is current and effective.
7. Assist in the mobilization of human, technical and financial resources for civil aviation facilities and services.
8. Ensure the greatest possible efficiency and effectiveness in the operations of the organization.

SARPs 19 Annexes

26

Annex 1 – Personnel Licensing, Licensing of flight crews, air traffic controllers & aircraft maintenance personnel

Annex 2 – Rules of the Air

Annex 3 – Meteorological Service for International Air Navigation

Annex 4 – Aeronautical Charts

Annex 5 – Units of Measurement to be used in Air and Ground Operations

Annex 6 – Operation of Aircraft

Annex 7 – Aircraft Nationality and Registration Marks

Annex 8 – Airworthiness of Aircraft

Annex 9 – Facilitation

Annex 10 – Aeronautical Telecommunications

Annex 11 – Air Traffic Services – Air Traffic Control Service, Flight Information Service and Alerting Service

Annex 12 – Search and Rescue

Annex 13 – Aircraft Accident and Incident Investigation

Annex 14 – Aerodromes

Annex 15 – Aeronautical Information Services

Annex 16 – Environmental Protection

Annex 17 – Security: Safeguarding International Civil Aviation Against Acts of Unlawful Interference

Annex 18 – The Safe Transport of Dangerous Goods by Air

Annex 19 – Safety Management (Since 14 November 2013)



Some Contributions of ICAO

International Standard Atmosphere: ICAO defines an International Standard Atmosphere, a model of the standard variation of pressure, temperature, density, and viscosity with altitude in the Earth's atmosphere for design purposes.

ICAO standardizes machine-readable passports worldwide.

ICAO standard passports have an area where some of the information written as strings of alphanumeric characters, printed in a manner suitable for optical character recognition. This enables border controllers and other law enforcement agents to process such passports quickly. A more recent standard is for biometric passports. These contain biometrics to authenticate the identity of travelers.



Air Navigation Infrastructures: ICAO is active in infrastructure management, including Communication, Navigation, Surveillance / Air Traffic Management (CNS/ATM) systems, which employ digital technologies (like satellite systems with various levels of automation) in order to maintain a seamless global air traffic management system.

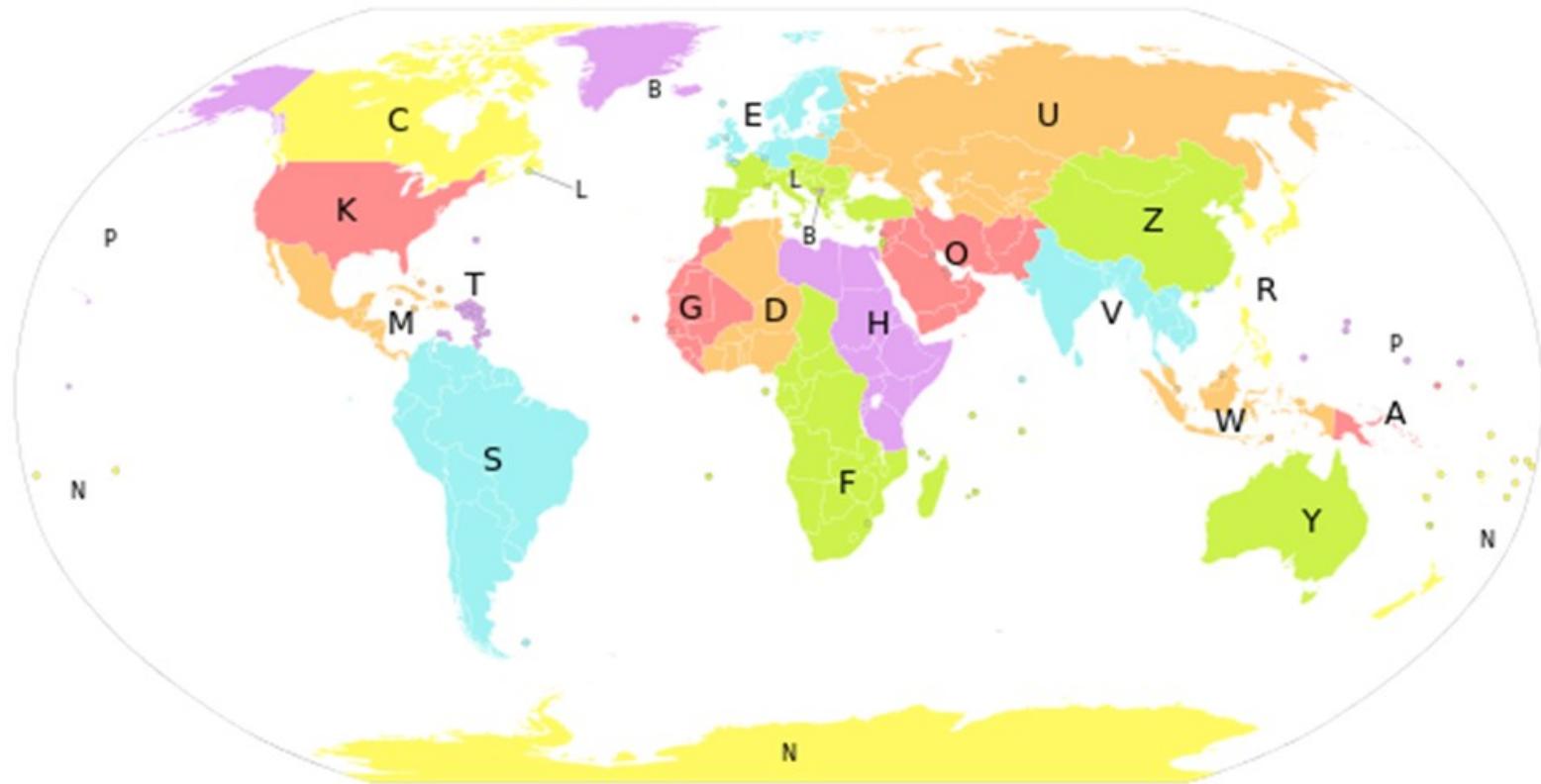
Investigations of air disasters

Most air accident investigations are carried out by an national aviation agency of a country that is associated in some way with the accident. For example, the Air Accidents Investigation Branch conducts accident investigations on behalf of the British Government. ICAO has conducted three investigations involving air disasters, of which two were passenger airliners shot down while in international flight over hostile territory.

- [Libyan Arab Airlines Flight 114](#) which was shot down on 21 February 1973 by Israeli F-4 jets over the Sinai Peninsula during a period of tension that led to the Arab-Israeli Yom Kippur War.
- [Korean Air Lines Flight 007](#) which was shot down on 1 September 1983 by a Soviet Su-15 interceptor near Moneron Island just west of Sakhalin Island during a period of heightened Cold War tension.
- [UTA Flight 772](#) which was destroyed by a bomb on 19 September 1989 above the Sahara Desert in Niger, en route from N'Djamena, Chad, to Paris, France.

ICAO Registered Codes

- ICAO assigns standard airport and airline codes. **ICAO codes are used by air traffic control and airline operations such as flight planning.** ICAO uses 4-letter airport codes. The ICAO code is based on the region and country of the airport—for example, Charles de Gaulle Airport has an ICAO code of LFPG, where L indicates Southern Europe, F, France, PG, Paris de Gaulle, while Orly Airport has the code LFPO.



ICAO Registered Codes

- ICAO assigns 3-letter codes to each aircraft operating agency (or airline), aeronautical authority, and services related to international aviation. Airline codes for e.g., United Airlines is UAL, Cathay Pacific CPA. The 3-letter systems has been employed since 1987.
- ICAO maintains the standards for aircraft registration ("tail numbers"), including the alphanumeric codes that identify the country of registration. For example, airplanes registered in the United States have tail numbers starting with N. The tail number helps people to identify it and this is important for operation around an airport. It is also important so that someone can report a violation, and that someone and its State is accountable for the aircraft.



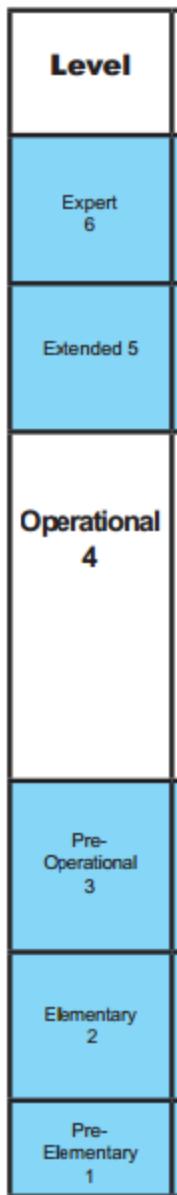
ICAO English Proficiency

English is the de facto civil aviation language. Historically, insufficient English language proficiency on the part of the flight crew or the controller has contributed to a number of accidents and serious incidents (~70%), and in some instances, where recoverable emergency situations were not saved.

In 2003, the ICAO has introduced language proficiency requirements for air traffic controllers, pilots and flight crew with the objective to improve the level of language proficiency globally and reduce the frequency of communication errors.

The requirements for language proficiency for operational personnel are detailed in ICAO Annex 1 - Personnel Licensing

ICAO Level 4



There are six skill areas:

- Pronunciation
- Fluency
- Structure
- Vocabulary
- Comprehension
- Interaction

The proficiency scale ranges from Level 1 to Level 6. The individual's proficiency level will affect personnel licensing.

Flight crew, Air Traffic Controllers and all others who use English in R/T communication on international routes must be at ICAO English Language Level 4 (Operational) or above.

Reassessment Procedures

ICAO require that language skills of pilots and controllers rated at Level 4 are reassessed every three years, Level 5 pilots and controllers - every six years, while at Level 6, no further assessment of English language skills is deemed necessary.

Civil Aviation Authorities

Although ICAO oversees the sky. It does not act as an enforcer of all signatory states. Instead, contracting countries pledge to adhere to standards set forth by the organization, and to establish civil aviation authorities (CAA) and civil aviation regulations within their own governments - in accordance with ICAO's Annexes to the Chicago Convention. E.g., FAA is the CAA in the US, CASA is the CAA in Australia, EASA is the CAA in the European Union, and CAD in Hong Kong.

When ICAO makes a safety recommendation, all contracting states, civil aviation authorities, airlines and all civil aviation stakeholders listen.

Way of working: It is a two way street, ICAO work together with all contracting states, civil aviation authorities, airlines and all civil aviation stakeholders to establish common standards and recommended practices for civil aviation, and to promote international civil aviation and seamless global travel.



Civil Aviation Authority

Civil Aviation Authorities

At a national level, the country's air transport system is governed and regulated by the national aviation authority.



International regulatory body



中國民航
CAAC



National Aviation Authority



Infrastructure

Operation

Vehicles



Civil Aviation Authorities



Under the Chicago convention, all Signatory states are required to establish their own civil aviation authority (CAA) and civil aviation regulations within their own governments to enforce and ensure adhesion to standards set forth by the organization.



The FAA in the US, the EASA in the European Union, the CAD in Hong Kong, the CASA in Australia, the CAA in Canada, the CAA in UK, the CAAC in China are just a few of the civil aviation organizations around the world.



FAA, EASA, CAD

National aviation authorities such as FAA (US) and EASA (EU) are the standards and safety requirement enforcers for all things in the civil aeronautics and aviation industry within the region of their jurisdiction.

Defense/military equipment plays to a different set of rules called Military standards, such as MIL-SPECS (US) and DefStan (UK). However, aviation authorities around the globe tend to work with high level of mutual cooperation thanks to the ICAO.

The Civil Aviation Department (CAD)

of Hong Kong regulates the civil aviation activities within Hong Kong.

The Federal Aviation Administration (FAA)

is the national aviation authority of the United States. It has authority to regulate and oversee all aspects of American civil aviation.

The European Aviation Safety Agency (EASA)

is a European Union (EU) agency with “regulatory and executive tasks in the field of civilian aviation safety and environmental protection” within EU, Norway and Switzerland. The EASA succeeded the functions of the Joint Aviation Authorities (JAA) in 2003 after the European Commission adopted the “Single European Sky” to coordinate regulate the airspace and air traffic within the EU, Norway and Switzerland.

Civil Aviation Authority

The CAAs oversee, regulate and ensure the required standards are met for the following areas of civil aviation within their national territory.

- **Personnel licensing** — regulating the basic training and issuance of licenses and certificates.
- **Flight operations** — carrying out safety oversight of commercial operators.
- **Airworthiness** — issuing certificates of registration and certificates of airworthiness to civil aircraft, and overseeing the safety of aircraft maintenance organizations.
- **Aerodromes** — designing and constructing aerodrome facilities.
- **Air traffic services** — managing the traffic inside of a country's airspace.
- **Certification** - process to ensure the design complies with the required standards, meets the quality assurance tests, and issuing of type certificates to civil aviation equipment.

Aviation Regulations and Guidelines

FAR (Federal Aviation Regulations) are rules prescribed by FAA, and are organized in Parts. Each part deals with a specific type of activity.

For example:

- **Part 21** Cert. Procedures for Products and Parts
- **Part 23** AS: Normal, Utility, Aerobatic and Commuter Airplanes
- **Part 25** AS: Transport Airplanes
- **Part 27** AS: Normal Rotorcraft
- **Part 29** AS: Transport Rotorcraft
- **Part 33** AS: Aircraft Engines
- **Part 35 – AS**: Propellers
- **Part 47 – Aircraft Registration**
- etc

The rules specified by EASA are called Certification Specifications (CS). Each CS deals with a specific type of activity. For example:

- **CS-22** (Sailplanes and Powered Sailplanes)
- **CS-23** (Normal, Utility, Aerobatic and Commuter Aeroplanes)
- **CS-25** (Large Aeroplanes)
- **CS-27** (Small Rotorcraft)
- **CS-29** (Large Rotorcraft)
- **CS-31GB** (Gas Balloons)
- **CS-31HB** (Hot Air Balloons)
- **CS-31TGB** (Tethered Gas Balloons)
- **CS-E** (Engines)
- **CS-P** (Propellers)
- etc

All aircraft and operators must meet the airworthiness standards and comply with aviation regulations before taking-off into the sky.

ICAO Annex 8: Airworthiness of Aircraft

- Certification requirements for civil [commercial] aircraft are derived from ICAO Annex 8 Airworthiness of Aircraft [ICAO, 2016] and the ICAO Airworthiness Manual, Part V State of Design and State of Manufacture [ICAO, 2014]. Each ICAO contracting state then establishes its own legal framework to implement the internationally agreed standards and recommended practices.
- The main technical codes to be followed for the design of products for certification are set out below as a list of certification specifications for Europe (EASA) and airworthiness standards for USA (FAA) applicable to different categories of product and environmental consideration.

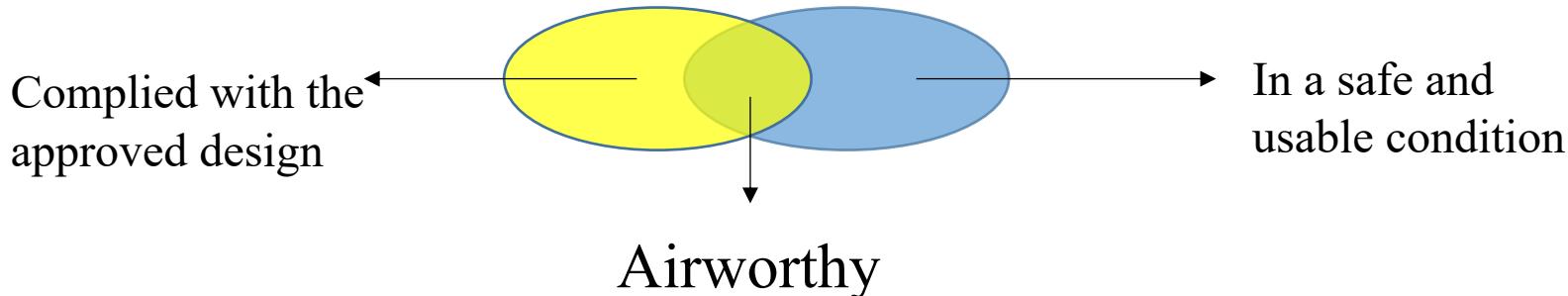
Airworthiness

Airworthiness--is the condition of an aircraft, aircraft system, or component in which it operates in a safe manner to accomplish its intended function.

It means compliance with applicable aviation authorities regulations, that define the **minimum safety level** for an aircraft. But manufacturer like Airbus can suggest the higher level .

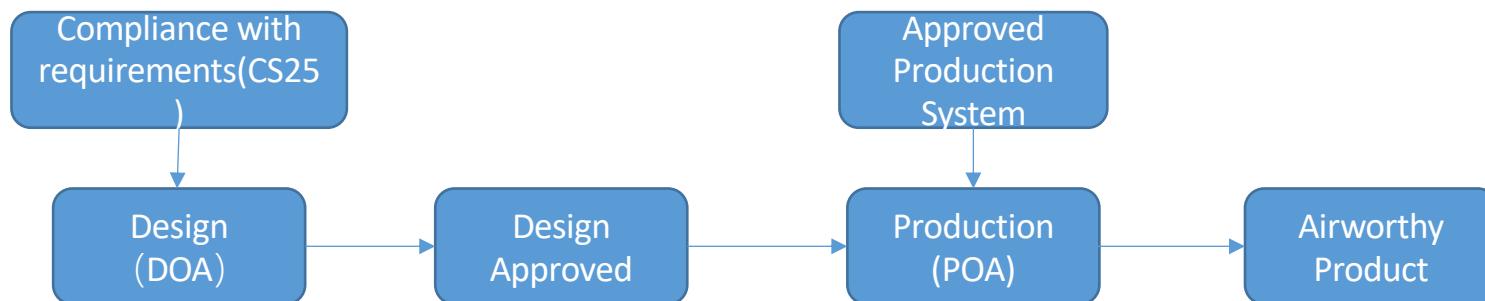
An aircraft is airworthy when:

- designed and built according to applicable regulations,
- operated within its intended environment, quantified and declared limitations
- maintained in accordance with procedures acceptable to the responsible authority.



Airworthiness

- Initial Airworthiness = Design+Production
- Continued Airworthiness = Operation+Maintenance

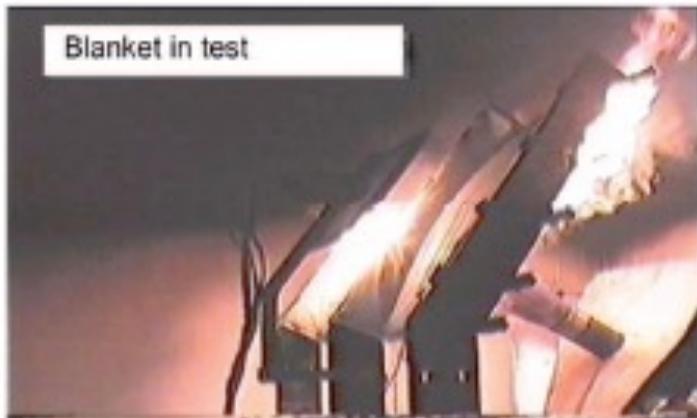


- Continued Airworthiness:
 - The aircraft must be the same as that described in the type certification, supplementary TC, and any approved alternations
 - Performed all necessary Airworthiness Directives
 - Manufacturer Service Bulletins
 - Inspections and maintenance
 - Repair any accidental damages according to repair manual and/or manufacturer advice.

Certification

- **Certification**—is the legal recognition that a product, service, organization or person complies with the applicable requirements. For example,
- **Type Certificate (TC)**--signifies the airworthiness of a particular category of aircraft, according to its manufacturing design ('type'). It confirms that the aircraft is manufactured according to an approved design, and that the design ensures compliance with airworthiness requirements.
- **Supplemental Type Certificate (STC)**-- The approval of a major change to the Type Design by a Design Organization other than the TC Holder, or by the TC Holder under procedures other than the TC procedures
- **Parts Manufacturer Approval (PMA)**--Is a combined design and production approval for modification and replacement articles. It allows a manufacturer to produce and sell these articles for installation on type certificated products. (**CAAC&FAA definition**)

Compliance demonstration—Cabin practical example



Flammability

- 1100 °C
- Tow insulation blankets
- As installed in the A/C

Requirements *CCAR-25 856*

Documents

- No flame penetration within 4 min
- Heat flux density < 23 kW/m² in a distance of 304 mm from the front side of the blanket
- 3 identical test set ups have to fulfil
- Test plan & Test report

General Requirements

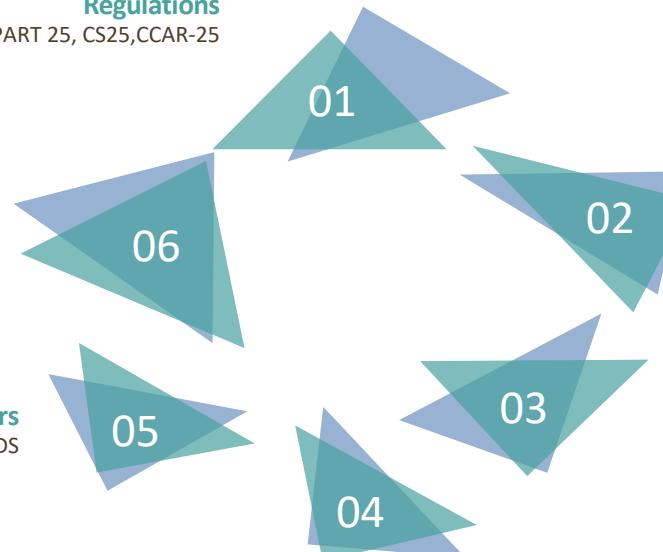


ARINC 404
Air transport Rack



Others
ARINC STANDARDS

Regulations
PART 25, CS25,CCAR-25



ARINC 601
design control/Display
Interface
criteria and guidance

Do-160G

Environmental Conditions and
test Procedures for Airborne
Equipment (incl. Temperature,
pressure, mechanical, EMC...)



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DO-178

Software considerations in
airborne systems and
equipment certification

DO-160 Test

TEST	A/C Product	Mobile phone
Vibration	Frequency 10~2000Hz(0.5g-pk)	Frequency 10~30Hz
Humidity	2 cycles of 24 h (+38°C, 85% RH /+ 50°C, 95% RH)	60°C 96%RH for 60h
ESD	Level A:+/-15kV ~ +/-16.5kV	+/-4kV ~ +/ -8kV
Drop Test	-20g	Drop from 1.5m to marble Floor
Temperature	<ul style="list-style-type: none"> “Operating High and Low Temperature” between +55°C and -15°C “Ground Survival Test” for High and Low Temperature between +85°C and -55°C 	“Operating High and Low Temperature” between +55°C and -15°C
Flammability	Burn length: below 152 mm	
Smoke density	Dm*: Limit: 200	
Heat released	HRRmax ¹ : Limit:65 kW/m ²	
Pressure	<ul style="list-style-type: none"> Steady State Altitude (15000 ft, 571,8 mbar) Decompression (116 kPa) Overpressure (170 kPa) 	

DO-160 Test

TEST	A/C Product
Radio frequency	Injection in power and signal cable bundle between 10 kHz – 400 MHz, CAT T
RF radiated susceptibility	<ul style="list-style-type: none">• RF power between 100 – 400 MHz at 20 V/m CW• RF power between 400 MHz – 8 GHz 150 V/m pulsed modulation
RF radiated susceptibility (int. transmitter environment) sec. 20.5	<ul style="list-style-type: none">• RF power between 300 MHz – 6 GHz at 20 V/m CW• Add. modulated signal at same level
Lightning induced transient susceptibility, cable bundle test sec. 22.5	Cable induction test on Power bundle between 3 - 10 MHz, multiple stroke, e.g. 500 V / 20 A
Conducted emission of RF energy	Power line test, all lines between 150 kHz – 200 MHz
Radiated emission of RF energy	Radiated RF power in horizontal and vertical polarization between 2 MHz – 6 GHz

E.g. Airworthiness Certificate

UNITED STATES OF AMERICA DEPARTMENT OF TRANSPORTATION—FEDERAL AVIATION ADMINISTRATION STANDARD AIRWORTHINESS CERTIFICATE			
1. NATIONALITY AND REGISTRATION MARKS	2. MANUFACTURER AND MODEL	3. AIRCRAFT SERIAL NUMBER	4. CATEGORY
N12345	CESSNA C-150L	6969	NORMAL
5. AUTHORITY AND BASIS FOR ISSUANCE			
This airworthiness certificate is issued pursuant to the Federal Aviation Act of 1958 and certifies that, as of the date of issuance, the aircraft to which issued has been inspected and found to conform to the type certificate therefor, to be in condition for safe operation, and has been shown to meet the requirements of the applicable comprehensive and detailed airworthiness code as provided by Annex 8 to the Convention on International Civil Aviation, except as noted herein.			
Exceptions: NONE			
6. TERMS AND CONDITIONS			
Unless sooner surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator, this airworthiness certificate is effective as long as the maintenance, preventative maintenance, and alterations are performed in accordance with Parts 21, 43, and 91 of the Federal Aviation Regulations, as appropriate, and the aircraft is registered in the United States.			
DATE OF ISSUANCE	FAA REPRESENTATIVE	DESIGNATION NUMBER	
1/29/96	R.E. BARO	AEA-FSDO-03	
Any alteration, reproduction, or misuse of this certificate may be punishable by a fine not exceeding \$1,000 or imprisonment not exceeding 3 years, or both. THIS CERTIFICATE MUST BE DISPLAYED IN THE AIRCRAFT IN ACCORDANCE WITH APPLICABLE FEDERAL AVIATION REGULATIONS.			
FAA FORM 8100-2 (8-82)			GPO 892-804

Operating Rules

The airworthiness authorities also regulates and specify rules in relations to how airplane shall be flown and how airlines shall operate in order to assure safety. Selected FAR Parts relevant to these aspects include:

Part 45 – Identification and Registration Marking

Part 47 – Aircraft Registration

Part 61 – Certification: Pilots, Flight Instructors, and Ground Instructors

Part 91 – General Operating and Flight Rules

Part 97 – Standard Instrument Approach Procedures

Part 119 – Certification: Air Carriers and Commercial Operators

Part 121 – Operating Requirements: Domestic, Flag, and supplemental Operations

Part 125 – Certification and Operations: Airplanes Having a Seating Capacity of 20 or More Passengers or a Payload Capacity of 6,000 Pounds or More

Part 135 – Operating Requirements: Commuter and On Demand Operations and Rules Governing Persons on Board Such Aircraft



Air Carrier Certificate

This certifies that

GRANDE AVIATION, LLC,
10119 MURDOCK K DRIVE,
KNOXVILLE, TENNESSEE, 37931

has met the requirements of the Federal Aviation Act of 1958, as amended, and the rules, regulations, and standards prescribed thereunder, for the issuance of this certificate and is hereby authorized to operate as an air carrier and conduct common carriage operations in accordance with said Act and the rules, regulations, and standards prescribed thereunder and the terms, conditions, and limitations contained in the approved operations specifications.

This certificate is not transferable and, unless sooner surrendered, suspended, or revoked, shall continue in effect indefinitely.

By Director of the Airline Division



WALLACE E. LEWIS
DIRECTOR OF THE AIRLINE DIVISION
FEBRUARY 23, 2011

Certificate number: 0G0484MS
Effective Date: FEBRUARY 23, 2011
Issued At: NASHVILLE, TN

CENTRAL ROCKY REGION
REGISTRATION

Aircraft Registration



Country	Registration Prefix	Presentation
Australia	VH	VH-AAA to VH-ZZZ
:	:	:
Germany	D	D-AAAA to D-AZZZ for aircraft with more than 20t MTOW D-0001 to D-9999 for Gliders
:	:	:
Hong Kong	B-HAA B-KAA B-LAA	B-HAA to B-HZZ B-KAA to B-KZZ B-LAA to B-LZZ
:	:	:
United Kingdom	G	G-AAAA to G-ZZZZ
:	:	:
United States of America	N	N1 to N99999 N1A to N9999Z N1AA to N999ZZ

Certification: Air Carriers and Commercial Operators

The RHS shows a sample of the air operator's certificate issued by the Civil Aviation Department of Hong Kong.



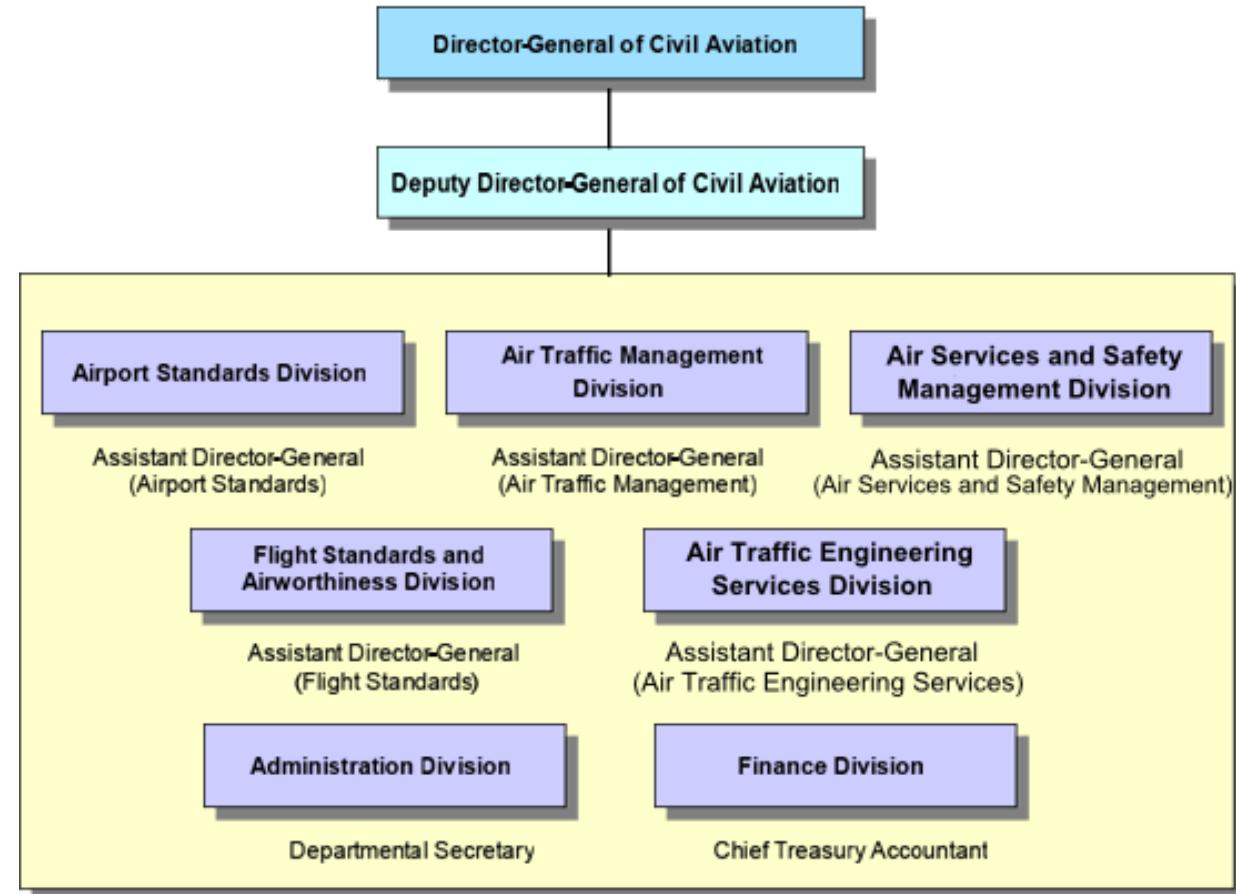
AIR OPERATOR'S CERTIFICATE		
	香港特別行政區政府 THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION 民航處 CIVIL AVIATION DEPARTMENT	
AOC #: 99 Issue #: 99 (Rev 99) Expiry date: 31-12-20xx	XYZ AIRLINES LIMITED Operator Address: XYZ Airlines Limited 99 th Floor XYZ Building 99 XYZ Road XYZ District Hong Kong Telephone: (852) 1234 5678 Fax: (852) 1234 5678 E-mail: info@xyzairlines.com	OPERATIONAL POINTS OF CONTACT Contact details at which operational management can be contacted without undue delay are listed at page 2.
<p>Pursuant to the Air Navigation (Hong Kong) Order 1995 (CAP 448C), this certificate certifies that XYZ Airlines Limited is competent to perform the public transport of passengers and cargo, as defined in the attached operations specifications, in accordance with the operations manual and CAP 448C.</p> <p>This certificate shall remain in force until 31 December 20xx unless previously revoked or suspended.</p> <p>The AOC #99 previously issued is hereby revoked.</p>		

Civil Aviation Department of Hong Kong



The chart on the RHS is the organizational chart of the Civil Aviation Department of Hong Kong.

The Department is headed by the Director-General of Civil Aviation, whose deputy is the Deputy Director-General of Civil Aviation.



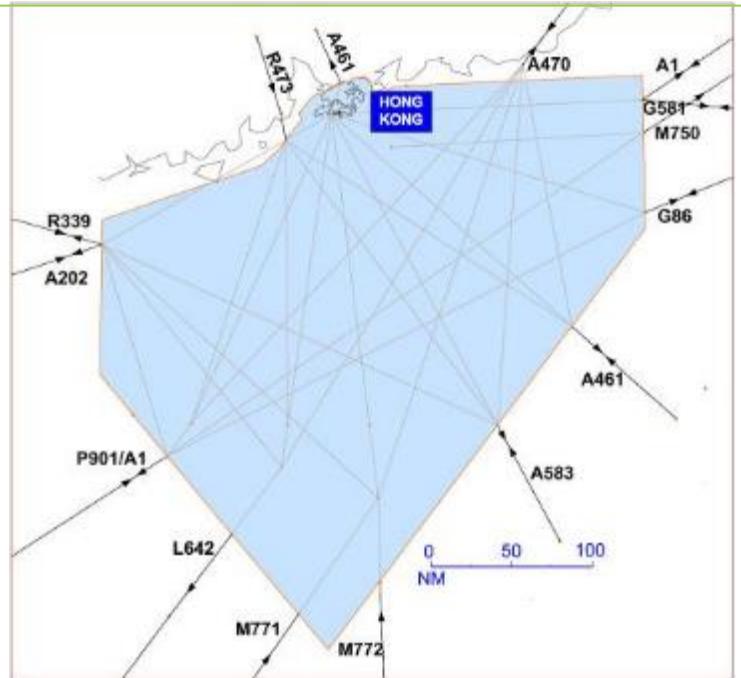
Under the Director-General and Deputy Director-General are seven divisions, which includes 5 technical divisions, plus the Administration Division and the Finance Division

CAD Technical Divisions

The Responsibilities of the **Air Traffic Management Division** are:

- the provision of air traffic control service,
- flight information service and alerting service within the HK Flight Information Region (FIR) as assigned by ICAO.

The airspace covers a total area of 276,000 square kilometers extending over the South China Sea.



CAD Technical Divisions cont.



Civil Aviation Department
The Government of the Hong Kong Special Administrative Region

GovHK 香港政府一站通 繁體版 簡體版 MY COLOUR A A SEARCH Enter search keyword(s) SITE MAP | SITE MAP

- Home
- What's new
- About us
- Topical issues**
- Complaint Hotlines (Aircraft Noise and Other Aviation Matters)
- Publications and press releases
- Access to information
- Accessibility of Government Premises, Facilities and Services
- Facts and statistics
- Public services
- Recruitment
- Public forms
- Tender notices
- FAQ
- Links

Topical issues

- Home > Topical issues
 - Reporting of Aircraft Accidents and Incidents
 - For Travellers
 - Booking Tips for Air Passengers **NEW**
 - Packing Tips for Air Passengers
 - Air Passenger Departure Tax
 - Scheduled/ Charter / Private Flights
 - Dangerous Goods
 - Aviation Security
 - Regulated Agent Regime (RAR)
 - Airspace
 - Aircraft Noise Management
 - Flight Paths
 - Aircraft Noise
 - Air Traffic Control Safety
 - Functions of various air traffic control equipment for the Airport
 - Reduced Vertical Separation Minimum (RVSM)
 - Satellite-based Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) Systems
 - Licence and Certificates
 - Aerodrome Licence
 - Air Operator's Certificate
 - Pilot Licences
 - HKAR-66 Aircraft Maintenance Licence
 - HKAR-66 AML Exam Dates
 - Aeromedical matters
 - Aircraft Registration
 - Aerodrome Operating Minima
 - Control of Obstructions

http://www.cad.gov.hk/english/topical_issues.html

The responsibilities of the **Airport Standards Division** are:

- licensing
- regulation
- inspection
- monitoring of safety and security of aerodromes in Hong Kong

The **Air Services and Safety Management Division** is responsible for:

- implementation of air services arrangements and aviation policy to enable air services to be operated to meet demand
- development and implementation of safety policy to promote and enhance safety in the aviation system
- setting and enforcement of air navigation services standards in compliance with international civil aviation safety requirements
- regulation of air navigation services and operations

CAD Technical Divisions cont.

The Flight Standards & Airworthiness Division

is responsible for:

- monitoring and inspection of Hong Kong airlines in respect of airworthiness standards
- approval of maintenance facilities, and issue of certificates of airworthiness;
- examination of applicants and issue of licenses for flight crew and maintenance engineers
- registration of aircraft
- managing the mandatory occurrence reporting scheme and investigation of aircraft incident and accident.

The responsibility of the **Air Traffic Engineering Services Division** are the planning, co-ordination, provision and subsequent maintenance / enhancements of the air traffic control (ATC) systems, radar, navigational aids and communication equipment for the Hong Kong International Airport (HKIA) at Chek Lap Kok (CLK). The division is also responsible for the planning and design of the replacement Air Traffic Control System



Appendix

Establishment and History of ICAO

Come About of ICAO

Wartime cooperation overcame many political barriers. Military aircraft were able to operate within ally territories, and into enemy territories at will.

After the war, many political and technical obstacles must be overcome if the same freedom of the air and benefits were to be enjoyed by international civil aviation.



International Civil Aviation Issues

In the tie of international civil aviation, countries need to decide:

- The problem of air commercial rights
- What arrangements needed to be made for the airlines of one country to fly into and through the territories of another
- What could be done to maintain the air navigation facilities installed during the WWII, and further develop such facilities around the globe.
- How to standardize and regulate air transportation to ensure high level of safety is meet everywhere
- How to establish equal opportunity in international civil aviation for all states

Air navigation facility means any facility designed and available for use in aid of air navigation. This includes airports and any structures, mechanisms, lights, beacons, markers, communicating system or devices useful as an aid to the safe operation of aircraft, or provide safe and efficient operation of an airport.

Conference on International Civil Aviation

Initiated by the US and with consultations between the major allied, the US government extended an invitation to 55 allied and neutral states to attend, in November 1944, an International Civil Aviation Conference in Chicago.

- to discuss the principles and methods to be followed in the adoption of a new air transport convention.
- to make arrangements for the immediate establishment of provisional world air routes and services
- to set up an interim council to collect, record and study data concerning international aviation,
- to make recommendations for its improvement.

In essence, the purpose of the conference was to discuss the regulations, conventions and development of international Civil Air Services and Transport for peaceful purposes.

Conference on International Civil Aviation

Four Principle Agreements resulted from the Conference on International Civil Aviation in Chicago.

1. The interim agreement of international Civil Aviation
2. The Convention on International Civil Aviation
3. The International Air Service Agreement
4. The International Air Transport Agreement

Interim agreement of international Civil Aviation:

Foreseen inevitable delays in the ratification of the Convention, the Conference had signed this Interim Agreement to establish a provisional body, the Provisional International Civil Aviation Organization (PICAO), so that work could start immediately. This Organization was in operation from August 1945 to April 1947 when the permanent ICAO came into being.

Conference on International Civil Aviation

The Convention on International Civil Aviation:

The agreement known as the Chicago Convention was signed by 52 states who attended the conference. The agreement affirms every state's "complete and exclusive sovereignty over the airspace above its territory. It states that:



- Scheduled international air services may be operated from one country into or over the territory of another foreign country only with the latter's authorization, and member states are permitted to establish prohibited areas.
- Nonscheduled flights may be conducted by civil aircraft of one country into or over the territory of another subjected to certain conditions and limitations.

Conference on International Civil Aviation

The International Air Service Agreement: guarantees

(1) freedom of civil aircraft to fly over foreign countries and territories as long as they do not land (Freedom 1), and (2) the freedom of civil aircraft to make non-traffic landings, for refueling or overhaul only, in foreign territory (Freedom 2). The agreement established for the first time the principle of automatic right of transit and of emergency landing.

The International Air Transport Agreement: This transport agreement established three other freedoms of the air. (3) Freedom to transport passengers and cargo from an aircraft's home country to another country, (4) Freedom to transport passengers and cargo from another country's territory to an aircraft's home country, and (5) Freedom to carry air traffic between countries other than the aircraft's home country.

The Assembly

The Assembly, composed of representatives from all Contracting States, is the sovereign body of ICAO. It meets every three years, reviewing in detail the work of the Organization and setting policy for the coming years.

Languages of the Assembly

The Standing Rules of Procedure of the Assembly provide that all documentation of the Assembly and its decisions shall be prepared and circulated in five languages – English, Arabic, French, Russian and Spanish.

Six languages – English, Arabic, Chinese, French, Russian and Spanish may be used in the deliberations of the Assembly and its bodies. Speeches in any of these languages are interpreted into the other five languages. (Managing all of these languages represents a huge task for the ICAO and substantially impacts on the ICAO's budget.)

The Council

The Council, the governing body which is elected by the Assembly for a three-year term, composes of 36 States. The Assembly chooses the Council Member States under three parts:

- Part I - States of chief importance in air transport,
- Part II - States which make the largest contribution to the provision of facilities for air navigation, and
- Part III - States those designation will ensure that all major areas of the world are represented.

As the governing body, the Council gives continuing direction to the work of ICAO. It is in the Council that Standards and Recommended Practices (SARP) are adopted and incorporated as Annexes to the Convention on International Civil Aviation.



ICAO Divisions

The Secretariat, headed by a Secretary General, is divided into five main divisions:

- the Bureau of Administration and Services
- the Air Navigation Bureau
- the Air Transport Bureau
- the Technical Co-operation Bureau
- the Legal Bureau

Professional-level personnel of ICAO are recruited on a broad geographical basis in order to ensure that the work of the Secretariat reflects a truly international perspective.

The Bureau of Administration and Services

The Bureau of Administration and Services (ADB) is responsible for providing the administrative support required by the Organization and plays a leading role in its effective and efficient administrative management.

The Air Navigation Bureau

Unmanaged air traffic growth can lead to increased safety risks in those circumstances when it outpaces the regulatory and infrastructure developments needed to support it.

The Air Navigation Bureau manages the Safety and Infrastructure strategies of ICAO in a partnership with aviation stakeholders. This work is carried out within a framework with the following elements:

- Policy and Standardization,
- Safety and Infrastructure monitoring,
- Safety and Infrastructure Analysis, and
- Safety and Infrastructure Implementation.

The Air Transport Bureau

The Air Transport Bureau supports the implementation of the Strategic Objectives of ICAO in particular:

- Security and Facilitation
- Economic Development of Air Transport and
- Environmental Protection.