

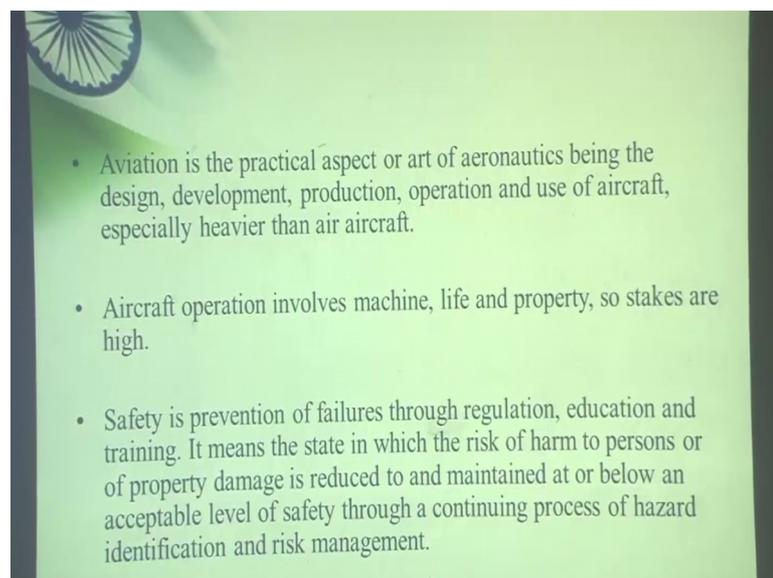
Aircraft Design
Prof. A.K Ghosh
Department of Aerospace Engineering
Indian Institute of Technology, Kanpur

Lecture - 42
Aircraft Maintenance Guidelines

Hello I am Barfer Matodh chief engineer flight lab IIT Kanpur. I am here to present a small presentation about the aircrafts, how the aircrafts are operated maintained in a small organization in our country.

Before understanding the operations the maintains it is very important to understand what are the things involved for any aircraft to operate; right from designing, developing an aircraft, the regulatory authorities involved, the various inspections involved, the various guidelines by the manufactures. It is very important to understand the intricacies involved; in addition to the inspections we will also be showing you the various inspections which we carry out during a daily inspection how the aircraft is released for flight, what are the inspections that are carried out on an airplane, before releasing an airplane followed by an engine grounded up.

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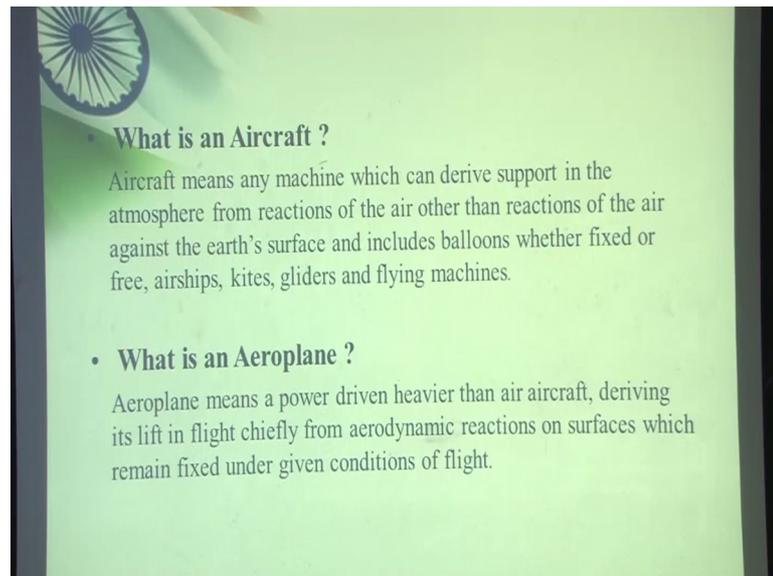
So, you can see aviation anything related to aircraft is aviation, that is the practical aspect or art of aeronautics that is either designing an aircraft, development of an aircraft development of the design, production of the designed aircraft, operation and the use of

aircraft specially heavier than air aircraft. There first of all you have to design a machine based on the design, that machine has to be developed produced and once the production is done finally, it has to be operated and put into use. So, aviation is all about design development production operation and use of aircraft. Now since this aircraft operation involves machine life and property.

So, stakes are very high and everything revolves around safety, we have to be very careful about safety everybody working at aircraft operation whether it is a pilot an engineer or the regulatory authority, all of us together are working for safety. Safety it is prevention of failures through regulations, education and training. The failures can be prevented by making rules regulations by educating the personal involved in the operation, involved in maintenance, involved in handling the machine and there training proper training. It means the state in which the risk of harm to persons or property or damage is reduced to and bill maintained at or below an acceptable level of safety. By making regulations by educating and training personnel involved, the risk of harm to persons and property is minimized and it is a continuous process of hazard identification and risk management.

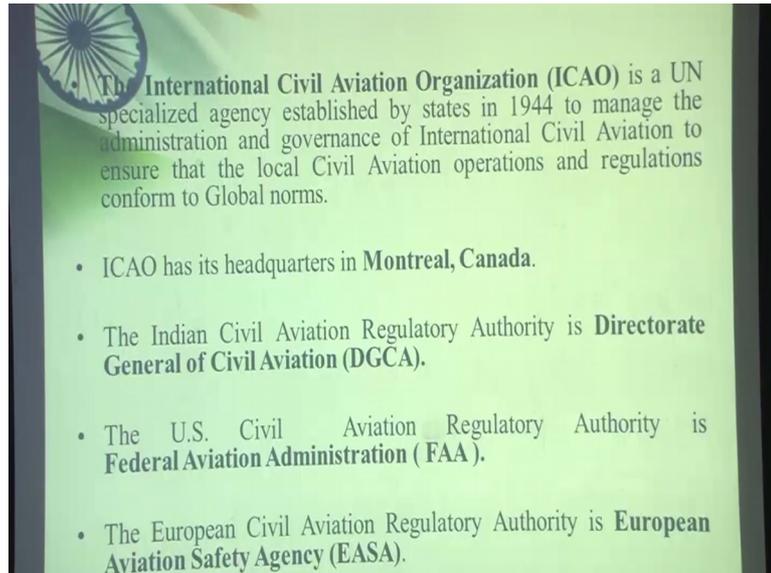
So, you can see safety is prevention of failures through regulation education and training it means the state in which the risk of harm to persons or property of damage is reduced to and maintained at or below an acceptable level of safety through a continuing process of hazard identification and risk management. So, all of us are working for safety by minimizing the hazards involved by minimizing the risks involved, we manage the risk what is an aircraft. Now aircraft is any machine which can derive support in the atmosphere from reactions of the air, other than reactions of the air against the earths surface and it includes balloons whether fixed or free airships, kites, gliders and flying machines.

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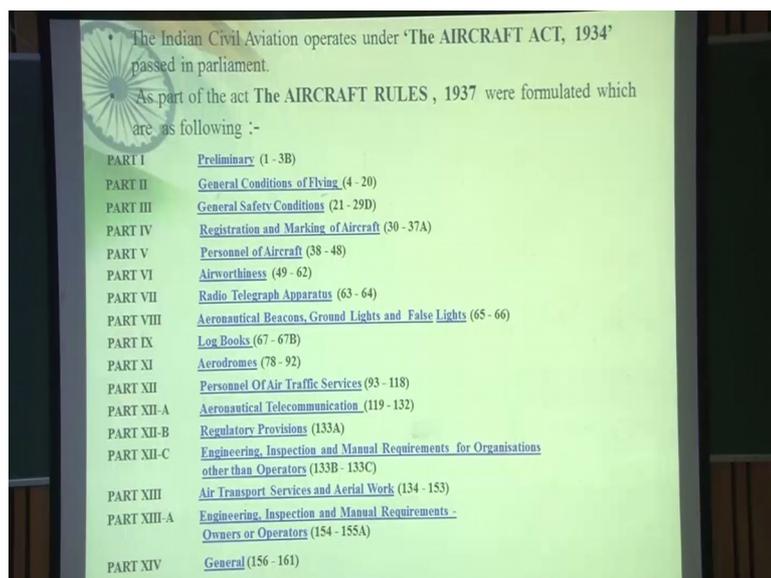
So, you can see any machine which can derive support in that atmosphere from reactions of the air, other than the reactions of the air against the surface earth surface is an aircraft it may be a free it may be a balloon with the fixed or free, it may be an airship, a kite glider or any flying machine it is an aircraft. Now what is an aeroplane? Aeroplane is a power driven heavier-than-air aircraft, which derives its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight. So, you can see the difference between an aircraft and an aeroplane, aeroplane it is also an aircraft, but a power driven heavier-than-air aircraft, which derives its lift and flight chiefly from the aerodynamic reactions on surfaces. Now this aircraft operation all over the world is governed by an international body, a un specialized agency called the international civil aviation organization ikaw it is a un specialized agency which was established by states in 1944.

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So, that the aircraft operation the aviation all over the world can be administered and governed, and the international rules and regulations and the norms are in sync all over the place. ICAO has its headquarters in Montreal Canada, in India the civil aviation regulatory authority is the directorate general of civil aviation DGCA. In U.S the civil aviation regulatory authority is federal aviation administration FAA and in Europe it is the European civil aviation regulatory authority called the Europeans aviation safety agency EASA.

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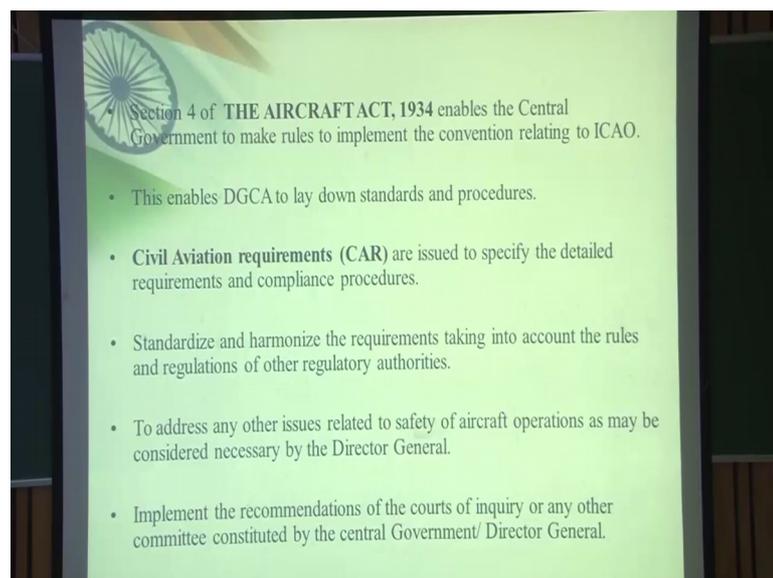


So, now the Indian rules the Indian aircraft rules the Indian civil aviation operates under the aircraft act 1934, which was passed in parliament. As part of that act the aircraft rules

1937 were formulated which are you can see the rules there are various parts the Indian aircraft rules 1937 is divided into various parts, you can see part one preliminary part two general conditions of flying, part three general safety conditions, part four is registration and markings of aircraft, part five is personal of aircraft, part six is air wilderness, part seven radio telegraph apparatus, part eight aeronautical beacons ground lights and false lights, part nine log books, part eleven aerodromes, part twelve personnel of air traffic services, part twelve A aeronautical telecommunication, twelve B regulatory provisions, twelve C engineering inspection and manual requirements for organizations other than operators, about thirteen air transport services an aerial work or thirteen A engineering inspection and manual requirements owners or operators and part fourteen is general.

So, you can see the aircraft rules they are divided into various parts, and in front of them in the brackets you can see they are the rules rule numbers for example, in preliminary 1 dash 3B from rule 1 to 3B there are some curtain rules, you can see part 6 airworthiness we the aircraft maintenance people we are mainly concerned with the air worthiness of aircraft and the rules are from rule number 49 to rule number 62. Section 4 of the aircraft at 1934 enables the central government to make rules to implement the conventions relating to a cow.

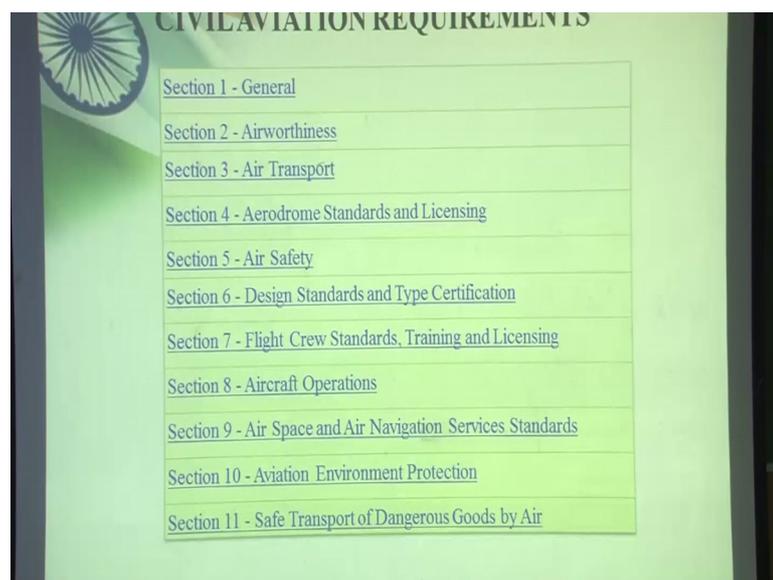
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So, there are certain requirements which the regulatory authority, which the country the civil aviation in the country has to comply with the requirements of a cow, with the convention relating to a cow. So, in order to comply with those requirements the section 4 of the aircraft act enables the central government to make rules this enables DGCA to lay down standards and procedures civil aviation requirements, which we call them a CAR are issued to specify the detailed requirements and compliance procedures. It standardizes and harmonizes the requirements taking into account the rules and regulations of other regulatory authorities.

It addresses any other issues related to safety of aircraft operations as may be considered necessary by the director general. Director General here implies as director general civil aviation. It implements the recommendations of the courts of enquiry or any other committee constituted by the central government or director general.

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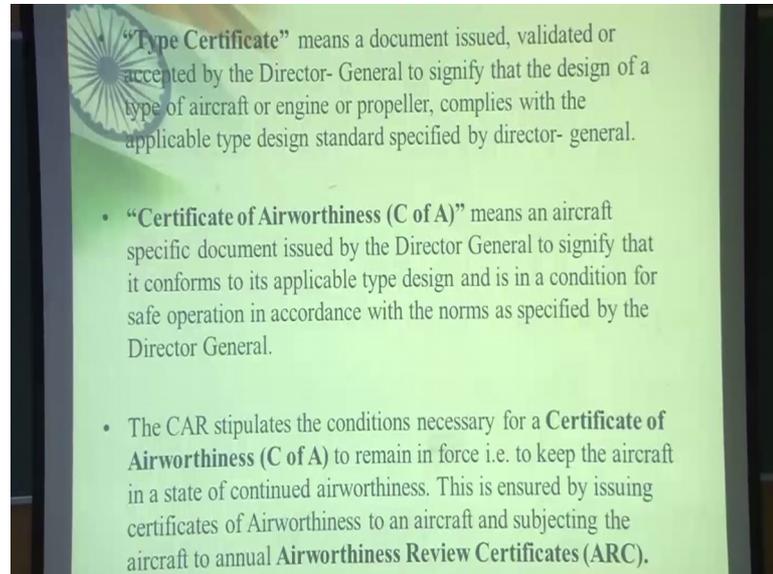


CIVIL AVIATION REQUIREMENTS	
Section 1 - General	
Section 2 - Airworthiness	
Section 3 - Air Transport	
Section 4 - Aerodrome Standards and Licensing	
Section 5 - Air Safety	
Section 6 - Design Standards and Type Certification	
Section 7 - Flight Crew Standards, Training and Licensing	
Section 8 - Aircraft Operations	
Section 9 - Air Space and Air Navigation Services Standards	
Section 10 - Aviation Environment Protection	
Section 11 - Safe Transport of Dangerous Goods by Air	

Now, you can see the civilization requirement that is the CAR which is issued. It also has got various sections; you can see section 1 is general, section 2 is air worthiness, section 3 air transport, section 4 aerodrome standards and licensing section 5 air safety, section 6 design standards and type certification, section 7 flight crew standards training and licensing, section 8 aircraft operations section 9 airspace and air navigation services standards, section 10 aviation environment protection, section 11 safe transport of dangerous goods by air. Again aircraft maintenance is mainly concerned with section 2

airworthiness. So, you can see the various sections in civil aviation requirements now this was all about the regulations the aircraft rules the civil aviation requirements.

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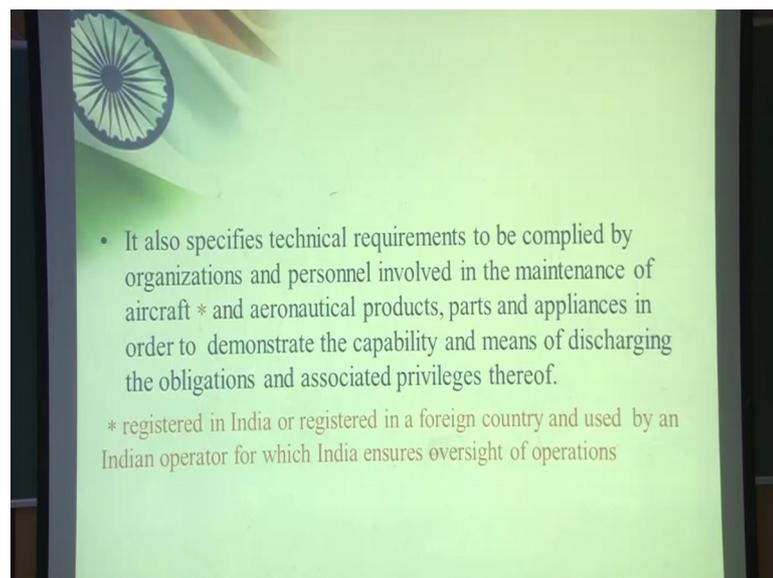
Now, coming to the designing of an aircraft once the aircraft is designed and developed in order for the designed aircraft to be certified, a DGCA issues are type certificate. A type certificate it is a document which is issued validated or accepted by the director general, to signify that the design of a type of aircraft or engine or propeller complies with the applicable type design standard specified by the director general. The type certificate signifies that the aircraft is manufactured according to an approved design, and that this design ensures compliance with the airworthiness requirements. The regulating authority compares design documents and processes to determine, if the design meets the requirements established for the type of equipment. Once the aircraft is type certified a certificate of airworthiness is issued. Certificate of airworthiness means an aircraft specific document it is specific to the aircraft issued by the director general to signify that it confirms to its applicable type design, and is a condition for safe operation.

In accordance with the norms as is specified by the director general. The CFA the certificate of airworthiness is the essential requirement to fly an aircraft, it is this document is a specific to the aircraft and confirms that the aircraft has been designed as per the applicable type design as per the applicable type certificate, and it complies with all the requirements as specified by the director general the regulatory authority and the

aircraft is in a safe condition for operation. The CR stipulates the conditions necessary for a certificate of airworthiness to remain in force, that is to keep the aircraft in a state of continued air worthiness. This is ensured by issuing certificates of airworthiness to an aircraft and subjecting to the aircraft to annual airworthiness review certificates. We call them arc. Once the C of A is issued in order to ensure the continued airworthiness of an aircraft the aircraft is subjected to annual review and is followed by issuance of an annual arc or the airworthiness review certificate.

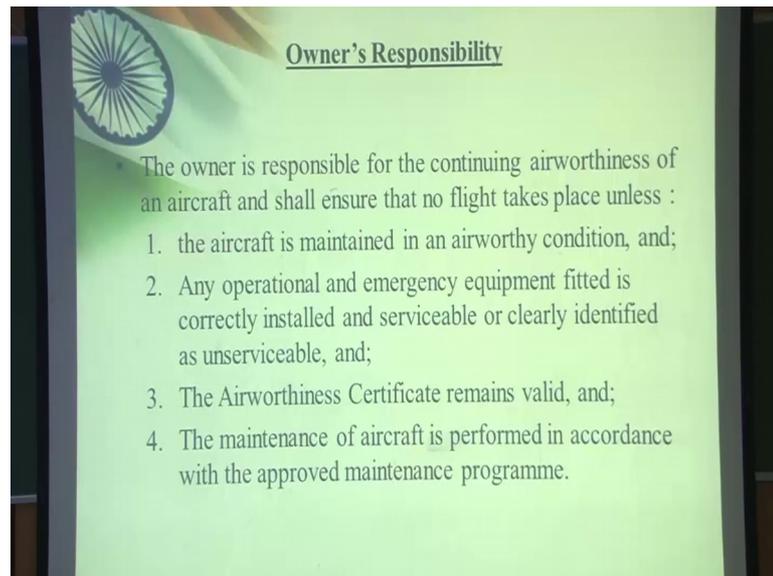
So, the C of A and the arc is the essential requirement for any aircraft to fly. The C of A is deemed to be valid if the arcs are valid. It also specifies technical requirements to be complied by organizations and personnel involved in the maintenance of aircraft, which may be registered in India or registered in a foreign country.

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But used by an Indian operator for which India ensures oversight of operations and aeronautical products parts, and appliances in order to demonstrate the capability and means of discharging the obligations and associated privileges there off.

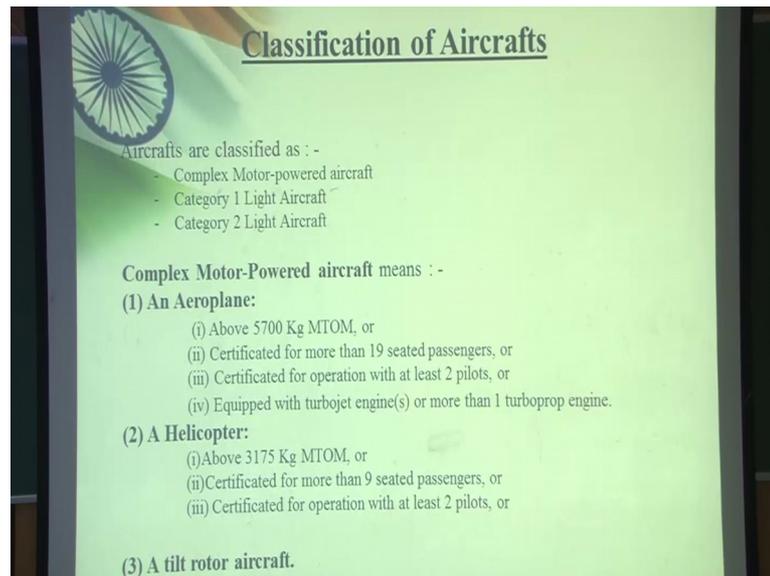
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Now, we will see what are the owner responsibility, what are the responsibilities for the aircraft owner before operating an any aircraft in India. The owner is responsible for the continuing airworthiness of an aircraft and shall ensure that no flight takes place unless the aircraft is maintained.

In an airworthy condition, any operational emergency equipment fitted is correctly installed and serviceable or clearly identified as unserviceable. The airworthiness certificate remains valid and the maintenance of aircraft is perform in accordance with the approved maintenance program. So, you can see the various responsibilities first the aircraft has to be maintained airworthiness condition, all the equipments whether operational emergency everything has to be serviceable. In case if something is unserviceable the it has to be clearly identified, clearly mentioned clearly (Refer Time: 15:49) the pilot operating the machine needs to be aware of what is unserviceable, and whether it is within the regulations to operate the aircraft with that unserviceable equipment. The airworthiness certificate that is the airworthiness review certificates is valid; the maintenance of aircraft is performed in accordance with the approved maintenance program and as per the requirements mentioned by the manufacturer of that aircraft.

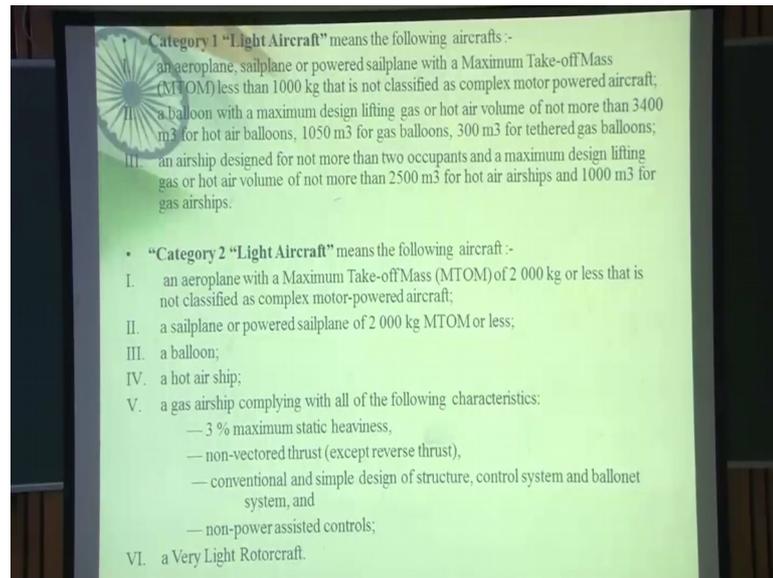
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Now, there is a classification of aircraft aircrafts are classified as complex motor powered aircraft category one light aircraft and category two light aircrafts complex motor powered aircraft means an aeroplane which is above 5700 kg maximum takeoff mass or certificated for more than 19 seated passengers or certificated for operation with at least two pilots or equipped with turbojet engine or engines or more than one turboprop engine. So, any aeroplane which is above 5700 kg weight or anything which is it can carry for more than 19 passengers or it has to be operated by at least two pilots or it is equipped with at least one turbojet engine or more than one turboprop engine any of this these is a complex motor powered aircraft.

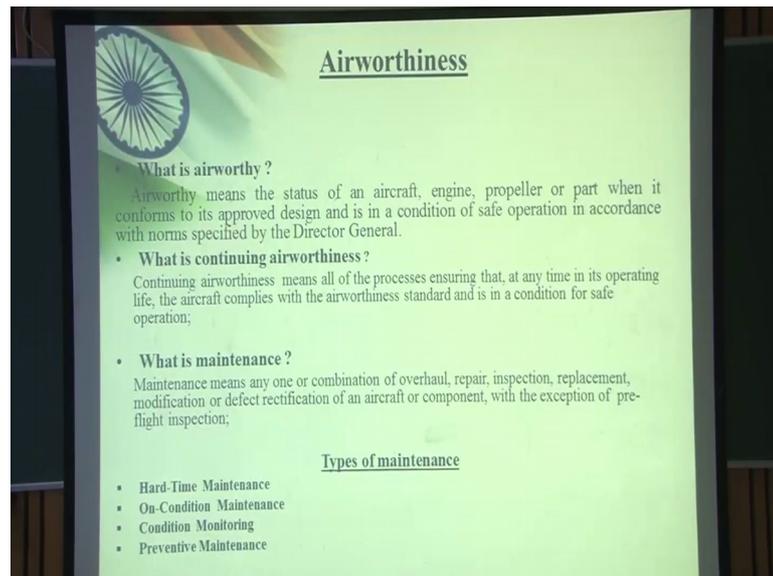
In case of a helicopter it has to be above 3175 kg MTOM or certificated for more than 9 seated passengers or certificated for operation with at least two pilots or if it is a tilt rotor aircraft. So, it in case of aeroplanes and in case of helicopters, you can see in if any machine is falls in this category falls in this weight category or it is certified to carry these the number of passengers or it has to be operated by these number of pilots it has a complex motor powered aircraft. Category one light aircraft means the following aircrafts an aeroplane sailplane or powered sailplane (Refer Time: 18:19) maximum takeoff mass less than 1000 kg that is not classified as complex motor powered aircraft. A balloon with a maximum design lifting gas or hot air well volume of not more than 3400 meter cube for hot air balloons, 1050 meter cube for gas balloons and 300 meter cube for tethered gas balloons. An airship designed for not more than two occupants and a maximum design lifting gas or hot air volume of not more than 2500 meter cube for hot air ships and 1000 meter cube for gas airships.

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So, you seen the various requirements for any machine to fall under category one light aircraft, again for category two light aircraft means the following aircraft, an aeroplane with a maximum takeoff mass of 2000 kg or less, that is not classified as complex motor powered aircraft a sail plane or powered sail plane of 2000 kg mtom or less a balloon a hot airship a gas airship complying with all of the following characteristics, 3 percent maximum static heaviness non vectored thrust except reverse thrust conventional and simple design of structure, control system and ballonet system and non power assisted controls or a very light rotor aircraft rotor craft. So, these are the requirements for any aircraft to fall under the category two light aircraft.

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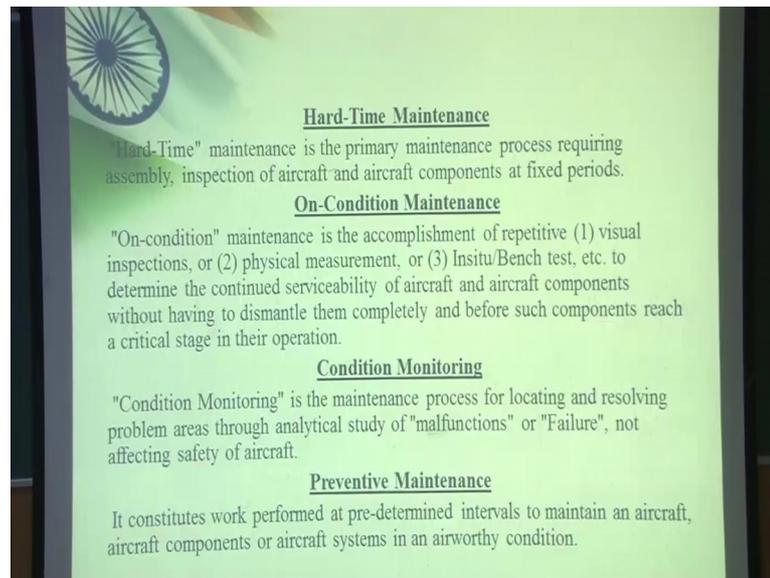


Now, coming to air worthiness; what is air worthiness? Air worthiness means the status of an aircraft engine propeller or part, when it confirms to its approved design and is in a condition of safe operation in accordance with the norms specified by the director general. So, any machine any aircraft engine or propeller which is manufactured as per the approved type design, is maintained as per the requirements mentioned by the manufacturer by the regulatory authority is maintained as per the approved aircraft maintenance program, and is in a condition of safe operation; as per the regulations, as per the norms specified by the director general is considered to be airworthy. What is continuing air worthiness? Continuing air worthiness means all of the processes ensuring that at any time in its operating life, the aircraft complies with the a worthiness standard and is in a condition for safe operation. The aircraft has to be maintained in continuing air worthiness condition, it at any point of time in its operating life, it has to comply with all the requirements all the regulations regulatory requirements all the requirements specified by the manufacturer by the regulatory authority, it has to be maintained as per the air worthiness standard it has to be maintained.

As per the approved type design and has to be in a condition for safe operation at all times. If the aircraft or any engine or propeller or any machine complies with all these requirements, it is considered to be in a state of continuing air worthiness. What is maintenance? Maintenance it is a combination of overhaul a repair, inspection, replacement modification or defective rectification of an aircraft or component with the exception of pre flight inspection. So, any one or a combination of these overhaul repair inspection, replacement, modification or defective rectification of any aircraft or

component is considered to be maintenance. There are various types of maintenance hot time maintenance, on condition maintenance, condition monitoring preventive maintenance hard time maintenance. Hard time maintenance is the primary maintenance process requiring assembly inspect of aircraft and aircraft components at fixed periods.

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In this maintenance the components the items of inspection they are to be performed at fixed periods. There that is why they are called hard time for example, any component which has been specified whose life has been specified say for example, 4 years then that particular component has to be removed after 4 years irrespective of whether the component is serviceable at that point of time or unserviceable. The that particular component has to be removed. So, there is a specific life for that particular component that is called hard time maintenance, where the component has to be removed at a fixed period. On condition maintenance; on contingent maintenance is the accomplishment of repetitive, visual inspections, physical measurements institute bench tests excreta to determine the continued serviceability of aircraft, and aircraft components without having to dismantle them completely and before such components reach a critical stage in their operation.

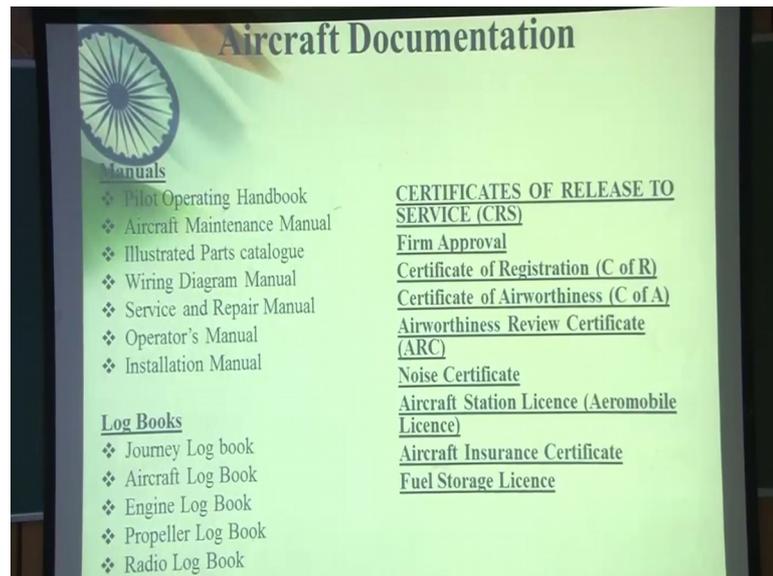
So, you can see in on condition maintenance you have to perform repetitive inspections they are visual inspections, they may be physical measurements they may be bench tests or institute tests. So, that the continued serviceability of the aircraft and aircraft

components can be ensured without having to dismantle them completely, and by doing this we ensure that the component can be removed before it reaches a critical stage in their operation. For example, any instrument which has been specified to be maintained as per on condition maintenance, we carry out been checked for that instrument for say after 2 years. So, every 2 years we remove the instrument carry out been check or there may be some certain instrument or certain equipment where we are not supposed to remove it from the aircraft, or the check has to be performed in situ. So, but it that particular cheque that particular inspection has to be done at 2 years, if it has been specify a specified to be carried out at 2 years.

Similarly, visual inspections if they are called for or physical measurements, the that particular component is maintained as per the on condition maintenance, but at a specified period that inspection or measurement or check has to be performed. We do not remove the component if it is serviceable, but we ensure that the component does not reach a critical stage in its operating life. In condition monitoring it is the maintenance process for locating and resolving problem areas through analytical study of malfunctions or failures not affecting safety of aircraft.

So, in this kind of maintenance we are constantly monitoring the condition of the component of the equipment by locating and resolving problem areas by studying the malfunctions or failures so that the safety of the aircraft is not affected. Preventive maintenance it constitutes work performed at predetermined intervals, to maintain an aircraft, aircraft components or aircraft systems in an air worthy condition. So, you can see the maintenance that we are doing all preventive maintenance by constituting work which are performed at predetermined intervals so, that the aircraft and aircraft components are kept in a state of continued air worthiness, they are maintained in an air worthy condition at all time.

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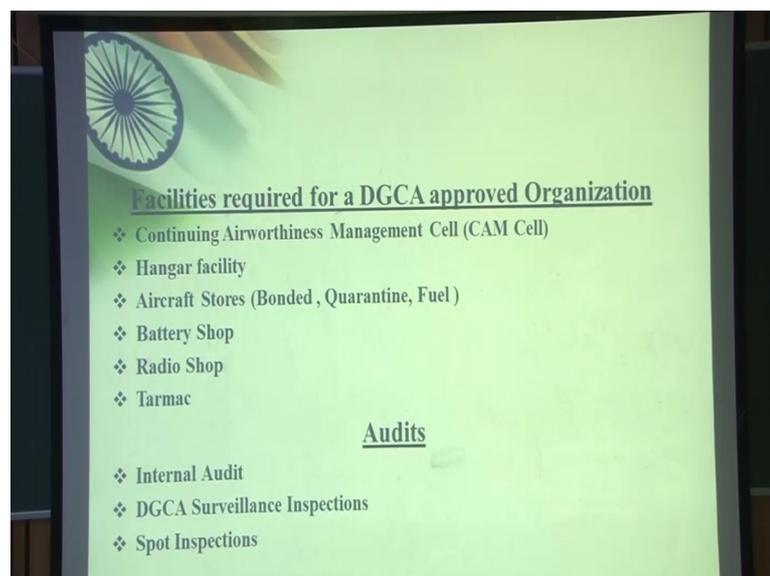
You can see the various manuals logbooks certificates required for aircraft operation coming to manuals, there is a pilot operating handbook, which specifies the normal procedures the emergency procedures and various guidelines required to be followed by the pilot to operate an aircraft. Then there is another aircraft maintenance manual which specifies various procedures which mentions various steps to be followed in order to maintain an aircraft, the then is there is an illustrated parts catalog which mentions the various parts, various components in an aircraft, it mentions there part numbers it mentions the quantity, it illustrate gives illustrations. Then there is a wiring diagram manual which mentions about the wiring diagrams the electrical diagrams the wiring diagrams for different systems in the aircraft there is another manual called the service and repair manual, which mentions about the repair for an aircraft then there is an operators manual for various components for example, propeller engine we have the operators manual and the installation manual.

Apart from these manuals to operate an aircraft to we need to maintain various logbooks, journey logbook, journey logbook mentions the duration of the flights, the name of the pilot, the place from where the aircraft has flown to the lesser nation place, it mentions the type of flight, it mentions the fuel and oil carried by the aircraft, it mentions the various snags or incident involved in aircraft operation. So, journey logbook is all about the journey of the aircraft then there is an aircraft logbook aircraft logbook again mentions the number of hours the aircraft has flown it mentions various inspections that have been carried out on that particular aircraft the number of replacements the modifications that have been carried out on the aircraft. The engine log book mentions

the number of hours the engine has completed the inspections, the modifications the replacements that have been carried out on that particular engine, same is with the propeller and say radio.

So, we have journey logbook, aircraft logbook, engine logbook, propeller logbook and radio logbook then there are various certificates required certificate of release to service this certificate of release to service is required, after the aircraft has been inspected. This certificate has to be issued by the engineer who is releasing the aircraft stating that the aircraft is fit for flying, that that the aircraft is in an air worthy condition. So, once the certificate of release to services issued, the pilot accepts the aircraft by signing the pilot acceptance. Apart from this certificate of release to service there are various other certificates for an aircraft, that is the certificate of registration you can see which is we call as c of r certification of airworthiness which we are mentioned earlier it is the C of A called C of A air worthiness review certificate called ARC. The C of A and ARC is very much required to operate an aircraft, then there is a noise certificate issued by the DCA stating the acceptable level of noise the aircraft is permitted to make, then there is an aircraft station license called the air mobile license, and there is aircraft insurance certificate for any aircraft to operate so, that the aircraft is insured.

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So, in order to operate an aircraft the organization needs to be approved by DGCA there are various requirements, there are various guidelines specified by the DGCA for any

organization to be approved, some of the requirements some of the facilities which are required for any DGCA approved organization to have are that it should have a continuing a air worthiness management cell, it should have a hangar facility, it should have an aircraft store; aircraft stores are again there were different types of stores bonded store, quarantine store, fuel store then it needs to have a battery shop, a radio shop, again and you need to have a tarmac where you can park the aircrafts. After having all these facilities and various audits by DGCA by internal audits different spot checks, and after complying with all the requirements of DGCA organization is approved by DGCA.

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CA 27 (REV. 1997)

Cert.No. 4397
Category 'A'



Regn. Marking
VT-IIT

GOVERNMENT OF INDIA
DIRECTORATE GENERAL OF CIVIL AVIATION
OPP. SAFDARJUNG AIRPORT, NEW DELHI-110003
CERTIFICATE OF REGISTRATION

Nationality & Registration Marking	Manufacturer and manufacturer's designation of aircraft	Aircraft Serial No.	Year of Manufacture
VT-IIT	CESSNA AIRCRAFT COMPANY WICHITA, KANSAS, USA CESSNA 260H STATION AIR	2660R346	2012
Name of Owner / Lessor INDIAN INSTITUTE OF TECHNOLOGY, KANPUR			
Address: IIT, KALYANPUR, KANPUR - 208016			
Nationality: INDIAN			
Name of operator INDIAN INSTITUTE OF TECHNOLOGY, KANPUR			
Address: IIT, KALYANPUR, KANPUR - 208016			
Nationality: INDIAN			
Usual Station: IIT, KANPUR			
Validity of Lease:	Validity of Registration:	Signatures	

It is certified that the above described aircraft has been duly entered in the register of India with effect from 17.01.2013 in accordance with the Convention on International Civil Aviation dated 7th Dec, 1944 and with the Aircraft Act, 1934 and rules made there under.

Date of Issue: 17.01.2013
New Delhi


 DY. DIRECTOR OF AIRWORTHINESS
 (RAJ KANWAR)
 Authorized Signatory



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No. 6506



No. 23/C.A.23

GOVERNMENT OF INDIA
DIRECTORATE GENERAL OF CIVIL AVIATION
OPP. SAFDARJUNG AIRPORT, NEW DELHI-110003
CERTIFICATE OF AIRWORTHINESS

Nationality and Registration Marking	Manufacturer and Manufacturer's Designation of Aircraft	Aircraft Serial No.	Year of Manufacture
VT-IIT	CESSNA AIRCRAFT COMPANY WICHITA, KANSAS, USA CESSNA 260H AIRCRAFT	2660R346	
Category:	NORMAL		
Use: (Public/ Private)	PRIVATE		
Maximum weight (Maximum crew included):	ONE		
Maximum payload (Maximum all-up weight included):	1633 KGS		

This Certificate of Airworthiness is issued pursuant to the Convention on International Civil Aviation dated the 7th December, 1944, and the Aircraft Rules, 1937 as amended from time to time, in respect of the above mentioned aircraft which is considered to be airworthy when maintained and operated in accordance with the foregoing and the pertinent Operation Limitations.

This certificate shall remain valid, subject to the above compulsory conditions being fulfilled until the date shown, unless withdrawn, or suspended earlier.

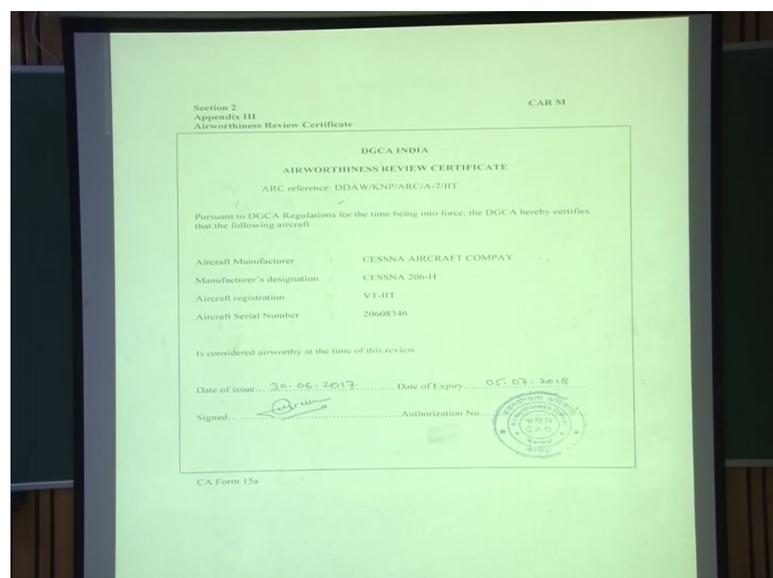
Date of Issue: 23.02.2013
New Delhi


 (Name: RAJ KANWAR)
 Designation: Dy. Director of Airworthiness



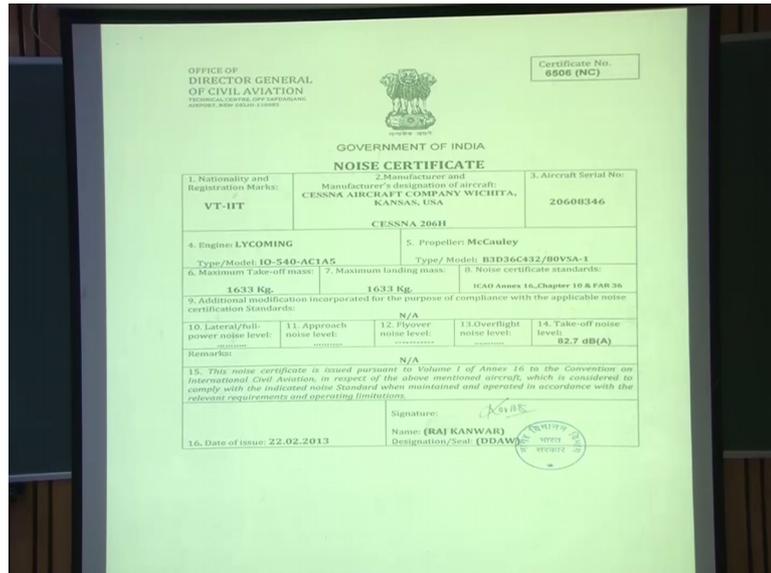
So, the various certificates required you can see this is a certificate of registration of one of the aircraft issued by DGCA; this is certificate of airworthiness issued by the director general of civil aviation. You can see it mentions the nationality and registration mark of the aircraft at manufacture; it mentions the manufacturer of the aircraft and the aircraft serial number the category in which the aircraft is approved and you can see in this case it is normal private. The minimum crew required to operate the aircraft and the maximum all operate authorized for this aircraft. You can see again the certificate mentions that this certificate of airworthiness is issued pursuant to the convention on international civil aviation dated the seventh December 1944 and aircraft rules 1937 as amended from time to time in respect of the above mentioned aircraft, which is considered to be a worthy when maintained and operated in accordance with the foregoing and pertinent operation limitations. This certificate shall remain valid subject to the (Refer Time: 33:5) above compulsory conditions, being fulfilled until the date shown unless withdrawn or suspended earlier.

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So, once the aircraft is issued with C of A, it is subjected to annual review and subsequently issued with an airworthiness review certificate, you can see air worthiness the certificate review certificate here this certificate is valid for one year, and in order for C of A to remain valid the aircraft needs to have a valid air worthiness review certificate.

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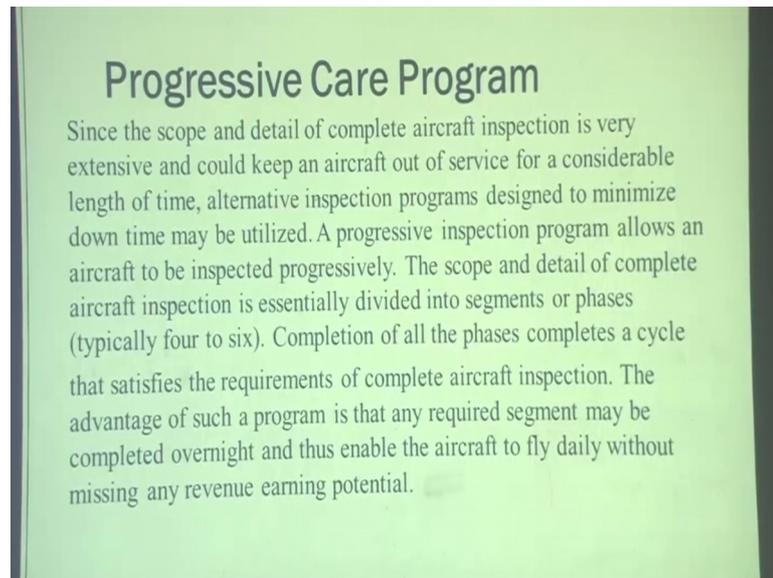
In case the air worthiness review certificate is not valid the C of A is deemed to be suspended. Then you can see this is the noise certificate for the for one aircraft which mentions the nationality and registration marks, the manufacturer of the aircraft the aircraft serial number, the type of engine installed the type of propeller installed, the maximum takeoff, mass the maximum landing mass, the noise certification standards which are to be followed and the takeoff noise level. You can see the noise certificate this is certificate is required for every aircraft then every aircraft has to have a weight schedule.

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So, you can see the weight schedule which is required for every aircraft, the aircraft has to be weight the aircraft empty weight has to be computed then this weight schedule you can see the it mentions the weight of crew members plus baggage, the usable fuel the maximum payload with fuel tanks full and the aircrafts cg range.

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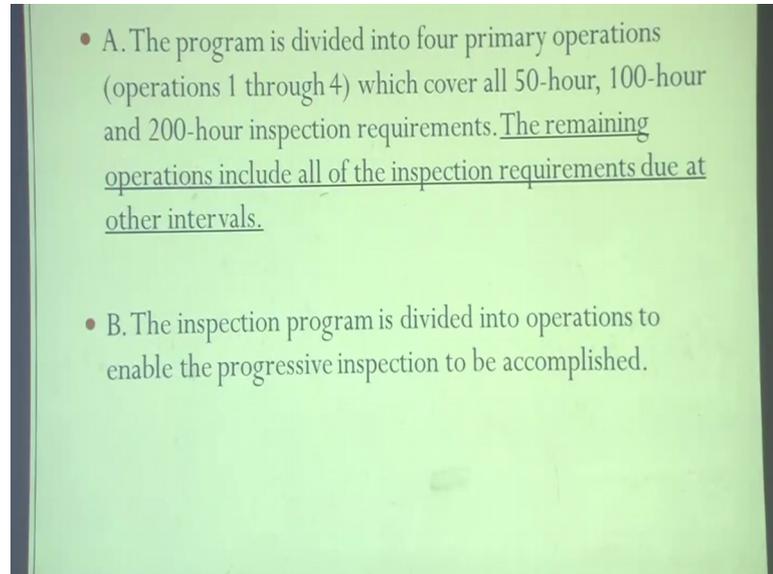


So, this weight schedule has to be prepared and approved by DGCA for every aircraft. So, now, coming to air craft maintenance, the aircraft manufacturer has designed a care program called a progressive care program. So, that the aircraft maintenance aircraft inspections are performed in a planned manner and at the same time, the aircraft downtime is minimized. You can see since the scope and detail of complete aircraft inspection is very extensive, and it can keep an any aircraft out of service for a considerable length of time. So, alternative inspection programs are designed to minimize the downtime. A progressive inspection program allows an aircraft to be inspected progressively. Inspecting the aircraft progressively means that we can inspect the aircraft stage wise for example; we can inspect the aircraft one portion of the aircraft at one stage.

In the second stage we can inspect the aircraft we can inspect a different area of the aircraft and we can divide the complete aircraft the different areas of the aircraft in different stages, and in each stage we can inspect the aircraft. The scope and detail of complete aircraft inspection is essentially divided into segments or phases typically 4 to

6 and completion of all the phases completes our cycle which satisfies the requirements of complete aircraft inspection.

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The advantage of such a program is that any required segments may be completed overnight and thus enabled the aircraft to fly daily, without missing any revenue earning potential. This progressive care program is divided into 4 primary operations; operations 1 through 4, which covers all 50 hours, 100 hours and 200 hours inspection requirements, the remaining operations include all the inspection requirements due at other intervals.

So, you can see the main operations are operations 1 through 4 and which have to be done at every 50 hours; 100 hours and 200 hours inspections; there are various other inspection requirements which are to be complied at various other intervals.

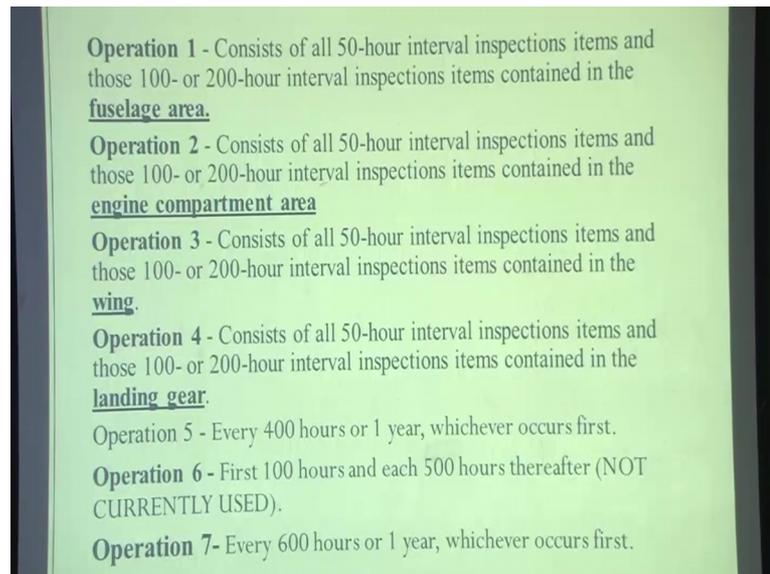
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- The Component Time Limits should be checked at each inspection interval to ensure proper overhaul and replacement requirements are accomplished at the specified times.
- The Inspection Operations have been developed based on normal usage under average environmental conditions. Airplanes operated in extremely humid areas (tropics), or in exceptionally cold, damp climates, etc., may need more frequent inspections for wear, corrosion, and lubrication. Under these adverse conditions, do the periodic inspections in compliance with the Inspection Operations at more frequent intervals until the operator can set his own inspection periods based on field experience. The operator's inspection intervals must not deviate from the inspection time limits.

The inspection program is divided into operations to enable the progressive inspections to be accomplished. The component time limits should be checked at each inspection interval, to ensure proper overhaul and replacement requirements are accomplished at the specified times. The inspection operations have been developed based on normal usage under average environmental conditions, airplanes operated in extremely humid areas tropics or in exceptionally cold damp climates excreta may need more frequent inspections for wear corrosion and lubrication. Under these adverse conditions do the periodic inspections in compliance with the inspection operations at more frequent intervals until the operator can set his own inspection periods based on field experience the operators inspection intervals must not deviate from the inspection time limits.

So, based on the local conditions, based on the geographical conditions in which the aircraft is being operated, the frequency of inspections the type of inspections can be modified, but the minimum requirements as is specified by the manufacturer have to be followed in any case. So, you can see operation one it consists of all the 50 are in interval inspection items and those 100 or 200 are interval inspection items contained in the fuselage area.

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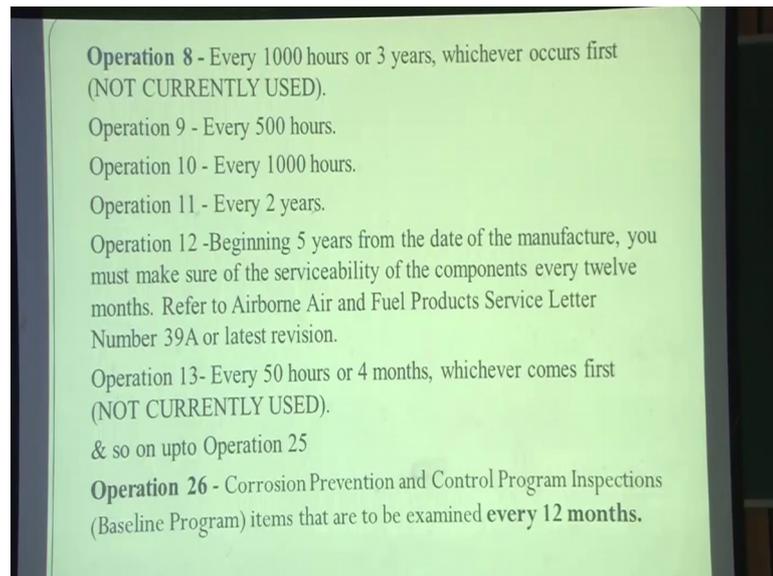


So, operation one is related to fuselage area, which consists of 50 hour interval inspections 100 our interval inspections and 200 hour interval inspections, all related to fuselage area. Operation 2 is related to the engine compartment area consisting of all the 50 hour interval inspections, 100 hour 200 our interval inspections.

Similarly, operation 3 is related to the wing area which consists of all the 50 hour interval inspections 100 hour interval inspections and 200 hour interval inspections; operation 4 is related to landing gear consisting of all 50 hours 100 hours and 200 hour interval inspection items. So, you can see operation one covers fuselage area, operation 2 covers engine compartment area, operation 3 covers wing, operation 4 covers landing gear. So, with these 4 operations more or less the main areas are covered fuselage engine wing landing gear.

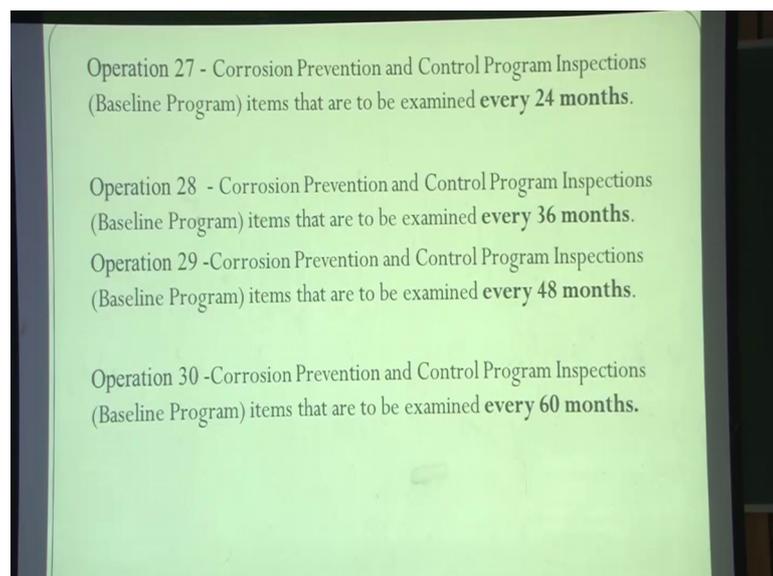
Now, from operation 5 onwards we have various specific inspections which have different time limits which are to be complied at different frequencies some of the examples are given here like operation 5 for example, 4 hours one year operation 6 100 hour and each 500 hour thereafter; that means, this operation 6 has got a repeat inspection every 500 hour us operation 7 600 hour or one year whichever occurs first.

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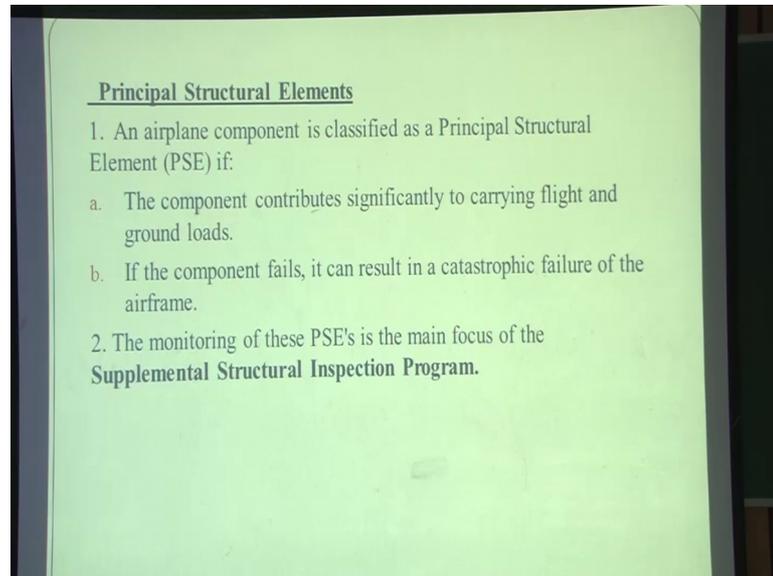
Similarly, you can see various operations up to operation 25, they have got different frequencies different time limits and there are specific inspections in different areas of the aircraft. Operation 26 onwards we have a corrosion program corrosion prevention and control of program inspections, again see we call them CPCP inspections corrosion prevention and control program inspections, they are to be complied with they are to be examined at different frequencies 12 months, 24 months, 36 months, 48 months, 60 months.

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So, CPCP program the corrosion prevention and control program inspections are also required to be carried out at different frequencies different time intervals; 12 months 24 months 36 months, 48 months, 68 60 months.

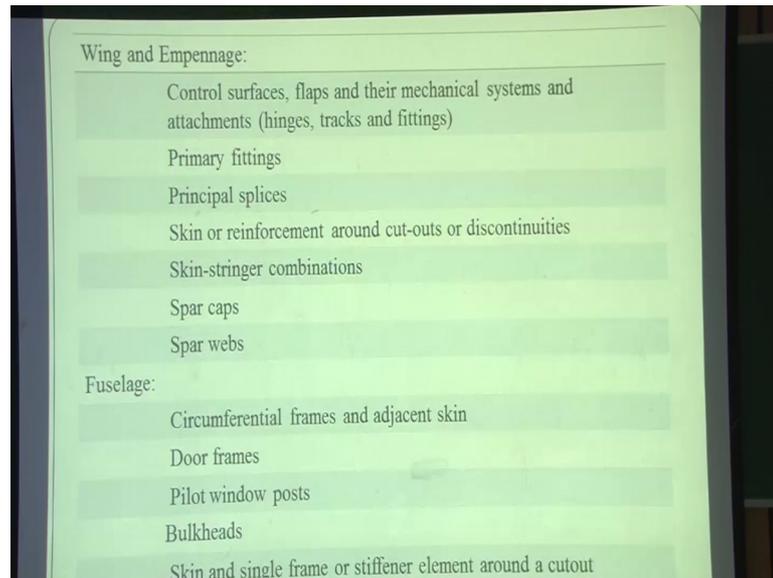
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Now, there are various principal structural elements in an aircraft; an airplane component is classified as a principal structural element, if the component contributes significantly to carrying flight and ground loads and if this component fails it can result in a catastrophic failure of the airframe. The monitoring of these principal structural elements is the main focus of supplemental structural inspection program.

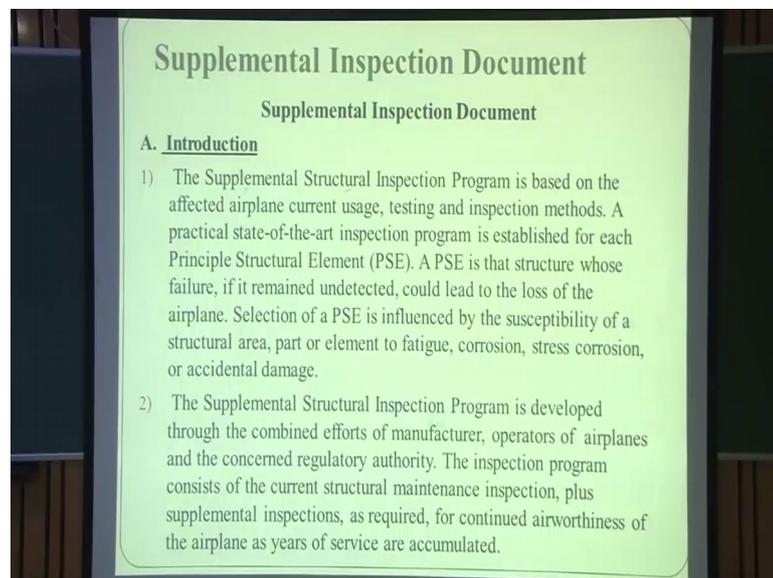
We call it as SSIP any aircraft has to be maintained as per the requirements mentioned in the approved director of maintenance program as per the guidelines, manufacture specified by the manufacturer of the aircraft, those are regular inspections carried out at various intervals as we had seen operation 1, 2 operation 4 and from operation 5 to operation 25 and different operations requiring specific inspections at specific frequencies. Apart from the regular inspections we have seen the aircraft has to be inspected for corrosion which we call as CPCP corrosion prevention, and control program again it was to be carried out at different frequencies operation at say 12 months, 24 months, 36 months, 60 months. Now there is another program called the SSIP which is required to be complied to take care of the principal structural elements, we call it SSIP program supplemental structural inspection program.

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You can see these are the various supplemental sorry these are the various structural members the principal structural elements in the aircraft, in the wings and amperage in the fuselage.

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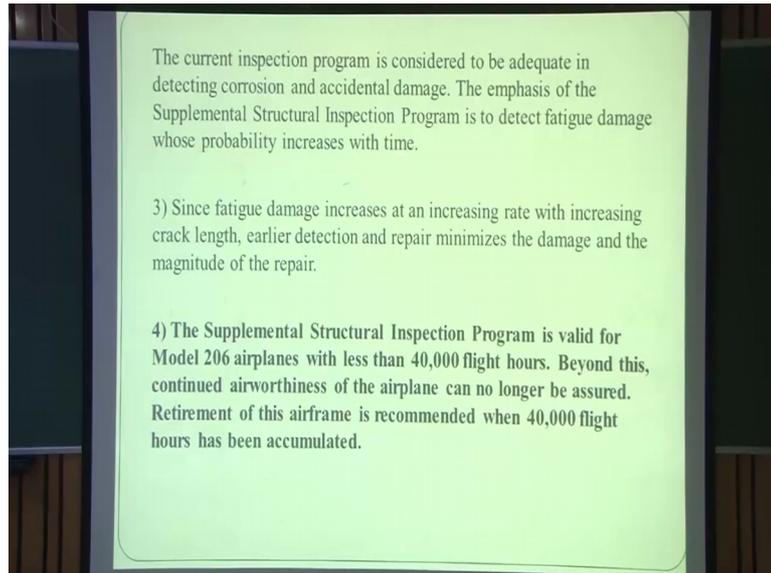
So, in order to take care of the principal structural elements our supplemental inspection document has been prepared by the manufacturer. This supplemental structural inspection program called as SSIP is based on the affected aircraft current usage testing and inspection methods. A principle state of the art inspection program is established for

each principle structural element. A principle structural element is that structure whose failure if it remained undetected, could lead to loss of the airplane. Selection of a principle structural element is influenced by the susceptibility of a structural area part or element to fatigue, corrosion stress corrosion or accidental damage (Refer Time: 45:44) [FL] (Refer Time: 45:45) start the principle structural elements cut.

So, in order to take care of the principal structural elements a supplemental inspection document called supplemental structural inspection program is prepared by the manufacturer, which is based on the current usage of the airplane testing and inspection methods. A practical state of the art inspection program is established for each principal structural element, a principal structural element is that structure whose failure if remains undetected could lead to loss of an aircraft. Selection of a principal structural element is influenced by its susceptibility to fatigue corrosion, stress corrosion or accidental damage. The supplemental structural inspection program is developed through the combined efforts of manufacturer operators, and the concerned regulatory authorities. The inspection program consists of current structural maintenance inspection plus supplemental inspections as required for continued awareness of the airplane as years of service are accumulated.

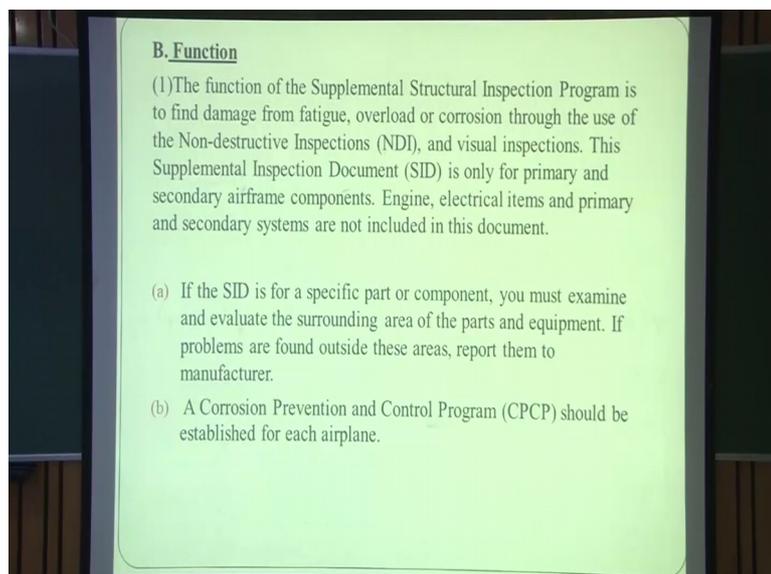
So, you can see this SSIP program is based on the inputs from the operators, from the regulatory authorities, from the research by the manufacturers. So, based on all the inputs SSIP program is prepared to take care of all the principal structural elements, because as the aircraft gets older the principal structural elements need to be taken care of need to be closely monitored for corrosion for structural damage. So, the manufacturer has come out with this supplemental inspection document, to take care of all the principal structural elements in that particular aircraft. The current inspection program is considered to be adequate in detecting corrosion and accident damage. The emphasis of the supplemental structural inspection program is to detect fatigue damage, whose probability increases with time.

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Since fatigue damage increases at an increasing rate with increasing crack length earlier detection and repair minimizes the damage, and the magnitude of the repair. The supplemental structural program is valid for model tooth 206 airplanes with less than 40,000 flight hours. Beyond this continued awareness of the airplane can no longer be assured retirement of airframe is recommended when 40,000 flight hours has been accumulated.

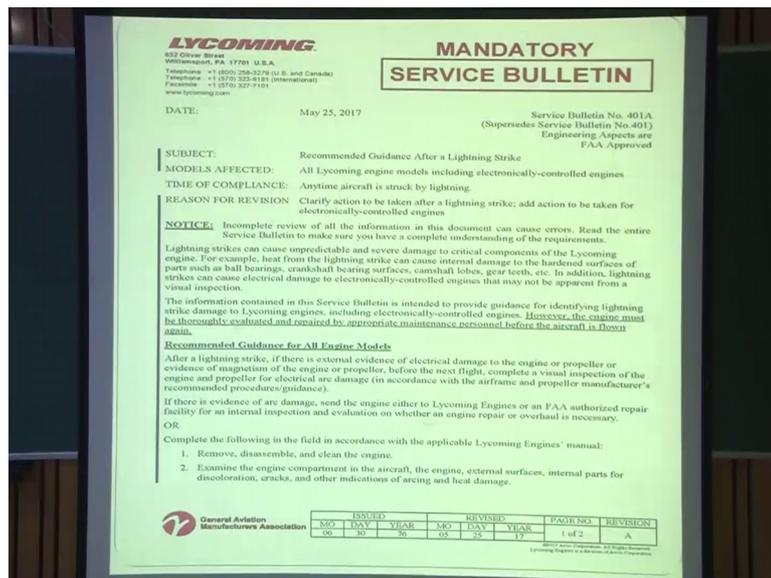
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So, this is one example where the manufacturer has limited the aircraft life to 40,000 flight hours, it states that after 40,000 flight dollars this aircraft is will not be considered as air worthy this is for Cessna 206 airplane. The function of the supplemental structural

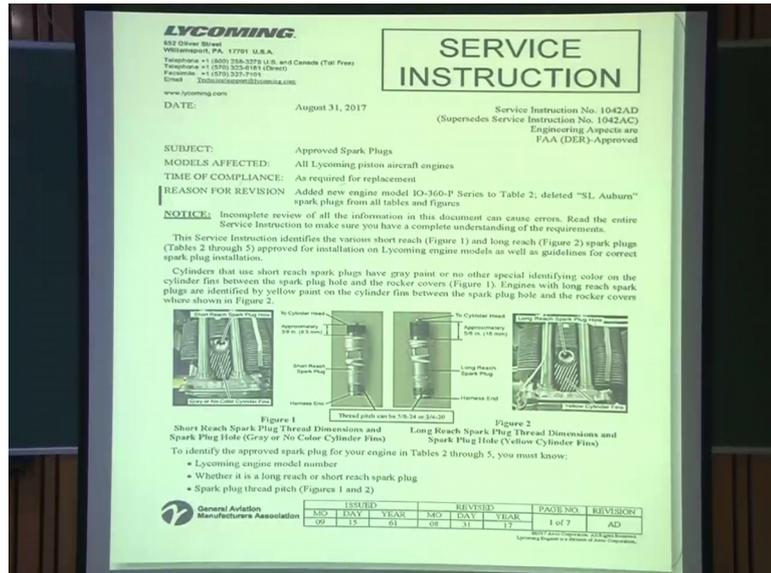
inspection program is to find damage from fatigue overload or corrosion through the use of non destructive inspections, and visual inspections. This supplemental inspection document is only for primary and secondary airframe components, engine electrical items and primary and secondary systems are not included in this document. If the SID is for a specific part or component, you must examine and evaluate the surrounding area of the parts and equipment.

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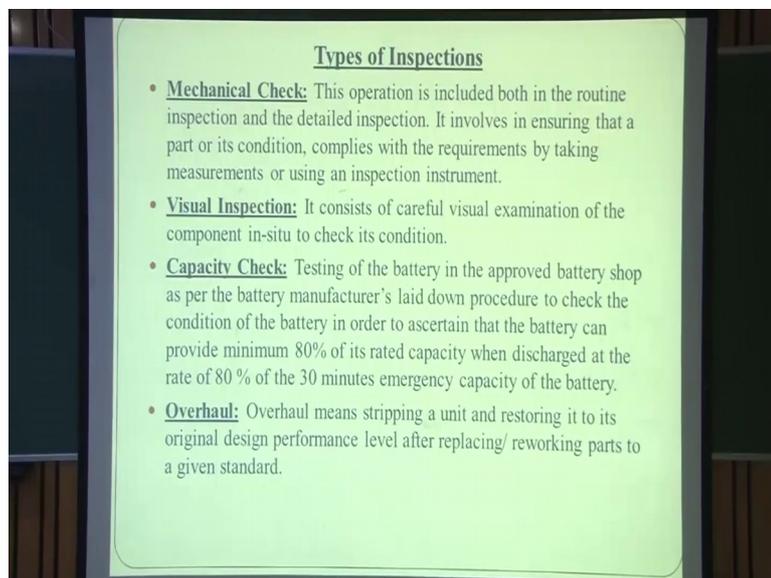
if problems are found outside these areas report them to manufacturer, this is very important any inspection which is to be performed the surrounding areas the adjacent areas also needs to be inspected, and in case if some malfunction some problem is found in these adjacent areas it should be reported to the manufacturer. A corrosion prevention and control program CPCP should be established for each airplane. In addition to the regular maintenance and the principal structural element inspections, the corrosion inspections, manufacturer of the aircraft or an engine or propeller, also issues regular service bulletins service instructions and service letters for the guidance of the operators you can see here there is one example of a service bulletin it is a mandatory service bulletin that is why it is marked in red color it mentions the subject the models affected the time of compliance and the reason why this service bulletin has been issued it mentions the maintenance which has to be performed.

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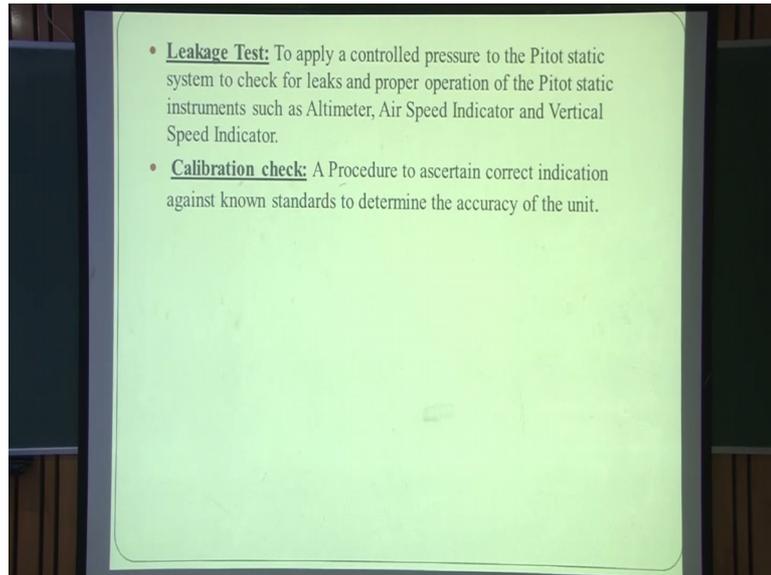


On that particular aircraft you can see here there is a service instruction, thus the service instruction mentions the maintenance steps which are in detail related to that particular service bulletins, then there are service letters also issued by the manufacturers, there are various types of inspections which are carried out on an aircraft.

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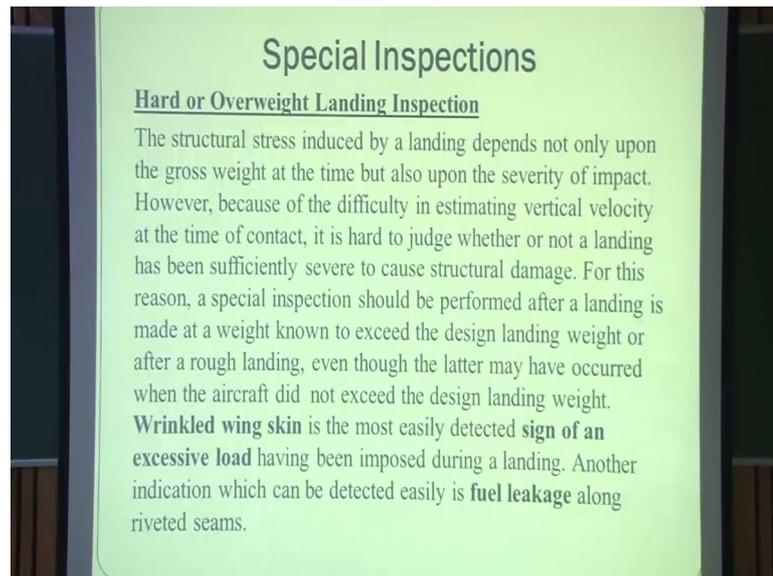
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They may be a mechanical inspection visual inspection, capacity check, overhaul, leakage test, calibration check coming to mechanical check. It is an operation which includes both routine inspection and detailed inspection, it involves ensuring that a part or its condition it complies with the requirements by taking measurements or using an inspection instrument. Visual inspection consists of careful visual inspection of the component in situ to check its condition, capacity checks they are testing of the battery in the approved battery shop.

As per the battery manufacturers laid down procedures to check the condition of the battery in order to ascertain that the battery can provide minimum 80 percent of its rated capacity, when discharged at the rate of 80 percent of the 30 minutes emergency capacity of the battery; overhaul means stripping a unit and restoring it to its original design performance level and replacing or reworking parts to a given standard. Leakage test to apply a controlled pressure to the pitot static system, to check for leaks and proper operation of the pitot static instruments such as altimeter a speed indicator and vertical speed indicator; calibration checks it is a procedure to ascertain correct indication against known standards to determine the accuracy of the unit in addition to the inspections mentioned above. There are various special inspections which are to be carried out.

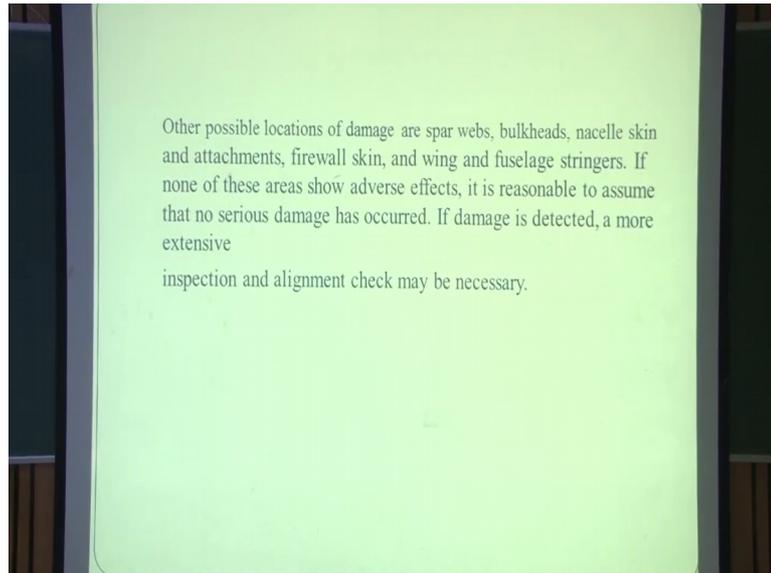
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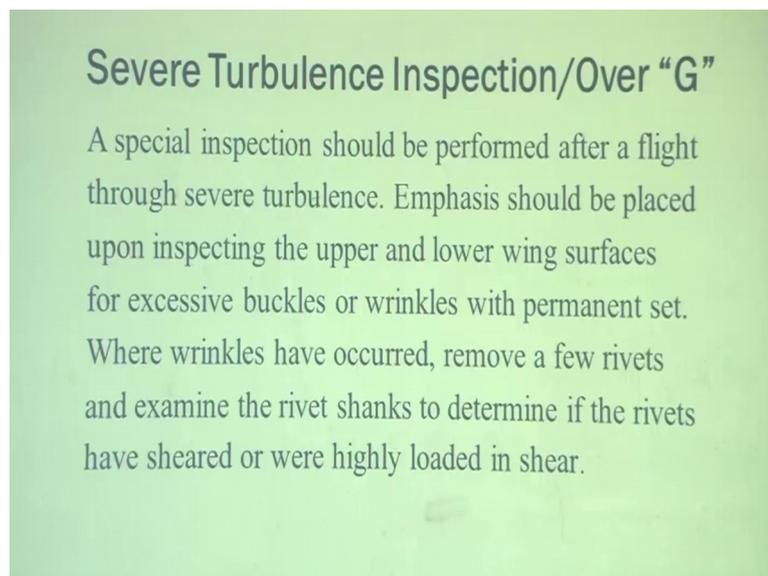
In case there is an incident in case if there is a hard landing or overweight landing, some inspections are required. The structural stress induced by a landing depends not only upon the gross weight at the time, but also upon the severity of impact; however, because of the difficulty in estimating vertical velocity at the time of contact, it is hard to judge whether or not a landing has been sufficiently severe to cause structural damage. For this reason a special inspection should be performed after the landing is made at a weight, known to exceed the design landing weight or after a rough landing; even though the latter may have occurred when the aircraft did not exceed the design landing weight.

So, wrinkled wing skin is the most easily detected sign of an excessive load having been imposed during a landing. Another indication which can be detected easily is fuel leakage along the repeated seams. So, these are the signs in case if you see a wrinkled wing skin or a few leakage along the riveted seen seams, these are some of the indications which indicate that your aircraft has carried out a hard landing or a rough landing, and you need to carry out inspection for hard landing. Other possible locations of damage are spar webs, bulkheads, nacelle skin and attachments firewall skin and wing and fuselage strangers. If none of these show areas show adverse effects it is reasonable to assume that no serious damage has occurred; if the damage is detected a more extensive inspection and alignment check may be necessary.

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In case if the aircraft has flown through severe turbulence, then a special turbulence inspection has to be carried out, it should be performed after a flight through severe turbulence emphasis should be placed upon inspecting the upper and lower wing surfaces for excessive buckles or wrinkles with permanent set. Where wrinkles have occurred remove a few rivets and examine the river shanks to determine if there ever have sheared or were light highly loaded in shear.

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Lightning Strike

Although lightning strikes to aircraft are extremely rare, if a strike has occurred, the aircraft must be carefully inspected to determine the extent of any damage that might have occurred. When lightning strikes an aircraft, the electrical current must be conducted through the structure and be allowed to discharge or dissipate at controlled locations. These controlled locations are primarily the aircraft's static discharge wicks, or on more sophisticated aircraft, null field dischargers. When surges of high voltage electricity pass through good electrical conductors, such as aluminum or steel, damage is likely to be minimal or non-existent. When surges of high voltage electricity pass through non-metallic structures, such as a fiberglass radome, engine cowl or fairing, glass or plastic window, or a composite structure that does not have built-in electrical bonding, burning and more serious damage to the structure could occur. **Visual inspection of the structure is required.** Look for evidence of **degradation, burning or erosion of the composite resin** at all affected structures, **electrical bonding straps**, static discharge wicks and null field dischargers.

In case the aircraft has encountered a lightning strike although it is very rare, the aircraft must be carefully inspected to determine the extent of any damage that might be occurred. When lightning strikes an aircraft the electrical current must be conducted through the structure, and be allowed to discharge or dissipate at controlled locations. These controlled locations are primarily the aircrafts static discharge wicks on or more sophisticated aircraft null field discharges.

When surges of high voltage electricity passed through good electrical conductors such as aluminum or steel, damage is likely to be minimal or nonexistent. When surges of high voltage electricity passed through nonmetallic structures, such as a fiberglass or a dome engine cowl or fairing glass or plastic window or a composite structure that does not have built in electrical bonding burning and more serious damage to the structure could occur. Visual inspection of the structure is required look for evidence of degradation burning or erosion of the composite resin at all affected structures, electrical bonding straps static discharge wicks and null field discharges.