NATIONAL CADET CORPS

HEAD QUARTERS DG NCC

National Cadet Corps

Edition 2017, HQ DG NCC, India

Copies:

Published By: The Director General, National Cadets Corps
Delhi-110030

Design, Layout: NCC OTA, Kamptee, Air Cell HQ DG NCC

Printed By: Shri Sai Enterprises
RZ-147, Street-3, Dabri Indl. Area,
New Delhi-110045
Ph. : 011-25381787, 9810274844

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, Having Solemnly Resolved To Constitute India Into A [1][SOVEREIGN SOCIALIST

SECULAR DEMOCRATIC REPUBLIC] And To Secure To All Its Citizens :

JUSTICE, Social, Economic And Political;

LIBERTY Of Thought, Expression, Belief, Faith And Worship;

EQUALITY Of Status And Of Opportunity; And To Promote Among Them All

FRATERNITY Assuring The Dignity Of The Individual And The[2] [Unity And Integrity Of The Nation];

IN OUR CONSTITUENT ASSEMBLY This Twenty-Sixth Day OfNovember, 1949, Do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

[1]Subs, By The Constitution (Forty-Second Amendment) Act.1976, Sec.2, For "Sovereign Democratic Republic" (W.E.F. 3.1.1977)

[2]Subs, By The Constitution (Forty-Second Amendment) Act. 1976, Sec. 2, For "Unity Of The Nation" (W.E.F. 3.1.1977)

THE CONSTITUTION OF INDIA

Chapter IV A
FUNDAMENTAL DUTIES

ARTICLE 51A

Fundamental Duties - It Shall Be The Duty Of Every Citizen Of India-

To Abide By The Constitution And Respect Its Ideals And Institutions, The National Flag And The National Anthem;
To Cherish And Follow The Noble Ideals Which Inspired Our National Struggle For Freedom;
To Uphold And Protect The Sovereignty, Unity And Integrity Of India;
To Defend The Country And Render National Service When Called Upon To Do So;
To Promote Harmony And The Spirit Of Common Brotherhood Amongst All The People Of India Transcending Religious, Linguistic And Regional Or Sectional Diversities;
To Renounce Practices Derogatory To The Dignity Of Women;
To Value And Preserve The Rich Heritage Of Our Composite Culture;
To Protect And Improve The Natural Environment Including Forests, Lakes, Rivers, Wild Life And To Have Compassion For Living Creatures;
To Develop The Scientific Temper, Humanism And The Spirit Of Inquiry And Reform;
To Safeguard Public Property And To Abjure Violence;
To Strive Towards Excellence In All Spheres Of Individual And Collective Activity So That The Nation Constantly Rises To Higher Levels Of Endeavour And Achievement;
[1](K) Who Is A Parent Or Guardian To Provide Opportunities For Education To His/Her Child Or, As The Case May Be, Ward Between Age Of Six And Forteen Years.

[1]Ins. By The Constitution (Eighty - Sixth Amendment) Act, 2002 S.4 (W.E.F. 12.12.2002)

NATIONAL ANTHEM

Jana Gana Mana Adhinaayak Jaya Hey,

Bhaarat Bhaagya Vidhaataa

Panjaab Sindhu Gujrat Maraatha

Draavid Utkal Banga

Vindhya Himaachal

Yamuna Ganga,

Uchchhal Jaladhi Taranga

Tav Shubh Naamey Jaagey

Tav Shubh Aashish Mange

Gaayy Tav Jaya gaathaa

Jana Gana Mangal Daayak

Jaya Hey Bhaarat

Bhagya Vidhaataa

Jaya Hey, Jaya Hey,

Jaya Hey, Jaya Jaya Jaya, Jaya Hey.

Preface

1. National Cadet Corps (NCC) came into existence on 15 July 1948 under an Act of Parliament. Over the years, NCC has spread its activities and values across the length and breath of the country, in schools and colleges in almost all the districts of India. It has attracted millions of young boys and girls to the very ethos espoused by its motto "Unity and Discipline" and moulded them into disciplined and responsible citizens of the country. NCC has attained an enviable brand value for itself in the Young India's mind space.

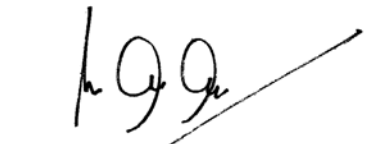
2. National Cadet Corps (NCC) aims at character building and leadership in all walks of life and promotes the spirit of patriotism and National Integration among the youth of the country. Towards this end, it runs a multifaceted training, varied in content, style and processes with added emphasis on practical training, outdoor training and training as a community.

3. With the dawn of Third Millennia, there have been rapid strides in technology, information, social and economic fields bringing in a paradigm shift in learning field too, NCC being no exception. A need was felt to change with times. NCC has introduced its New Training Philosophy, catering to all the new changes and developments taking place in Indian Society. It has streamlined and completely overhauled its training objectives, syllabus, methodology etc thus making it in sync with times. Subjects like National Integration, Personality Development and Life skills, Social Awareness etc have also been given prominent thrust.

4. Air wing specialized syllabus has been designed to generate interest among students about the defence forces and Indian Air Force in particular.

5. The syllabus has been revised to make it cadet friendly, colourful, visually appealing with large number of photographs, charts, pictures etc. It is hoped that this will facilitate better assimilation and increased interest among the cadets.

6. Contents of this hard work must form the basis of Institutional Training with explicit commitment.



Vinod Vashisht
Lieutenant General
Director General
National Cadet Corps

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ARMED FORCES : GSK-1

BASIC ORGANISATION OF ARMED FORCES

As a Cadet of NCC, it is very important to understand the basic organisation of our Armed Forces. An overview of the command and control structure shows how finely it has been tuned to meet India's security requirements, based on the major wars that it has fought and the present day relations between India and its neighbours.

PART I – ARMY

The Indian Army is the land based branch and the largest component of the Indian Armed Forces. The President of India serves as the Supreme Commander of the Indian Army, and it is commanded by Chief of Army staff(COAS),who is a four star general.. The Chief of Army Staff is the head of the Indian Army and is responsible for all army activities. Officers who assist him are:-

(a) Vice Chief of Army Staff.

(b) Two Deputy Chiefs of Army Staff.

(c) Principle Staff Officers (PSOs).

(d) Heads of Arms and Services.

(e) Field Army (Commands).

Command Headquarters

Command Headquarters is commanded by an officer of the rank of Lieutenant General who is called Army Commander or GOC – in - C. The whole country is divided into Seven theatre Commands who have subordinate formations under them. These are:-

Command Insignia	Command Name	Headquarters
	Headquarters, Indian Army	**New Delhi**

	Central Command	**Lucknow**
	Eastern Command	**Kolkata**
	Northern Command	**Udhampur**
	Southern Command	**Pune**
	South Western Command	**Jaipur**
	Western Command	**Chandimandir**
	Army Training Command	**Shimla**

PART II – NAVY

Our country is covered almost from three sides with water with a coastline of approximately over 6000 Kms. The sea around India has impact/effect on India's freedom, trade, commerce, and culture. The Indian Navy (Bharatiya Nau Sena) is the naval branch of the Indian Armed Forces. The President of India serves as Supreme Commander of the Indian Navy. The Chief of Naval Staff, a four-star officer in the rank of Admiral, commands the navy. The Indian Navy is the fifth largest in the world. The primary objective of the navy is to secure the nation's maritime borders.

Constituents of the Navy

As of 2017, the Indian Navy has a strength of 67,109 personnel and a large operational fleet consisting of one aircraft carrier, one amphibious transport dock, eight landing ship tanks, 11 destroyers, 14 frigates, one nuclear-powered attack submarine, one ballistic missile submarine, 13 conventionally-powered attack submarines, 23 corvettes, six mine countermeasure vessels, 29 patrol vessels, four fleet tankers and various other auxiliary vessels.

Organisation and Administration

Chief of Naval Staff commands Indian Navy. Integrated Headquarters of the Ministry of

Defence (Navy) is located in New Delhi. The Navy is divided into three commands: -

Commands	**Headquarters**
Western Naval Command	Mumbai
Eastern Naval Command	Vishakhapatnam
Southern Naval Command	Kochi

PART III – AIR FORCE

Indian Air Force is the youngest of the three Services.It is the air arm of the Indian armed forces. It is the world's fourth largest air force in terms of both personnel and aircraft Its primary responsibility is to secure Indian airspace and to conduct aerial warfare during a conflict It came into existence in the year 1932. Indian Air Force comprises of fighter aircrafts, transporter aircrafts, bombers and helicopters. The President of India serves as Supreme Commander of the IAF. The Chief of Air Staff, an Air Chief Marshal, is a four-star officer and commands the Air Force

Air Headquarters

Indian Air Force is commanded by Chief of the Air Staff. The staff of Air Headquarters consists of three branches:-

(a) Air Operations.

(b) Administrative branch.

(c) Maintenance branch.

Commands

The Air Force is organized into seven commands which are controlled by Air HQ. Each Command is placed under the command of an Air Officer Commanding-in-Chief. The Commands are: -

Commands	Headquarters
Operational commands	
Central Air Command (CAC)	Allahabad, Uttar Pradesh
Eastern Air Command (EAC)	Shillong, Meghalaya
Southern Air Command (SAC)	Thiruvananthapuram, Kerala
South Western Air Command (SWAC)	Gandhinagar, Gujarat
Western Air Command (WAC)	New Delhi
Functional Commands	
Training Command (TC)	Bangalore, Karnataka
Maintenance Command (MC)	Nagpur, Maharashtra

CONCLUSION

The organisation of the Armed Forces is structured in a manner to facilitate coordination of the functioning of all the three services with the nucleus being the Service Headquarters and various Formations down the Chain of Command.

ARMED FORCES : GSK-2
BADGES OF RANKS

The Indian Armed Forces consists of three professional uniformed services: the Indian Army, Indian Navy, and Indian Air Force. All the three services have distinct Badges of ranks which help in identifying soldiers and their commanders. The ranks of Badges are given as per professional competence and length of service in Armed Forces.

Common Military Ranks		
Navy	**Army**	**Air Force**
Commissioned		
Admiral of the fleet	**Marshal or Field Marshal**	**Marshal of the Air Force**
Admiral	**General**	**Air Chief Marshal**
Vice Admiral	**Lieutenant General**	**Air Marshal**
Rear Admiral	**Major General**	**Air Vice-Marshal**
Commodore	**Brigadier**	**Air Commodore**
Captain	**Colonel**	**Group Captain**
Commander	**Lieutenant Colonel**	**Wing Commander**
Lieutenant Commander	**Major**	**Squadron Leader**
Lieutenant	**Captain**	**Flight Lieutenant**
Sub Lieutenant	**Lieutenant**	**Flying Officer**

PART I - BADGES OF RANK-ARMY

Commissioned Officers : Army

Commissioned Officers of Indian Army are those who command their troops from Platoon or equivalent up to Corps and higher and hold Presidents commission. Field Marshal is an honorary rank and is given to a General for his valuable services. K.M Cariappa was awarded the rank of Field Marshal in the year 1986 for his valuable services to Indian Army.S.H.F.J Manekshaw was Army Chief in 1971 war against

Pakistan which liberated Bangladesh. He was awarded the Rank of Field Marshal for his exemplary leadership during the war. A Field Marshal is a Five Star Rank. The badges of rank worn by commissioned officers are as given under:

Junior Commissioned Officer (JCO) Army

The second set of officers in the Army is Junior Commissioned Officers. The soldiers who become JCOs join the Army as sepoys and come up through the NCO ranks. The ranks of Subedar Major, Subedar and Naib Subedar are used in the Infantry and other Arms and Services. While the ranks of Risaldar Major, Risaldar and Naib Risaldar are used in the Armed Corps. The badges of rank worn by the JCOs are :-

Non Commissioned Officer (NCO) Army

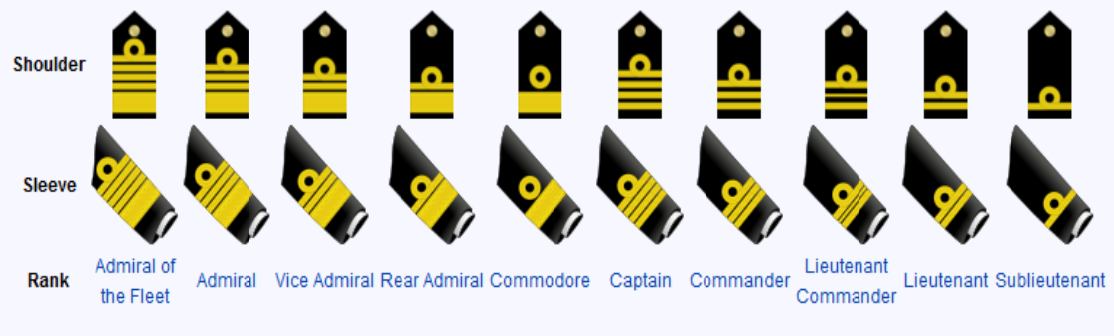
The third set of officers is the Non Commissioned Officers (NCOs). These ranks are given to jawans according to their merit and seniority. The badges of ranks for NCOs are :-


Sepoy / Sowar

PART II - BADGES OF RANK- NAVY

Commissioned Officers : Navy

Admiral of the Fleet is an honorary rank given to an Admiral for his invaluable service and will continue to serve the rest of his term with the honorary rank. This rank has not been used in the Indian Navy. The badges of rank worn by Naval Officers are:-



Junior Commissioned Officers (JCOs) Navy

The badges of rank worn by these Officers are:-

Non Commissioned Officers (NCOs) Army

The badges of rank worn by the NCOs are:-

PART III - BADGES OF RANK- AIR FORCE

Commissioned Officers : Airforce

Marshal of the Air Force is an honorary rank given to an Air Chief Marshal for his invaluable service. In recognition of his services the Government of India gave the rank of Marshal of the Air Force to Arjan Singh in January 2002 making him the first and the only “Five Star” rank officer with the Indian Air Force. The badges of rank worn by officers are:-

Junior Commissioned Officers (JCOs) Airforce

The badges of rank worn by these Officers are:-

Non Commissioned Officers (NCOs) Airforce

The badges of rank worn by these NCOs are:-

CONCLUSION

The officers, Junior Commissioned Officers and Non Commissioned Officers of all the three services have different badges of rank. The badges of ranks facilitate easy recognition of rank of Officers, JCOs and NCOs.

ARMED FORCES : GSK-3

HONOURS AND AWARDS

The Armed Forces of India are awarded many military decorations, honours and awards. The awards and honours are awarded for extraordinary bravery and courage, as well as for distinguished service during times of war and peace. For the purpose of classification, Indian Armed Forces honours and awards can be divided into two categories:

(a) Gallantry Awards

(b) Non-Gallantry awards / Distinguished Service Awards

PART II - GALLANTRY AWARDS

Gallantry awards are divided into two categories:

(a) **Gallantry in the Face of Enemy (War Time)**.

S. No	Name of the Award	Image
(i)	Param Vir Chakra	
(ii)	Maha Vir Chakra	

(iii)	Vir Chakra	
(iv)	Sena Medal	
(v)	Nao Sena Medal	
(vi)	Vayu Sena Medal	
(vii)	Mention in Despatches	
(viii)	Chiefs of Staff Commendation Card	

Gallantry Other than in the Face of Enemy (Peace Time).

S. No	Name of the Award	Image
(i)	Ashoka Chakra	
(ii)	Kirti Chakra	
(iii)	Shaurya Chakra	

PART III –NON-GALLANTRY /DISTINGUISHED SERVICE AWARDS

S. No	Name of the Award	Image
	Sarvottam Yudh Seva Medal	
	Param Vishisht Seva Medal	

	Uttam Yudh Seva Medal	
	Ati Vishisht Seva Medal	
	Yuddh Seva Medal	
	Vishisht Seva Medal	

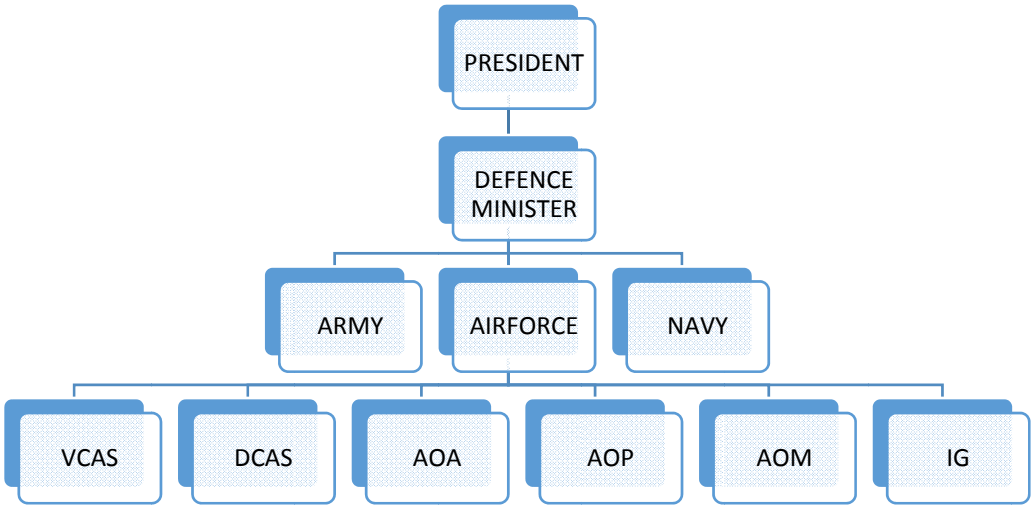
NOTE:- Award like Sena Medal is given for all three catagories i.e. during War,Peace and also as a Distinguished Award.

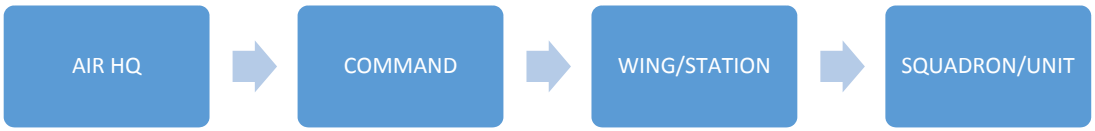
CONCLUSION

Honours and Awards are ultimate recognition by the nation for unmatched act of bravery and selfless service, dedication and supreme sacrifice by soldiers /civilian /or any other professional.

ORGANISATION OF IAF GSK 4

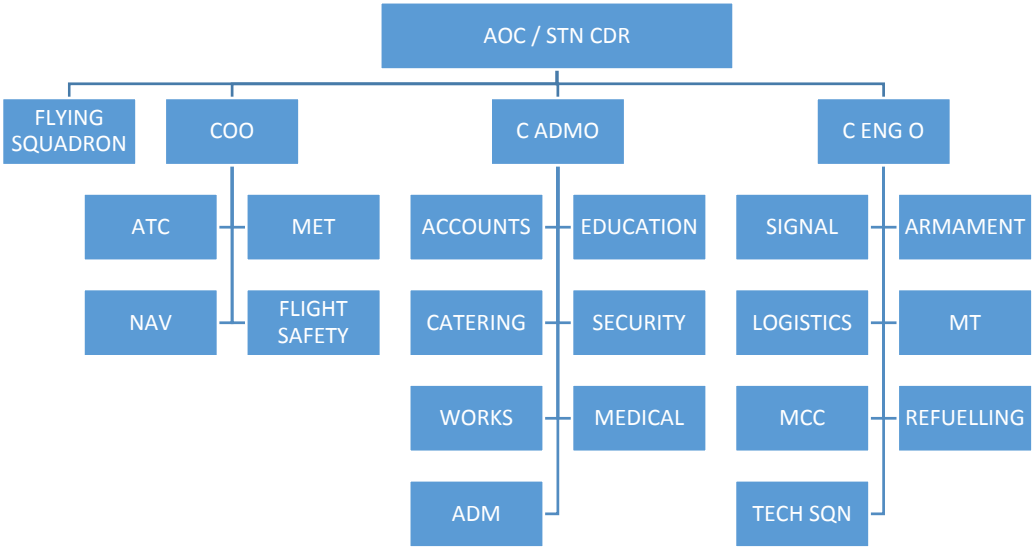
The President is the Supreme Commander of the Armed Forces of Indian Republic. The primary role of the Air Force is the air defence of the country, means Guarding of our air space from enemy intrusion and giving support to the Army and the Navy. Its secondary role is to aid the civil power in maintaining law and order and in providing relief during natural calamities.



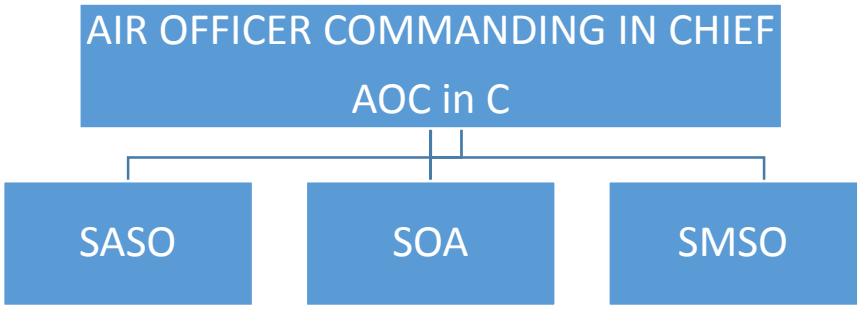


STATION/WING

Station/Wing is always what is called a self-accounting unit, i.e. it is fully capable and independently responsible for its own administration. A Sqn/lodger unit is essentially a non-self-accounting unit and it is a lodger to a Wing/Station and depends fully on that Wing/Station for its administration. A Wing/Station exercises its functional and administrative control over its lodger units.



ORGANISATION CHART – OPERATIONAL COMMAND



Commands

The Western, Central, Eastern, South Western, Southern Air Commands control all operational units. Operational Commands execute the operational roles of the Air Force in war. They also handle the training of paratroopers for airborne operations. Training Command is responsible for training of Officers and Airman in all flying and ground training at various academy/training institution/colleges under it. Maintenance Command is responsible for the maintenance, repair and storage of aircraft, MT, Signal equipment, Armament, Ammunition and explosives etc, and exercise functional and administrative control over Base Repair Depot (BRDs) and Equipment Depot (EDs).

Following are the Air Command with their Head Quarters: -

Southern Air Command	-	Trivandrum
Training Command	-	Bangalore
Eastern Air Command	-	Shillong
Maintenance Command	-	Nagpur
Western Air Command	-	New Delhi
South West Air Command	-	Gandhi Nagar
Central Air Command	-	Allahabad

BRANCHES OF IAF (GSK 5)

For smooth functioning of organization different branches among staff is essential. Vast organization like Indian Air Force requires various branches to make the organization successful and flawless. The responsibility of branches like Flying, Medical, Administration and so on has got their respective role. In this lesson we will discuss about branches in IAF.

EXPLANATION

Following are the different Branches in the IAF

(a) Flying Branch
(b) Navigation Branch
(c) Education Branch
(d) Medical Branch
(e) Administration Branch
(f) Logistic Branch
(g) Meteorology Branch
(h) Engineering Branch

CONCLUSION

In this lesson we learnt about various branches of IAF. The branches among personnel made the organization to function smoothly. The role and responsibilities of the branches in IAF perform their activities selflessly and obediently. Without the co-operation there is no existence of an important defence organization like IAF.

MODES OF ENTRY IN THE IAF (GSK 6)

Followings are the essential requirements for entry in the IAF to become Commissioned Officer:-

Branch/Type of Entry	Educational Qualification	Age Limit	Advertisement Schedule
(A) FLYING BRANCH			
1.National Defence Academy (NDA) For Men only	**10+2 With Physics& Math**	**16 1/2 –19**	**Mar/Oct**
2. Combined Defence Service (CDSE) For Men only	**Any Grad. With Physics & Math at 10+2 or BE**	**19-23**	**Apr/Sep**
3. NCC Special Entry	**Any Grad. with Physics & Math at 10+2 or BE&NCC Air Wing Sr Div. "C' Certificate**	**19-23**	**Jun/Dec**
4. Short Service Commission (For Women only)	**Any Grad. With Physics Maths at10+2 or BE**	**19-23**	**Mar/Sep**
(B) TECHNICAL BRANCH (PC For Men/ SCC For Women)			
1. Aeronautical Engineering (Electronics) **2. Aeronautical Engineering (Mechanical)**	**First class degree in Engineering or GATE score of 70% & above in Electronics / Mechanical/ Allied subjects as per advertisement**	**18-28**	**Feb/Aug**
(C) GROUND DUTY BRANCH (PC For Men / SCC For Women			
1. Administration **2. Logistics** **3. Accounts**	**First Class Graduate or PG in subjects as per advertisement**	**20-23** **20-25**	**Mar/Sep**
4. Education **5. Meteorology**	**PG in subjects as per advertisement**	**20-25**	**Mar/Sep**

TO BECOME AN AIRMEN

GROUP	#AGE (As on date of Enrolment)	EDUCATIONAL QUALIFICATION
Group 'X' (Technical) Trades	17 - 22 Years	Passed Intermediate / 10+2 / equivalent examination with Mathematics, Physics and English with a minimum of 50% marks in aggregate. OR Three years Diploma course in Engineering (Mechanical / Electrical / Electronics / Automobile / Computer Science / Instrumentation Technology / Information Technology) with at least 50% marks in overall aggregate from a Government recognised Polytechnic Institute.
Group 'X' (Education Instructor) Trade	20-25 Years	Graduate in Arts, Commerce or Science with B. Ed degree/two years teaching experience in a Government recognised School/College. Candidate should have scored a minimum of 50% marks in aggregate in Graduation as well as B. Ed. OR
	20-28 Years	Passed MA English / M Sc in Mathematics, Physics, Computer Science / MCA with B Ed degree /2 Years teaching experience in a Government recognised School / College.
Group 'Y' Trades (Except Med Asst and Musician Trade)	17-22 Years	Passed Intermediate /10+2 / equivalent examination with Science, Arts or Commerce subjects or equivalent vocational course with minimum 50% marks in aggregate. Vocational courses should be recognised by Association of Indian Universities. OR Three years Diploma in any stream of Engineering from a Government recognised Polytechnic Institute.
Group 'Y' (Med Asst) Trade	17-22 Years	Passed 10+2 / Intermediate / equivalent exam with Physics, Chemistry, Biology and English with a minimum of 50% marks in
Group 'Y' (Musician) Trade	17-25 Years	Passed Matriculation /10th class or equivalent with minimum pass marks from any Government recognised School/Boards and should be proficient in playing at least one of the following musical instrument: Trumpet / Bass / Violin / Saxophone / Clarinet / Euphonium / Jazz- Drum / Piccolo / Bass Trombone / Key Board / Guitar / Sarod / Viola /

 # Age Date on enrolment

CONCLUSION

During the lecture different types of entry have been discussed for entry in the IAF which including the qualifications and advertisement schedule.

DEVELOPMENT OF AVIATION (GSK-7)

Ancient Greek myth of Ikaros, pictured here, who attempted to fly..

The idea of human flight has engaged the thought of many men since the beginning of history. Tracing the evolution of flight, one gets into a world of myths, religious beliefs and legends, when some of form of flying was visualized in the encounter and affairs of ancient life. There are the Vimanas of flying chariots in Indian mythology, the winged deities from Egypt and Assyria, the magic carpet from Arabia, the winged horse Pegasus and winged cap and heals of Hermes in Roman and Greek mythology. Mythologies aside, the first scientific venture in aviation were the tentative steps made in the fourth century B.C in China that eventually led to invention of the kite by the sixth century B.C, kites had found their way in military applications.

In 1890 LILIENTHAL in Germany started riding the air in gliders and it was his example, which fired the imagination of Wright brothers in America and turned their attention to solving the practical problems of aviation .The Balloon was joined by the parachute in 1797 when the French man, GARAERIN made the first human at PARIS. In 1852 the stream driven Airship became feasible, and also the light pressure ship of SANTOS and DUMONT.

The power airplane took ten years (1895-1905) to emerge from the Glider, which was perfected by the Wright Brothers. In 1906 Wright Flyer 111 emerged which could be banked, turned, circled and flown with ease and which could comfortably stay in the air for more than half an hour at a time.

ARCHAIC ORIGINS

Stories of people attempting to fly can be found throughout various ancient cultures. In Greek mythology there is the legend of Daedalus and Icarus, the father and son who created wings by combining feathers and wax. The story may have ended in tragedy, but it showed that men have always wanted to fly. Similar stories can be found in India, China and Europe.In 852 AD, Armen Firman of Spain covered his body with feathers and created wing-like garments that he attached to his arms. He then proceeded to jump from a tower. Although his attempt was unsuccessful, the garments slowed his descent, allowing him to survive with only minor injuries.**Kites**, which had been invented in China sometime in the 5th century, are known as the first aircraft made by man. **Man-lifting kites** were also utilized in China and Japan for military and punishment purposes. China is also credited with inventing **hot air balloons** (3rd century BC) and **rotor wings** (400 BC). The Renaissance in Europe, from the 14th to

17th century, witnessed a creative explosion in architecture, art, music, politics and science. Famous Renaissance artist and inventor Leonardo da Vinci developed the early drafts for a rational aircraft. Among his inventions were the parachute and the aerial screw. While his ideas were not scientifically sound, they were at least reasonable.The age of modern aviation began during the 1700s, and came to embody to main categories: **lighter-than-air** aviation and **heavier-than-air** aviation.

LIGHTER THAN AIR AVIATION

This type of aviation mainly involved balloons and airships. On June 4, 1783, brothers Joseph-Michel and Jacques-Étienne Montgolfier exhibited their unmanned hot air balloon, which flew over Annonay, France. By August 27 of the same year, brothers Anne-Jean and Nicolas-Louis Robert, along with Jacques Charles, flew their unmanned hydrogen-filled balloon over Champ de Mars, Paris.On October 19, the Montgolfier brothers sent up a manned flight with a tethered hot air balloon piloted by Giroud de Villette, Jean-Baptiste Réveillon and Jean-François Pilâtre de Rozier. Then, on November 21, the brothers launched their first untethered flight with Pilâtre de Rozier and François d'Arlandes onboard. The balloon was lifted by hot air from a wood fire and flew a total of nine kilometers in 25 minutes. Despite having enough fuel to fly for a longer duration, the two aeronauts had to land because the firewood's embers began to burn the fabric.
Hot air balloons suffer from a disadvantage, however: lack of maneuverability. The invention of **airships**, otherwise known as dirigibles or zeppelins, solved this issue. Dirigibles derive lift from hydrogen or helium gas instead of from heat. These airships were the first to carry passengers over long distances. Perhaps the most famous were the dirigibles manufactured by German airship company Luftschiffbau Zeppelin. Airships are classified into three categories:

- **Non-rigid** – Also known as blimps, they lack a solid wood or metal framework. They basically consist of envelopes filled with gas, with a small gondola attached below.
- **Semi-rigid** – An airship with a solid supporting structure that only runs on the bottom part of the ship's interior.
- **Rigid** – These airships have a full internal framework, usually constructed from wood or some type of metal, covered with an envelope. One or more gasbags inside provide lift.

The age of lighter-than-air aviation waned with the development of better airplane designs. On May 6, 1937, the zeppelin *Hindenburg* burst into flames and crashed to the

ground at Lakehurst, N.J., killing 22 crewmen, 13 passengers and a ground worker. The accident would mark the end of the airship era.

HEAVIER THAN AIR AVIATION

First successful flight of the Wright Flyer, by the Wright brothers. The machine traveled 120 ft (36.6 m) in 12 seconds at 10:35 a.m. at Kill Devil Hills, North Carolina. Orville Wright was at the controls of the machine, lying prone on the lower wing with his hips in the cradle which operated the wing-warping mechanism. Wilbur Wright ran alongside to balance the machine, and just released his hold

There had been various contenders for the title of having developed the first true heavier-than-air aircraft, and more than a little controversy surrounding the various claims. On October 9, 1890, French inventor Clément Ader made one of the first powered flights. His "flight" was only 20 centimeters above the ground but covered a total distance of 50 meters, which was quite significant at the time. However, the official and most universally accepted date that kick started aviation as we know it today is December 17, 1903. On that day Orville and Wilbur Wright made four flights in their Flyer, the longest of which lasted 59 seconds and covered 852 feet. The Wright brothers flight combined both power and control, setting a new standard for aviation. The world's first scheduled passenger air service began in Florida on January 14, 1914. It operated between St. Petersburg and Tampa. Despite only lasting for four months, the flights helped pave the way for modern-day transcontinental service. The 1920s and 1930s were a time of explosive growth in civil aviation. Revolutionary aircraft designs such the Douglas DC-3 — a reliable all-metal passenger airplane — helped make air travel more accessible and comfortable for the public.

POST-WORLD WAR II CIVIL AVIATION

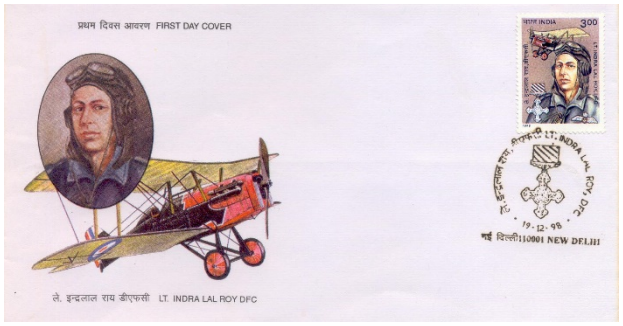
By the end of World War II, many towns and cities had built their own airports. Civil aviation experienced rapid growth during this period, as military aircraft were repurposed as airliners or personal planes. In 1944 the Convention on International Civil Aviation, aka the Chicago Convention, was established. The agency's goal was to standardize the efficiency, safety and consistency of all civil flights. Today that standardization has paid off in safer, more economical airliners operated by the major carriers. Europe-based Airbus, U.S.-based Boeing, Brazil-based Embraer, Russia-

based United Aircraft Corporation and Canada-based Bombardier are five of the top aircraft manufacturers today.

THE ERA OF DIGITAL AVIATION

With the emphasis during the modern era on adopting digital or computerized techniques, the aviation industry has really taken off. During the 1970s, computer-aided design and computer-aided manufacturing (CAD/CAM) software enabled the creation of better aircraft designs. Computer simulations have also led to the discovery of better materials for creating lighter and stronger airplanes.Digital systems have found their way inside the modern aircraft, rendering most mechanical and analogue instruments obsolete. An example of this is the “glass cockpit” employing LCD screens instead of the mechanical gauges and dials.

AVIATION IN INDIA



The first Indian aviator both pilot and aircraft constructor was Prof Venketa Subba Setty of Mysore who was a remarkable person, being the first Indian to fly, and as a pioneer in aeronautical engineer, to design, build and fly an aircraft. This was on 16 June 1912, while he was with A.V Roe and CO (Avro) at Brooklands in the Manchester area of England. VS Setty had joined A.V Roe on 08 May 1911 as a time keeper and within some weeks on 27 May 1911 along with another Indian SV Sippe began to practice for flight in a Gnome powered Farman pusher biplane. Within some months he had rolled (flown) in a 35 H.P Viale engined Avro type D (No.6). On 27 September 1911, Setty had his first flying incident ending up in the sewage farm adjacent to Brooklands which happened frequently to early aviators and Setty ended up there again on 21 February 1912 while flying on Avro type B; but was uninjured. Prof Setty’s interests included automobiles, he participated in car races in the U.K this pioneer of aviation only lived till the end of the First World War, passing away in 1918. There was barely any aviation activity in India during years of the Great War. However, a central flying school had been set up in Sitapur on 1 October 1915 under the control of Army HQ with the object of Officers gaining experience under Indian conditions, with some five air planes in service. Individual Indian aviator had, however engaged themselves in aviation pursuits when they managed to enlist in the Royal Flying Course. Lt Hardeep Singh Malik, Lt Indra Lal Roy, D.F.C and Lt SG Welingkar, M.C, where amongst the Indian in the RFC. Although the First World War had disrupted the development of aviation in India, it had given an opportunity for these young pilots to distinguish themselves. Lt Indra Lal Roy was one of the first Indian to receive the king’s commission at the age of 18. He was with No.56 Squadron RFC on the western front and No 40 Squadron during July 1918 shooting down several German fighters. Sardar Hardeep Singh Malik who was later to

be Indian Ambassador to Paris served in both the RFC and RAF. He had joined the RFC in April 1917, later was in operation with No.28 Squadron and flew Sopwith Camels as a fighter pilot. In 1913 there was about five air machines in India. There was no pilot apart from a few British Officers of the Indian Army who had learned to fly in England in 1915.

Civil aviation in India picked up soon when intercontinental flights started between Europe and India. As part of British Empire the initiative for development of the aviation, civil and military in India was naturally the prerogative of the British government. One of Britan's immediate objectives was to have independent air route to India. With Seften Brancker being director of civil aviation during this period, India naturally became the focus point in British aviation plans. Seften Brancker's ambitious plans for intercontinental air links were realized when, on 17 March 1925, he flew aboard a D.H 50 from Croyvon terminal in London to Rangoon inn Burma and returned back, thereby completing an 8000 miles air trip to India and back. This adventures expedition laid the foundation for intercontinental civil air services. However the first proving flight of KLM Royal Dutch Airlines to Java, passed through India even before Brancker took off from London. The KLM flight landed in Karachi on 9 November 1924. The directorate of civil aviation was established in 1927 as an integral part of the department of industries and labour, Lt Col Shelmderdine being appointed as the first director of civil aviation. His first priority was the creation of chain of aerodromes with good permanent hangars incorporating workshops and offices on the Karachi-Calcutta and Karachi-Southern India routes. Another vital task to be accomplished was establishing a wireless communication network and direction finding station, comprising point to point communication on the entire route. Shelmderdine spent considerable time in organizing the state owned India state air services to operate the Indian sector of the entire route between London and Far East. He was also the person pushing for establishing flying clubs across the country as also the aero club of India.

Officers of 'A' Flight IAF at Drigh Road in 1935. L-R are **Aspy Engineer**, HC Sircar, Daljit Singh, an Army Liaison Officer, AB Awan, KK Majundar and Narendra.

Among the early aviators of India, there was an elite class of incredibly talented flying enthusiastic who contributed majorly to the growth and sustenance of aviation in India. There were A.M Engineer, popularly known as ASPY, Man Mohan Singh and JRD Tata. Born on 15 December 1912, A.M Engineer was, at 17 the youngest Indian pilot of the time. He won the Aga Khan Trophy being the first Indian to fly solo from England to India in a Gypsy Moth. Later, he trained at RAF Cranwel where he was adjudged the best all-round cadet was commissioned in to A Flight of IAF, and flew the Wapitis in the North Western frontier province. No 1 Squadron was formed in July 1938, Engineer was appointed the Flight Commander and flew operations in North Waziristan in May 1939. A flight under Engineer's command carried out 403 hours of flying operation, a

feat which was acknowledged as remarkable in view of the small number of aircraft and crew available.

Another distinguished aviator who became a legend in Indian aviation history was Man Mohan Singh a remarkable person. An engineer from Bristol University, he was the first Indian to fly solo from England to India. He had earlier completed a two years course in flying and aeronautical engineering at Bristol on an Indian government scholarship. In 1934-35 Man Mohan Singh accomplished another solo flight in a light aircraft, again the first by an Indian, from England to South Africa.

Bombay airport on 15 October 1962 shows Mr. J. R. D. Tata, Chairman of the Tata group and of Air-India, who piloted this flight and the original 1932 flight as well,. Behind him is the De Havilland DH85 Fox Moth, VT-AKH in which he recreated the flight.

J.R.D Tata, was the first Indian to secure an A-license within the shortest number of the hours and is perhaps the most acclaimed personality of Indian aviation, the visionary who laid the foundation for commercial air transport in India. The passion for flying was kindled in him from the legendary Bleriot, the first man to fly across the English Channel. J.R.D's first flight during his childhood days was with a joy-riding pilot in Hardelot. The first entry in his flight logbook was on 22 January 1929 when he made his first flight in a Gypsy Moth at the Bombay flying Club, done remarkable after only 12 days 3 hours and 45 minutes of dual flying experience at the flying club. He lost his air lines service on 15 October 1932 with a Push Moth airmail service to Karachi in 1938 at the age of 34. The pioneering efforts by the house of Tata's ably assisted and nourished by Neville Vintcent, a former RAF pilot who came to India in 1929 and built up the aviation department of Tata Sons as a full-fledged domestic airline service which was, two turbulent decades later to evolve into the country's international career, Air India International in 1948.

CONCLUSION

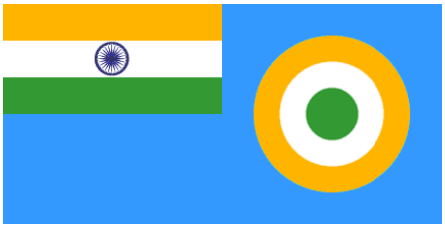
We have seen here the chronological development of aviation from beginning to era where man flies with the help of machines.

HISTORY OF IAF (GSK 8)

The Indian Air Force is the youngest the three services. Even though young it has a bright history. The bravery, valour and achievement of the officers and airmen of the IAF are integral part of its proud heritage.

BIRTH OF THE IAF

The origin of the IAF can be traced to the Indian Sandthurst committee known as a Skeeny committee. This committee was setup by the Govt. of India in 1925 with Sir Andrew Skeen, The Chief of General Staff as its chairman to enquire and recommend the rate at which Indians should be recruited for the grant of commissions in the Armed forces. The report was published on 1st April 1927. The Skeeny committee recommended that steps should be taken to create an Air Arm of the Indian Army and till such time facilities for flying Trg made available in India, its officers should be trained at Royal Air Force(RAF) college, Cranwell. From 1928 onwards 2 seats were reserved at the RAF College, Carnwell for Indians in 1930, six Indians, selected by the government of India to enter the college. They were S.C. Sarkar, Subroto Mukherjee, Bhupinder Singh, Awan, Amarjit Singh and J.N.Tandon.



The first batch was granted their commission as pilots with the exception of Tandon. He was commissioned in the equipment branch and he became the first equipment officer in Indian Air Force.

22 Airmen were selected on 19 Jan 1932 as a ground staff. They began their Trg at Karachi. They were known as Hawai sepoys.

The Government passed the IAF bill on 4 April 1932. The Indian Air Force came into being with the promulgation of the IAF bill on 8 Oct 1932. The Governor General-in-Council at that time consequently ordered the establishment of Indian Air Force with effect from 8 Oct 1932. The Indian Air force anniversary is celebrated on 8 Oct every year.

No.1 Squadron (A Flight) of the IAF was formed at Drigh Road, Karachi. It consisted of 4 wapiti aircraft, 6 Officers and 22 airmen then known as hawai sepoys. The six officers included the two ex-chiefs of the Air Force, Air Marshal S Mukherjee and Air Marshal AM Engineer.

Two more flights (B&C) were formed and added to No.1 Squadron in 1936 and

1939 respectively. Flight lieutenant S Mukherjee took over the command of No.1 Squadron.

When World War II broke out in 1939 the problem was of guarding India's vast coastline across and the IAF took active steps to solve it.

Trg of volunteer reserves began in November, 1939. Six coastal defense flights (CDF) were formed at Madras, Bombay, Calcutta, Cochin, Karachi and Vishakapatnam with Wapiti and Atlanta aircraft. Towards the end of 1942, these flights were disbanded and the new squadrons were formed.

GROWTH AND EXPANSION

In its early years expansion of IAF was rather slow. In Sep, 1939 it consisted of only one squadron with a complement of 16 officers and 144 airmen. During World War II the increasing commitments of the RAF in Europe and the impact of Japanese invasion in south-east Asia accelerated the pace of progress.

At the end of March 1941, No.1 Squadron and 3 CDFs gave up their Wapitis which were requisitioned to equip No.2 Squadron raised at Peshawar in the following months and were issued instead with Armstrong Withworth Atlanta transport, used to patrol the Sunder bans Delta area south of Calcutta. No.2 CDF had meanwhile received requisitioned D.H.89 Dragon Rapides for convoy and coastal patrol, while No.5 CDF took on strength a single D.H.86 which it used for convoy and patrol the waters of Cape Comorin and the Malabar Coast. By Oct 1943, the strength rose to 8 full squadrons with 911 officers and 40146 airmen. By the end of war two more squadrons were added to it. The squadrons were equipped with variety of aircrafts, viz., Lysander, Wapiti, Audax, Hurricane, Vengeance and Spitfire.

THE INDIAN AIR FORCE TODAY

There are five operational Air commands, The Western Air Command with headquarters in Delhi being the prime such and responsible for Air operations from Kashmir southwards to Rajasthan and including the capital and the Punjab, with an operational group dedicated for Jammu and Kashmir including Ladakh. Central Air Command based at Allahabad, encompasses most of Indo-Gangetic plain while, Eastern Air Command, from Shillong, is responsible for Bengal, Assam, the Eastern

states of Arunachal Pradesh, Meghalaya, Mizoram and the other bordering on Tibet, Bangladesh and Burma.

South Western Air Command, at Gandhinagar, is responsible for air operations in most of Rajasthan, southwards through Gujarat to Saurashtra and the Kutch area. Southern air command was formed in July 1984 with headquarters at Thiruvananthapuram and has, geographically, the largest territory, from the Deccan plateau area to the southern tip of the peninsula and including the islands territories of Lakshadweep and the Andaman and Nicobar islands.

Trg command has its headquarters at Bangalore with the majority flying and ground training establishment located in southern India. The Maintenance Command functions in Nagpur in central India.

The five operational commands through administrative wings, control some 45 fixed wings squadrons, 20 helicopter units and numerous surface to air missile squadrons, with unit establishments varying from 12 to 18 aircrafts. This represents total aircrafts strength of 1700 including Trg and support types, manned by some 170000 personnel.

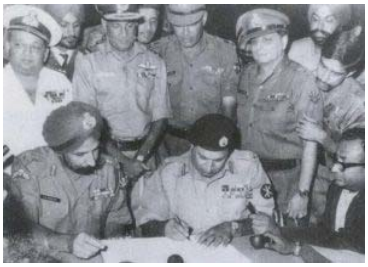
CONCLUSION

From the raising of Air Force, It has seen various changes and is marching towards the modernization. Since it is the youngest force it has the responsibility of defending the Air territory of our Country.

It is the eye in the sky and has the nature of devastating the enemy of the country. From the organization of the Air force and having a few personnel now it has more than a lakh personnel.

The five operational commands through administrative wings, control some 45 fixed wing squadrons, 20 helicopter units and numerous surface to air missile squadrons, with unit establishments varying from 12 to 18 aircrafts. This represents total aircrafts strength of 1700 including training and support types, manned by some 170000 personnel.

INDO PAK WAR- 1971 (GSK 9)



India's commitment to peace has always been total and irrevocable. This does not, however, mean submission before force or violence. Gandhiji always made the subtle but significant distinction between non violence and cowardice. Hence, when the Pakistan hordes descended on us on the evening of 3rd December, we were left with no option but to give a fitting reply. This is what precisely our defence forces did. In the process the enemy's war machinery was dealt crippling blows. What is more, our armed forces in conjunction with the Mukti Bahini ended the dark night of oppression and brutality in East Bengal and ushered in the new state of Bangladesh. All this was achieved in a remarkably short period of fourteen days. In fact the unconditional surrender by the enemy's one lakh armed forces is unprecedented.

AGGRESSION BY PAKISTAN

Darkness had just fallen on the evening of 3rd December 1971 when air raid alert was sounded at 6 PM in most of the cities in India. With the sounding of siren all lights went off. Everyone including the President, the Cabinet Ministers, the Member of Parliament, the newsmen was taken unaware. The briefing officer told newsmen that the raid alert was a genuine one. Soon people realised the seriousness of the situation. The street lights were never switched ON. The cities were plunged into darkness. The A.I.R then revealed the unfortunate incident of unprovoked aggression by Pakistan.

The military junta of Pakistan seemed to have chosen the hour of attack with some deliberation and care. The Prime Minister Smt Indira Gandhi was away from New Delhi on days visit to Calcutta, where she had just finished speaking to a large gathering on the Pakistani threat to India's security and the liberation struggle in the Bangladesh. The Defence Minister, Shri Jagjivan Ram was at Patna. The Finance Minister YE Chavan left the capital minutes before the Pakistani attack was launched.

The Pakistani Air Force and ground troops following the Israeli type pre-emptive strike had launched a massive attack on the Western front stretching from Jammu & Kashmir to Rajasthan. Pakistani Radio went on the air alleging an Indian attack, when the Pakistani planes were bombing our air fields in sneak raids. Pakistan's friend, philosopher and guide Peking's New China News Agency also broadcasted similar allegations.

In addition to air raids by the Pakistani Air Force the ground forces also launched a massive attack on our border posts.

AGGRESSION ANTICIPATED

Although unprovoked aggression came as a surprise to the people in general, and they were taken unaware, the Govt of India is reported to have anticipated it. The aircraft had been removed from those airfields well in advance. In view of, while damage had been caused to runways or otherwise to some airports, Pakistan's basic strategy failed. The intruding Pakistani fighter planes, despite the persisted raids made on various airfields, could not destroy any Indian aircraft. Necessary steps had been taken by Govt to ensure the safety of our aircraft. Indian anti-aircraft guns went into action and IAF Gnats chased the Pakistani planes away. In this process three Pakistani planes had been shot down.

DAMAGE REPORTED

Civil Areas

(a) In Rajasthan six people were injured, when a Pakistani aircraft dropped two bombs near bus stand.

(b) In Pathankot one person was killed in the Pakistani bombing.

(c) Houses in Gandhinagar were rocked by the unprovoked Pakistani shelling.

Military Airfields and Aircrafts

Aircraft and one 3 tonne vehicle had been hit by Pakistani bombs near Amritsar. In Halwara Pakistani planes dropped four time bombs which exploded after the aircraft fled.

PAKISTANI SOLDIERS SURRENDER

In Akhaura area 12 soldiers of the Pakistani army and 10 personnel from among Pakistani para military troops surrendered to the Indian Army.

WHY INDO-PAK WAR?

The main problem was creation of conditions in Bangladesh which would be conducive to the safe and speedy return of 11 million refugees which had crossed our borders from East Bengal. During 1972, the cost of feeding refugees would amount to £290 million as against the international aid of about £190 million. On 5th December 1971, Sunday Times, London reported "one result of India's victory would be the collapse of military rule and the triumph of democracy. It is no paradox therefore, to see that India is fighting to bring freedom to all the people of the sub-continent, who are in the eye of God, one people".

RECOGNITION OF BANGLADESH BY INDIA

The East Pakistan Rifles and East Bengal Regiment became the Mukti Fouj and later the Mukti Bahini which was joined by thousands of young East Bengal's determined to sacrifice their lives for freedom. Government of Bengla Desh and Government of India unanimously decided to grant recognition to the 'Gana Prajatantra Bangladesh'. The father of the new state became Sheikh Mujibur Rehman, Dhaka became the capital.

SUMMARY

15. In fact the suppression by military junta of Pakistan carried on in Bangladesh and the exemplary courage displayed by the people of Bangladesh in facing such situation is not a secret. It has been recorded in the world press. No one can say that India's decision to recognise Bangladesh is based on emotions and not based on present and future realities. It can also not be said to be a hasty step for recognition was accorded only after Pakistan was unable to exercise any control over the people of Bangladesh. "The will of the nation substantially expressed". The act of according of recognition to Bangladesh is to admit realities, and since history has such precedence, when an emerging colony was accorded independence, recognition Bangladesh, which has been treated as a colony and which was emerged successfully from its parent country, cannot be condemned by any nation. Later on National flag and National song sung by free country Bangladesh 'Amar Sonar Bangla tomai ami bhalobasi'.

OPERATION SAFED SAGAR (GSK 10)

Operation Safed Sagar was the codename assigned to the Indian Air Force's strike to support the Ground troops during Operation Vijay that was aimed to flush out Regular and Irregular troops of the Pakistani Army from vacated Indian Positions in the Kargil sector along the Line of Control. It was the first large scale use of air power in the Jammu and Kashmir region since the Indo-Pakistani War of 1971.

Ground Operations

Initial infiltrations were noticed in Kargil in early May, 1999. Because of the extreme winter weather in Kashmir, it was common practice for the Indian and Pakistan Army to abandon forward posts and reoccupy them in the spring. That particular spring, the Pakistan Army reoccupied the forward posts before the scheduled time not only theirs but also which belonged to India, in a bid to capture Kashmir.

By the second week of May, an ambush on an Indian army patrol acting on a tip- off by a local shepherd in the Batalik sector led to the exposure of the infiltration. Initially with little knowledge of the nature or extent of the encroachment, the Indian troops in the area initially claimed that they would evict them within a few days. However, soon reports of infiltration elsewhere along the LoC made it clear that the entire plan of attack was on a much bigger scale. India responded with Operation Vijay, a mobilization of
200,000 Indian troops. However, because of the nature of the terrain, division and corps operations could not be mounted; the scale of most fighting was at the regimental or battalion level. In effect, two divisions of the Indian Army numbering 20,000, along with several thousand from the Paramilitary forces of India and the air force were deployed in the conflict zone. The Indian Army moved into the region in full force. Soon, the intruders were found to be well entrenched and while artillery attacks had produced results in certain areas, more remote ones needed the help of the air force.

Air Operations

The Indian Air Force (IAF) was first approached to provide air support on 11 May with the use of helicopters. On 21 May a Canberra on a reconnaissance mission was hit by ground fire. The flight was however, recovered safely, and returned to base on one engine. On 25 May, the Cabinet Committee on Security authorized the IAF to mount attacks on the infiltrators without crossing the LoC. Initial indications from the government to the IAF was to operate only Attack helicopters. However, the Chief of Air Staff put forth the argument that in order to create a suitable environment for the helicopters, fighter action was required. On 26 May, the go-ahead was given and the IAF started its strike role. Flying from the Indian airfields of Srinagar, Avantipur and Adampur, ground

attack aircraft MiG-21s, MiG-23s, MiG-27s, Jaguars and the Mirage 2000 struck insurgent positions.

The first strikes were launched on the 26 May, when the Indian Air Force struck infiltrator positions with fighter aircraft and helicopter gunships. The initial strikes saw MiG-27s carrying out offensive sorties, with MiG-21s and (later) MiG-29s providing fighter cover. Mil Mi-17 gunships were also deployed in the Tololing sector. Srinagar Airport was at this time closed to civilian air-traffic and dedicated to the Indian Air Force.

However, on 27 May, the first fatalities were suffered when a MiG-21 and a MiG-27 jets were shot down over Batalik Sector by Pakistan Army. The following day, a Mi-17 was lost- with the loss of all four of the crew- when it was hit by three Stinger missiles while on an offensive sortie. These losses forced the Indian Air Force to reassess its strategy. The helicopters were immediately withdrawn from offensive roles as a measure against the man-portable missiles in possession of the infiltrators.

On 30 May, the Indian Air Force called into operation the Mirage 2000 which was deemed the best aircraft capable of optimum performance under the conditions of high- altitude seen in the zone of conflict. Armed initially with 250 kg "dumb" bombs, No.7 Squadron over three days, struck infiltrator positions in Muntho Dhalo, Tiger Hill and Point 4388 in the Drass Sector. The strikes on Muntho Dhalo on 17 June also destroyed logistics and re-supply capabilities of the infiltrators in the Batalik Sector. Through the last weeks of June, the Mirages, armed with LGBs as well as with "dumbs", repeatedly struck the heavily defended Tiger Hill.

The choppers used were Mi-8 and the Mi-17. The transport planes were Avro, An-32 and IL-76. On May 27, the IAF had sent a MiG-27 on a photo reconnaissance mission over the Indian side of the Line of Control in Kashmir Pilot ejected from MiG-27 after an engine flameout due to Pakistani retaliation.

The next day the Air Force lost an Mi-17 Helicopter to a shoulder fired missile near Tololing, killing the crew of four. This resulted in a change in strategy and technology. With the Israelis providing around 100 Laser-guided bomb kits to the Indian Military, the air force chose to make maximum use of this and retaliated with regular sorties on Pakistani occupied bunkers. The aircraft operated at 10,000 meters AGL (33,000 feet above sea level), well out of MANPADs range, leading to a drop in the accuracy rate of the bombs. The low number of airstrips for take-off and landing of the flights also

constrained the efficiency of the attacks. Despite this, there were hundreds of sorties on the intruders with no further material or personnel casualties enabling a gradual takeover of the mountain posts by Indian troops. According to IAF the "air strikes against the Pakistani infiltrators, supply camps and other targets yielded rich dividends."

By July all the remaining intruders had withdrawn and the operation was ended, being declared a success by the IAF in having achieved its primary objectives. However there has also been criticism of the methods initially used and the type of planes being unsuitable to the terrain that resulted in early losses. This is believed by many in the air force as coming as a wakeup call to upgrade the ageing fleet of craft (especially the attack aircraft and helicopters) to better enable them to fight in the mountainous region. But, in the context of the war and in light of the poor information available on the infiltrations, the Indian Air Force was able to coordinate well with the Army and provide air support to the recapture of most the posts before Pakistan decided to withdraw its remaining troops.

CONCLUSION

Operation Safed Sagar, as the air operation in the Kargil area was called, was indeed a milestone in the history of military aviation. This was the first time that air power was employed in such an environment. Fighters as well as armed helicopters carried out many hundreds of sorties against the armed intruders who had infiltrated into the Indian Territory. The use of air power in this theatre was instrumental in accelerating the end of the conflict to India's advantage. IAF's air strikes against enemy supply camps and other targets yielded rich dividends. A noteworthy fact is that there was not a single operation on ground that was not preceded by air strikes, each and every action was a result of coordinated planning. The enemy was kept off the backs of the Indian Army. In the area of interdiction of enemy supplies, the successful and incessant attacks on the enemy's logistic machines, over the weeks, culminated in a serious degradation of the enemy's ability to sustain them.

AIRCRAFT RECOGNITION (ACR-1)

Aircraft Recognition is essential to identify the aircraft during both in peace and war.

IDENTIFICATION OF AIRCRAFTS

During Peace Time. Aircraft recognition helps to identify the different types of aircraft possessed by the enemy and assess the strength of the country and prepare for own self-defense.

During War Time. Aircraft recognition helps the MOP (mobile observation post) to identify while Aircraft is friend or foe. It also helps to know the capability of the aircraft by identifying its type.

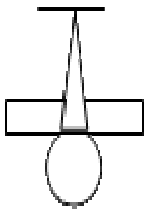
EXPLANATION

There are various methods used to identify the aircrafts:

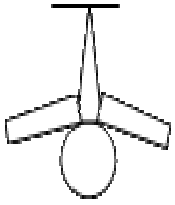
(a) Wing position (b) Wing shape (c) Shape of wing tips
(d) Shape of canopy (e) Shape of fins and tail plane (f) Markings

(a) Recognition by the Wing Position.

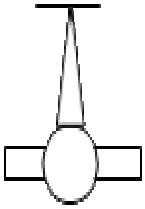
(i) High wing (ii) Shoulder wing (iii) Mid wing
(iv) Low mid wing (v) Low wing (vi) Parasol wing



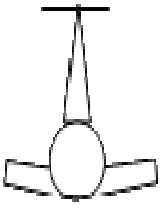
High Wing



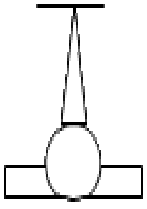
Shoulder Wing



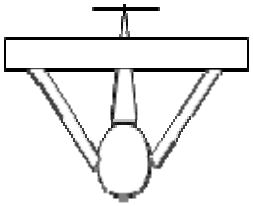
Mid Wing



Low Mid Wing



Low Wing



Parasol Wing

(b) Wing Shape

(i) Backward Taper (ii) Equitaper (iii) Delta

(iv) Crescent (v) Swept Back (vi) Swept Forward
(vii) Bi Plane (viii) Mono plane (ix) Dihedral

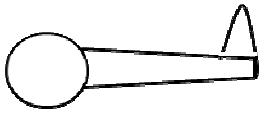
(c) Shape of Wingtip

(i) Circular (ii) Taper (iii) Pointed (iv) Square

(d) Shape of Canopy

(i) Inline (ii) Submerged (iii) Teardrop

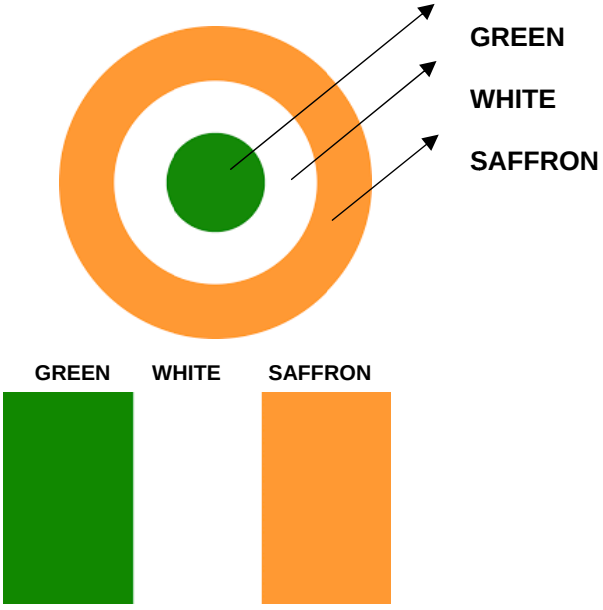
(iv) Glasshouse (v) Bubble



(e) Shape of Fin and Tail Plane.

(i) High tail plane (ii) High mid tail plane (iii) Mid tail plane
(iv) Low mid tail plane (v) Low tail plane

(f) Markings.



AIRCRAFT RECOGNITION (ACR-2)

FIGHTER AIRCRAFT

SU-30 MKI : Twin seater twin engine multirole fighter of Russian origin which carries One X 30mm GSH gun alongwith 8000 kg external armament. It is capable of carrying a variety of medium-range guided air to air missiles with active or semi-active radar or Infra red homing close range missiles. It has a max speed of 2500 km/hr (Mach 2.35).

MIRAGE-2000 : A single seater air defence and multi-role fighter of French origin powered by a single engine can attain max speed of 2495 km/hr(Mach 2.3). It carries two 30 mm integral cannons and two matra super 530D medium-range and two R-550 magic II close combat missiles on external stations.

MiG-29 : Twin engine, single seater air superiority fighter aircraft of Russian origin capable of attaining max. speed of 2445 km per hour (Mach-2.3). It has a combat ceiling of 17 km. It carries a 30 mm cannon alongwith four R-60 close combat and two R-27 R medium range radar guided missiles.

MiG-27 : Single engine, single seater tactical strike fighter aircraft of Russian origin having a max. speed of 1700 km/hr (Mach 1.6). It carries one 23 mm six-barrel rotary integral cannon and can carry upto 4000 kg of other armament externally.

MiG-21 BISON : Single engine, single seater multirole fighter/ground attack aircraft of Russian origin which forms the back-bone of the IAF. It has a max speed of 2230 km/hr (Mach 2.1) and carries one 23mm twin barrel cannon with four R-60 close combat missiles.

JAGUAR : A twin-engine, single seater deep penetration strike aircraft of Anglo-French origin which has a max. speed of 1350 km /hr (Mach 1.3). It has two 30mm guns and can carry two R-350 Magic CCMs (overwing) alongwith 4750 kg of external stores (bombs/fuel).

TRANSPORT AIRCRAFT

C-130J : The aircraft is capable of performing paradrop, heavy drop, casuality evacuation and can also operate from short and semi prepared surfaces. C-130J is the heaviest aircraft to land at DBO in Aug 2013.

C-17 : The aircraft is capable of carrying a payload of 40-70 tons up to a distance of 4200-9000 km in a single hop.

IL-76 : A four engine heavy duty/long haul military transport aircraft of Russian origin with a max speed of 850 km/hr. It has a twin 23 mm cannon in tail turret and capacity to carry 225 paratroopers or 40 tonnes freight, wheeled or tracked armoured vehicles.

AN-32 : Twin engine turboprop, medium tactical transport aircraft of Russian origin with a crew of five and capacity to carry 39 paratroopers or max load of 6.7 tonnes. It has a max cruise speed of 530 km/hr.

EMBRAER : The main role of employment of this executive Jet Air craft is to convey VVIPs/VIPs to destinations within India and abroad. Air HQ Communication Squadron operates this aircrafts and it has maintained a flawless incident/accident free track record till date.

AVRO : Twin engine turboprop, military transport and freighter of British origin having a capacity of 48 paratroopers or 6 tonnes freight and max cruise speed of 452 km/hr.

DORNIER : Twin engine turboprop, logistic air support staff transport aircraft of German origin capable of carrying 19 passengers or 2057 kg freight. It has a max speed of 428 km/hr.

BOEING 737-200 : Twin engine turbofan, VIP passenger aircraft of American origin with total seating capacity of upto 60 passengers. It has a max cruise speed of 943 km/hr.

HELICOPTERS

MI-25/MI-35 : Twin engine turboshaft, assault and anti armour helicopter capable of carrying 8 men assault squad with four barrel 12.7 mm rotary gun in nose barbette and upto 1500 Kg of external ordnance including Scorpion anti-tank missiles. It has a max cruise speed of 310 km/hr.

MI-26 : Twin engine turboshaft, military heavy lift helicopter of Russian origin with carrying capacity of 70 combat equipped troops or 20,000 kg payload. It has a max speed of 295 km/hr.

MI-17 V5 : The Mi-17 V5 is a potent helicopter platform, equipped with modern avionics and glass cockpit instrumentation. They are equipped with state-of-art navigational equipment, avionics, weather radar and are NVG-compatible.

CHETAK : Single engine turboshaft, light utility French helicopter with capacity of 6 passengers or 500 kg load. It has a max speed of 220 km/hr.

CHEETAH : Single engine turboshaft, FAC/casevac helicopter of French origin having capacity to carry 3 passengers or 100 kg external sling loads. It has max cruise speed of 121 km/hr and can climb to 1 km in 4 minutes.

TRAINING AIRCRAFT

KIRAN (HJT-16)

Role. Basic Jet and Armament Trainer

Particulars.

Length/Span/Height - 10.6 / 10.7 / 2.67 m
Max Take-Off Weight - 5000 Kgs
Fuel Capacity - 345+4X255 Litres (Drop Tanks)
Pay Load - 2X250 Kg Bombs
(or Rocket Pods) plus 2X7.62 mm Guns

Performance.

Cruise/Max Speed - 600/715 KMPH
Range - 1075 Km
Engine (Thrust) - Single Turbojet (1900 Kg)

Special Features.

- Indigenous design of HAL.MK-II has high powered engine and four (instead of two) hard points for weapons.

HAWK

Role

- Advanced Jet Trainer

Particulars

Crew: 2: student, instructor
Length: 12.43 m ,Wingspan: 9.94 m
Height: 3.98 m
Empty weight: 4,480 kg ,Useful load: 3,000 kg
Max takeoff weight: 9,100 kg
Powerplant: 1× Rolls-RoyceTurbomeca Adour Mk. 951 turbofan with FADEC, 29 kN (6,500 lbf) 29 kN

Performance

- Maximum speed: Mach 0.84 (1,028 km/h, 638 mph) at altitude
- Range: 2,520 km (1,360 nmi, 1,565 mi)
- Service ceiling: 13,565 m (44,500 ft)

Armament

- ADEN cannon, in centerline pod
- Bombs
- Missiles

PILATUS PC-7

Role

The Pilatus PC-7 Turbo Trainer is a low-wing tandem-seat training aircraft, manufactured by Pilatus Aircraft of Switzerland. The aircraft is capable of all basic training functions including aerobatics, instrument, tactical and night flying.

MADE IN INDIA

LIGHT COMBAT AIRCRAFT (LCA)

Role. Single Seater Multi Role Combat.

Particulars.

Length/Span/Height - 13.2 / 8.2/ 4.4 m
Max Take-Off Weight - 8,500 Kgs
Pay Load - 4000 Kgs (Beyond-Visual-Range missiles, Reconnaissance / Electronic Warfare pods and 23 mm GSH gun.

Performance.

- Single engine aircraft expected to be supersonic at all altitude.
- Small size will reduce its chances of detection by enemy radars.
- Capable of Take-off and landing from very short runways.
- Inertial navigation system for accurate navigation and guidance.
- Inflight refueling probe for extended range.

Special Features

- World's smallest light weight and highly maneuverable combat aircraft with seven hard-points.

 Developed by aeronautical development agency with contribution from more than 100 government/private agencies.

HAL LIGHT COMBAT HELICOPTER (LCH)

Role

The HAL Light Combat Helicopter (LCH) is a multirole combat helicopter being developed in India by Hindustan Aeronautics Limited (HAL) for use by the Indian Air Force and the Indian Army.

Particulars

Crew: 2
Length: 15.8 m ,Rotor diameter: 13.3 m ,Height: 4.7 m
Max. takeoff weight: 5,500 kg
Powerplant: 2 × HAL/Turbomeca Shakti turboshaft, 895 kW (1,200 shp) each

Performance

Maximum speed: 265 km/h,Range: 550 km ,Service ceiling: 6,500 m

Armament

Guns,Hard points: 4 (two under each wing) and provisions to carry combinations of: Rockets,Missiles,Bombs

HAL Dhruv

Role

The HAL Dhruv is a utility helicopter developed and manufactured by India's Hindustan Aeronautics Limited (HAL).

Particulars

Crew: 1 or 2 pilots
Capacity: 12 passengers (14 with high density seating); or 4 stretchers with 2 attendants; or 2 stretchers with 4 attendants
Length: 15.9 m ,Width: 13.2 m , Height: 4.98 m
Empty weight: 2,502 kg,Max takeoff weight: 5,500 kg,Fuel capacity: 2600 kg

Performance

Maximum speed: 295 km/h ,Range: 640 km ,Endurance: 3h 42m
Service ceiling: 6,096 m (20,000 ft)

Armament

Missiles: Anti-tank guided missiles, Air-to-air missiles
Rocket Pods (Air-Force & Army)
Torpedoes,Depth charges or Anti-ship missiles

CONCLUSION

The individual has to learn to recognize aircraft. In this lesson we have learnt about how to recognize the various fighter aircrafts of IAF. Many factors are involved in making an identification of an aircraft and the distance at which it can be positively identified. Some of these are size, viewing angle, visibility, aircraft finish, visual characteristics, colour and external markings

FOREIGN AIRCRAFT (ACR-2)

SALIENT FEATURES - FOREIGN AIRCRAFTS

PAKISTAN

MIG- 19

Role. Single Seater all weather day fighter.

Particulars.
Length/Span/Height - 41'5" / 29'6"/ 12'5"
Pay Load - Three 30 MM Cannon and two ATOL AAMs or up to four pods, each housing nineteen 55 Mm rockets.

Performance.
Max Speed - 902 Mph
Range - 1365 Miles
Engine (Thrust) - Two Klimov VK-9 (7850 lbs each)

Special Features
- Manufactured by Russia and used by Pakistan and Chinese Air Force.

MIRAGE – 5

Role. Single Seater Ground Attack fighter aircraft.

Particulars.
Length/Span/Height - 15.55 /8.22/ 4.25 Metres
Max Take-Off Weight- 4200 Kgs
- Two 30 mm DEFA 5-52 cannon with 125 rounds per gun and seven external ordnance stations.

Performance.
Cruise / Max Speed - 956/2230 Kmph

Special Features.
- Manufactured by France and used by Pakistan Air Force.

C - 130 HERCULES

Role. Heavy duty transport aircraft.

Particulars.
Length/Span/Height - 97'9" / 132'7"/ 38'3"
- It can carry upto 92 troops or cargo 45000 lbs.

Performance.
Cruise / Max Speed - 340/384 Mph
Range - 2400 Miles
Engine (Power) - Four Allison T 56 Turbo-props engines.

Special Features.
- Manufactured by USA and used by Pakistan Air Force.
- The fuselage has a large protruding chin under the cockpit.

SIKORSKY S – 61 (SEA-KING)

Role. Medium Range Lift Helicopter.

Particulars.
Length/Height - 72'8" 16'10"

Performance.
Cruise/Max Speed - 136/166 Mph
Range - 625 Miles
Engine (Thrust) - Two T 58-GE-10Turbo shafts (1400 hp each)

Special Features.
- Manufactured by USA.
- The cabin can accommodate 26 troops, 15 Litters or cargo. It has also a provision for 840 lbs of weapons.

CHINA
MI- 15

Role. Single Seater day interceptor fighter aircraft.

Particulars.
Length/Span/Height - 33'1¾" / 33'0¾"/ 12'1¾"
- It carries one 37 MM and two 23 MM canon plus two 550 lbs bombs.

Performance.
Cruise / Max Speed - 480/668 Mph
Engine (Thrust) - Single Turbojet

Special Features.
- This mid wing aircraft has swept back wings with very slight taper ending in tapered wing tips.

CONCLUSION

2. The individual has to learn to recognize aircraft. In this lesson we have learnt about how to recognize the various aircrafts of neighbouring countries. Many factors are involved in making an identification of an aircraft and the distance at which it can be positively identified. Some of these are size, viewing angle, visibility, aircraft finish, visual characteristics, colour and external markings.

PRINCIPLE OF FLIGHT INTRODUCTION (PF-1)

(ELEMENTRY MECHANICS)

"*When once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return.*" - Leonardo da Vinci

It is essential to have a basic knowledge of elementary mechanics to understand the various Principles of Flight, because both the aircraft and the atmosphere in which it files are Matters and all matter are subjected to the laws of mechanics. Terms like Mass, Density, Motion, Speed, Velocity, Acceleration, Newton's First Law of Motion, Momentum, Force, Pressure, Newton's Third Law of Motion, Weight, Work, Power, Energy, Law of Conversation of Energy, Moment of a Force, Couple, and Equilibrium.

Mass. Unit - Kilogram (kg) - 'The quantity of matter in a body.' The mass of a body is a measure of how difficult it is to start or stop, ("a body", in this context, means a substance. Any substance a gas, a liquid or a solid).

Density. It is the mass per unit volume.

Motion. Motion is said to be there when a body changes its position in relation to its surroundings.

Speed. Speed is the rate of change of position.

Velocity. Velocity is speed in particular direction. Velocity is a vector quantity having both magnitude and direction.

Acceleration. Acceleration is the rate of change of velocity. The change may be in magnitude or direction or in both. Thus a body moving along a circular path at constant speed has acceleration.

$$\textbf{Acceleration} = \frac{\textbf{Force}}{\textbf{Mass}}$$

Newton's First Law of Motion. A body will continue to be in state of rest or of uniform motion in a straight line unless acted upon by an external force. This property of all bodies is called inertia and a body in such a state is said to be in Equilibrium.

Momentum. Unit - Mass x Velocity (kg-m/s) - 'The quantity of motion possessed by a body'. The tendency of a body to continue in motion after being placed in motion.

Force. Unit - Newton (N) -'A push or a pull'. Thatwhich causes or tends to cause a change in motion of a body.

Pressure. Pressure is force per unit area.

Newton's Second Law of Motion. The rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction of the application of the said force.

Newton's Third Law of Motion. To every action, there is an equal and opposite reaction.

Weight. The earth exerts a certain force towards its centre on all objects on its surface. This force is called Weight of the body and is equal to the mass of the body multiplied by the acceleration due to gravity 'g'.Unit - Newton (N) - 'The force due to gravity'. (F = m x g)

Work. Unit - Joule (J) - A force is said to do work on a body when it moves the body in the direction in which the force is acting. The amount of work done on a body is the product of the force applied to the body and the distance moved by that force in the direction in which it is acting. If a force is exerted and no movement takes place, no work has been done.

e.g. (a) Work = Force x Distance (through which the force is applied)

Power. Unit - Watt (W) - Power is simply the rate of doing work, (the time taken to do work)

e.g. (a) **Power (W) = Force (N) x Distance (m)**

Time (s)

Energy. Unit - Joule (J) - Mass has energy if it has the ability to do work. The amount of energy a body possesses is measured by the amount of work it can do. The unit of energy will therefore be the same as those of work, joules.

Law of Conversation of Energy. The sum total of all energy in the universe remains constant.

Momentum of a Force. Moment of a force is the turning effect of the force about a point and is measured as the product of the force and the perpendicular distance between the point and the line of action of the force.

Couple. A couple consists of two equal and opposite and parallel forces not acting through the same point. The moment of a couple is equal to the force multiplied by the perpendicular distance between the two lines of action.

Equilibrium. A body is said to be in equilibrium when:-

(a) Algebraic sum of all the forces acting on the body is zero.
(b) Clockwise moment is equal to the anti-clock wise moment about any point.

Centre of Gravity (CG). The point through which the weight of an aircraft acts.

(a) An aircraft in flight is said to rotate around its CG.
(b) The CG of an aircraft must remain within certain forward and aft limits, for reasons of both stability and control

Kinetic Energy. Unit - Joule (J) - 'The energy possessed by mass because of its motion'. 'A mass that is moving can do work in coming to rest'.

$KE = {}^{1}/_{2}\ m\ V^{2}$ joules

CONCLUSION

A flying object is a mechanical body in a three dimensional space. The knowledge of above definitions is necessary for effective understating of Principle of Flight.

PRINCIPLE OF FLIGHT - GLOSSARY OF TERMS (PF-2)

"Do not let yourself be forced into doing anything before you are ready."- Wilbur Wright

The following are the Main Glossary of Terms which required for understanding, Principle of Flight. Like Aerofoil, Chord line, Chord length, angle of attack, angle of incidence, total reaction, lift, drag, Thrust and weight.

GLOSSARY OF TERMS

Aerofoil. A body designed to produce more lift than drag. A typical aerofoil section is cambered on top surface and is more or less straight at bottom.

(a) Aerofoil

(b) Chord line

(c) Chord length

(d) Angle of Attack

(e) Angle of Incidence

(f) Total Reaction

(g) Lift

(h) Drag

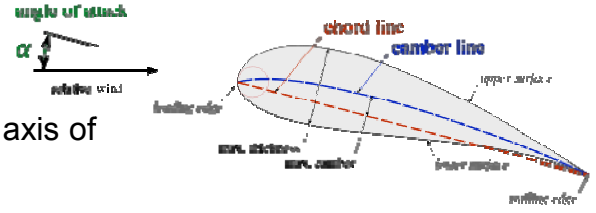
(j) Thrust

(k) Weight

Chord Line. It is a line joining the centres of curvature of leading and trailing edges of an aerofoil section.

Chord Length. It is the length of chord line intercepted between the leading and trailing edges.

Angle of Attack. It is the angle between the chord line and the relative air flow undisturbed by the presence of aerofoil.



Angle of Incidence. The angle between the chord line and the longitudinal axis of the aircraft.

Total Reaction. It is one single force representing all the pressures (force per unit

area) over the surface of the aerofoil. It acts through the centre of pressure which is situated on the chord line.

Lift. The vertical component of Total Reaction, resolved at right angles to the relative airflow.

Drag. The horizontal component of the Total Reaction acting angles and in the same direction as the relative airflow.

CONCLUSION

The Flying cadets should have thorough understanding of the above definitions for better understanding of Principle of Flight and aerodynamics of flying objects.

PRINCIPLE OF FLIGHT (PF-3)

FORCES ACTING ON AIRCRAFT

"*It is possible to fly without motors, but not without knowledge and skill.*"- *Wilbur Wright*

An Aircraft is considered to be in straight and level flight when it is flying at a constant altitude and speed, maintaining lateral level and direction. Force acting on aircraft and any given movement are Lift, Drag, Thrust and Weight.

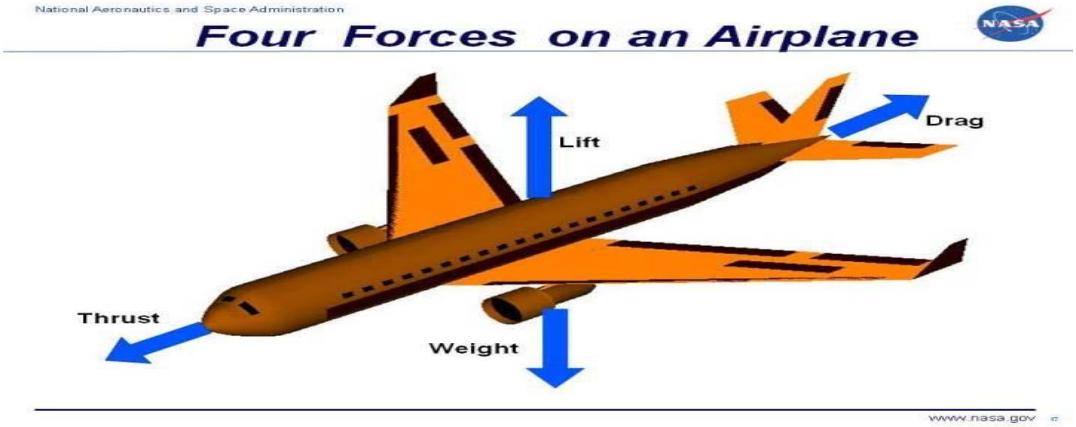
FORCES ACTING ON AIRCRAFT

Lift is a positive force caused by the difference in air pressure under and above a wing. The higher air pressure beneath a wing creates lift, and is affected by the shape of the wing. Changing a wing's angle of attack affects the speed of the air flowing over the wing and the amount of lift that the wing creates.

Weight is the force that causes objects to fall downwards. In flight, the force of weight is countered by the forces of lift and thrust.

Thrust is the force that propels an object forward. An engine spinning a propeller or a jet engine expelling hot air out the tailpipe are examples of thrust. In bats, thrust is created by muscles making the wings flap.

Drag is the resistance of the air to anything moving through it. Different wing shapes greatly affect drag. Air divides smoothly around a wing's rounded leading edge, and flows neatly off its tapered trailing edge...this is called streamlining.



CONCLUSION

10. The flight cadets should thoroughly be understanding the above basic concepts of level flight for better understanding of aerodynamics.

PARTS OF AN AIRCRAFT (PF-4)

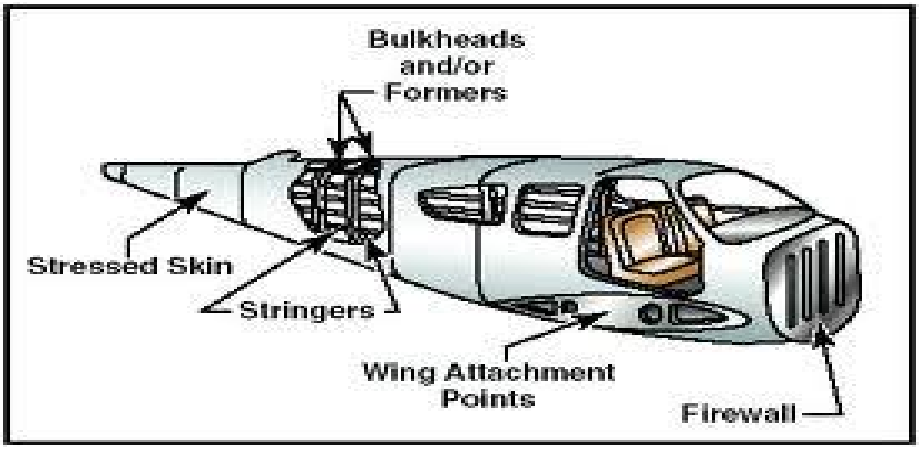
Fuselage is the main body of the aircraft to which all the other components like wings, ailerons, rudders, elevators and undercarriage are attached. It also contains the cockpit from where the pilot controls the aero-plane. It provides the space for the freight and passengers.

BASIC DESIGN OF A FUSELAGE

The basic design of fuselage should satisfy the following:

(a) Smooth skin of the required aerodynamic form.
(b) Sufficient strength to withstand aerodynamic loads.
(c) Sufficient stiffness to retain its correct shape under all loads.
(d) Mounting points for engine, armament, fuel tanks and equipment.
(e) Protection of aircrew and passengers from ambient conditions.

A basic fuselage layout is shown below for easy understanding. As can be seen, it comprises fire wall, wing attachment points, landing gear attachment points, stringers, bulk head/formers and stressed skin.



MATERIALS USED

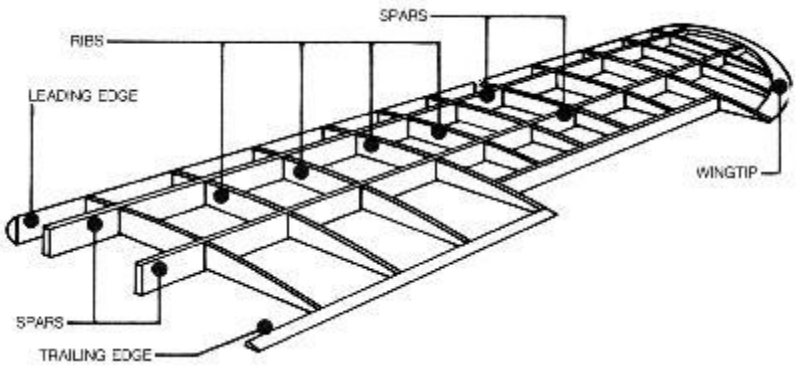
The various types of materials can be classified as follows:

(a) Wood
(b) Metals
(c) Composites

MAIN PLANE AND TAIL PLANE

Main plane and Tail plane play a major role in ensuring effective control of aircraft during its flight.

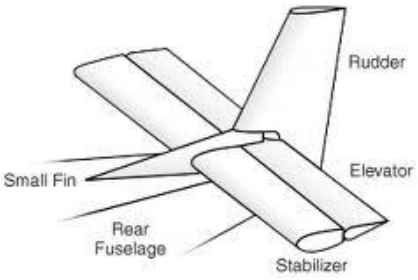
MAIN PLANE



There are various types of wings as shown in figure below. They are as follows:

(a) Straight wing
(b) Swept back wing
(c) Delta wing
(d) Tapered wing
(e) Variable geometry wing

TAIL PLANE



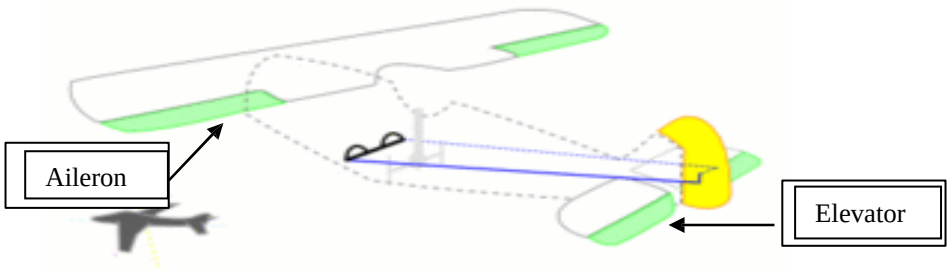
As shown in figure above, a tail plane, also known as horizontal stabilizer is a small lifting surface located on the tail behind the main lifting surfaces of a fixed-wing aircraft as well as other non-fixed wing aircraft such as helicopters**.** The tail plane serves three purposes: equilibrium, stability and control.

AILERON AND ELEVATORS

The main control surfaces such as Aileron and Elevators of a **fixed-wing aircraft** are attached to the airframe on hinges or tracks so that they may move and thereby deflect the air stream passing over them.

AILERONS

The figure below shows the position of Aileron and Elevator on an aircraft.

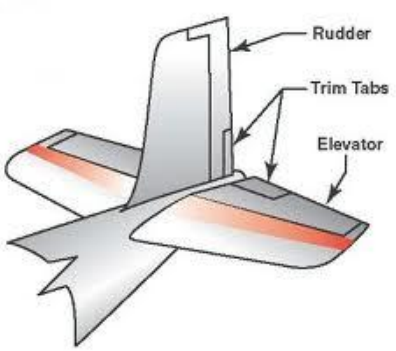


Ailerons are mounted on the trailing edge of each wing near the wingtips and move in opposite directions. When the pilot moves the stick left, the left aileron goes up and the right aileron goes down. A raised aileron reduces lift on that wing and a lowered one increases lift, so moving the stick left causes the left wing to drop and the right wing to rise. This causes the aircraft to roll to the left and begin to turn to the left.

ELEVATORS

An elevator is mounted on the trailing edge of the horizontal stabilizer on each side of the fin in the tail, as shown in the figure above. They move up and down together. When the pilot pulls the stick backward, the elevators go up. Pushing the stick forward causes the elevators to go down. Raised elevators push down on the tail and cause the nose to pitch up.

RUDDERS



The **rudder** is a fundamental control surface in order to provide means of controlling yaw of an airplane about its vertical axis.The **rudder** is a control surface which is controlled by pedals rather than at the stick. It is the primary means of controlling yaw-the rotation of an airplane about its vertical axis. On an aircraft, the **rudder** is a directional control surface. The rudder is usually attached to the fin which allows the pilot to control yaw about the vertical axis.

LANDING GEAR

The **undercarriage** or **landing gear** in aviation is the structure that supports an aircraft on the ground and allows it to taxi, take-off and land. Typically wheels are used, but skids, skis, floats or a combination of these and other elements can be deployed, depending on the surface.

A **Landing gear** can be classified in to two types as follows:

(a) **Fixed Landing Gear**. A fixed gear always remains extended and has the advantage of simplicity combined with low maintenance.

(b) **Retractable Landing Gear**. To decrease drag in flight, some undercarriages retract into the wings and/or fuselage with wheels flush against the surface or concealed behind doors. This is called retractable gear.

CONCLUSION

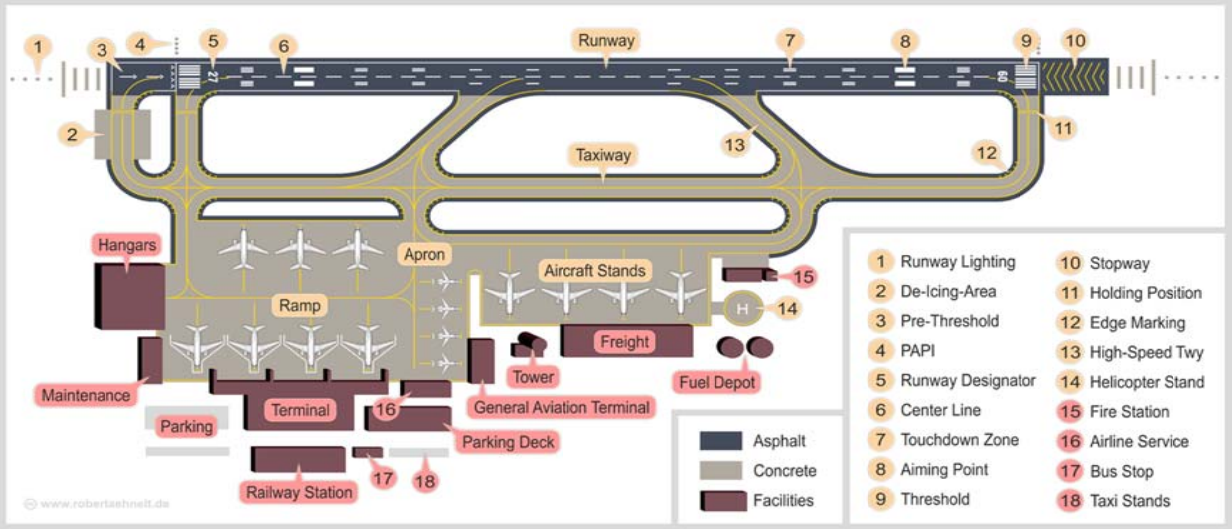
The fuselage is an aircraft's main body section that holds crew and passengers or cargo. In single-engine aircraft it will usually contain an engine The fuselage also serves to position control and stabilization surfaces in specific relationships to lifting surfaces, required for aircraft stability and maneuverability Since fuselage is the main attachment point for wing attachment, landing gear, stringers, bulk head/formers etc, its basic design and selection of materials play a major role in deciding the strength of aircraft.

AIRFIELD LAYOUT (AR-1)

The sitting, layout and physical characteristics of an airfield should facilitate safe, orderly and expeditious flow of air traffic. The basic areas associated with physical characteristics have been standardised for all airfields/aerodromes with subsequent amendments from time to time. The standardised physical characteristics have been worked out considering most of the aircraft available today and standardised by DGCA conforming to international rules and regulations.

LAYOUT OF AERODROMES/AIRFIELDS

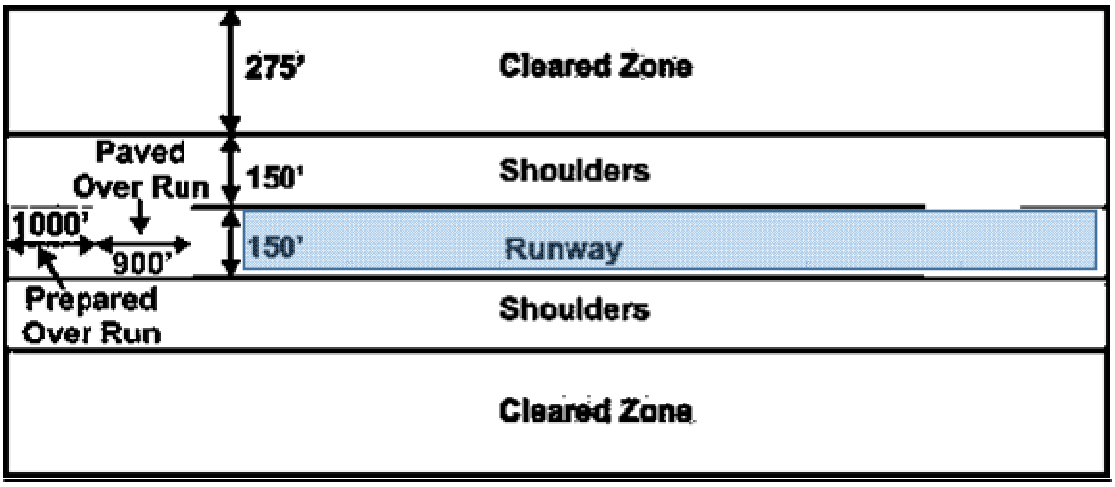
Following are the areas laid down at the airfields to facilitate safe and expeditious conduct of aircraft operations



(a) **Movement Areas**. Movement areas are that part of an airfield intended for the surface movement of the aircraft. These are paved areas and include runways, taxiways, dispersal areas, aprons.

(b) **Flight Strip**. It is the rectangular portion of an airfield containing the runway and paved over-runs along with the shoulders and cleared zones

(c)



Runways. Runways are paved surfaces intended for take-off and landing run of ac. The number and orientation of runways at an airfield will depend upon the volume of traffic, runway occupancy time and climatological data on surface winds.

(d) **Taxiways**. These are paved surfaces provided for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another.

(e) **Shoulders**. These are areas immediately adjacent to the edges of the runway, taxiways, over-runs and SGAs prepared for accidental or emergency use in the event of an aircraft running off the paved surface.

(f) **Cleared Zones**. These are those areas of the flight strip adjacent to the shoulders which for safety of aircraft operations, should be levelled and be free of obstructions as far as possible.

(g) **Over-Run Areas**. A defined rectangular area on ground at the end of runway in the direction of take-off prepared as a suitable area in which an aircraft can be stopped in case of abandoned take off, or during a landing emergency.

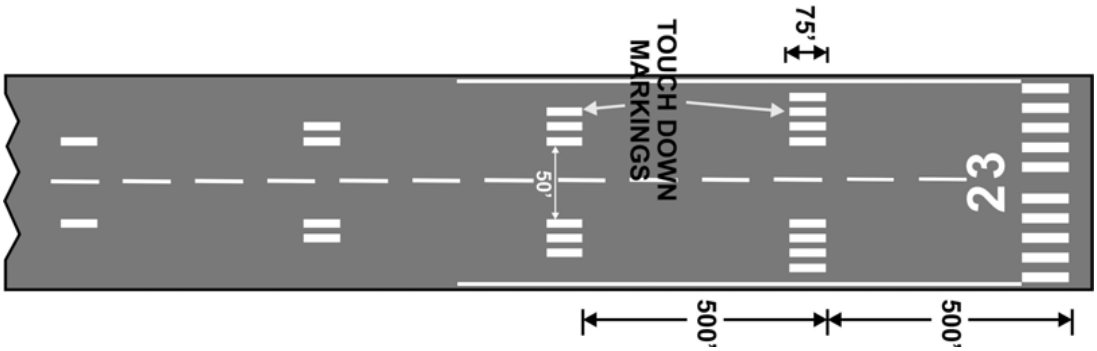
AERODROME MARKINGS

Aerodrome markings consist of signs on surface of movement areas to convey aeronautical information.

Aerodrome ground markings shall consist of the following:

(a) Runway markings.
(b) Taxiway markings.
(c) Unserviceability markings.

RUNWAY MARKINGS



Runway markings shall consist of:

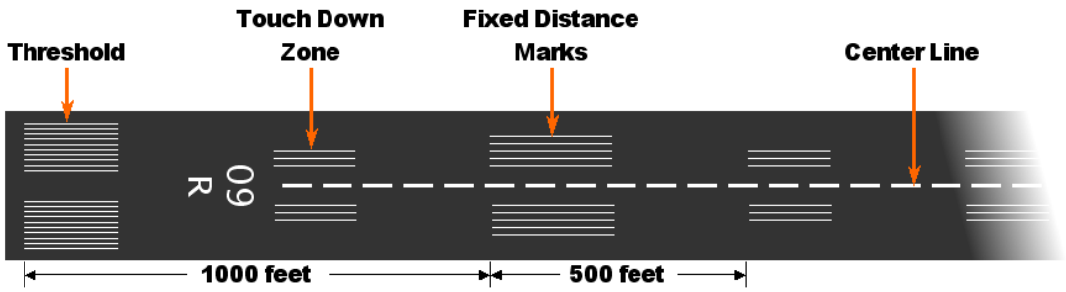
(a) **Runway Designation Markings**. Runway designation markings shall consist of a two-digit number and on parallel runways shall be supplemented by a letter. The two- digit number shall be the whole number nearest to one tenth of magnetic azimuth of centre line measured clockwise from magnetic North when viewed from direction of approach.

(b) **Runway Centre Line Markings**. Runway centre line markings shall consist of a series of broken longitudinal lines along the runway centre line and extending along the whole length of the runway

(c) **Runway Threshold Markings**. The markings shall consist of a series of longitudinal strips of uniform dimensions symmetrically placed on both sides of runway centre line and extending laterally to 1.5 m (5 ft) from the edge of runway.

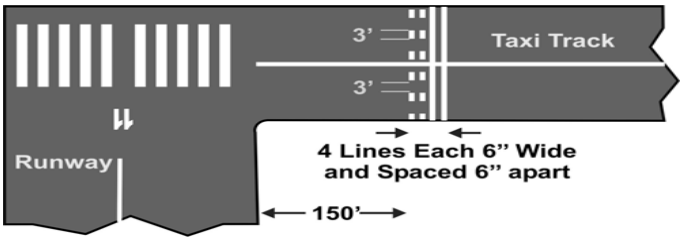
(d) **Runway Touch Down Zone Markings**. Touch down zone markings shall be located over the first 600 m (2000 ft) of instrument runways at longitudinal spacing of 150 m (500 ft). These markings shall be provided with distance coding.

(e) **Runway Side Strip Markings**. Side strip markings shall be provided on all paved runways. These markings shall consist of two lines extending the whole length of the runway parallel to and equidistant from runway centre line.



Taxiway Markings. These markings shall consist of:

(a) Taxiway centre line markings.
(b) Runway holding position markings.

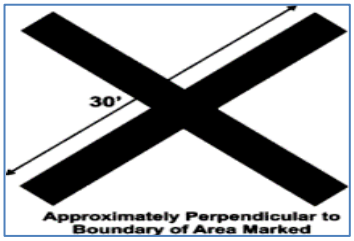


Taxiway Centre Line Markings. These markings shall be single unbroken lines 0.15 m (6") wide along the centre line of taxiway.

Runway Holding Position Markings. These markings shall consist of four lines of 0.15 m (6") width each with spacing of 0.15 m (6").

Unserviceability Markings

. Unserviceability markings shall be displayed on those parts of movement area, which are unfit for landing, take-off or surface movement of aircraft. Unserviceability markings shall be in the form of a cross as given below



Aerodrome Lighting. There are several types of approach and airfield lighting in use in the service. All permanent installations are normally on the mains electricity supply but also have some alternative arrangements for use in the event of power failure. Aerodrome lighting is considered under two headings.

(a) **Approach Lighting**. This is to assist the pilots to make an approach for landing in poor visibility or at night.
(b) **Airfield Lightings**. Modern installation consist of raised high intensity white lights along each side of the runway, beamed towards the landing aircraft. At the beginning of runway, called the thresh hold, is a bar of green lights going across the full width of the runway

CONCLUSION

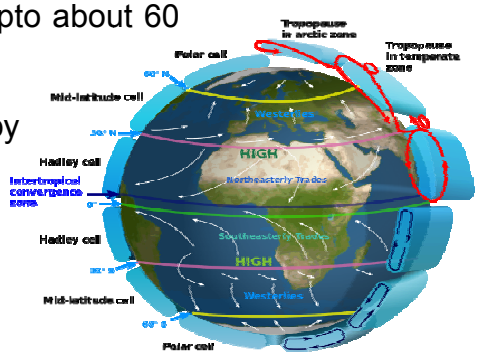
The concept of airfields has changed considerably since the early days of flying. The aircraft of yester years needed comparatively small, level grass areas. When these airfields were built, the number of cross wind landing was reduced by building a triangular pattern of three runways, the longest of which was usually in line with the prevailing winds. But as the aircraft became faster, their landing and take-off runs became longer and the airfields had to be enlarged to meet their ends. With faster approach and landing speeds of aircraft, the lengths of runway became more important factor than the wind direction. The modern tendency, therefore, is for operations to be confined to one or at the most two runways on each airfield. The longest of these runways is usually designed for instrument landings in bad weather and it is known as instrument runway having full, lighting, radio, radar and instrument landing facilities. Today the runways are even more than 6000 yds long and 200 ft wide and constructed of concrete surface with asphalt to give a clean and smooth operating surface.

ATMOSPHERE (MET-1)

The invisible and odourless gas which we breathe, which sustains life and produces an infinite variety of phenomena is what we call air. The envelope of air surrounding the earth and extending to great heights is the atmosphere where vast physical processes occur, giving rise to the ever changing weather phenomena.

COMPOSITION OF AIR

Air is a mechanical mixture of a variety of gases. The main constituents of this mixture are nitrogen and oxygen, accounting for almost 99% of the whole, with roughly three parts of nitrogen to one part of oxygen. There are small amounts or traces of other gases. This composition is more or less the same upto about 60 kilometers.



The percentage of composition of dry air by volume is in the proportions as shown below:-

Nitrogen	-	78.09 %
Oxygen	-	20.95 %
Argon	-	0.93 %
Carbon dioxide	-	0.03 %

The atmosphere is never completely dry. Water vapours are always present in varying amounts. Water vapours also behave as a gas. It is the change in the amount and state of the water vapours (solid, liquid, gas) which is important in the physics of the weather processes in the atmosphere. Apart from water vapours suspended particles like dust, smoke and other impurities affect the transparency of the atmosphere causing reduction in visibility.

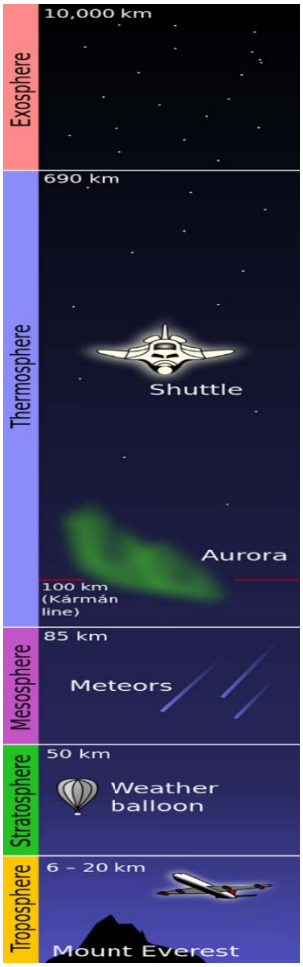
In the higher layers there is a concentration of Ozone between 30 and 50 km.

LAYERS OF ATMOSPHERE

While the pressure and density decrease as the height increases, the variation of temperature is different. Due to this there is a tendency for the atmosphere to be divided into several spheres as mentioned below:-

(a)	Troposphere	-	Up to about 11-16 km
(b)	Stratosphere	-	Up to about 50 km above troposphere
(c)	Mesosphere	-	50 to 85 km
(d)	Thermosphere	-	Above 85 km

Troposphere. The troposphere is the region nearest to the earth and is generally the region of weather. It has a more or less uniform decrease of temperature with height. The lapse rate is roughly 6.5°c /km (1.98°c /1000feet). The upper boundary of the troposphere is called the tropopause whose height varies from equator to the poles, being highest at the equator (16-18 km) and lowest over poles (8-10 km).



Stratosphere. The stratosphere is the layer extending from the tropopause to about 50 km. The temperature in this region is steady or increases with height. In the higher stratosphere the temperature is of the order of 0°c. The upper boundary of the stratosphere is the stratopause.

Mesosphere. The layer above the stratosphere is the mesosphere, where the temperature again decreases with height. The boundary of the mesosphere is the mesopause, about 85 km high, where the lowest temperatures in the atmosphere are found (about - 90°c).

Thermosphere. Above the mesosphere is the thermosphere. Its upper limit is undefined. However at about 700 km, the gravitational pull of the earth is practically absent and the particles can escape from the atmosphere into space. This region is often referred to as exosphere.

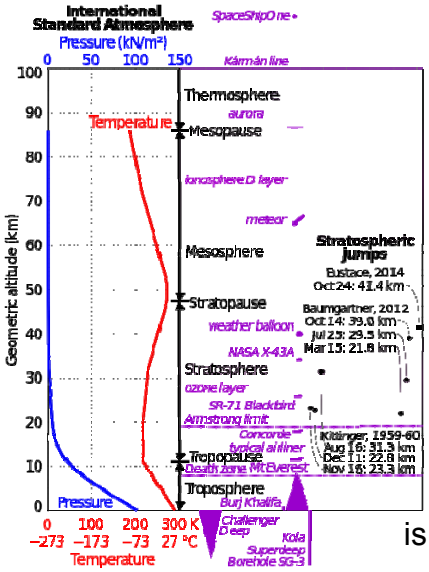
Ionosphere. The lower thermosphere is in a highly ionized state and is hence called ionosphere. This layer causes reflection of radio waves and makes long wave radio communication possible.

International Standard Atmosphere. A standard average atmosphere has to be specified for various purposes like the design and testing of aircraft, evaluation of aircraft performance, calibration of pressure altimeter etc. For this purpose a standard atmosphere is defined and used as a basis of references. The most widely used atmosphere for reference purposes is the one defined by ICAO, known as International Standard Atmosphere (ISA) whose specifications are :-

Mean Sea level temperature	-	15°c
Mean Sea level pressure	-	1013.25 mb
Surface density	-	1225 g/m3
Acceleration due to gravity	-	980.665 cm / sec2
Rate of fall of temp with height up to 11 km	-	6.5°c /km (1.98°c / 1000)

ATMOSPHERIC PRESSURE

Pressure as weight of the air above: Atmospheric pressure at any level in the atmosphere refers to the weight of the column of air of unit cross section vertically above the point of observation. In other words air has weight and therefore exerts a pressure which is equivalent to a column of air extending vertically till the total height of atmosphere. This pressure is expressed in various units like millibars, pounds per square inch etc.



When an aircraft climbs away from the earth surface the height of the column of air above it decreases and therefore the weight and pressure exerted by that column decreases (Atmospheric pressure decreases with height). This rate of decrease of atmospheric pressure is found to be 1millibar for every 30 feet of height (and vice-versa).

CONCLUSION

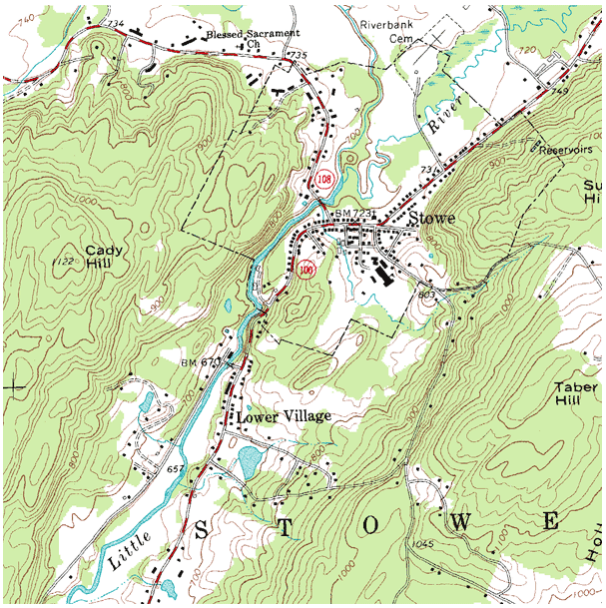
The atmosphere extends from the surface of earth till about 500 miles. Troposphere is the layer closest to earth surface and is most important to aviation. Weather processes occurring in troposphere affects aviation. Atmospheric pressure vary from place to place depending on temperature and cause high pressure and low pressure areas. Air moves from high pressure to low pressure area and this motion of air is called wind. Wind has both direction and speed.

MAPS (MP-1)

Topographical map is one in which a good pictorial representation of a country is portrayed and is provided mainly to be used for map reading.

TYPES OF MAPS

The four basic elements required in a map are:



(a) Areas will be shown correctly.
(b) Bearing measurement anywhere on the reduced earth will be identical to the measurement on the earth.
(c) Shapes will be correct.
(d) Distances will be measured accurately by use of a graduated scale which is provided at the bottom of each map. The distances are given in (1) \
Kilometers (2) Nautical miles (3) Statute miles.

In aviation both maps and charts are used for Navigation. When a projection has a graticule of latitudes, longitudes and an abundance of ground features it is called a map. A chart has a projection on which it contains a graticule of latitude and longitude with very few geographical features.

Relief. Mountains, hills, coast lines and other natural features are of considerable interest to a pilot as they are valuable landmarks for navigation purpose or are, sometimes pose dangerous barriers for flight. Relief is indicated on maps and charts in one or more of five different ways:

(a) Spot heights or depths
(b) Contours and form lines
(c) Layer tints
(d) Hachures
(e) Hill shading

Spot Heights and Depths. These are shown against places where the exact height above sea level or depth below mean sea level has been measured. On some maps, heights are recorded in feet. On other maps the height is recorded in meters. One has to be very particular to note the units of heights shown on maps.

Contours and Form Lines. Contours are lines joining all places having the same heights above a certain datum level. When these lines are shown approximately then they are known as form lines. The closeness of the contours on a map shows the steepness of any hill. Where the changes of height is rapid, the contours will be closer than on slopes where they are spaced.

Layer Tints. These are commonly used on maps to show relief. Layers of earth between certain contours are coloured with the tint intensifying with successive increase in height. Thus at a glance, a map will indicate major irregularities in the surface of the country.

Hachures. These are short, tapering lines drawn on maps and they radiate from peaks and high ground. They only serve to show slopes.

Hill Shading. This is produced by assuming that a bright light is shining across the map sheet so that shadows are cast by all high ground on its lower side. The effect is to give the map something of a stereoscopic appearance by optical illusion. These shadows obliterate other details on the map and are not commonly used.

SYMBOLS USED IN MAPS

The details on topographical maps are shown by symbols. Some of which are pictorial in nature, while others are given by a symbol which is accepted internationally. These symbols are used to denote the details of a map and these are called as conventional signs.

The signs are uniform on all maps but the colour used may vary on different scale maps. Therefore, it is difficult to give a complete list of conventional signs used on various maps. However, all maps have a list of signs marked on the side of map and these should be studied before using the map for reading purposes.

Knowing the amount of details to be expected on maps of different scales and given knowledge of conventional signs by which that detail is indicated, the map reader is in a position to appreciate the relative value of the feature seen on the ground. The beginner is sometimes confused by the amount of detail confronting to his untrained eye. He must learn to distinguish the more significant features and to remain undistracted by irrelevant back ground. The following may help to indicate the types of which is of value to the map reader.

(a) Coast line (b) Water Features (c) Mountains and hills
(d) Towns and Villages (e) Railways (f) Roads
(g) Wooded areas.

SCALES OF MAPS

The scale is the ratio of a distance measured on the map to the corresponding distance on the earth surface. Scales on a map is represented commonly by (1) representative fraction (2) graduated scale line or by (3) statement in words.

Most common maps used in aviation are ¼ million maps, ½ million maps and 1 million maps. ¼ million maps have larger scale than ½ million and ½ million have scale larger than 1 million. A larger scale map represents comparatively lesser ground distance and consequently more ground details can be inserted.

CONCLUSION

Maps and charts are used for plotting and planning purposes in navigation. It is essential to understand various scales, symbols and methods by which relief features are represented in a map for effective planning and subsequent reading. Before execution of navigation sortie a pilot must thoroughly go through map preparation, distance measurement and other calculations to be able to conclude the sortie accurately.

RT PROCEDURE (RT-1)

As an Air Wing NCC cadet it is must to know about ATC &RT procedure prior to start flying. Timely information of weather, wind speed and position are essential parameters for flying. To access all the timely required information for a safe operation we must know the ATC & RT procedure.

DEFINITIONS

Air Traffic Services. Services provided for the safe and efficient conduct of flight are termed as air traffic services.

Objectives of Air Traffic Services.

(a) To prevent collision between aircraft.
(b) To prevent collision between aircraft on the maneuvering area and obstructions on that area.
(c) To expedite and maintain an orderly flow of traffic.
(d) To provide advice and information useful for the safe and efficient conduct of flights.
(e) To notify appropriate organisations regarding aircraft in need of search and rescue aid and assist such organisation as required.

The ATS include the following:-

(a) Air Traffic Control Services
  (i) Area Control Service.
  (ii) Approach Control Service.
  (iii) Aerodrome Control Service.

(b) Flight Information Service.
(c) Air Traffic Advisory Service.
(d) Alerting Service.

Air Traffic Control Service. A service provided for the purpose of:-

(a) Preventing collisions between aircraft.
(b) Prevent collisions on the maneuvering area between aircraft and obstructions.
(c) Expediting and maintaining an orderly flow of air traffic.

Area Control Service. ATS service for controlled flights in control areas.

Approach Control Service. ATC service for arriving or departing controlled flights.

Aerodrome Control Service. ATC service for aerodrome traffic.

Flight Information Service (FIS). A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights. Flight information service shall include the provision of pertinent information such as: Sigmet information, Nav aids, aerodromes facilities, weather etc.

Air Traffic Advisory Service. A service provided within advisory airspace to ensure separation, in so far as possible, between aircraft which are operating in IFR flight plans.

Alerting Service. Provided to notify appropriate organisations regarding aircraft in need of search and rescue and assist such organisations when required.

Air Traffic Service Units.

(a) **Area Control Centre.** A unit established to provide air traffic control service to controlled flights, in control areas, under its jurisdiction.

(b) **Approach Control Office.** A unit established to provide air traffic control service to controlled flights arriving at or departing from, one or more aerodromes.

(c) **Aerodrome Control Tower.** A unit established to provide air traffic control service to aerodrome traffic.

(d) **Flight Information Centre.** A unit established to provide flight information service.

Jurisdiction of Various ATS Units.

(a) **Control Area.** An airspace of defined dimensions extending upwards from specified limit above the earth, within which control service is provided to controlled flights.

(b) **Control Zone.** An airspace of defined dimensions extending upwards from the surface of the earth to a specified upper limit, within which Air Traffic Control Service is provided to controlled flights.

(c) **Aerodrome Traffic Zone**. Airspace of defined dimensions established around an aerodrome for the protection of aerodrome traffic.

(d) **Flight Information Region**.Airspace of defined dimensions with in which flight information service and alerting service are provided.

(e) **Advisory Airspace.**

(i) **Advisory Area**. A designated area within a flight information region where air traffic advisory service is available.

(ii) **Advisory Route**. A route within a flight information region along which air traffic advisory service is available.

Responsibilities of the Various A.T.S. Units. In India the responsibilities of the Area Control Centres are:-

(a) Providing flight information service to aircraft in flights within its region.
(b) Providing Air Traffic Control Service to controlled flights within control areas under its jurisdictions.
(c) Maintaining up-to-date aeronautical information regarding aerodromes and facilities within its region.
(d) Obtaining current weather information.
(e) Handling and assisting diversions of aircraft within its region. (f) Initiating search and rescue.

Aerodrome Control Tower. It is responsible for:

(a) Control of all traffic (aircraft vehicular and pedestrian) on the maneuvering area of the aerodrome.
(b) Control of aircraft flying in the vicinity of the aerodrome in VMC.

Approach Control. It is the provision of air traffic control service for the parts of the controlled flights associated with arrivals or departures.

Area Control. The organisation responsible to provide ATC service to controlled flights in control area is known as “Area Control Centre” Control areas include airways and TMAs (Terminal Maneuvering Areas).

Functions of Area Control.

(a) Issuance of ATC clearance for the purpose of preventing collisions between controlled flights under its control and jurisdiction.

(b) To expedite and maintain an orderly flow of traffic of flights provided with area control service.

(c) To provide flight information service.

(d) To provide air traffic advisory service, if required, in advisory area and routes after proper co-ordination with the concerned FIC.

(e) Alerting service.

Airways Control

Area Control Service provided to controlled flight in their en-route phase is termed as airways control. To extend area control to en-route traffic, controlled airspace in the form of 'Corridors' are established and defined with radio navigational aids. Such Corridors are known as Airways' and have specified lower and upper limits. An airways extends along a track starting from one navigational aid to another or through series of navigational aids. The width or lateral dimension of airways vary from 8 km to 20 km (4 nm to 10 nm) on either side of the track. An airway in 10 nm wide over land and 20 nm wide over sea / oceans. This width depends on the accuracies of the navigational aids available along the route.

TMA

When different airways approach in the vicinity of one more major aerodromes, the resultant terminal airspace is protected and control area is established. Such controlled areas at the confluence of airways are called "Terminal Maneuvering Areas" (TMA). TMAs are suitably lined with control zones of the aerodromes, located in terminal airspace to facilitate the provision of approach control service for flights arriving at and departing from these aerodromes.

Transfer of Control

Transfer of control from one ATCC / ACC to another takes place:

(a) At an agreed airways reporting point.
(b) At the estimated time given for FIR boundary
(c) At any other agreed D/R position / location.

An ATCC transferring control of an aircraft should pass an estimate for the arrival of such aircraft at the transfer point to the next ATCC / ACC 30 minutes ahead of aircraft's actual passage and on subsequent revision to this estimate in excess of 3 minutes.If 30 minutes prior intimation cannot be given an 'approach acceptance' request shall be made to the ATCC / ACC accepting/taking over control of aircraft.
Instruction regarding the transfer of communication will normally be given to aircraft 5 minutes before the ETA over transfer point.

RT PROCEDURES AND PHRASEOLOGY

Radio Communication Standard Phraseologies.

When proper names, service abbreviations and words of which the spelling is doubtful are spelled out in Radio Telephony (RT) the following alphabet shall

be used:

Letter to be Identified	Identifying Word	Representation of Pronunciation in English
A	Alfa	Alphah
B	Bravo	BrahVoh
C	Charlie	Charlee (or Shar Lee)
D	Delta	Dell Tah
E	Echo	Eck Oh
F	Foxtrot	Foks Trot
G	Golf	Golf
H	Hotel	Hoh tell
I	India	In Dee Ah
J	Juliet	Jew Lee Et
K	Kilo	Key Loh
L	Lima	Lee Mah
M	Mike	Mike
N	November	No Vem Bar
O	Oscar	Oss Car
P	Papa	PahPah
Q	Quebec	Qeh Beck
R	Romeo	Row Me Oh
S	Sierra	See Airrah
T	Tango	Tang Go
U	Uniform	You Nee Form
V	Victor	VikTah
W	Whiskey	Wiss Key
X	X-Ray	Ecks Ray
Y	Yankee	Yan Key
Z	Zulu	Zoo Loo

2. **Pronunciation of Numbers** 1		
2	Two	Too
3	Three	Tree
4	Four	Fower
5	Five	Fife
6	Six	Six
7	Seven	Saveen
8	Eight	Ait
9	Nine	Niner
0	Zero	Zee Row
.	Decimal	Day - See - Mal
1000	Thousand	Tou - sond
All numbers except whole thousand will be transmitted by pronouncing each number separately. Whole thousands shall be transmitted by pronouncing each digit in the number of thousand followed by the word thousand. Some of the examples are **Number**		
10		One Zero
75		Seven Five
100		One Zero Zero
583		Five Eight Three
5000		Five Thousand
25000		Two Five Thousand

CONCLUSION

Standard phraseology is recommended in the interest of clarity and brevity. The use of standard phrases does provide uniformity in transmission and makes your transmission more readily understood by ground station operator and vice versa. Correct procedure on the part of operators of radio telephony equipment is necessary for the efficient exchange of communication is particularly important where lives and property are at stake. It is also essential for a sharing of “on the air” time in the crowded radio spectrum.

HISTORY OF AEROMODELLING (AM-1)

"When once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return." - Leonardo da Vinci

Aeromodelling is one of the finest & costly hobbies, which is very popular worldwide among people of all ages and professions. It has often been the starting point of many pilot and aero-nautical engineer. The aims of including aeromodelling in the NCC curriculum are to increase the air mindedness in the youth of our country. If taken on the right lines, it can be extremely thrilling for all, as by constructing the models by one's own hands, will make understanding of various principles of flight and problems of construction etc., very easy, apart from providing great personal satisfaction to the aero- modeler.

HISTORY OF AEROMODELLING

The history of aeromodelling goes back much further than the history of real aircraft. The successful experiments, however, started in the nineteenth century. Dr. Thomas Young was the first person to discover the 'lifting' property of a cambered surface in comparison to the flat surface. Sir George Caley built a helicopter model, based on a design of Leonardo-da-vinci, in 1796. Another aeromodelling genius was John String fellow, who built, in 1842, a small spring 'Operated model', followed by a number of different and bigger models, powered by 2-stroke as well as steam engines. Another great name amongst the pioneers of aeromodelling is of Alphones Penand, who invented models fitted with tail surfaces and wings with dihedral angles. This gave substantial stability of flight to aero models, which till this time had lasted for very short duration. Next came energy, enthusiasm and tenacity of purpose which earned him the distinction of being the most active champion of glider flying. After this, came the era of miniature petrol-driven engines. In 1878, Professor Langley builds a petrol driven model called 'Aerodrome No.5'. This revolutionalised the concept of aeromodelling, as there was now an ideal power plant small enough for the requirement, available to the enthusiasts. Hundreds of varieties of petrol models were subsequently built. Later, these gave ways to more powerful diesel engines, which are in use even today.

CONCLUSION

The ‘aeromodelling’ provides an earnest approach to the understanding of an otherwise highly technical subject, i.e. ‘aerodynamics. The ‘air-minded’ aeromodeller of today is the potential aircraft designer of tomorrow. Although, aeromodelling is a technical hobby and is usually cluttered up with complicated calculations and formulae, it need not necessarily discourage the beginners and the non-technical persons, as they can still derive immense pleasure and satisfaction from this hobby. Aeromodelling is becoming increasingly popular all over the country especially amongst the NCC Air wing cadets.

MATERIALS USED IN AEROMODELLING (AM-2)

"*Do not let yourself be forced into doing anything before you are ready.*"- Wilbur Wright

Aeromodelling requires a variety of materials. Selection of correct material and proper use of the same is important factor of Aeromodelling.

MATERIALS USED IN AEROMODELLING

The following are the main substances from which the Aeromodels can be made:

(a)	Balsa Wood	(b)	Spruce	(c)	Japanica Wood
(d)	Ply wood	(e)	Cement	(f)	Fast Setting Epoxy
(g)	Cyanoacrylate Glue (Cyano)			(h)	Putty
(j)	Metal paste	(k)	Dope	(l)	Paint
(m)	Sand paper	(n)	F iber glass	(o)	Carbon Fiber
(p)	Silver Foil	(q)	Monokote & etc		

Basic tools

(a) Screw driver
(b) Hand drill
(c) Sand paper and pins
(d) Pliers
(e) Knives with different blades
(f) Different kind of saw
(g) Files. Soldering irons
(h) RC set (Transmitter, Receiver, Servos) etc.

CONCLUSION

After selection of good materials and required tools one has to handle these tools carefully. Mishandling of tools may cause serious injuries to the Aeromodellers/builders.

TYPES OF AEROMODELS (AM-3)

"It is possible to fly without motors, but not without knowledge and skill."- Wilbur Wright

There are quite a number of variants of aeromodels, which are classified according to the role and utility of the particular type. These are static models, gliders, control line models and RC models.

TYPES OF AEROMODELLING

The following are the different type of Aeromodels:-

Static Modes. These are the miniature replicas of original aircrafts. The following aircrafts can be prepared as static models.

(a) Fighter aircraft models
(b) Transport aircraft models
(c) Helicopter models

Gliders. These are the different types of gliders:-

(a) Chuck Glider
(b) Catapult Glider
(c) Towline Glider
(d) Free flight Glider

Control Line Models. The following are the different types of Control Line model**:-**

(a) Control Line Aerobatic Model
(b) Control Line Speed Model

Radio control Models. The following are the different types of Control Line model**:-**

(a) Radio Control Power
(b) Radio Control Glider
(c) Radio control Helicopter
(d) Jet Powered Model

CONCLUSION

Building and flying the different types of models would help the aero modeler to improve their aerodynamic knowledge and skills.

FLYING/BUILDING OF AEROMODELS (AM-4)

"What is chiefly needed is skill rather than machinery."- Wilbur Wright

Individual personally required to build or construct the models by given design or own design and fly the models by using Fly By Wire / Radio Control set.

CONSTRUCTIONS OF STATIC MODELS

These are the miniature replicas of original aircrafts, full sized aircraft types and attract the best skill of the model maker. The scope of this particular type is boundless and depends upon the ideas of the individual concerned. It requires only an elementary knowledge of carpentry and involves fitting together of various parts as well as finishing and painting of the models.

Constructions plans are provided normally with all model kits. These should be studied thoroughly. Then follow the shaping of various parts using sandpaper and sand blocks as shown in the blue print. After which the whole plan is fixed on the drawing board. Then the individual parts are placed on the blue print and make sure it is proper as per the blue print. Parts are then assembled together as per the dimensions provided in the blue print. Dope is applied with brush but only in thin coats two to three times. Sand the excess dope using a fine emery paper.

Painting. Apply a coat of surfacer using a brush or spray gun and make sure it has covered all the wooden area. After the surfacer is dried up check for dents and apply putty or metal paste to cover the dents. After it dries up using a wet emery paper, sand the model to get a clean surface till it is suitable for painting. Etch rivet marking as shown in the blue print. Spray a thin layer of base coat and paint the model as per the required colour scheme. Add details, undercarriage, wheels, drop tanks etc& apply lacquer or polish if required.

Demo and Practical

CONCLUSION

The construction/building of static models is one of the main event in all India level competitions like AIVSC and RDC. In AIVSC, the given static model has to be built in stipulated time and for RDC competition, three different static models have to be built that is fighter, transport and helicopter.

CONSTRUCTIONS OF CONTROL LINE MODELS

Each and every part of a model aero plane is important as it would not function in the absence of even one component. Construction plans are provided normally with all model kits. These should be studied thoroughly. Then follows the actual construction of various parts. The power units are, also available in readymade forms, and are required to be installed as they are, as per the power/weight combination prescribed by the manufactures

First, the whole plan is fixed on to the drawing board. Then the individual parts are fixed on it with the help of pins parts are then glued together with cement. After drying, the various components are assembled together with correct alignment. Sand papers of various grades are used for smoothening out of edges and curves. Patience and meticulous operation is needed at this point. Assemble the bell crank assembly with the lead outs carefully. Model is then covered with sliver foil, monokote or tissue paper. Dope may be applied with brush, in thin coats two to three times.

Before engine installation, ensure that the engine compartment is properly treated with paint work. While installing the engine, extreme care is needed to be taken to ensure that the thrust line of the propeller is in line with the fuselage. Out of line thrust will result in the model going hay wire and crashing. Engines are mounted either by projection made of hard wood beams or on screws against the plywood.

Demo and Practical

CONCLUSION

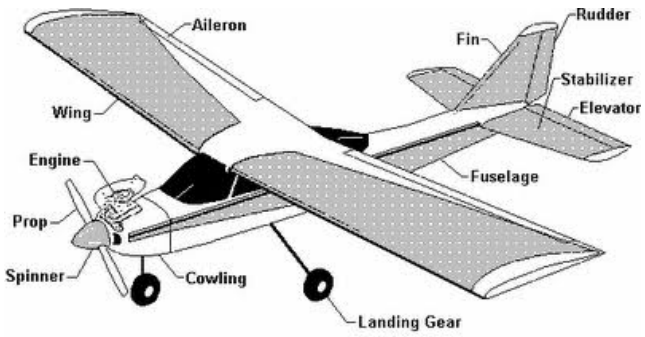
The construction of control line model is slightly advanced as compared to tow line glider and free flight models. In this model, there is only one control surface for most control line aircraft; the up and down movement of the elevator on the stabilizer. The rudder is set so the aircraft will always pull away from the flier (to help keep the control line taut)

CONSTRUCTIONS OF REMOTE CONTROL MODELS

Each and every part of a model aero plane is important as it would not function in the absence of even one component.

Construction plans are provided normally with all model kits. These should be studied thoroughly. Then follows the actual construction of various parts. The power units are, also available in readymade forms, and are required to be installed as they are, as per the power/weight combination prescribed by the manufactures.

First, the whole plan is fixed on to the drawing board. Then the individual parts are fixed on it with the help of pins parts are then glued together with cement. After drying, the various components are assembled together with correct alignment. Sand papers of various grades are used for smoothening out of edges and curves. Patience and meticulous operation is needed at this point. Model is then covered with sliver foil, monokote or tissue paper. Dope may be applied with brush, in thin coats two to three times.



Basic Trainer

Before engine installation, ensure that the engine compartment is properly treated with paint work. While installing the engine, extreme care is needed to be taken to ensure that the thrust line of the propeller is in line with the fuselage. Out of line thrust will result in the model going hay wire and crashing. Engines are mounted either by projection made of hard wood beams or on screws against the plywood.

Install the Radio-control servos as per the requirement to make sure the control rods should move freely without causing any disturbance to the other control rods. Wrap the receiver and the battery pack in foam and place it in the model in such a way that the CG of the model is correct as per the marking shown in the plan by the manufacturer of the kit. Then assemble the wing using a pairs of rubber bands or nylon screws.

Demo and Practical

CONCLUSION

This type of model is fitted with radio receiver sets of actuators operate the control surfaces of the model. The radio receiver receives signal from the control box which is operated by the “pilot”. The control box is nothing, but a transmitter with various channels for operating the respective controls including throttle. This way, the model can be operated without physical contact.

FLYING THE MODELS (AM-5)

The necessity of choosing a large field for flying the aero models is obvious. However, trees and wooded areas are the greatest hazards for the aeromodeller. Trees cause air pockets and down-draughts and often 'suck' the model into their branches.

First check the model for correction of alignment. The wing and tail must be checked from the front and rear for setting and must not be warped or out of plane. Testing is carried out during mid-day when there is little or no wind. The model is held on the point of balance i.e. approximately 1/3rd back from leading edge of the wing, and is gently launched into wind slightly nose down attitude. If the model is set properly and trimmed correctly, it will glide forward gracefully and will land on wheels. Use plasticine or lead weight at the nose and tail for balance as required.

Power flight is not advisable till the gliding test is carried out successfully. For trail flight, a small amount of fuel is put into the fuel tank and the engine started by rotating the propeller. And the model launched gently the model should fly short distance and land perfectly.

Demo and practical (Models and field equipment)

SAFETY CODE
GENERAL

(i) I will not fly my model aircraft in competition or in the presence of spectators until it has been proven to be airworthy by having been previously successfully flight tested.

(ii) I will not fly my model higher than approximately 400 feet within 3 miles of an airport without notifying the airport operator. I will give right of way to, and avoid flying in the proximity of full scale aircraft. Where necessary an observer shall be utilized to supervise flying to avoid having models fly in the proximity of full scale aircraft.

(ii) Where established, I will abide by the safety rules for the flying site I use, and I will not willfully and deliberately fly my models in a careless, reckless, and/or dangerous manner.

RADIO CONTROL

(i) I will have completed a successful radio equipment ground range check before the first flight of a new or repaired model.

(ii) I will not fly my model aircraft in the presence of spectators until I become a qualified flyer, unless assisted by an experienced helper.

(iii) I will perform my initial turn after takeoff away from the pit, spectator, and parking areas, and I will not thereafter perform maneuvers, flights of any sort, or landing approaches over a pit, spectator, or parking area.

CONTROL LINE

(i) I will subject my complete control system (including safety thong, where applicable) to an inspection and pull test prior to flying.

(ii) I will assure that my flying area is safety clear of all utility wires or poles.

(iii) I will assure that my flying area is safely clear of all non-essential participants and spectators before permitting my engine to be started.

CONCLUSION

25. The individual has to undergo practically in Aeromodelling workshop to build and in flying field to fly the models

QUESTIONS FOR REVISION - JD/JW

1. Name the seven Commands of IAF and its Headquarters.

2. Name any five Gallantry awards in the face of enemy on war time.

3. What are the different branches in IAF?

4. What is the age limit for entry in IAF through NDA?

5. IAF day is celebrated on ……..

6. Write Short note on Indo-Pak war 1971.

7. Write about Operation “Safed Sagar” of 1999.

8. Name any five fighter aircrafts used in IAF?

9. Name any five transport aircraft used in IAF?

10. Name any five helicopters used in IAF?

11. What is the difference between *Speed* and *Velocity*?

12. Write Newton's laws of motion (all three).

13. Define the following:
    (a) Density
    (b) Acceleration
    (c) Pressure
    (d) Centre of Gravity
    (e) Couple

14. Define *Force* and write its SI unit?

15. What is Kinetic Energy?

16. Define the following:
    (a) Aero foil
    (b) Chord line
    (c) Angle of attack
    (d) Lift
    (e) Drag

17. With help of a diagram mention all four forces acting on an aircraft.

18. Draw a diagram of Runway and its markings.
19. What are the main constituents of Air?
20. Name the different layers of atmosphere.
21. What is International Standard Atmosphere?
22. What is Atmospheric Pressure?
23. Write Short note on Air Traffic Services.
24. What is Scale in a map? How is it represented in a map?
25. What is Aero modeling?
26. Write down the materials used for Aero modeling.
27. Name any five tools used to make an Aero model.

Vision

Empower volunteer youth to become potential leaders and responsible citizens of the country

Mission

To develop leadership and character qualities, mould discipline and nurture social integration and cohesion through multi-faceted programs conducted in a military environment

Aim

To develop character, camaraderie, discipline, secular outlook, spirit of adventure and ideals of selfless service amongst youth.

To create a human resource pool of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of nation

To provide a suitable environment to motivate youth to take up a career in armed forces