Civil Aviation In India

CAPTAIN MUSTAFA ANWAR

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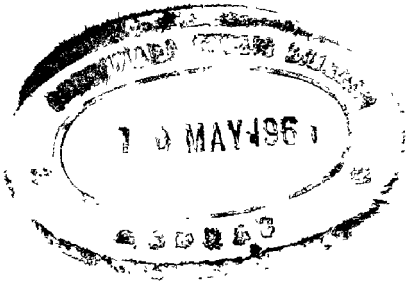

Dedicated to

The Humble Unknown

Who Keep Our Aircraft Flying

PREFACE

Throughout the following pages of this book I have attempted to bring out a picture of Indian civil aviation and its utility in the economic reorganisation of the nation. I most frankly admit that, having written this book in the spare time between my flights, it has not been possible for me to do full justice to this new side of our national life.

An honest attempt however is made with a hope that it will be followed up by better works on the subject. Much of the statistics and details which I would have liked this book to contain were not available.

This book covers almost all the subjects of aviation in India in general. Its introductory part contains the history of world aviation as information to our public. Some of my articles appearing in dailies and monthly magazines are reproduced in chapters 10 to 14 in revised forms. "Flying Disasters"--chapter 13—appeared in the *Hindusthan Standard* on the 26th February 1953. "Astronautics," which is a subject on rocketry, was published in the *Indian Skyways*, June 1949. This is included to show the trend of future development in aviation. The last pages include some supplementary general information which may be useful to some readers.

In my search for the story of Indra Lal Roy, which is the opening chapter of the book, I had the fortune of meeting his eldest brother Mr. P. L. Roy in Calcutta. It may be noted that all the three Roy brothers joined military services in England—Mr. Roy in 1914 as a Private in the British Army. He gave me the

details of Indra Lal Roy who is stated to be the first Indian to learn to fly. In the October issue of the *Calcutta Review*, 1922, Indra Lal's mother, Lolita Devi, wrote an article on her brave son. Much valuable information was obtained from it.

I owe my gratitude to the following for various assistance in connection with this book:

Mr. P. L. Roy; Mr. P. M. Reddy; Chairman, Indian Airlines Corporation; Director General of Civil Aviation; General Manager, Hindusthan Aircraft Ltd.; Dr. S. Mull, Regional Director of Meteorology, Alipore (1953); Mr. Y. R. Malhotra, Inspector of Air Accidents and many more friends without whose support I could not have ventured to publish it.

The jacket is designed by Annada Munsi, to whom I remain deeply indebted.

M. A.

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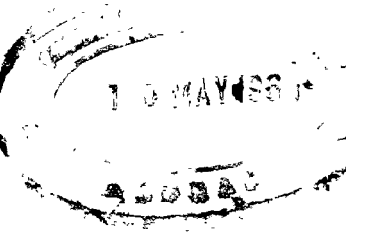

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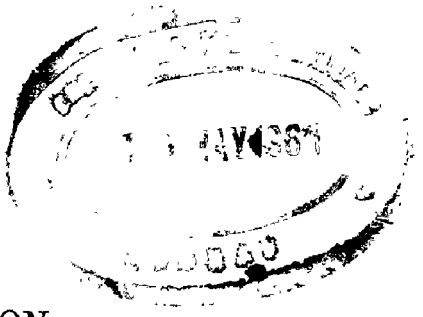


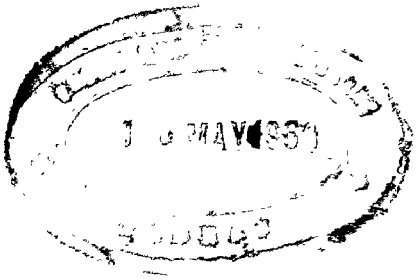
INTRODUCTION

Aviation in India, both civil and military, is comparatively insignificant on a world standard. But all things have a beginning, and though our beginning was made quite late and though it was undermined by foreign interests we have a history of our own.

Passing through various phases of national struggles for political freedom, eventually with the cessation of British rule in India, Indian civil aviation shot up into undue prominence. The factors guiding it were uncontrolled; conditions in the country were chaotic; there was an excess of enthusiasm on the part of those businessmen who amassed huge profits during the war.

Many were the pitfalls. Our civil aviation therefore progressed falteringly. Even then these were the days of a real beginning.

In the decade before the Second World War, aviation in India was an expensive and thrilling hobby for the rich. It is still an affair mainly of the rich. The social and economic history of this sub-continent is, however, undergoing a revolutionary change. On this new socio-economic foundation of India today our aviation is now beginning to bloom into manhood to take part in the growth of the nation's prosperity.



HISTORICAL BACKGROUND

In the annals of the conquest of flight we made no contribution. It was entirely a development of the Western people. As a starting point we shall therefore begin our story from the very early days of human efforts to fly in the air.

Little did man know in those dark days of the possibilities of flight, but he marched on and on to unlock the mysteries of the unknown till he succeeded. From the beginning of his conscious human existence he must have imagined to fly like birds.

Numerous legends and myths of flights by man or animal have come down to us from time immemorial. We find such legends in all countries. In India, we have the myths of Hanuman who possessed the power to fly, of the Pushpak Rath (the Flying Chariot) and of the Pakshmiraj Ghora (the Flying Horse).

In ancient Egypt, as the story goes, there was a heretic Pharaoh, who is said to have flown towards the Heaven on a wooden platform with the intention of killing God.

Four huge vultures were tied to the platform, one at each corner, as the "propulsive power". The "motive power" for the ascent or descent was supplied by chunks of meat tied to ends of ropes. When the king desired to climb he simply hung them up just above the reach of the vultures, so that the greedy birds in their efforts to devour them, continuously flew upwards with the king sitting on the platform. For the descent, all the king was required to do was to

dangle the chunks of meat below the vultures which then flew downward. The platform thus flew between heaven and earth at the king's pleasure.

The Chinese also have many such legends in their early history. There is even a record of an engraving of a flying craft with a paddle wheel.

The Persians likewise have many such legends of flight.

A Greek legend tells us of Daedalus and Icarus who tried to fly away from the Labyrinth with the help of waxen wings covered with feathers. Bladud, an English king, is said to have broken his neck in an attempt to fly.

A Saracen in Constantinople flew, according to legend, from a tower in the presence of his emperor. A wing broke and he was killed in the attempt. Such attempts are said to have been made by many more in later periods.

The first man, however, to consider flying scientifically was that towering versatile genius Leonardo da Vinci, one of the world's greatest painters—the creator of Mona Lisa. He was also a renowned scientist and a great mathematician. The picture of the human anatomy is presumed to have been produced first by him.

As evident from his note book, he had developed a fair knowledge of the principle of flight. There are many drawings of his projected flying machine in it. One of such machines resembles closely a helicopter with flapping wings.

Da Vinci's explorations into the possibilities of flight by man were made around A.D. 1500. This year we may take to be the beginning of the history of aviation on a scientific line.

Da Vinci died in 1519. After his death nothing much was done towards the conquest

of flight as a progressive scientific thought. Many stories are in hand, however, of men in their zeal to fly, jumping off a hill or tower with wings fixed on to their persons. These crude heavier-than-air attempts at flight almost always ended in disaster.

All these years man was exerting to fly by heavier-than-air process. He was ignorant that there could be some other system as well. It was not till the last quarter of the eighteenth century that he learned something else, and quite by surprise, his ambition to float and fly in space came about through a different scientific aspect of aerodynamics.

LIGHTER-THAN-AIR-AIRCRAFT

Two French brothers, Joseph and Etienne Montgolfier, invented an ingenious flying craft. They constructed a large frameless object which came to be known as the Balloon. They inflated this balloon, made of paper-lined linen, with hot air and then let it go. It went up and floated in the air! The ascensive power was produced by the rising hot air which is lighter than normal air.

The Montgolfier brothers gave the first public demonstration of their invention on the 5th June 1783, at Annonay. This was the beginning of what we call today, the Lighter-than-air-Aircraft; and it actually marks the successful beginning of man's flight in space. On this occasion it was only the balloon which was sent up. Man went up a few months later.

To avoid confusion an explanation regarding these above mentioned terms is given. The Heavier-than-air-Aircraft is that which is actually heavier than the air it displaces. It remains in the air entirely by means of mechanical reactions, whereas the Lighter-than-air-

Aircraft floats or flies in the air by virtue of it being actually lighter than the amount of air it displaces. In the beginning this lightness was achieved by less dense hot air. In a later period Hydrogen or Helium gases were used for the same purpose.

The first balloon rose to a height of about 6,000 feet. It had a circumference of 110 feet with a height of 126 feet, and it was inflated with hot air from a furnace. As the hot air cooled the balloon slowly descended.

On the 19th September 1783, another balloon constructed by the same two brothers was sent up from Versailles. This time it carried in a cage a cock, a sheep and a duck. All of them landed safely.

On the 15th October of the same year, 1783, the first human ascent was made. This balloon was also constructed by the Montgolfier brothers. It was of an oval shape and had a capacity of 60,000 cubic feet.

This balloon had an improvement. A new device was incorporated in it. A wicker basket containing a fire pot was attached by rope directly below the mouth of the balloon. It was first inflated with hot air on the ground as usual. Thereafter the fire pot kept on supplying the hot air so that the balloon could fly for a longer period.

Made fast to the ground by a rope, Pilatre de Rosier, a Frenchman, ascended in this balloon to a height of about 80 feet from the ground. He made a few such captive ascents in the same balloon on the 17th and 18th October 1783. On these ascents Pilatre experienced that he could control the height of the balloon by regulating the supply of hot air from the furnace.

Encouraged by this great success, Pilatre de Rosier with Marquis de Arlandes made a free

ascent in the same Montgolfier balloon on the 21st November 1783, from Bois de Boulogne near Paris. These two were thus the first men to have made an aerial voyage. Pilatre on this occasion ascended to a height of about 3,000 feet, and after a flight of 25 minutes, descended safely at a distance of five and a half miles from the point of departure.

The flight was not without incident. At one time a part of the balloon caught fire. It was immediately put out by Pilatre, who had very thoughtfully taken up a wet sponge along with him in anticipation of such an emergency.

The Frenchmen those days were the pioneers in balloon flight. They invented and developed it. At a later period, after the first successful heavier-than-air-aircraft flight, the Frenchmen also made great contributions in setting up many record aeroplane flights.

While the Montgolfier brothers were flying the hot air balloons, some Frenchmen were busy experimenting with balloons filled with the newly discovered Hydrogen gas. Hydrogen was discovered by an English chemist, Henry Cavendish in 1766. This gas is lighter than air. Many foresaw the limitations of the hot air balloons in that they could not be kept in the air for a reasonably long period and could not attain much height. The ascensive power being the hot air, a large amount of fuel had to be taken up and the balloon itself had to be of a vast dimension. Furthermore, there was always the risk of the fire going out or the balloon itself catching fire.

A French physicist, Jean Roberts, was the inventor of the hydrogen gas balloon. The first flight in such a balloon was made by Jacques Alexandre Cesar Charles on the 1st December

1783. He was accompanied by Anne Roberts on this historic flight.

The balloon ascended from Tuileries Gardens, Paris, and after remaining in the air for nearly two hours, landed safely at Nesle, 27 miles from there.

The success of hydrogen balloons created great enthusiasm in many other countries, and many started thinking seriously about the possibilities of flying as a thing to come. Although the days of passenger hot air balloons were coming to an end, and the hydrogen balloons were making very great strides in the progress of lighter-than-air-aircraft, the famous Montgolfier brothers made yet another hot air balloon, the largest of its kind ever made. This one had a capacity of 230,000 cubic feet. One of the Montgolfiers, Pilatre de Rosier and five others went up in it on the 19th January 1784, and landed safely about three miles off Lyons, from where the flight was made. The hot air balloons were now slowly going into oblivion to make room for the hydrogen balloons. One may see them now in their relegated form of paper balloons, floating about in space above Calcutta, during the festival of Kali Puja.

Ballooning was also becoming popular in England in those days. On the 25th September 1784, Vincenzo Lunardi, an Italian, made the first successful balloon flight in that country. He took off from London in a hydrogen balloon and landed at Ware in Herfordshire, a distance of 25 miles, in two and half hours.

One of the greatest balloon flights was made by two Englishmen, Coxwell and Glaisher, on the 5th September, 1862. They ascended to more than 29,000 feet. This was a remarkable feat without any equipment for breathing in

rarefied atmosphere and without proper protection against extreme cold. The airmen suffered severely due to these difficulties, and they had actually lost consciousness at about 29,000 feet while still rising.

Man's original dream to fly in space thus became a possibility. Yet it was merely the beginning, for he was still not able to fly as he liked. He was still unable to go about in the air in the direction he desired. He still had no means of propulsion. All these, however, followed in the process of further development. As time rolled on, man learned more about these through his ceaseless striving to pierce the unknown.

The success of hydrogen balloons set many thinking about the dirigibility of balloons. Hitherto there was no means of steering them in any desired direction. They could only rise and float in the air with the wind. Many, therefore, attempted new devices.

The first attempt ever made at dirigibility was by Guitton de Morvean and Bertrand. They tried to achieve the directional control by means of a main sail, a rudder and two oars. On their first flight the apparatus failed to work; on the second, which took place on the 12th June 1784, it was found to be unsuccessful. But that did not deter others from experimenting further. The ball was set rolling and a new aspect of aviation was now in sight.

On the 18th July 1784, Blanchard, another Frenchman, made an ascent in a hydrogen balloon designed to be dirigible. He tried to achieve directional control by means of four wings and a rudder. He was partially successful.

About five months later, on the 7th

January 1785, Blanchard along with his friend Jefferies, crossed the Straits of Dover in this balloon. Blanchard eventually went to America where he made the first balloon flight on the 9th January 1793. Dirigible balloons later came to be known as Dirigibles.

In 1787 Blanchard was partly successful in developing the parachute. Using a parachute he sent down a dog from a balloon. This experiment was followed by many and the first human descent with a parachute was made by Andre Jacques Garnerin at Paris in October 1797. With a parachute attached, he descended from a balloon. This experiment was repeated in Paris in 1802 and then again at the same place in 1851.

Meanwhile a great mishap had taken place in the world of aviation of those days. Pilatre de Rosier, the hero of balloon flights, the first man that we know of in history to have ever flown successfully, was killed together with a friend of his, M. Romaine, when the balloon in which they had ascended from Boulogne exploded. This was the first historic aerial fatality. It took place on the 15th June 1785.

Pilatre on this occasion was attempting a flight to England. With the 150,000 livres which he received from the French Government for the development of balloon flight, he had a gas balloon constructed. To this balloon he very unwisely added a Montgolfier Cylinder. This ultimately caused the tragedy. The balloon exploded in flight and thus ended the life of a great airman.

A proper dirigible, that is a balloon which could actually be steered and flown in the direction required, was not invented before 1852. Henry Giffard, a Frenchman and reput-

able engineer, produced a dirigible propelled by a steam engine. To minimise air resistence, Giffard made the balloon long in shape and tapered at both ends. This was how the balloon was beginning to transform progressively into what we call today, the Airship. We shall still however not use this name for Giffard's invention. It was yet not worthy of the name.

This balloon had a capacity of 25,000 cubic feet and had a steam engine which developed three horse power. The engine drove a propeller of 10 feet in diameter at a speed of 110 revolutions per minute (cruising revolution per minute of a modern aero engine may be anywhere between 1900-2400). It was hung below the body of the balloon from ropes.

On the 24th September 1852, Giffard ascended in this balloon from the Hippodrome in Paris and landed safely near Trappes, 17 miles away, making a speed of about four to five miles per hour. This was the first successful flight of a navigable aircraft.

Having ascended to a height of about 6,000 feet he proved the manoeuvrability of his machine by turning circles. The engine was, however, too low-powered to be effective in making headway against the wind prevalent at the time.

Giffard thus struck a new line in the progress of lighter-than-air-aircraft. The circular shape of the balloon gradually gave way to the elongated cigar shape and it became more and more an airship as we know it today. The engine power and capacity also increased slowly.

In 1870 the first successful airmail and passenger service was made. During the great seige of Paris, 164 passengers and a large quantity of mails were known to have been safely transported by dirigible balloons from Paris to many

towns in France between the period of 23rd September 1870 to 28th January 1871.

Another remarkable dirigible flight was made on the 9th August 1884. This aircraft, named "La France" was propelled by an electric motor developing nine horse power. It had a capacity of about 66,000 cubic feet.

This was the first dirigible to make a flight out and back to the point of departure under its own power. It was flown by Renard and Arthur Kerbs, both Frenchmen. They took off from Calais Meudon, went to Villacoublay, a distance of five miles and returned. The voyage was made at a speed of about 13 miles per hour.

On the 18th September 1898, Santos Dumont ,for the first time in the history of aviation, at a trial at Paris, successfully made use of an internal combustion engine to propel an aircraft; a dirigible in this case. This same Santos Dumont was the first to fly in an aeroplane in Europe on the 12th November 1906, nearly three years after the first successful aeroplane flight.

The old century was now at its end, and a new one with signs of greater activities was looming ahead. A world of great strife and commotion seemed to be appearing. Nevertheless, a new world was in sight.

In the very first year of the twentieth century came the first flight of the real airship as we know it today. This aircraft was constructed by a great German, F. Von Zeppelin. It was what we call the Rigid Airship, having framework within the envelope. Another German, Schwarz, however, was the first in history to have constructed the Rigid Airship in 1897, and he was also the first to have used the

newly invented internal combustion petrol engine to propel an airship. Unlike Zeppelin's this airship had a metal envelope. It crashed on its first flight owing to gas leakage from the metal casings.

Zeppelin was born on the 8th July 1838, and he died during the First World War on the 8th March 1917. He served in the army and as far back as 1873 planned the construction of a rigid airship. In 1887 he wrote the first treatise on the possibilities of airships.

The plans for the first airship L.Z.I. were ready in 1893, but it could not be made because of a German Commission reporting those plans being practically useless. The Association of German Engineers in 1896 reported in favour of the plans and the construction of the airship was eventually completed in 1899, twelve years after it was planned—a proof of the strong German character.

The first flight in this airship was made on the 2nd July 1900 from Lake Constance and it was not very successful. A second one was constructed. The third made a number of successful flights. This turned the tide and within a few years much progress was made in the development of airships. When the war broke out in 1914 a large number of Zeppelins, being named after the inventor, were constructed and used against the enemy.

The first Zeppelin had a capacity of 400,000 cubic feet with a length of 420 feet, about the length of a present-day large cargo ship. It had two petrol engines giving a total output of 32 horse power to make good a speed of 20 miles per hour. This was followed by more than 100 airships constructed by the Zeppelin works. Their last but one was the L.Z. 129, the Von Hindenberg. 130 Zeppelins were actually not

constructed as given to understand by the serial number of L.Z. series—the letters denoting airships built by Zeppelin Works. Airships of L.Z. serial numbers 70, 115—119, 122—125 and 128 were never built.

Of all airships ever built the Graf Zeppelin (L.Z.127) was the most famous, having outstanding records which are yet to be beaten.

She was built in 1928, and had a length of 772 feet with 100 feet of diameter, propelled by five petrol engines producing a total output of 2650 horse power. Her gas capacity was 3,710,000 cubic feet and she had cruising speed of 80 miles per hour. And it cost the Germans £250,000 even as far back as 1928. It was the property of the German people having been paid for by public subscriptions.

In 1929 the Graf Zeppelin made a flight round the world covering a total distance of 21,000 miles in the record time of 21 days $7\frac{1}{2}$ hours. From March 1932 she commenced the first regular air transport across the Atlantic between Germany (Friedrichshaven) and South America (Brazil). During her nine years of continuous service this wonderful airship had flown about 1,053,391 miles in a flying time of over 13,000 hours; and had carried well over 27,000 passengers mostly between Germany and South America. She made a total of 590 flights, including 144 ocean crossings.

The Graf Zeppelin was still in service when in May 1937 the Great Hindenburg disaster took place. Her South American services were then immediately suspended, and shortly afterwards it was decided not to fly her again. Prior to the breaking out of the War in 1939, she was being used to house the Zeppelin museum. She was

dismantled in April 1940 together with her name sake (L.Z.130).

The L.Z. 129 or the Von Hindenberg was another great achievement of the Germans. She was launched in 1938 and was the first aircraft to establish a scheduled North Atlantic Air Service. She had an overall length of 813 feet, speed of 84 miles per hour and could carry 50 passengers with a cargo of 10,000 lbs. Her volume was about 7,000,000 cubic feet. It gave her a lift of 220 tons. (Average lift of a Dakota is about 3 tons). She made a total of 63 flights, including 37 ocean crossings.

On the fateful day of 6th May 1937, when the Hindenberg was about to moor at Lakehurst, she burst into flames and was completely destroyed in about 32 seconds. 21 of her 70 crew members and 11 out of 39 passengers were burnt to death immediately. Most of the survivors were injured and some died later. The disaster was said to have been caused by sparks which ignited the hydrogen.

The Germans did not give up the development of airships after the disaster, but owing to the preparations of war and other difficult situations further progress was greatly retarded.

Of the 121 Zeppelins only three survived prior to World War II—both the Graf Zeppelins, old and new, and the Los Angeles. The latter was handed to the United States by Germany in 1924 as a part of war reparations. She was eventually dismantled in 1939. 46 Zeppelins were destroyed in the First World war; 11 were surrendered to the Allies, 7 were destroyed to prevent surrender. 25 were destroyed in accidents, 21 were dismantled, and 6 were lost through unknown reasons.

Britain and the United States also took to

the construction of airships but they did not attain such great height of success as the Germans. None of these countries ever achieved any commercial success in airship operations.

Britain's worst airship disaster was that of the R 101, which crashed in France in 1930 and was completely destroyed while on her maiden voyage to India. 46 lives out of 54 were lost in this accident. Previous to this they had lost NS 11 and R 38 among others. The latter was wrecked over Hamburg in February 1935 with a loss of 44 lives.

Among the losses of the United States the Shenandaoh, Akron and Macon are noteworthy. Both Shenandaoh and Akron were wrecked in storms. In the Akron crash 74 out of 77 were killed.

England now has entirely given up airship construction. The United States, although using some nonrigid type of airships for naval purposes, have also abandoned large scale airship construction. It would be interesting to note that in 1946 one M-Type nonrigid airship, belonging to the United States Navy, flew continuously for a record time of 170 hours (i.e., 7 days 2 hours) with a crew of 13; and this was done without any mid air refuelling.

At the height of its glory the days of airships came to an abrupt end. War cries were thundering on the horizon. And this time it was to be the most severe, the most disastrous human strife. Airships had no place in it. The scientific world was beginning to realise the limitations in further development of this type of aircraft. The difficulties were many, such as—

(1) Difficulty in manoeuvring.
(2) Extreme risk in flying through storms.
(3) High cost of construction.
(4) Grave risks of fire.

Although helium gas was found to be much less dangerous to handle, this gas was mainly available in the U.S.A. It was not possible for other countries to procure it from there.

Airships made remarkable progress in their process of evolution. Flying in them as passengers was much more comfortable than in any modern aeroplane. There was ample space in them to provide amenities which are impossible in aeroplanes of today. They had dining saloons, sitting rooms, sleeping berths for each passenger, bathrooms and all such associated luxuries as well as necessities.

Probably airships have finished their days and they may never return to take part in modern aviation.

PARTICULARS OF SOME OUTSTANDING AIRSHIPS

AIRSHIP	COUNTRY	DATE	LENGTH FT.	MAX. DIAMETER	GAS CAPACITY	ENGINES NO.	ENGINES TOTAL H.P.	SPEED M.P.H.	REMARKS
LZ 1	Germany	1900	420	38	400,000	2	32	20	First Zeppelin.
LZ 7	„	1910	485	46	690,000	2	360	35	The Deutschland, first airship for passenger transport.
R 1	England	1911	510	48	660,000	2	400	40	The Mayfly, first British rigid airship. It was destroyed before the first flight.
R 9	England	1915	526	53	890,000	4	720	42	
R 34	„	1918	643	79	1,960,000	5	1250	60	Copy of LZ 33. The first airship to cross the Atlantic, to U.S.A. and back, July 1919. Once brought down by enemy gunfire in 1916.
LZ 114	Germany	1918	770	88	2,470,000	6	1500	71	Last Zeppelin constructed during the war. After being surrendered to France it was renamed Dixmude.

LZ 120	„	1919	400	61	710,000	4	960	75	Small post war Zeppelin for passenger transport. It was built under treaty restriction.
R 38	England	1921	700	85	2,740,000	6	2100	66	Built for U.S.A. Destroyed on her maiden flight.
LZ 127	Germany	1928	772	100	3,710,000	5	2650	80	Graf Zeppelin, the most successful airship ever built.
R 100	England	1929	709	132	5,150,000	6	4200	80	Crossed North Atlantic and returned, 1930. Dismantled in 1931.
R 101	„	1929	724	132	5,000,000	5	2400	80	Wrecked in France, 1930, while enroute to India.
Akron	U.S.A.	1932	785	133	6,500,000	8	4480	80	A Helium filled airship. Wrecked in 1933.
Macon.	U.S.A.	1933	785	133	6,500,000	8	4480	84	Also Helium filled. It could carry five areoplanes (hung under the belly). Wrecked in 1934.
LZ 129	Germany	1936	813	135	7,000,000	4	4,000	84	Von Hindenburg. It was the last but one Zeppelin and the largest airship ever built. Wrecked on 6th May 1937.

NOTABLE AIRSHIP ACCIDENTS

DATE	AIRSHIP	COUNTRY	CAUSES OF ACCIDENTS
1913	LZ 14	Germany	Wrecked in storm while flying over North Sea. 13 of crew members were drowned.
1913	LZ 18	Germany	Exploded in flight. All the crew of 28 were lost.
1923	Dixmude (LZ 114)	Germany	This airship was handed over to France by the terms of the Versailles Peace Treaty. She was caught in a violent storm while flying over the Mediterranean, and was lost with a crew of 50.
1925	Shenandaoh	U.S.A.	Being caught in a line squall she broke in two. 14 of her crew were killed.
1928	Italia	Italy	Crash landed on ice while returning from a flight over the North Pole. She then drifted off with part of crew, the remainder being thrown out onto the ice. Nine of them were rescued later. Seven died.
1930	R 101	England	Crashed in France on her maiden flight to India with a crew of 54. 46 were killed.
1933	Akron	U.S.A.	Crashed in sea while flying through a violent storm. 74 out of a crew of 77 were killed.
1935	Macon	U.S.A.	Crashed in sea due to a major structural failure. Only two out of a crew of 83 were killed.
1937	LZ 129 Von Hindenburg	Germany	Caught fire and exploded while landing at Lakehurst, New Jersey. There were 70 crew and 39 passengers on board. About 36 died and most of the rest were badly injured.

HEAVIER-THAN-AIR-AIRCRAFT

On the other side many were attempting to fly by the heavier-than-air-aircraft method. Leonardo da Vinci was the first to conceive the scientific basis of flight. Thereafter it was a history of trials and efforts.

After Leonardo's death in 1519 nothing revolutionary occurred in the field of aerodynamics till about the beginning of the 19th century. Sir George Cayley who was known as the Father of British Aeronautics, during that period carried out many original experiments with models, through which he realised that man would never be successful in flying by flapping wings.

Cayley was born in 1773. He was said to be the first to make and demonstrate a model aeroplane, and the first to realise the necessity of light engine as the propulsive power for aeroplane. He was also the first to have made an attempt to construct such an engine using gun powder as the fuel.

In 1810 another Britisher, Thomas Walker, published a book on aeronautics. It added more knowledge to the design of the aeroplane. Samuel Henson followed him. After some years Samuel was joined by his friend John Stringfellow in the sporadic attempt of man to fly in aeroplane. Those two inventors concentrated much on the construction of light engine as the propulsive power unit for their intended aeroplane, and they actually constructed a small steam engine for that purpose. After many experiments on model gliders, a large model aeroplane fitted with this engine was built by Stringfellow alone (Henson had retired by then). It successfully flew under its own power

in 1848. This was the first model aeroplane to fly in the history of man.

Stringfellow's model aircraft was a monoplane weighing about six and half pounds, having a total wing area of 18 square feet. The centrally placed engine was connected by ropes to two propellers, one on each side of the fuselage (the main body of an aeroplane). They rotated in opposite directions. The double-acting single cylinder type of steam engine was fuelled by methylated spirit. Stringfellow continued his experiments until he died in 1883.

Enthusiasm in the experiments of aeroplane flights spurted up after Stringfellow's success. Many tried to fly their model aeroplanes the same way as he did.

It is stated that in 1890 Clement Ader himself flew in a steam driven aeroplane designed by him. But this is a very doubtful account and is not at all authentic.

It is also claimed by some that an aeroplane constructed by a Russian scientist, Alexander F. Mazhaisky, was successfully flown in 1882. Information in regard to this matter is so far not available.

Sir Hiram Maxim was another who was experimenting on power driven aeroplanes. He met with little success. A German, Otto Lilienthal, then came prominently into the picture. During the period of his experiments, 1891 to 1895, he made a great stride in actual flight of an aeroplane.

Hitherto most of the experiments were on model gliders and aeroplanes. Lilienthal cut a different line altogether. He started experiments on man-carrying gliders and achieved a considerable success. Gliding from a hill slope, he often attained a height above the starting

point. He was the first to have successfully flown in a glider and was supposed to have made about 2,000 gliding flights.

Initiated by his success with gliders, he attempted to fly a power driven aeroplane of his own make. The aircraft was actually flown by Lilienthal, but while in flight a wing broke and in the ensuing crash he was killed (in 1896). It is a matter of regret that although Lilienthal was the first successful flier of a glider, and his was the first man-carrying aeroplane that actually flew, his name in the annals of the conquest of the air has not been given much prominence. The following wars and their associated national hatred probably had something to do in this matter.

Sinclair Pilcher, an Englishman, who had met Lilienthal personally was a close imitator of the latter. He also attained much success in glider flights. Pilcher died in a crash while gliding.

Then on the 17th December 1903 came one of the most notable heavier-than-air-aircraft flights. The first successful aeroplane flight had taken place on this date. After several years of hard trials two brothers, Wilbur and Orville Wright of the United States of America, constructed this aeroplane. By a decision of toss, Orville Wright flew it from the wind swept sand dunes of Kill Devil Hill, Kitty Hawk, North Carolina. The first flight covered 120 feet in 12 seconds. Shortly after, 852 feet in 59 seconds was completed. This marked the beginning of a new age.

The Wright brothers incorporated something novel in their aeroplane. Like the modern one, it had all the three flying controls, directional,

longitudinal and lateral. It was, however, a tail first type and was very unstable.

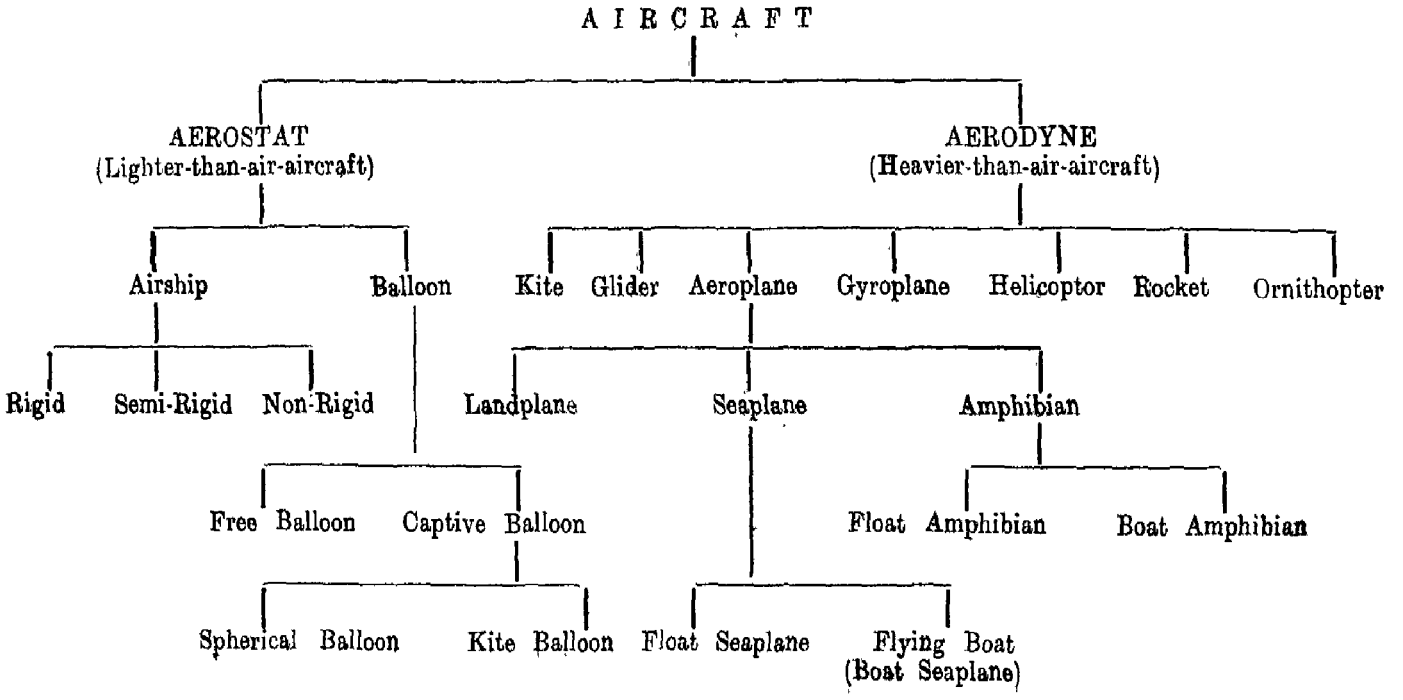
A strange historical coincidence is noteworthy in the history of aviation. Two brothers, Etienne and Joseph Montgolfier, constructed the first man-carrying lighter-than-air-aircraft. 120 years later it was again two brothers, Wilbur and Orville Wright, who were the builders of the first successful mechanically driven heavier-than-air-aircraft.

Aviation has since advanced far too fast—too fast to keep pace with the slow moving civilization of the world today. Within about 50 years after Orville Wright's crude aeroplane flight of a few hundred feet for a fraction of a minute, man today flies aeroplanes at the supersonic speed of 700 miles per hour or more; he flies round the world without a stop and carries a bomb load of nearly 50 tons.

Unfortunately aviation has grown mainly in the flow of blood of our fellow human beings during the two wars. An invention, which originally was never intended to be a weapon of war, and which can be of great service to the progress of civilization, has been utilised largely for the destructive process of mankind, negatively thinking in terms of war.

It is a pity that the creative genius of man is not always harnessed for the happiness of mankind but for his destruction.

FAMILY OF AIRCRAFT



SOME NOTABLE FLIGHTS AND DATES

WORLD

1783, 5th June.
The first balloon flight was made. This balloon was constructed by the Montgolfier brothers and it was a hot air type.

1783, 15th October.
The first human ascent was made by Pilatre de Rozier in a hot air balloon constructed by the Montgolfier brothers. This was not a free ascent.

1783, 21st November.
The first aerial voyage was made in the same Montgolfier hot air balloon by Pilatre de Rozier accompanied by Marquis de Arlandes.

1783, 1st December.
The first hydrogen balloon, invented by Jean Roberts, was flown.

1797, October.
The first successful parachute descent from a balloon was made by Andre Jacques Garnerin at Paris.

1848.
The first model aeroplane, constructed by Stringfellow, was flown.

1852, 24th September.
The first successful flight by a dirigible (balloon) propelled by a steam engine was made. The aircraft was constructed and flown by Henry Giffard.

1870.

During the siege of Paris, 164 passengers and a large quantity of mail were flown out of Paris between the period 23rd September 1870, and 28th January 1871.

1891—1896.

The first man-carrying glider flight was made by Otto Lilienthal during this period.

1896.

The first man-carrying aeroplane was flown by Otto Lilienthal. The wing broke while in flight and Lilienthal died as a result of the crash.

1900.

The first Zeppelin was launched.

1903, 17th December.

The first successful man-carrying aeroplane flight was made. Constructed by the Wright brothers, the aeroplane was flown by Orville Wright.

1919, 13th October.

The first convention for the Regulation of Aerial Navigation was signed in Paris.

1947, 4th April.

International Civil Aviation Organisation came into being.

INDIA

1877.

The first balloon flight in India was made by Mr. Joseph Lynn on 27th November from

Lalbagh Gardens, Bombay. It is known to have attained a height of about 7,500 feet.

1919, 16th January.

The first England-India flight via Egypt and Bagdad was made by Squadron Leader Maclaren.

1927.

The Aero Club of India was founded.

1929, 6th April.

The first Imperial Airways London-Karachi service arrived at Karachi.

1930, 3rd-21st March.

Ramnath Chawla and Aspy Engineer (now Air Vice Marshall) won the Indian Government Prize of 500 guineas for being the first Indian pilots to fly between India and England. They flew in a Gypsy Moth.

1930, April.

J.R.D. Tata (now Chairman of Air India International) won the prize offered by the Aga Khan for the return flight from England, beating Aspy Engineer by a good margin.

Chapter 1

A SMALL BEGINNING

THE PIONEER INDRA LAL ROY

The first demonstration of aeroplane flight in India is said to have taken place in 1911.

It is also notable that the very first authentic carriage of mail by aeroplane in the world was undertaken in India. A French pilot, Picquet, accomplished this historic air mail flight from Allahabad to Naini, a distance of six miles, on the 18th February 1911. A bag of official mail was flown on this occasion. The first official air mail in England was flown some six months later.

Many years before, there had taken place in India a balloon flight as well. That historic flight was made on the 27th November 1877, when Mr. Joseph Lynn took off from the Lalbagh Gardens in Bombay, and was reported to have attained a height of 7,500 feet.

All these were but the efforts of foreigners and they do not reflect on any glory to our nation, apart from being historic incidents. Our humble beginning was yet to be made. It began with the unpublicised pioneer Indra Lal Roy. Very few of us have even heard of this brilliant young man, who was an exceptional pilot. He is known to be the first Indian to learn to fly.

Indra Lal Roy joined the Royal Flying Corps in April 1917 as a flight cadet when he was just 18. He was the second son of P. L. Roy, Bar-at-Law, Zamindar of Lakutia, Barisal, East Bengal.

Born in Calcutta on the 2nd December 1898, Indra Lal, with his two brothers, was educated in England from his childhood. The whole family was residing in England in those days. All the three brothers had their schooling at St. Paul's Preparatory School, London.

Indra Lal entered this school when he was just five. All through his scholastic career he was brilliant, winning several open scholarships at various stages and eventually he joined the Oxford University having obtained the Baliol Scholarship. He was actually to have competed for the I.C.S. but fate destined his carreer differently. No sooner had he reached the required age limit than he joined the Royal Flying Crops in the flying branch. He is said to be the first Indian to do so and in due course the first Indian to receive a King's Commission in this service.

After a period of six months' training as a flight cadet at Oxford, he obtained a King's Commission and in October 1917 was sent to France to join No. 56 Squadron of the Royal Flying Corps.

Indra Lal Roy, after joining Squadron 56 of the Royal Flying Corps for operations in France, when out on a sortie in December 1917, was shot down by the Germans in "No Man's land" between the German and the British lines. After being unconscious there for nearly three days he was picked up by British troops and was sent to Etaples British Military Hospital (in France). Here he was given up as dead and sent to the mortuary. Miraculously enough he recovered consciousness while lying in that storage of dead soldiers.

For some months Indra Lal was grounded as a result of this mishap. He was however

INDRA LAL ROY

INDIA'S PIONEER PILOT

Born in Calcutta: 2nd Dec. 1898

Killed in Aerial Combat over France: 8th July 1918

declared fit to fly again and was posted to No. 40 Squadron in June 1918.

Once again he was sent out on operations, back to France. During the 13 days from the 6th to 18th July 1918, he shot down no less than 9 German aircraft before he was shot down himself by them. For this achievement he was posthumously awarded the Distinguished Flying Cross, being also the first Indian to receive this coveted flying decoration.

Indra Lal's flying log book, wings, a book of his own sketches pertaining to the actual air combats in which he had taken part, his D. F. C. together with King George V's letter, and the letters from his Commanding Officer and others to his mother Lolita Devi are now preserved in the Indian Air Force Museum. One such letter reads :

"Dear Mrs. Roy,

I am writing to tell you all I know about your son. He went up on a patrol with 3 other fellows and then met 4 German aeroplanes. 2 German machines were seen to fall and one of our own, which was the machine your son was flying. From the time your son came to the Squadron his one aim in life was to shoot down Huns and through his skill as pilot and a wonderful dash he succeeded in bringing down nine enemy machines (in 13 days—author). For the time he was here that is a wonderfully fine record. I am sure he was very happy here. He was admired by all the men and Officers in the Squadron and was very popular in the mess. I have every reason to believe that he will be rewarded for the brave deeds that he has done. The whole Squadron join with me in sending

their sincerest sympathy to you in your great loss.''

Thus wrote Major Alex Keane, Officer Commanding, No. 40. Squadron, Royal Air Force, from an operational zone somewhere in France on the 27th July 1918, and thus ended the life of our pioneer pilot.

Chapter 2

GROWTH OF INDIAN AVIATION UP TO THE END OF WORLD WAR II

India was under foreign rule and the British were not here to develop the country for the sake of India itself. Whatever they did or established was primarily to enhance their capacity to exploit the economic resources of the country. This fact must be borne in mind while studying India's early aviation development.

The first air service in India was organised in January 1920 by the Government of India between Karachi and Bombay. This was purely an affair of the British and was operated by the Royal Air Force. The enterprise was developed at the incentive of Lord Lloyd (then Sir George) who was the Governor of Bombay.

The service was operated experimentally with the object of exploring the possibilities of establishing air services for the use of the public. It lasted only six weeks.

Air services for the public, however, were not started till quite late. Due to financial reasons, it was stated to be most inopportune to commence air services in India at that time.

In the meantime external air services and links had already begun. The first England-India (Karachi) flight was made by Squadron Leader Maclaren in a four engined Handly Page bomber between the 13th and 16th January 1919. Before this, Capt. Ross had made the first Cairo-Karachi flight in 1918. The French and the Dutch also organised some air

connections to their colonies in the East across India.

In 1927 a Civil Aviation Department was formed and a Director of Civil Aviation was appointed to look after the aviation in India. India was gradually becoming aviationally important to the European countries.

By an agreement with the Air Ministry in 1925, Imperial Airways obtained a contract to operate air services between England and India. The agreement did not materialise before the 30th March 1929, when the London-Karachi service was inaugurated. Sir Bhupendra Nath Mitra was holding the Industries and Labour portfolio in the Viceroy's Executive Council at that time. Through his efforts emanated the Karachi-Delhi Service under a special arrangement. Connecting the London-Karachi service, it came into operation from the 30th December 1929.

The Government of India made a contract with Imperial Airways that the London-Karachi service, on completing its schedule to Karachi, would proceed to Delhi on charter to the Government of India carrying their passengers and mail. All the expenses for this sector of operation of the air service by Imperial Airways were thus totally covered by the Government of India, while also assuring a fixed rate of profit to the carrier.

In December 1931, on the expiration of the above contract, which was very expensive, a novel method as a make shift gap, was adopted. Early in 1932, the Delhi Flying Club was given a contract to undertake the above service between Karachi and Delhi, connecting Imperial Airways' weekly London-Karachi service, for the carriage of mail and passengers. They

operated for a period of about 18 months and the arrangement then came to an end about the middle of 1932.

Bhupendra Nath Mitra was succeeded by Sir Joseph Bhore. Under the direction of the latter a scheme of weekly air services between Karachi and Calcutta, connecting the weekly London-Karachi service, was drafted. Four Avro 10 aeroplanes were bought for this scheme. Owing to the general world slump and acute economic depression in India in 1931, it was however abandoned. With the exception of one aeroplane which was retained for the use of the Viceroy, the other three Avros were sold. Thus abruptly ended the first Indian Government attempt to start an airline.

The scheme was revived successfully in 1933. This time it was again another arrangement with the British Government and its Imperial Airways. Under the new arrangement the London-Karachi service of Imperial Airways was to be extended across India to Singapore as a link in the England-Australia service.

A private company was formed under the name of Trans-Continental Airways. In this company Imperial Airways held 51 per cent of the total shares, Indian National Airways 25 per cent and the Government of India took the remaining 24 per cent of shares. This company jointly operated with Imperial Airways a weekly service from Karachi to Singapore. There it connected with Qantas Empire Airways weekly Singapore-Australia service.

The main function of an internal air service for the purpose of the public was hardly served by the above company. It was an Impe-

rial Trunk Route—a life line to the colonies which the company helped to establish.

INDIAN NATIONAL AIRWAYS

Indian National Airways was formed in May 1933 by R.E. Grant Govan, to participate as shareholder in Indian Trans Continental Airways and to run certain internal air services. They commenced a bi-weekly service on the Calcutta-Rangoon route. The Calcutta-Dacca route was operated in early 1934. There was a plan to extend services to Assam if possible.

Under a ten year contract with the Government of India I.N.A. also operated a weekly service from Lahore to Karachi to link with Imperial Airways' London-Karachi service. A similar contract for another route was given to Tata Airlines, which company had come into existence earlier than Indian National Airways. Rangoon and Dacca services from Calcutta were abandoned in 1935 due to lack of sufficient traffic.

EMPIRE AIR MAIL SCHEME

In 1936, a scheme known as the Empire Air Mail Scheme was prepared by the British Government. Under this all first class mail between the United Kingdom and her colonies and dominions on the Australian and African routes was to be carried without any surcharge. The Government of India, in collaboration with the Ceylon Government, participated in this scheme. It was put into operation from the 28th February 1938. The London-Karachi service of Imperial Airways was accordingly extended to Calcutta with an increase of services to four times a week.

The two existing companies—Tata Airlines

and Indian National Airways—entered into a 15 year contract with the Government of India for the internal collection and distribution of air mail on their routes so as to connect the Imperial Airways services at Karachi. Tata Airlines was guaranteed by the Government a yearly payment of Rs. 1,500,000 for the carriage of mail on the Karachi-Madras-Colombo route for mail load up to 500,000 pounds per year, plus rupee one for each extra pound of mail. Indian National Airways was guaranteed a payment of Rs. 325,000 a year for the carriage of mail up to 130,000 pounds on their Karachi-Lahore route, plus rupee one for each extra pound of mail. These services were also simultaneously increased to four times a week in order to connect the Imperial Airways services at Karachi.

The Empire Air Mail Scheme was suspended on the outbreak of the War in September 1939.

AIR INDIA

The first fully Indian air transport enterprise, however, came into existence in 1932, when Tata Sons Limited floated a company in the name of Tata Airlines. This company commenced operations from the 15th October 1932, with a weekly air mail service between Karachi and Madras using two light single-engined aircraft.

The main income of the service was from its mail contract with the Government of India. It connected the Imperial Airways' London-Karachi service with Madras, having stops at Ahmedabad, Bombay and Bellary. Hyderabad was substituted in place of Bellary in 1934. Operations on a weekly Bombay-Trivandrum service commenced from October 1935. In the same year a bi-

weekly Bombay-Delhi service was inaugurated. The Karachi-Madras service was extended to Colombo in 1938 as per agreement under the Empire Air Mail Scheme.

When World War II started, much of the expansion plan of Tata Airlines was postponed. The Government then took over the fleet of multi-engined aircraft of the company, thereby placing them in further difficulties.

During 1941 and 1942, a number of twin-engined aircraft were loaned to the company by the Government for operations in connection with war efforts.

With the cessation of the War the company extended its operations by leaps and bounds, and prior to the nationalisation of airlines it was the biggest, the most efficient, and the best organised company in India comparable to any efficient airline of the world. The Tata Lines changed its name to Air India in July 1946.

AIR INDIA INTERNATIONAL

Air India International was formed on the 8th March 1948, exclusively for international services. It marked a progressive phase of Indian aviation. The new company was jointly sponsored by the Government of India—now a national Government—and Air India together with some public shares.

49 per cent of the issued and paid up share capital of Rs. 20,000,000 was acquired by the Government, 25 per cent by Air India and their associates and the remaining 26 per cent was acquired by the public.

By agreement, the Government of India guaranteed Air India International against losses of operation including depreciation and initial

expenses, for a period of five years. It was further agreed that such losses could be recovered from the profits subsequently made.

Air India undertook the responsibility of complete management of the company and also became the chief booking agents in India, Pakistan and Ceylon for the next ten years.

Using Constellation aircraft, a weekly Bombay-London service via Basrah, Cairo and Geneva was inaugurated on the 8th June 1948. The frequencies within a short time reached the company's operational capacity. In May 1950, a weekly service to Nairobi (East Africa) via Aden was opened.

Air India International today stands out unique as one of the world's best International Air Services

AIR SERVICES OF INDIA

There was another company, Air Services of India, which also came into existence before the War. It was formed in 1937 and operated between Bombay and several points in Kathiawar States. The company's operations ceased in 1939 owing to financial difficulties arising from insufficient income. It was, however, revived in 1946 at the termination of the War.

Such was the position of commercial aviation in India before the World War II began. There was nothing much to boast of, nothing particular to note. It was a feeble effort of a colonial people. The overall position of airline operations may be seen from the following comparative data :

Year	*Route Miles*	*Miles flown*
1938	5,190	1,514,000
1946	10,123	4,520,046
1952	27,763	19,562,267

FLYING CLUBS

Meanwhile Flying Clubs were being gardually established in large cities. Sometimes during the year 1927 the Aero Club of India was founded.

Sir Victor Sassoon was much interested in the organisation of flying clubs in our country. In December 1927, the Government of India received a conditional offer of financial contribution from him subject to a grant of Rs. 30,000 to the Aero Club of India and a grant of Rs. 20,000 by the Government to each club formed. He was prepared to bear any deficit between the income and expenditure of the club concerned until grants were available. The Government accepted this offer and decided to provide for each club an initial grant of two aeroplanes, a spare engine and a contribution towards the cost of a hangar where no hangar was available. Four flying clubs; one each at Calcutta, Bombay, Karachi and Delhi were thus started.

Three more, the Northern India, the U.P. and the Madras Flying Clubs, came into being later. When the World War II broke out in 1939, there were ten of them; the Karachi, Bengal, Delhi, Bombay, Madras, U.P., Northern India, Hyderabad, Jodhpur and Jaipur Flying Clubs. Of these, seven were subsidised by the Government of India, each being paid according to the types and number of aircraft maintained. The maximum subsidy was limited to Rs. 25,000.

These flying clubs were nothing more than clubs and they were mainly concerned with non professional or private flying. Only a few members—a very small percentage—were trained for professional flying licences. There was only a few opportunities for employment of professional pilots.

During the War some of the flying clubs

had to be closed down for lack of funds and facilities. Other clubs—Karachi, Bihar, Bombay, Northern India and Madras Flying Clubs—were given defence department flying assignments. For some time they were engaged in anti-aircraft co-operation, and later towards the end of the War in Indian Air Training Corps flying.

Flying clubs in India never attained any important role in the life of the nation. They remained as impotent as ever, mainly as an expensive hobby centres for the rich. When the War ended, there were not even half as many pilots as were required for civil aviation, which was showing signs of growth even during the latter part of the War. There was no planning behind the organisation of these clubs. They just grew.

There is and has always been an extreme lack of professional seriousness in the flying club training of commercial pilots. Although individually some brilliant Indian pilots have come out of the flying clubs, and there are some excellent veteran flying instructors in some of them, the average creation of these clubs is much below the standard of modern flying.

After the War, a few more flying clubs were opened. The Government also helped them to grow with subsidies and aircraft.

As on the 1st August 1953, there were ten centrally subsidised flying clubs, e.g., the Bengal, Bombay, Madras, Delhi, Hind Provincial (Lucknow), Northern India (Jullunder), Orissa (Bhubaneswar), Madhya Bharat (Nagpur), Bihar (Patna), and Rajasthan (Jaipur). A fixed yearly subsidy of about Rs. 30,000 are paid to each of these clubs. The Government also pay Rs. 20 to the club concerned for each hour of flying on

account of a pupil below the age of 28. This in fact is an indirect subsidy to the pupil, who accordingly pays Rs. 25 instead of Rs. 45 per hour of flying. In addition, most of the training aircraft of the clubs are loaned by the Central Government.

In post war India, vigorous aviation training was launched without due regard to the number of pilots required or to modern flying training methods. Inevitably the consequences were very unhappy. Indian aviation at higher levels was monopolised by many foreign pilots and therefore many of the club trained pilots failed to obtain employment.

Impetus to join the flying clubs thus received a setback. Even the enthusiasm for private flying has almost died out now. And slowly but surely the days of the luxury flying clubs are also coming to an end, for they serve no useful purpose to a growing nation fighting against adversities. They may reappear fruitfully years later only for private flying when the conditions of the country as a whole are far improved.

Chapter 3

DURING THE WAR

The onrush of the war upset the already feeble economic foundation of the country. As was to be expected, civil aviation was also adversely affected. The Empire Air Mail Scheme was suspended and the two existing airlines were utilised by the Government of India to increase war efforts. Air services were then run mainly for the Defence Services and other governmental requirements.

Towards the later part of the War, the Government loaned to both the companies the lease-lend aircraft, Expeditors, DC 2 and DC 3 for the operation of internal services. The following were the routes operated by them during the War as necessitated by the exigencies of the time in the execution of war.

Karachi-Colombo,
Bombay-Delhi,
Bombay-Calcutta,
Bombay-Coimbatore,
Bombay-Karachi,
Bombay-Colombo,
Delhi-Karachi,
Calcutta-Dinjan,
Calcutta-Jorhat,
Calcutta-Gaya-Allahabad-Kanpur-Delhi
Lahore-Multan-Jacobabad-Karachi,
Lahore-Guzrat-Rawalpindi-Peshawar,
Lahore-Jacobabad-Quetta,
Delhi-Bhopal-Hyderabad-Bangalore-Trichinopoly-Colombo,
Delhi-Jodhpur-Karachi,
Delhi-Ahmedabad-Bombay.

During the period of the War Tata Airlines and Indian National Airways performed, besides various odd military assignments, the arduous work of evacuating civilian refugees from Burma.

When the hostilities ceased, the traffic load figures pertaining to scheduled air services for 1945 in comparison to those of 1938 and 1952 were as shown below.

Year	Route Miles	Miles flown	Passengers carried	Freight carried lbs.	Mail carried lbs.
1938	5,190	1,514.000	2,782*	101,209*	548,600
1945	—	3,320,277	24,080	852,068	480,616
1952	27,763	19,562,267	434,480	86,037,607	8,376,813

*Figures doubtful.

Chapter 4

THE POST WAR DEVELOPMENT OF AIRLINES

The atom bombing of Hiroshima marked the end of one brutal era of man slaughter and began an era of struggle for economic supremacy. To the Indians, the cessation of the War came as a great relief.

India was becoming poorer each day. Her endurance was coming to a breaking point. National movements were gaining ground and the British thought it wise to part company with India—divided.

India's wildest blood bath then followed. We obtained our independence, but at the terrible price of many thousands of human lives.

Towards the end of the War, while the whole world was still groaning under the fearful persecutions of war, American and United Kingdom aviation industries were beginning to establish worldwide net work of aviation services. The International Civil Aviation Organisation was accordingly set up to promote that cause.

In India there were only two air companies operating in the beginning of 1946, Tata Airlines and Indian National Airways. Although India had no aircraft of her own, she also was caught up by the general agitation for the promotion of civil aviation.

It was easy to float aviation companies, for many left over surplus American C 47 or DC 3 aircraft were available from the Government at the end of the War. They were sold cheap.

Many came forward to invest money in air companies intending to operate air services with these aircraft. By luck there was the Hindusthan Aircraft Limited at Bangalore to overhaul and convert them into suitable airliners. Hitherto, they were solely used for military air transport. About 115 of these C 47 were bought by various air companies.

Tata Airlines and Indian National Airways now reobtained their full control; at the same time Air Services of India also revived itself.

In all 21 air companies were registered with an authorised capital of Rs. 420,000,000 of which the Government authorised the issue of Rs. 97,000,000. Among the new comers were Ambica Airlines, Airways (India) (April, 1947), Bharat Airways (June, 1947), Deccan Airways, Dalmia Jain Airways, Jupiter Airways, Mistry Airways (September, 1946), Orient Airways, Air India International, Kalinga Airlines and later Himalayan Aviation.

Orient Airways eventually was transferred to Pakistan and established its base at Karachi. Even then including the three older ones, altogether 13 Indian air companies were issued licences to operate scheduled routes.

Such position was quite bad and it soon became apparent that there was no room for so many airlines in this underdeveloped country. One after the other, the companies collapsed. It was pitiful but it had to be so.

Ambica Airlines was the first victim. It was closely followed by Jupiter and Mistry Airways.

In June 1949, Dalmia Jain Airways surrendered its licence for the Delhi-Srinagar route and amalgamated with Indian National Airways to form one company. Thus by the end of 1952,

there remained in all nine scheduled air companies—Air India, Air India International, Air Services of India, Airways India, Bharat Airways, Deccan Airways, Indian National Airways, Kalinga Airlines and Himalayan Aviation.

During 1946 and 1947, Air India and Indian National Airways bought Vikings for direct Delhi-Calcutta, Delhi-Bombay and Calcutta-Bombay nonstop services.

THE AIR LICENSING BOARD

Until 1946 there was no proper licensing of air routes. Except for the requirements of the Indian Aircraft Rules regarding the technical matters of personnel, aircraft maintenance and such other items, air companies were almost free to operate on any route they desired.

By an amendment to the Indian Aircraft Rules in March 1944, it became a law that after 1st October 1946, no air transport service in India should operate without a licence issued by the Air Licensing Board. Accordingly, the Air Licensing Board came into existence to control the public air transport organisations of the country. Its control was mainly in respect of setting up and maintaining superior technical standard of Indian air transport services and secondly of cutting down all wasteful competition.

It served its purpose to a large extent, though there were some drawbacks. Had the Board taken into its hands the power to control the number of air companies, scheduled and non scheduled operators, and had it designed a definite policy for their rationalisation, much of the efforts and money which were wasted could have been saved and the air industry would not have grown in so hectic a manner as it did.

The Air Licensing Board allowed the old

companies to operate on their existing routes until formal licences were issued to them.

IMPACT OF THE PARTITION OF INDIA

The Great Partition of India was announced on the fateful evening of the 3rd June 1947, by Lord Mountbatten. Coincidentally, the author was half way through a flight between Bombay and Calcutta on that occasion. The Hindus and Muslims, as a result of over hundred and fifty years of political manipulation, went for the blood of each other.

The partition brought in its wake a great evacuation of people in which Indian air companies played an important part.

From the time of the partition in August 1947, thousands of people were trekking both-ways between the two parts of the Punjab. Thousands were stranded. Thousands were homeless and there was no proper communication.

KASHMIR OPERATION (27th October—19th November 1947)

Within a few months, towards the end of October 1947, fresh troubles broke out over Kashmir. This time all available Dakotas were commandeered by the Government of India for carrying military personnel and material to Kashmir to ward off the raiders.

This was the famous Kashmir Operations, one of the most remarkable feats ever undertaken by civil aircraft. Within 21 days from the start—the vital phase of the operations—Indian civil aircraft had made 750 flights to Kashmir without a single fatal accident; carried 3,000,000 pounds of load and flew 600,000 miles. These astounding figures were revealed by Prime Minister Nehru on the 19th November 1947,

when he went to Willingdon Airport to congratulate the Indian civil aviation men for their wonderful achievements.

The evacuation and the Kashmir operations, ironically brought relief to the Indian air companies. But for these, some more of would have collapsed. ?

THE BENGAL RIOTS (Dec. 1949—March 1950)

While India and Pakistan were still bleeding from the wounds of the disasters that followed the partition, towards the end of 1949 fresh troubles were brewing in the eastern sector of the country. The emergency which arose now in East and West Bengal created an acutely tense situation in which the demand for air conveyance both for passenger and freight shot up tremendously. Due to the stoppage of trade between India and Pakistan, and prohibition of surface transport through East Bengal from West Bengal to points in Assam, Tripura and also some northern parts of West Bengal, carriage by air was sought in emergency as the quickest means of conveyance. Much of the accumulated goods were despatched by air. A detailed account of this will be found elsewhere in this book.

THE NIGHT AIR MAIL

The Night Air Mail was introduced in February 1949, by the Government of India when Rafi Ahmed Kidwai was the Communication Minister. Under the scheme, the mail between the four largest cities of India—Calcutta, Bombay, Madras and Delhi—was to be carried by aircraft operated at night. The operational arrangement for the Night Air Mail was to be such that aircraft from each of the aforesaid four big cities met at Nagpur at night, and then after

transferring their loads of mail returned to their bases by the morning. This scheme was eventually to be backed up by an allied scheme of the Communication Ministry called the All Up Air Mail Scheme, which was introduced a few months later—from the 1st April 1949.

The introduction of this latter scheme, was in fact a boost to airline income, helping to obtain greater load. Previously, only the surcharged air mail was flown.

According to the All Up Air Mail scheme, all letters as far as possible were lifted by air wherever scheduled airlines existed. There was no airmail surcharge, but the postal charges for an enveloped letter was enhanced from six pice to two annas. This overall increase of two pice per letter was beneficial. By virtue of the scheme, letters which are addressed to places served by scheduled airlines reach their destinations much quicker. Many were therefore benefited in a small way, though a greater many at the same time unnecessarily paid two pice more for no benefit, because for them there were no possible aerial mail connections.

As the Night Air Mail scheme was an experiment and as the night facilities enroute were not fully developed, initially only mail was transported. Passengers were to be carried when appropriate facilities were ready.

The scheme was duly discussed with airline operators. It was strongly opposed by them on various grounds. They wanted a guaranteed minimum payment; but the Government was not prepared to undertake any such guarantee. The same existing rate for the carriage of mail was maintained. Only Indian Overseas Airlines offered to work the scheme on these conditions.

The Air Transport Licensing Board granted

a licence for the operation of the Night Air Mail Service to Indian Overseas Airlines for one month with effect from the 31st January 1949. This was eventually extended to the end of June 1949.

Up to 31st March 1949, the total mail carried by the night services was about 48,000 pounds per month. With the introduction of the All Up Air Mail scheme on the 1st April 1949, the amount of mail carried by Indian Overseas Airlines almost trebled.

For some time, day services suffered a slight reduction in the carriage of mail. But this was soon compensated by an overall increase of air mail all over India.

About the middle of 1949, Indian Overseas Airlines was in a critical financial position and it had to give up the Madras-Delhi Night Air Mail service on the 19th May 1949, and the Calcutta-Bombay Night Air Mail Service on the 8th June 1949. These services were operated till the end of June by Deccan Airways on the Madras-Nagpur sector, and the Delhi-Nagpur sector by Indian National Airways under a special arrangement with the Government of India. For the short period between the 8th June 1949 to the end of that month, however, there were no night services between Calcutta and Bombay. With the approach of the monsoon all night services were suspended.

The Government intended to reopen the Night Air Mail from the following October at the end of the monsoon period. Negotiations to that effect were going on in the meantime.

Air India, Air Services of India, Deccan Airways, Indian National Airways and Airways India offered to run the night services at a guaranteed minimum payment of Rs. 3 per

mile flown. Bharat Airways quoted a lower rate of Rs. 2-12 per mile. The Government of India was unwilling to guarantee any minimum payment. Therefore, none of these companies could be allowed to operate the night services.

It was a test for the Government this time. Most of the scheduled companies declined to operate on the Government's terms. The operators very strongly opposed the resumption of the Night Air Mail services and termed it as being ill advised.

However, the Night Air Mail Services were resumed with effect from the 15th October 1949 inspite of all opposition from the scheduled operators. The Government this time very stubbornly gave the permit to a non scheduled operator, Himalayan Aviation, who offered to operate without any guarantee.

The initial grant of the licence was for three months and the special feature now was the permission to carry passengers together with mail and freight. This was a step forward and was helpful to the operator.

By now the night routes were fairly well equipped with night flying facilities. Safety conditions were reinforced by arranging various aerodromes for emergency landings.

The passenger fare by the night services were fixed low. It was kept at the existing first class railway fares on the respective routes plus 12 per cent. On the Calcutta-Bombay route it thus came to be Rs. 172 as against Rs. 205 by day service and on the Madras-Delhi sector it was Rs. 191 as against Rs. 220 by day service.

At the expiration of the term of three months, Himalayan Aviation, in view of its good operational record, was allowed to renew the licence until January 1951.

At the end of this period Himalayan Aviation was asked to operate till the end of May 1951. Then it was decided to hand over the Night Air Mail Services to Deccan Airways, which had become a mainly nationalised company, the State Government holding the major share. This same concern was very profitably operating the Night Air Mail Services upto the time of complete nationalisation.

The Night Air Mail system eventually proved a brilliant success. Its popularity may be fathomed from the traffic figures of one month alone. During August 1953, the Night Air Mail Services carried 1,062 passengers, 196,180 pounds of mail and 64,556 pounds of freight. The figures speak of a very high percentage of load.

This success forced home three points that (1) government control can provide greater facilities for air operations, (2) airlines in India can profitably operate on lower rates and (3) greater services to the public can be rendered under government control.

ENQUIRY COMMISSION

These and the consideration of extending greater benefit to a greater number of people, and the fact that all was not going on well with the scheduled Indian Air Companies, as many of them were found to be running at loss, the Government of India appointed an Enquiry Commission in February 1950. They were charged with the exclusive purpose of finding the ills of the Indian air transport industry and recommending ways of improvement. The committee was constituted of the following:

Chairman: Justice Rajadhaksha.

Members: H. L. Dev; Member, Tariff Board.

R. Narayanaswami ; Joint Secretary, Ministry of Finance, Government of India.

Advisers : D. Chakravarty; Deputy Director General of Civil Aviation.
Air Commodore R. H. D. Singh ; Air Officer Commanding, Training Command, I.A.F.

Technical Adviser : J. L. Watkins, B.E., A.F.R. AE.S.; Superintendent of Organisation and Technical Services, Trans Australian Airlines.

It is necessary to mention that although the Government granted scheduled Indian air companies a rebate of nine annas per imperial gallon of petrol with effect from March 1949, introduced the all up airmail system and the fact that freight in general had increased, most airlines were said to be incurring heavy losses prior to nationalisation.

COMPARATIVE TRAFFIC STATISTICS FOR 1938, 1945-53 of SCHEDULED AIR SERVICES IN INDIA

YEAR	ROUTE MILES	MILES FLOWN	PASSENGER CARRIED	FREIGHT CARRIED (LBS)	MAIL CARRIED (LBS)
1938	5,190	1,514,000	—	—	—
1945	—	3,320,277	24,080	852,068	480,616
1946	10,123	4,520,046	105,251	1,318,153	1,026,403
1947	11,790	9,361,673	254,960	5,647,562	1,405,073
1948	18,685	12,648,765	341,186	11,974,736	1,582,645
1949	19,387	15,098,354	357,415	22,499,679	5,031,989
1950	25,662	18,896,139	452,869	80,006,755	8,356,144
1951	30,044	19,497,505	449,462	87,665,229	7,181,611
1952	27,763	19,562,267	434,480	86,037,607	8,376,813
1953	27,406	19,202,388	403,992	84,820,083	8,846,181

Chapter 5

FLYING AND OTHER AVIATION TRAINING IN INDIA

There was practically no systematic modern civil flying or ground training in India before 1948. The flying clubs had some kind of training for pilots, ground engineers and mechanics, but it was not adequate in many respects. In post war civil aviation the flying club training of Commercial Pilots and Ground Engineers were found to be quite incompatible with the present requirements of civil aviation.

During the war, however, many received good flying as well as mechanical training from the air force. This was found to be an asset in the post war development. But the number of such personnel was not enough.

Taking the opportunity after the cessation of the War. flying clubs commenced training many commercial pilots without due regard for the requirement.

The Government was also coming into the field of civil aviation training. In 1946, it established an Aeronautical Communication School at Saharanpur. In 1948 a training school for civil pilots was opened at Allahabad.

The Saharanpur School was eventually closed and was absorbed into the Allahabad School in 1950, being renamed as the Civil Aviation Training Centre.

The Civil Aviation Training Centre now comprises four sections, viz. (a) Flying Training for Commercial Pilots, (b) Engineering Training for Aircraft Engineers, (c) Air Traffic Control

Training for Air Traffic Control Officers and (d) Communication Training for Radio Communication Operators.

In the context of the newly nationalised phase of aviation of India a new system of aviation training is necessary with a view to impart the best possible training with the least expense. A broad basis for such training is enunciated briefly.

TRAINING FOR PILOTS

Of all the aviation training this is the most expensive and laborious inasmuch as it is always elastic in its mode and a great deal of safe flying depends upon it. It has not been of the proper standard hitherto. It had suffered from a lack of correct attitude, being devoid of any national purpose. Flying in India was more of a game, or a glamorous adventure than a serious profession. Therefore, self praise, imagination and complacency had taken the place of reality, rigidity and accuracy. Although Indian civil aviation has grown out of its cradle, complacency is still its hallmark. We are inclined to feel that all is well with our civil aviation.

A majority of the civil flying instructors even today are not of the required standard, being most improperly trained by untrained instructors. When judged on this basis, the whole flying training system in India is found to be out of date and totally unsuited to the more rigorous modern conditions of flying.

By dint of a culturally sober temperament average Indians generally have the making of fine pilots. When properly trained they have proved themselves to be among the best in the world. In spite of this proud fact unfortunate mishaps have taken place in Indian civil avia-

tion owing to improper flying training. We may do well to admit this fact with all frankness, so that we may be able to avoid further mishaps and bring about a comprehensive system of modern civil flying training, organised and imparted by capable persons who are fully conversant in the trade of such flying training.

Indian Airlines Corporation and Air India International will require a supply of pilots every year according to their needs. This may be done in several phases, the first of which is the *ab initio* Training. Thereafter the training is to continue through two more phases, the Initial Airline Flying Training and the Advanced Airline Flying Training. For co-ordination, and for imbuing the airline character and spirit of flying, it is absolutely imperative that the latter two phases be imparted directly under the care and control of Indian Airlines Corporation or Air India International as explained later.

The First Phase of training must be of a general character so that it may be fitted into any new condition for further development. Whether the pupil wishes to be an Air Line Transport Pilot, or a Commercial Pilot for light aircraft engaged in various commitments such as anti-locust work, crop protection and chartered flying; or a flying instructor, he must inevitably go through this First Phase, being the primary standard condition.

On completion of the *ab initio* Training the pupil, let us say Mr. X, joins the Second Phase under Indian Airlines Corporation. He is now trained to fly the operating aircraft on which he is to be a member of the crew as a copilot, being graded as a Third, Second or First Officer, whichever the case may be.

During the whole period of service as a co-

pilot X is to be watched for his progress through a system of regular training and checks as necessary. This is his Initial Airline Training. When he becomes proficient in his particular work and shows promise he may then be transferred to the Third Phase or the Advanced Airline Flying Training with a view to train him to be a Captain on the required operating aircraft. In the same way as before he is to be watched again through a system of regular training and checks as necessary during the whole period of service in the capacity as a Captain.

Systematically, Air India International should draw the number of pilots required for their purpose from Indian Airlines Corporation, and then train them on their aircraft through the two phases of Initial and Advanced Training as in the case of the former.

The question now is, where are we to have these three phases of training? The following arrangements are suggested.

a. *ab initio* Phase : At the C.A.T.C. Allahabad. This will save the Corporations a great amount of extra expense.

b. Initial and Advanced Airline Training :

To avoid extra expenses on the part of Indian Airlines Corporation to run a fully separate training base on one hand, and on the other, individual expenses to the aircrew concerned, it is best to organise four training bases; one at each operational

headquarters at Calcutta Bombay, Delhi and Madras. In this arrangement a separate engineering section and aircraft are not necessary, thereby making possible the maximum utilisation both of men and aircraft. Furthermore, being at the main operational bases, the instructors can keep a direct touch with the flying or link training of each individual and they can be in a position to check the pilots consistently and mark their flying progressively. These four bases will normally have link trainers, which can be profitably used instead of having to establish several more such expensive sets of apparatus separately elsewhere.

OTHER TRAINING

All other technical training may be carried out on the same line. The first phase at the C.A.T.C., then the major phases at either of the three bases at Calcutta, Bombay or Delhi. Engineers, Radio Officers and Navigators, all of them obviously have to obtain their licences before they can be taken into the Corporations; but such personnel must be exclusively selected for service in the Corporations or other professional flying organisations prior to the commencement of their training.

With the exception of the first phase, the

training of the Traffic Assistants, Pursers, Stewards and Hostesses may be conducted at the three main operational bases mentioned above.

The matter of training the personnel of Indian Airlines Corporation, Air India International and other commercial flying organisations is very important, and it is hoped that all due considerations will be given to it.

Chapter 6

HINDUSTHAN AIRCRAFT LIMITED

The benefits which accrued out of the war were immensely insignificant to the path of ruins it paved. Ironically, the Hindusthan Aircraft factory was one such organisation which helped to boost the country's aviation to a very large extent as a result of the war. This aircraft factory which perhaps is the biggest in the East, was founded by Walchand Hirachand Brothers and a few others with the financial assistance of the Government of India and Mysore in 1940.

The original plan was to assemble Harlow trainers, Curtriss Hawk fighters and Vultee Bombers and to manufacture spare parts for these aircraft for the Asian markets. The plan however completely changed with the entry of Japan and the U.S.A. into the war in 1942. Asia became a hot bed of conflagration then.

The first plane to be assembled at H.A.L. was a Harlow PC5 which made its maiden flight in August 1941. Work on Curtiss Hawk Fighter was taken in hand soon after the start of the Harlow Programme. This aircraft went off the assembly line and did its first test flight successfully in July 1942.

The above programme evidently was that of assembly only. Actual design and manufacture by Hindusthan Aircraft was not invovled till then.

In 1942 the factory designed and manufactured a 10 seater troop carrier glider which was built entirely out of indigenous woods. The maiden flight of this glider was made success-

fully in August 1942. This programme was however abandoned later.

As the war spread to the Middle East and Far Eastern countries the Government of India took full control of the factory and in September 1943 they handed its management over to the United States Army Air Force.

The factory was expanded largely by the Americans, employing at one time over 15,000 men. The main function of the factory then was assembling, repairs and overhaul of various types of aircraft. The Catalina amphibians were also overhauled here. The volume of work of the factory at such time may be fathomed from the following work done between the autumn of 1943 and May 1945.

C. 47 Dakotas	repaired	and	overhauled	over	410
Light Bombers	,,	,,	,,	,,	375
Four Engined Bombers	,,	,,	,,	,,	175
Catalina Amphibians	,,	,,	,,	,,	55
Miscellaneous Aircraft	,,	,,	,,	,,	160
Allied Engines	,,	,,	,,	,,	3800

This output included repair and overhaul of all instruments, radio components and such other allied accessories. For one factory to perform such diverse kinds of repair and overhaul work on such a volume is a great credit to the organisation and the capacity of those who worked behind. A large majority of the technicians were Indians.

In addition to the above work, it is remarkable to note that, the factory manufactured 1500 jettisonable fuel tanks of all metal construction per month for Lockheed Lightening P38 and Curtiss Hawk P40 aircraft.

With the cessation of the War the management of the factory was handed back to the Governments of India and Mysore in December 1945.

The factory then started a new phase of work. The country was astir for aviational growth. Many war surplus C47 Dakotas were available for sale from the Government of India. A number of airlines came into existence and it then became the explicit work of Hindusthan Aircraft to completely overhaul these aircraft as well as convert them into civil airliners for flying in the Indian skies.

Hindusthan Aircraft since the termination of the War thus took the work of national importance—changing in tune with the political changes which were now taking place in India.

About 150 Dakotas were completely converted into civil airliners by them. And unhesistantly one must say it was excellent work.

On the achievement of political independence in 1947 the Indian Air Force expanded very much. Hindusthan Aircraft was called upon to undertake all the major air force overhaul repair and assembly work. As a result 100 tiger moths were reconditioned and assembled. The repair and assembly of a number of Hawker Tempest Fighters and initial overhaul of Dakotas and four engined Liberator Bombers were undertaken and completed very creditably in a short time.

Apart from these national commitments, Hindusthan Aircraft also cater for many air lines and air forces of friendly Asian and Middle Eastern Countries.

In 1949 Hindusthan Aircraft was called upon by the Government to undertake complete manufacture of about 50 Prentice Trainer aircraft under a licence from Percivals of the United Kingdom. The first Indian built Percival Prentice test flew on the 30th April in that year.

One of the most important tasks which

HT-2

THE FIRST INDIAN MANUFACTURED AEROPLANE

(P in circle indicates Prototype)

MAX. POWER: 155 H.P.

CRUISING SPEED: 110 M.P.H.

Designed and built by

HINDUSTHAN AIRCRAFT LTD.

Hindusthan Aircraft undertook was that of the actual production of a basic trainer. It was a matter of great importance. A beginning to be self-sufficient in aircraft production was now made.

The factory in 1948 undertook to design and manufacture a modern all metal basic Trainer aircraft named HT-2. Dr. V. M. Ghatage was the designer of this aeroplane, which is the first to be ever manufactured in India. Its specification incorporated many novel features such as push-pull rods for flight control and metal covered control surfaces. The prototype made its maiden flight on the 13th August 1951. On completion of its various successful test flights and ground tests HT-2 was granted by the Government on the 3rd January 1953, the first Type Certificate ever to be granted to an aircraft in India. A number of these HT-2 are already in service with the I.A.F. Many more are to be used by them for basic training.

The engines and instruments for the HT-2 were imported from England. These items will take a long time yet to be produced in India.

Among the present assortment of work in hand, Hindusthan Aircraft under licence from De Havillands, are also assembling the Vampire jet aircraft for the Indian Air Force.

As a subsidiary scheme the factory was also commissioned to manufacture all metal rail coaches, and at one time 10-15 such coaches were manufactured per month. Besides these, they have also produced bus bodies of their own design. In future it intends producing an advanced trainer, the HT-10, designing of which is already in progress. The factory now is a completely state owned property.

Hindusthan Aircraft presently employs

about 10,000 men and is now fully Indianised with the exception of a few foreign technical experts. It has supplied many valuable and excellent technicians to the airlines of India.

In line with all future developments, the nationalised airlines and this factory can be coordinated to serve the people of this great country as a great team.

Chapter 7

METEOROLOGICAL ORGANISATION IN INDIA

Meteorology is a subject of paramount importance in modern aviation. Its development in India is comparatively new, and also far reaching.

Before 1865 some kind of meteorological observations of temperature, rainfall and pressures were recorded periodically but such observations were generally taken by unskilled persons like court clerks, compounders and such government employees of district headquarters, and they were unreliable. On the other hand, the instruments themselves were much in error, as there was no system of checking their correctness in those days. Quite often these readings, erroneously recorded as they were, did not reach the desired place for a long time, thus rendering them completely useless for the purpose. During the Sepoy Mutiny (1857-1860) even this arrangement ceased.

Regular observations of the above data were recorded only at a few observatories established by the East India Company for scientific purposes. They were :

1. The Madras Astronomical Observatory. Built in 1792. it began meteorological observations in 1796. A continuous series of observations is available here from that date to the present time.
2. The Colaba Observatory. Built in 1826. Meteorological observations commenced here from 1841.

3. Dodabetta Observatory near Ootacamund.
4. The Calcutta Observatory. This was situated in the Survey Office Buildings, Park Street, in 1853. Meteorological observations were regularly recorded there until the completion of the present Alipore Observatory in 1875.

There was also an observatory established in Trivandrum in 1836. This one was originated by the Maharaja of Travancore. It began meteorological observations from 1842.

Such was the position of meteorological activities in India in those early days. Interest in meteorology then was mainly confined to recording of meteorological observations. There was yet no organised meteorological department. The force of circumstances in the meantime was more and more pointing to the need of a proper meteorological organisation in India under one controlling authority.

In 1857, the Asiatic Society of Bengal appointed a committee to discuss the problems of a concrete meteorological organisation. A report was submitted by this committee to the Government, which until that time was still a Government of the East India Company. But owing to the Mutiny no progress was made until 1862.

There were also other events which forced the issue home. In October 1864 one of the most destructive cyclones on record passed over Calcutta. 80,000 human beings perished as a result of the ensuing storm wave that rushed up the Hooghly river. In a few weeks time another cyclone followed. It passed over Masulipatam causing a death roll of 40,000 people. The great famine of Bengal and Orissa during 1866-67 was also a factor which proved the necessity of a

proper meteorological organisation. Hundreds of thousands died of starvation in this famine.

All these events progressively focussed the attention of the Government, which was forced to look into the problems. The people were groaning under the repression of foreign rule and lately the country had plunged into a state of violence to overthrow it. A commission, called the Sanitary Commission, was appointed by the Government to investigate the meteorological conditions in India.

In persuance of the recommendations of the above committee provincial meteorological systems were established in five provinces, *viz.*, (1) Punjab and North West Frontier Provinces in 1865, (2) Madras in 1866, (3) Bengal in 1867, (4) the Central Provinces in 1868 and (5) Bombay in 1871.

H. F. Blanford, the author of the great pioneering work *The Weather and Climate of India Burma and Ceylon*, who was then the Professor of Natural Science in the Presidency College, Calcutta, was appointed the first Meteorological Reporter of Bengal, while still retaining his position in the Presidency College. The causes of air currents over Northern India, temperature distribution in the country and the relations between the monsoons, south west and north east, were first detected by him. This was one of the most valuable contributions to the pioneer work on the meteorological conditions in India.

The existing provincial arrangements were eventually found to be inadequate, and many difficulties arose owing to their independent character, there being no proper co-ordination amongst them. It was finally decided to consolidate all the five meteorological organisations in the country into one organisation under the

central control of a Meteorological Reporter, designated as the Imperial Reporter. Blanford was the first to hold this new post and it was under his scheme that the foundation of the present meteorological organisation in India was virtually laid in 1875.

Under the new scheme the area of observation was increased, uniform methods of observations were adopted and the number of observatories were increased from 77 to 94 in 1877.

Calcutta, which now became the Central Observatory, began to collect the data daily by post from the observatories and prepared daily charts on barometric pressures, wind, temperature and rainfall. Calcutta also repaired and kept a check on the standards of all instruments used in India.

However, the charts prepared were useless for any practical meteorological purpose, having to be prepared several days after the observations were taken. This delay was due to late receipt of data by post. But it served to throw considerable light on the day to day change of weather. It had an important scientific value in those days in the research into the unknown domain of meteorology.

Arrangements were made in June 1878 for weather observations from 51 observatories to be collected by telegraph for the preparation of the 10A.M. weather chart, and a report entitled "The Indian Daily Weather Report" was printed from the inferences thus obtained. This report was circulated among the government officials at Simla every following morning.

Blanford's successor, John Eliot, made a valuable contribution to the research on cyclones in the Indian seas. He based his research on the reports from ship's log. His "Report on

the Vizagapatam and Bakhargunj cyclones of October 1876'' roused considerable interest in the scientific world. In the Bakhargunj cyclone 200,000 were drowned in half an hour by a huge storm wave, which swept across the island of Sandwip and the surrounding area.

During the years following 1890 many of the states also joined the scheme of meteorological organisation of India. Some observatories were also established in Burma and Persia at about this time. Those in Persia were exclusively for the study of the origin and progress of the cold weather depressions which entered India during the winter months and gave plenty of rainfall in Northern India and snows in the Himalayas.

In Bombay a daily weather report was published from 1887.

By the end of 19th century, the Indian Meteorological Organisation was fully established, having had its beginning in 1875.

Eliot was kinghted in 1903 for his valuable meteorological work in India. He wrote many original books on the subject. His last publication, *The Climatological Atlas of India*, was the most valuable of all, and it was considered to be a towering work on meteorology in those days.

From 1905 work on upper air began. The importance of upper air observations was stressed by Blanford a long time ago. This originally began at Karachi with the help of a kite to which were attached light self recording instruments for varying pressures, temperature and humidity. In 1907, this experiment was carried out during the monsoon at Belgaum and from a ship in the Bay of Bengal.

The first trial of the meteorological balloon ascent was made at Jhang (Punjab) in 1908. These balloons were let off with self recording

instruments and they brought back much valuable data of the upper air. Some of the balloons were lost, but a majority of them were found with the instruments and the reading made therein almost intact. In three cases there were some signs of penetrating through the region of stratosphere.

More experiments with upper air balloons were carried out at Jhang in the following years in all seasons.

In 1912, as an outcome of these astoundingly successful results of the above experiments, the first Upper Air Observatory in India was established at Agra.

It is interesting to know that the Indian mechanics of the Meteorological Department developed a lighter version of the self recording instruments which were originally designed by W. H. Dines for upper observations. This improved instrument was found to be very satisfactory.

During the period 1909 to 1923, there was nothing revolutionary that took place in the Indian Meteorological Department. Due to the War of 1914-18 the department underwent a reduction. One point to note however was that, a system of transmission of weather reports to ships by wireless began from 1914.

There was yet another important point. During the period in question, Indian Meteorologists were taken for the first time in the department, initially in subordinate capacity. Rai Bahadur Hansraj was probably the first Indian Meteorologist. He died in 1920. In 1922 four Indians were appointed as regular officers of the department. Turning back to the beginning of the century about 1905 mention must be made of Dr. Simpson, who was then the only other meteorologist in India. He was engaged on the

experimental side of meteorology. Dr. Simpson was provided with a laboratory at Simla. He was investigating electricity in rainfall in this laboratory.

It was Dr. Simpson who found the hitherto unknown cause of thunderstorm formation. He showed that the breaking up of water drops, carried upwards by vertical air currents, was consequently the factor behind the formation of electricity in thunderstorm clouds. Thunder and lightening were the results of discharge of electric potential from a positively charged cloud area to the negatively charged cloud or air. This was one of his classical contributions to the science of meteorology. In 1910 he joined Captain Scott's South Polar Expedition.

METEOROLOGY FOR AVIATION

Probably the first use of the meteorological organisation for aviation was made in 1926. Until then it was exclusively meant for ships at sea and general purposes on land.

In 1926 a meteorological office was established at Karachi principally to issue weather reports and forecasts for the flying sector, Karachi to Chabbar, on the Cairo-Karachi aeroplane service of Imperial Airways. At a later period the Government of India undertook the responsibility of supplying weather forecasts for the Basra-Karachi sector of the forthcoming Imperial Airways London-Karachi service.

The London-Karachi Air Mail Service started in April 1929. The same year in December started the Karachi-Delhi State Air Mail Service. To cope with these increased aerial operations a forecast centre was opened at Delhi in November 1929.

From 1934 more exclusive services of

meteorology were extended to aviation. With effect from the 1st October 1934 arrangements were made to broadcast weather reports at fixed times in respect of the existing main air routes as a routine feature. Later in 1938 the introduction of the Empire Air Mail Scheme and its associated developments in internal air services in India involved considerable extension and revision of meteorological arrangements existent at that time.

During the Second World War Indian Meteorological Organisation for aviation underwent many radical changes. Radio Sonde stations were established at Delhi, Poona, Allahabad, Veraval, Multan and Cuttack. Radio Sonde is a self recording radio apparatus for recording upper air data on temperature, pressure and humidity.

When the hostilities ceased Indian Mteorological services to aviation were reorganised on a regional basis. Seven regions in all were established, with their centres at Calcutta, Bombay, Karachi, Lahore, Madras and Nagpur. With the partition of India these regions were rearranged ; the whole organisation was also vivisected. This was done in the following manner.

	India	Pakistan
A type forecasting centres	6	2
B type forecasting centres	3	—
C type forecasting centres	5	1
Auxiliary centres	12	5
Aerodrome reporting stations	40	8
Pilot balloon observatories	50	14
Surface observatories	222	82
Seismological stations	4	1
Radio Sonde stations	12	3

Some meteorological stations outside India were maintained by the previous Indian Meteorological Department. Out of these, the stations in Iran, Persian Gulf, Saudi Arabia, Afghanistan and Eastern Turkestan were given over to the Pakistan Meteorological Services. Those in Tibet and Sikkim were retained by the Indian Meteorological Department.

As stated before, there were seven meteorological regions in the pre-partition days. Pakistan now took over with some readjustment of Karachi and Lahore regions and a part of Calcutta region. There now remained five regions in India, viz., those of Calcutta, Bombay, Delhi, Madras and Nagpur.

In 1949 many important changes were made in the organisation in line with the World Meteorological Organisation. Since the 1st January 1949 new system of international meteorological codes came into force in India.

The following figures of forecasts issued will give a rough idea of the volume of work done for aviation by the forecast centres in India.

	Forecasts issued.
1935-36	8,624
1944-45	110,000
1945-46	80,000
1946-47	54,000
1948-49	64,000, Dum Dum issuing the maximum number of 20,250.
1953	Dum Dum alone issued 49,975 aviation forecasts.

INDIAN CLIMATE

Meteorology is one of the most difficult branches of modern science. Its elements are yet not understood fully. Vigorous research into their causes and effects are in progress and

in many of its aspects it is still vague and unaccountable. It is still not in the full grasp of our human knowledge. It is therefore easy for a common man to misrepresent mteorological facts. In our country ignorance in this subject is predominant.

Quite often one may come across in newspapers, even in some of the best ones, meteorological pehenomena being wrongly interpreted. For example, to mention some very common ones; severe thunderstorms are termed "Cyclones," sometimes "Cyclones" are called "Whirlwinds", or the "Nor'Westers" which are probably the severest type of thunderstorms in the world are just called "Squalls."

It is not in the scope of this book to go into the various conditions of the weather or climatology of our country. Only a broad basis is given here.

(A) MONSOON, JUNE—SEPTEMBER

In India the most important weather phenomenon is the Monsoon which covers the period of four months from June to the end of September. Starting with the West Coast of the Peninsula, and Bengal and Assam from about the first week of June, the effect of the monsoon gradually pervades almost throughout the whole of India by the end of July spreading north and north-westward. From the end of September the system starts retreating. The priod October—November is, hence, termed officially as the Retreating Monsoon Period when South India, especially the Coromandel Coast, receives rain from the North-East Monsoon Wind. (The period June—September is the South-West Monsoon period).

During the monsoon the country receives sufficient rainfall, the maximum being in Bengal,

Assam, the Gangetic Valley and on the West Coast, and the minimum in Rajasthan area. In the Bay of Bengal during this period many depressions form. They are called the Eastern or Monsoon Depressions. These depressions generally travel north-westward across Orissa, Bengal, Bihar, Madhya Pradesh, depending on their track, and some of them travel overland right across North-West India giving torrential rain all along its path. They are some of the agents, which utilise the moist monsoon wind to produce rainfall in India.

The monsoon period brings about four months of difficult flying conditions practically throughout the whole of India, at sometime or the other, though the weather in South India, excluding the West Coast, is comparatively better than the rest of India during this period.

Evidently, the monsoon is not a steady current. It comes in pulses. Weather condition over a region therefore may vary within very wide ranges during this period.

(B) CYCLONE AND RETREATING MONSOON PERIOD, OCTOBER—NOVEMBER

Cyclones are a form of Tropical Revolving Storms, which originate in the Tropical belt of the Indian Ocean and travel towards Eastern India up the Bay of Bengal. They generally travel north-westward, and are often known to have curved northward or north-eastward. Cyclones, Typhoons or Hurricanes are meteorologically the same phenomena—Tropical Revolving Storms. They are differently called in respect of the localities where they occur. In the Indian Ocean and the Bay of Bengal they are called Cyclones. They are known as

Typhoons in the Pacific area and as Hurricanes in the West Indies region.

Cyclones, the severe types particularly, occur generally during the months of October and November, which period in Indian climatology is termed as the Retreating Monsoon Period, though they are not unknown during the monsoon and pre-monsoon periods. Many cyclones have wrought disasters to the coastal regions of Bengal, Orissa and Madras. Some of them travel far inland and bring much needed rain to the country across its path. Cyclones produce hazardous flying conditions.

(C) COLD WEATHER PERIOD, DECEMBER—MARCH

The four months from December to March are climatologically the winter months of India. This period, despite some fog in East India and the Western Disturbances* of North-West and North India, is the best part of the year for flying.

(D) PRE-MONSOON PERIOD, APRIL—MAY

The period April—May is known as the Hot Weather Season or the Pre-Monsoon Period. The land is now sufficiently hot and conditions are very ripe for severe thunderstorms or dust storms. It is in this period that we generally have the famous Nor'Westers of Bengal (Kalbaishaki in Bengali, meaning the Messenger of Death in the month of Baishak). These storms generally originate in the hilly regions of the Bengal-Bihar border in the early afternoon and then sweep across in a south easterly direction to meet the Bay where they gradually dissipate.

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*"Western Disturbance" is a frontal type of depression which originates in the Medeterranean zone and then travels across Persia into Northern India and the Himalayan regions, sometimes stretching its effects as far as Assam.

The name Nor'Wester is derived from the direction North-West from which these storms approach. They are one of the most violent form of thunderstorms in the world. Wind speed in excess of 100 miles have been recorded on the ground.

In the "Thunderstorm Project" of the U.S.A. vertical up drafts and down drafts of above 60 miles per hour has actually been measured in thunderstorm cells. As the Nor'Westers of Bengal are known to be one of the severest types of thunderstorms, it is quite likely that vertical draft speeds, much in excess of this exist in them. They are hazardously turbulent for flying. A comet was lost on the 2nd May 1953 as a result of structural damage while flying through one such Nor'Wester.

Nor'Westers are predominant in the hot season, but storms of the same structure and peculiarities also occur during the monsoon and other seasons. They are not remarkably violent like the former, and therefore are not given any particular reference in weather forecasts and reports.

These are the general climates of India. They are not always easy to forecast. As stated previously the science of meteorology is still in its infancy. In addition, Indian Meteorological Department has domestic difficulties, arising out of national economy. The system of transmission of weather data from observatories is not sufficiently speedy; the number of these observatories are also not sufficient; besides, meteorological research work in India is yet not adequate. These make the work of the meteorologists in India difficult.

In spite of these unavoidable drawbacks our weathermen have rendered brilliant and in-

valuable service to the nation, and their work is held in high esteem by the meteorological world.

The meteorological organisation in India in general, and particularly for aviation, has grown tremendously during the past seven years. Its utility in the progress of mankind today is conceived by many; many at the same time are completely unaware of its implications, while many more are ignorant of the climates of our land.* To obviate this ignorance it may be found expedient to include Indian climatology in our school and college curricula as a compulsory subject.

*Technical details regarding the Meteorological Organisation in India for aviation are given in the Appendix at the end of the book.

Chapter 8

FLYING CONTROL IN INDIA

In the post war days a meagre and an extremely conventional form of flying control existed in India. The War brought the change. A new system of flying control was evolving on a world basis and India also took to the general progress.

During the War, flying control in our country was mainly under the care of the R.A.F. It was taken over by the Directorate of Civil Aviation in June 1947 and has been under this department ever since.

The Air Traffic Control (ATC for short), as it is known today, is responsible for the safety and control of aircraft in the air and on the ground. In India it had its origin in 1931, when some kind of flying control system was organised for the four controlled aerodromes of Karachi, Delhi, Allahabad and Calcutta—all along the Imperial Air Route across the country. Today there are about 75 aerodromes manned and controlled by personnel of the Directorate General of Civil Aviation.

Out of these, Dum Dum (Calcutta), Santacruz (Bombay), Juhu (Bombay), Palam (Delhi), Safdarjung (Delhi), St. Thomas Mount (Madras), Tiruchirapalli, Vishakapatanam, Agartala, Ahmedabad, Patna, Jodhpur, Amritsar and Bhuj are presently the 14 customs airports in India. An aircraft entering or leaving India must do so through any one of these aerodromes, provided all state formalities are complied with.

Dum Dum, Santacruz and Palam are the

three full fledged International Airports of our country conforming to international specifications.

Radio aids in respect of the control of flying and air navigation in India, are proportioned to the economy of the nation. With the exception of the very modern facilities, almost all the standard navigational radio aids are available in India, and they are good enough for our purpose at present.

HOW IT IS DONE

According to the prescribed system of Air Traffic Control, India has been divided into four regions, called the Flight Information Regions (F.I.R.), with their Flight Information Centres at Calcutta, Bombay, Madras and Delhi. The function of this Centre is to provide various operational information regarding weather, flight of other aircraft in the vicinity and such matters relating to the safety of the aircraft concerned within the respective region.

Within these four regions each controlled aerodrome in India has one or more specified air spaces—the Approach Control Zone and the Control Area. In addition, there is also the Aerodrome Control Tower which controls aircraft on the ground and in the vicinity of the airfield. The Approach Control is responsible for the control of aircraft up to 50 miles from the airfield. For some aerodromes this may extend only up to 25 miles. Beyond the 50 miles radius of the Approach Control Zone (of the four F.I.R. centres) is the Control Area, which has a radius of 100 miles from the airfield concerned. Dum Dum, Santacruz, Safdarjung and Madras only have Control Areas.

All these services are operated on Radio Telephone. The Aerodrome Control works on Very High Frequency Radio Telephone (VHF R/T) channel 118.1 megacycles (mc/s), Approach Control operates on VHF R/T channel 119.7 mc/s and the Area Control on 119.3 mc/s. The last mentioned is limitedly in use at Dum Dum and Santacruz. Two of the Area Controls—Dum Dum and Santacruz—generally operate in combination with the Approach Control on 119.7 mc/s; while Madras and Delhi Area Controls are normally operative on Wireless Telegraphy.

Dum Dum and Santacruz have separate Aerodrome, Approach and Area Control units on VHF R/T. At the other two Area Control Centres, that is, at Madras and Delhi, the Aerodrome and Approach Control units are operated jointly on VHF R/T, but the Area Control on Wireless Telegraphy. Most of the other aerodromes also combine their Approach Control with the Aerodrome Control (which operates on 118.1 as mentioned before), the latter performing both the functions.

An aircraft departing or arriving is respectively controlled by the Aerodrome Control, Approach Control and the Area Control (if this exists at the airfield concerned) and vice versa until it has landed when inbound or it is handed over to the F.I.R. Centre on its outbound flight.

The system is illustrated by an example of an aircraft proceeding to Nagpur from Calcutta. Several formalities are to be complied with before the aircraft can move out of its base.

The pilot is required to file a Flight Plan on a prescribed International Civil Aviation Organisation form and submit the same to the Air Traffic Control authority. It is required to be signed by the Meteor-

ological Officer for having issued the pilot concerned with the weather forecast enroute and briefing him on the general meteorological conditions; by the Communication Officer for having briefed the Radio Officer on wireless communication matters, and finally by the Air Traffic Control Briefing Officer.

The last mentioned briefs the pilot regarding weather warning, serviceability of airfields enroute and such operational matters. He may always suggest an alternative to the flight plan in consideration of the safety of aircraft in flight.

With due regard to the wind forecast obtained from the Meteorological Officer, the Safety Height and other operational considerations, the pilot decides on the altitude to fly. In the case of Calcutta-Nagpur route, the safety height is 4500 feet above mean sea level. This height is 1000 feet above the highest terrain within 20 miles on either side of the track. Our pilot decides to fly at 8000 feet. A good margin of height is always allowed for safe flying in conditions of bad weather or while flying at night. There is also another rule required to be observed in deciding the cruising altitude. To prevent risks of collision in the air in bad weather conditions or at night, varying cruising altitudes are assigned to aircraft. Between the magnetic track of 000° to 089° an aircraft must maintain a height in odd thousands of feet, i.e., 3000, 5000 feet, etc. above mean sea level; between the magnetic track of 090° to 179° it is odd plus 500 feet, i.e., 3500, 7500 feet and so on; between 180° to 269° the cruising altitude must be even thousands of feet, and between the magnetic track of 270° to 359° it is even thousands plus 500 feet. In fair weather condition the pilot need not always comply with the above regulation.

Accordingly, the cruising altitude for our intended flight to Nagpur (the magnetic track to which place is 260°), must be some altitude in even thousands of feet. At the same time this level must be above the safety height. Therefore, the minimum cruising level for our aircraft on our proposed flight is 6000 feet. Our pilot, however, wishes to maintain 8000 feet in order to avail himself of a favourable wind, which increases the ground speed of the aircraft.

We are now ready to depart. The aircraft, on starting its engines from the base, obtains permission from Dum Dum Tower, which is the Aerodrome Control Unit, on VHF R/T channel 118.1 mc/s for taxying out, taking off and such other purposes.

When the aircraft leaves the vicinity of the airport she is handed over to the Approach Control Centre. Dum Dum Approach Control then controls the aircraft up to a distance of 50 miles, which is the limit of its control. Beyond this is the Control Area. At present the same Approach Control unit (operating on VHF R/T 119.7 mc/s) generally controls the aircraft up to 100 miles limit. i.e., up to the limit of the Calcutta Control Area. The aircraft then enters Calcutta Flight Information Region. It now switches off the R/T and maintains a continuous Wireless Telegraphic Communication with Calcutta Flight Information Centre (which function in India at present is performed by the Area Control Centre).

As long as the aircraft is within the Calcutta Flight Information Region, she will report her position to the Calcutta Area Control Centre hourly by day or half hourly by night or as per previous instructions, and be in contact with it throughout its flight.

In flight, the Radio Officer also obtains weather messages every hour, and whenever he sends a position report the existing weather at the place is transmitted to the Area Control. Apart from these routine wireless transmissions various other operational messages also pass between the aircraft and the Area Control Centre. As the aircraft crosses 83° E Longitude, which is the demarcating longitude between the Bombay and Calcutta Flight Information Regions, Bombay Area Control accepts the responsibility of providing Flight Information to this aircraft.

Nagpur will exercise control on our aircraft when she is within 50 miles of there. That is the limit for the Nagpur Control Zone. The aircraft now once again changes to Radio Telephone, and it remains in constant contact with Nagpur until it has landed.

The men who control flying in the Indian skies are a band of young men, a number of whom are ex-Navy or Air Force Officers. When in 1947 flying control was handed back to the D.G.C.A. by the R.A.F., it was only a handful of such young men who bore the brunt of the whole organisation without proper training and against many odds. They fulfilled their commitments in a most commendable manner.

At present the Air Traffic Control Services are quite well organised and they now handle a heavy traffic, probably the heaviest in Asia. It is fine work.

INTERNATIONAL CIVIL AVIATION ORGANISATION AND INDIA

India is a member country in the International Civil Aviation Organisation. All new systems and procedures for the control and operation of civil aviation in India, therefore, are

guided by ICAO. She is not yet prepared for a full application of ICAO rules and procedures, but she has implemented almost all the annexes formulated by them as shown at the end of this book.)

ICAO came into being on the 4th April 1947, under the initiative of the United States Government. In short, its aims are to standardise world aviation rules, to set up a uniform system of air traffic control and to bring up the technical standard of all member countries to a uniform level. ICAO, virtually, is but a machinery to establish superior aviation facilities all over the world in order to be particularly helpful to the few aviationally advanced Western countries so that, they can spread a complete network of air routes for their airlines. Aviationally inferior ICAO member states are obliged by circumstances to undergo heavy expenses for various constructions and facilities.

ICAO was sponsored by the U.S.A. By virtue of her influence in world aviation, many of the American systems have been incorporated in it. This brings about a sharp contrast and many difficulties. Between American aviation system and that of any backward state the difference is too wide. To fill such a gap is not always economically feasible.

Essentially, the greatest achievement of ICAO lies in its attempt to standardise various aviation rules and procedures. It is in the interest of all nations that most of the civil aviation rules and procedures are standardised. But it must be mentioned also that many of its rules and procedures are unnecessarily complicated and they lack simplicity and universal appeal.

Chapter 9

SERVICE FLYING

This book basically deals with civil aviation in our country. But a mention of military aviation will not be out of place as information.

NAVAL AVIATION

Naval aviation in India has started only in recent times. A full fledged aircraft carrier force is contemplated as a future development. This fighting service now possesses a fleet of ten Shorts Sealand amphibians for the purpose of Target Towing, Air-Sea Co-operation and such naval air operations.

ARMY AVIATION

The army has a small flying organisation with its headquarters at Deolali for the purpose of artillery reconnaissance and other army observation work.

THE INDIAN AIR FORCE

Under the British Rule in India the formation of the Indian Air Force was taken in hand a long time after the cessation of the First World War. On the 1st April 1926, the Skeen Committee, which included among its members Motilal Nehru and M.A. Jinnah, recommended the formation of an Indian Air Force. It took five years to give full effect to the recommendation.

As a result of an Act of the Legislative Assembly, the Indian Air Force came into existence in 1932. Its first Flight (a portion of

a squadron) with 3 aircraft was formed on the 1st April 1933 at Karachi.

The first six officers to be selected for the newly born Indian Air Force were: Sirkar, Subroto Mukherjee (now Air Marshal and the Commander-in-Chief of the I.A.F., being the first Indian to hold this position), Bhopindra Singh, Awan, Amarjit Singh and Tandon. They were sent to England in 1930 for training at Cranwell. Nine months later Engineer (now Air Vice Marshal) joined them.

In those days the training of the Indian Air Force pilots was undertaken at Cranwell. All the young men did well for themselves there and when their course was over Engineer was awarded the Gove's Memorial Prize for the best all-round pilot of his time.

Others who followed the pioneers were Majumdar, Henry Ranganaden, Prithipal Singh, Narindra, Bulbul Khan, Mehar Singh, Arjan Singh, Ravindra Singh and Goyal. They were also trained at Cranwell.

Majumdar commanded No. 1 Squadron of the Indian Air Force in Burma in 1942 and won the D.F.C. for his gallantry there. This was the first award of the Distinguished Flying Cross to an Indian Air Force pilot. The first Indian to win the D.F.C. was Indra Lal Roy, who was in the Royal Flying Corps. On his return from Burma, Majumdar was promoted to the rank of Wing Commander. He was killed in an accident in a demonstration aerobatic flight over Lahore in 1945.

During the War an Indian Air Force Volunteer Reserve was formed. The officers of this reserve force initially manned the Coastal Flights in Calcutta, Bombay, Madras, Cochin and Karachi together with the R.A.F. person-

nel, and the squadrons engaged in the North West Frontier Province. 24 of the Reserve Officer pilots were sent to England in 1940 to undertake duties with the R.A.F. in England.

The Indian Air Force, since the 15th August 1947, is an independent command under a Commander-in-Chief of the I.A.F. In the days of British Rule, it was under the Commander-in-Chief of India who controlled all the three services. The arrangement is different now. Each service, the Army, Navy and the Air Force, is now headed by a Commander-in-Chief of its own. He is separately responsible to the Defence Ministry.

CHAPTER 10

AIRLINE OPERATIONS IN INDIA—1949

(Condensed from the *Amrita Bazar Patrika*, 21st November 1949)

With the recent collapse of two Indian airlines in quick succession and the position of a few others being none too satisfactory, there seems to be some uneasiness in the aviation business in India.

It is clear now that many air companies were formed in the post war period without proper planning and without much knowledge of the industry. Easy money earned during the War was invested much too aimlessly and without forethought. With the end of the War, in addition to the three existing companies, ten new ones came into existence.

The new ventures were mostly supported by businessmen who saw in civil aviation one of the most fruitful fields of investment for the huge profits they made during the War. To them running an airline seemed much the same as that of a jute or cotton mill or a bus service. Results, as experience showed, were not at all happy. Besides taking advantage of the ignorance of the investors, many adventurers and opportunists, including a number of foreigners, found their way into various executive positions in the new companies. These executives in most cases were inefficient and inexperienced in the trade. What was worse, some of them were corrupt. In several cases downright corruption on the part of executives as well as directors of companies was the main cause of failures.

There were executives who bought as many aircraft as they could from the disposals without calculating to what figures the expenses would run to service them for airworthy condition and how much recurring expenses they would incur to maintain them without fruitful operations of scheduled routes and whether they could sustain such expenses. There was one company which bought as many as an assortment of about 45 aircraft. The same company, even when staggering for existence, bought one four engined aircraft to operate on an international route. Results—a headlong crash !

There were also instances of employment of too many personnel and of paying salaries to executives, pilots and engineers at rates much higher than they deserved for their experience and merit. Another important clog in the wheel of progress of aviation in India on sound, prosperous and efficient lines, was the presence of too many foreign technicans in the field. In India about 70 per cent of the pilots in the aviation line today (1949) are foreigners.

The question of nationalisation of airlines in India has not been finally settled. It is widely felt that sooner or later they will all come under state ownership. Some are of the opinion that rationalisation rather than nationalisation would be the better policy, meaning a reduction of the number of air companies to three or four and reallocation of the routes in a balanced manner to them, allowing no cut-throat competition and no low utilisation of aircraft.

Rearrangement of air fares is another primary necessity for the improvement of the scheduled airlines in India. They are generally high, and are too high on a number of routes.

Most airlines seem to be unwilling to reduce fares. They abhor it, thinking that it will greatly reduce their income. On the contrary, by keeping a high rate of fare the number of passengers is reduced, hence a reduction in the total income is caused.

In many cases air fares were fixed without due consideration of the operational costs incurred by the carrier, the distance, traffic potentialities and the trend of future economy of the country.

By maintaining the rate as low as possible, a greater number of passengers is obtained and the total earning of a company definitely increases by an appreciable percentage. On short haul routes this is more obvious. For example : the present fare between Calcutta and Dacca by air is Rs. 50 per passenger and there are three daily services. The average number of passengers per service now, say, is eight at the rate of Rs. 50 per passenger. If this fare is reduced to Rs. 40 an easy increase of traffic by 50 per cent is quite possibly effected. That is to say the number of passengers will be about 12 instead of eight and the income will be Rs. 480 rather than Rs. 400.

Furthermore, air fares in various cases are not thoughtfully fixed and are considerably out of proportion. In the same example of the Calcutta-Dacca route, one can see that the fare between these two places, a distance of 146 miles, is Rs. 50 ; whereas it is Rs. 54 to Chittagong from Calcutta (a distance of 217 miles), and between Madras and Bangalore, which are 170 miles apart, it is Rs. 40.

Such examples are abundant in Indian aviation. Rates were more or less fixed traditionally from the pre-War and mid-War experience of the two airlines operating in those days. When

the operating companies complained of unprofitable operations they were allowed to increase their fares. Thus the air fare between Bombay and Calcutta was increased to Rs. 255 from Rs. 195 at random. Such enhanced rates of fare definitely retarded the natural increase of passengers. Statistics have proved it.

There is another important aspect of reducing the fares to the possible minimum. It will enable a greater number of people to travel by air which hitherto has been limited mostly to the rich and high level government personnel.

CHAPTER 11

BENGAL ASSAM OPERATIONS—1950

(Reproduced from the *Amrita Bazar Patrika*, 26th February 1950)

Assam was always dependent on Calcutta for its essential commodities. It is more so now on account of international complications. There are presently two means of going or sending goods to Gauhati or other places in Assam. One is by the newly opened Assam Rail Road Link. It takes a person two days to reach Gauhati from Calcutta by this route. The other is by air.

Towards the end of 1949, transhipment of cargo to Assam areas across East Bengal was prohibited by Pakistan. This caused a huge accumulation of various merchandise in Calcutta. Trade between Assam, North Bengal and Tripura on one side, and Calcutta on the other, had almost ceased for a while. Such a situation called for an emergency aerial transhipment and the Indian air companies undertook the task immediately.

With the return of normal conditions, and the Assam Link Railways running daily goods and passenger services, this air traffic will enevitably fall, but it remains to be seen whether the importance and the usefulness of air freighting within or across the Bengals will ever abate. Though expensive, as it is today, it is most certainly the safest and by far the quickest way of sending valuables, perishables and essential goods from Calcutta to places in North Bengal or the Assam valley.

Prior to December 1949, the amount of freight transhipped from Calcutta by scheduled and charter air companies was approximately 150,000 pounds per day, an appreciable share of this being for Gauhati alone. The load since has increased to 750,000 pounds per day; that is five times as much. A visitor to Dum Dum airport can find truck loads of cargo including cloth, *gur*, vegetable *ghee*, biscuits, medicines, machineries, powdered dye for *Holi* and such items of merchandise awaiting transhipment just outside the parking bays for freighters. The incoming loads, consist of oranges, tea, *supari* and *tejpat*.

Before January 1950, there was no such place as a "Freighter Bay" at Dum Dum airport. Freighters were loaded and unloaded at the usual berths allotted for internal passenger aircraft. It became almost impossible to accommodate the passenger aircraft together with the freighters comprising all the scheduled operators, namely Air India (Bombay), Airways India (Calcutta), Air Services of India (Bombay), Bharat Airways (Calcutta), Deccan Airways (Hyderabad), Himalayan Aviation (Calcutta), Indian National Airways (Delhi), Indian Overseas Airlines (Bombay), Kalinga Airlines (Calcutta); and the charter companies, Jamair and Indamer. A special area was, therefore, demarcated by the Aerodrome Officer exclusively for freighters.

The bulk of the present freight operations from Calcutta may be gauged from another comparison. Previously the normal aircraft movements at Dum Dum, including both take offs and landings, were about 70 to 80 per day; now (February 1950) it varies between 200 to 230 per day. Handling of this increased air traffic by the

existing number of control officers and men is a mark of a very high standard of efficiency which has no parallel in the record of Indian aviation.

In normal course, supposing there existed no international difficulties and barriers between East and West Bengals, most of this cargo, which is a great deal more than the pre-War days' level, would have been despatched by train-cum-steamer services ; and though the journey is lengthy they would have taken the greater bulk of the load. Yet air freighting in this part of old India would have assumed a position quite peculiar to other parts of the country. If these states had agreed on friendly terms, Dacca could have been linked with Bagdogra and Gauhati for the carriage of passengers to Darjeeling, Shillong and vice versa, in addition to a substantial amount of freight, including fish.

While flying right across East and West Bengals in several directions, an open minded observer, having some knowledge of both the countries, will be struck by their close economic link and by the difficulties of road transportation, particularly in the lower parts of both Bengals. Steamers are too slow and cannot be navigated in all waters throughout the year. Air transport would have been supreme in their utility in these areas.

Further, freighting by air being very much quicker than that by surface transports and freight charges not being too high for short distances, and in consideration of the above difficulties, many items of daily necessities could have been lifted by air from place to place in the Bengals and Assam. A certain amount of oranges from Bagdogra, Gauhati, Shella or

Sylhet; fish from Dacca and the *Haors* (marshes) of Sylhet and Mymensingh districts and those of the adjonining areas ; birds fowl, eggs, vegetables, medicines, newspapers and mail could be flown to a large extent.

The Bengals provide an excellent opportunity for short haul services with light amphibian aircraft having about eight to ten seats. They may be used for the carriage of passengers, mail and freight between important places not feasible to be connected by land planes. But the greatest utility of such services would be in the carriage of fish from the unexploited natural fisheries of East Bengal to the large fish eating cities of Calcutta, Darjeeling, Gauhati and Shillong. These aircraft could land in the Padma for *Hilsa*, in the huge *Haors* of Mymensingh and Sylhet and other areas, and load fish straight from the fishing points. The cargo could then be transhipped to the above and various other places, if necessary, through Dacca or other airfields by larger aircraft. Such transportation of foodstuff and other daily necessities both ways across the border is in the interest of common millions.

The partition has severely disrupted the economy of the two ill fated Bengals. Discretion in the use of civil aviation could have partly helped the economic readjustment. But, alas ! Who is there to bell the cat ?

The orange growers of Assam normally sent their oranges to the markets of East Bengal and other places outside through East Bengal. Oranges grown in the southern foothills were almost all taken by East Bengal via the orange market of Sylhet. But this year, owing to the strained inter state relations, these oranges did not go there. This fruit is the main source of income for the people of the aforesaid foothills.

No market for them meant acute economic distress in the area concerned.

The Government of Assam in conjunction with the Central Government immediately came forward with assistance. A fair weather strip, a little over 1000 yards long and about 100 yards wide, was made ready within less than a fortnight, entirely with the help of the local population. This strip is situated on the bank of a river, a few miles south of a picturesque village called Shella lying on the hill slope. Named after the village, Shella landing strip marks the meeting ground of the hills and the plains, and it is only 80 feet above sea level. Cherrapunji, which records the world's heaviest rainfall (mean of 426 inches per year), lies approximately 12 miles north east of this place on a 5000 feet hill-top.

Shella is 65 miles due south of Gauhati aerodrome by air. Aircraft from Gauhati land here empty and take off for Calcutta with full loads of oranges, probably the best of their kind in India. This operation is somewhat difficult due to the strip being short and soft, but it is carried out cheerfully by a band of willing air crew.

Assam, as a close neighbour to the Bengals, provides an equally important ground for a healthy growth of aviation. An air link between Calcutta and Assam has great commercial importance. It is a country rich in resources, having great productive potentiality. Assam is one of the world's largest tea growing areas and is rich in undeveloped minerals. It is a rich country with poor people.

Flying in the Bengals and Assam is not always comfortable on account of the severe Monsoon, Cyclones and the menacing Nor'

Westers; but these are fascinating lands. Amidst its green fields and the flowing rivers, live the humble dwellers in their frail huts with centuries of poverty and want. Their music and their poetry of life are mingled with the soft music of the everchanging rivers, the *koel* and the south wind.

Chapter 12

WHERE ARE THE PASSENGERS?

(Reproduced from the *Indian Airways Magazine*, October 1951)

Civil Aviation, or for that matter any industry, of any country must develop in accordance with the economic capacity of that country. That is a very fundamental rule and the basis on which is planned all progressive moves for any physical growth for the benefit of the people. Disruptive results are bound to emanate from any disregard of this common principle. Even if an industry is forcibly advanced by sheer support of money from enterprising men, it is bound to roll back to its natural level at which it can sustain itself with ease. To indulge in such practice would be wasteful luxury.

The basic need, however, is not the growth of industry through the people. It is quite the other way round. The progress of a people comes through the economic growth and utilisation of the basic industries of the country. Most industries grow on competition and direct money making propositions. The financially strongest one stands out and the rest fade away into oblivion. That is mainly the picture, and generally they do not always serve the requirements of the nation.

We find ourselves in the same situation regarding aviation, remembering that civil aviation is in no way a basic industry. It will take its shape according to the economic necessities. Unfortunately, not being planned economically

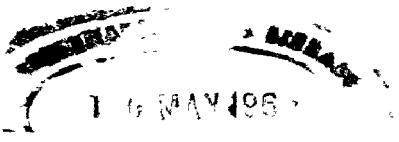
by statesmen and economists, there is none to tell us "thus far and no farther." Hence there are lots of gropings in the dark, pitfalls and wastage.

We must not compare our conditions of aviation with any Western country, including Australia; for there exists a clear line of demarcation in all respects between the general conditions of the West and the Asiatic countries. And this gives rise to different problems right from the outset.

In countries like India, Pakistan, Ceylon, Burma, Malaya, Indonesia, Indo-China, Siam, Japan, Korea, Afghanistan, Persia and all states of Middle East ; political conditions, with a few exceptions, are greatly alike. In Asia there are countries with great wealth, yet the peoples there are in abject poverty.

The major part of Asia, even today when there is so much talk about peace and freedom, is more or less under forces of domination in some form by one or the other of the big Western powers. This aspect brings the economic conditions of the Asiatics, excepting those of China, almost to one level. We have to keep that in view when we talk of Indian civil aviation.

To utilise aviation to its fullest capacities for the good of mankind, not in terms of war, a country has to acquire a certain minimum economic stability and self-sufficiency. It is more so in Asiatic countries because here the people are poor, they do not possess aircraft manufacturing industries and they do not have most of the materials they need for such a purpose in their own hands. For them air travel is rare, limited only to the rich and to high level government officials. Aviation as a means of travel in Asiatic countries hence is not of vital importance just as yet. Ironically, its greatest utility then



lies mainly in defence, as far as it is concerned with the benefit of the people of Asia.

On the civil side, the subcontinent of India and Pakistan is probably the most aviation minded country in Asia. Here too the problems are apparent and it suffers from the same inevitable drawback of civil aviation being utilised mainly by the rich, thus keeping alive the possibilities of quickly coming to the saturation point. The number of rich men is not likely to increase in the future. and if the number of air passengers are dependent on them in direct proportion they are also not likely to increase any more. In India this point of saturation seems very near or has already been reached (writing in 1951).

Attention is now directed towards the possibilities of freighting. But how much freighting for commercial purpose can there be in a poor country where the air freight charges are so much more than those of surface transports? The consumer has to pay more for the extra freight charges on all merchandise transported by air. It is, therefore, not a basic economic solution for the eradication of national poverty. To the contrary it may aggravate the problem.

Air freighting in India has always boomed during some calamity or other like flood, famine, evacuation, earthquake or international mishaps. In normal times it inevitably retracted to its limits. This only proves that aviation cannot grow without a direct relation to the environment. It can only grow spontaneously by the natural force of necessity. To boost commercial aviation through artificial means would be a burden on the people. and it would be a negative policy.

Unless there is a structural transformation in the economy of the country, the utilisation of

aviation cannot be stretched far beyond the present scope. Carriage of more passengers and freight can be affected only when aviation is an industry of the nation entirely for the benefit of the nation. and when it functions in harmony with national developments.

It must be a subsidiary aid to the people in their economic growth as well as in their misfortunes. It can then be engaged, besides the carriage of normal passengers and freight, in emergency food supply; relief work; transportation of perishable foodstuff; agricultural, medical and scientific work; the destruction of locust menace; crop protection work and such other. These are not commercial propositions, as you can see for yourself. They cannot be fostered individually. It is a part of national economy and therefore only the state can handle it.

Lately there has been a tendency on the part of airline operators in India to reduce passenger fares. The Night Air Mail system has already lead the way. Some operators are now innovating coach services for cheaper air travel (1951).

This is an indicator. Not only in India but all over the world the businessmen of air transport organisations are trying to find ways to increase their trade by stretching the facilities to less moneyed individuals as far as possible, and thus are attempting to keep their business alive. But there is a limit to it. When stretched beyond that, the business becomes unbalanced and possibly reaches a dead end. State control then becomes imminent, there being no other way out.

In the case of India and most other Asiatic countries the problems of civil aviation are secondary to that of food and other necessities

for human existence. Therefore, civil aviation in the initial stage here applies only in the matter of economic reorganisation.

To utilise civil aviation to the fullest advantage it would be most benificial to hold an Asiatic Civil Aviation Conference attended by all Asian countries including China. A conference of this kind should help to solve a part of our economic problems through aviation.

Chapter 13

FLYING DISASTERS

Since the cessation of the Second Great War, civil flying has increased greatly and with it the number of sordid aviation accidents, taking a toll of many lives. Each fatal airline accident adds to the already existing feelings of uncertainty of safety in the minds of air passengers. It is strange that, although the aerodynamic and constructional qualities of aircraft today are of a very superior standard, reducing all chances of accident to the lowest possible percentage, and although safety measures are enforced rigidly with the coming into force of the International Civil Aviation Organisation over the major portion of the globe, serious air accidents still occur unabated. Why?

The greatest factor for most of these accidents is human error, including the errors of the aircrew who fly the aircraft, the ground personnel who service them and the air traffic controllers who control their movements. By far the largest share of the human error is what is generally called "Pilot Error." The proportion is something like this: accidents due to engineering causes comprise about ten per cent of the total, another five per cent is due to human error affecting the engineering or the flying control personnel, and the remaining 85 per cent may be attributed to Pilot Error. This is alarming and is causing a great deal of concern to aviation experts. Rules are being made stricter, pilot qualifying training and examinations are made harder every day, yet there seems to be little change.

PILOT ERROR

ICAO has formulated many new safety conditions which are now being enforced in almost all ICAO member countries. But they have not prevented accidents to any appreciable extent. These facts call for very serious investigation.

The Pilot Error is a very queer aspect of flying accident. Misjudgment, mishandling of aircraft and inexperience or lack of knowledge of weather conditions attribute to the category of accidents under this heading. These again we may subdivide into two main classes, that is, (a) Pilot Error due to direct causes, and (b) Pilot Error due to indirect causes.

The above subdivisions are of a very elastic nature and one may find it difficult to come to a conclusion under various conditions. But the demarcation does exist, and it is of great importance that in the analysis of accidents due to Pilot Error the two classes are clearly differentiated. We shall illustrate this by a few examples :

(a) An aircraft crashed, killing all on board, while the pilot was trying to land at an airfield under a raging thunderstorm. He was warned in time and had definite standing instruction from his company not to land or take off in conditions of dangerous weather. In this case, it so happened that the aircraft was caught up by the storm while she was on the final approach for landing. She had enough fuel to divert immediately for another airfield having clear weather one hundred miles away, but the pilot kept proceeding with a decision to land. As a result she crashed almost at the destination. This was a direct Pilot Error.

(b) In another case, an airliner crashed, killing all, because the pilot took off with the rudder trimmer fully on one side. It is critical to judge such a case. It could be either of the two errors. The carelessness or inconsistent pre-take-off checks might have been accentuated by a habit acquired from his instructor or slackness of his company, or it could be just a slip on his own part.

(c) A scheduled passenger aircraft crashed on a hilly country while flying through a severe cyclonic weather. The pilot was not very experienced. He tried to fly through because the air superintendent of his company insisted that all schedules must go through. He decreed that there is no weather in which an airliner could not fly. The pilot's job was at stake so he took off against due warning from the control authorities. This was an indirect Pilot Error.

Going through the black pages of aviation history one can see that most of the accidents owing to Pilot Error are avoidable and the unavoidable ones are really rare. An unavoidable case may arise under certain extreme conditions.

Various avoidable accidents due to Pilot Error are a play of our inherent human character. A pilot is liable to be influenced by many associated social and professional factors. His professional work involves extra risk of accident to his normal daily risks in life. Moreover, flying still has a somewhat romantic appeal to flying men, due to which they are apt to be overtaken by a glamorous outlook on life and they

may thus disregard the professional seriousness. Accidents can take place in such a frame of mind. These superficialities in the minds of pilots can be curbed by all the allied forces to enable them to form rigid habits to be safe in flying. The government, the instructors who train the pilot, the airline or the place where the pilot works for his living and also the national character of the people of the country concerned are all the controlling factors in instilling the right flying character into the pilot who himself must be a normal man, physically and mentally.

Fast moving events are now forcing us to realise that if civil flying is to be safe, a new approach has to be made. It is not at all enough to tighten up the rules and regulations; the problem has to be tackled from its root. It is first of all imperative to close all possibilities which create or enhance Pilot Error. Air accidents under this category must be viewed in proper perspective and we should look into the contribution of others who were indirectly responsible for the cause of the error. All Pilot Errors are not directly pilots' errors. That should be the most modern attitude of going into the subject of air accidents in which pilots are blamed.

Enquiries held in this spirit will unfold many hitherto unknown facts about air disasters. For this purpose it is necessary to go into the antecendents of the pilot's training, his professional career, his working conditions under the employers and even his private life, as far as possible, to bring out the indirect reasons for air accidents. Many of the accidents known to have been caused by the so called Pilot Error could then be traced to many operational irregularities

of the company, improper training or an inefficient control of civil aviation by the government and thus recurrence of many disasters might be prevented to a large extent.

PSYCHO-ANALYSIS

In the analysis of Pilot Error another new aspect is to be taken into consideration. It is the psychological side of man. Unfortunately, together with the speedy technical progress of civil aviation, his emotional and psychological development has not been seen to. He is also not put through his paces intellectually and trained to be a correct social as well as professional man.

Individually a pilot, through foolhardiness or overconfidence, may not give a thought to his own life and therefore not to others either. He may be irresponsible out of boldness, reckless habits in private life or bad training. Another, though good in flying, may be highly egoistic and resort to unnecessary showmanship to receive praise. These types may indulge in hazardous flying in order to impress others.

Then again, another may be humble and meek but lacking in self-confidence. He is likely to lose his head in an emergency. Another, the worst of the lot, may be the one who thinks too much of himself. This is most dangerous when it is tinged with irresponsibility, showmanship and bad flying aptitude.

Finally, there is the pilot who takes no chances, does his work with the courage of conviction in the attitude of perfecting his flying and who knows his own limitations and also those of the aircraft. He is undoubtedly the right man for the profession of flying.

The psychology of the individual pilot thus plays a great part in the role of safety in flying.

But this fact is not being seriously considered as one of the vital conditions of the airman's medical fitness. He is only tested severely for his physical standard. Even ICAO gives no guidance whatsoever in this direction. Some countries like England and America are thinking about it. In the Indian Air Force some psychological tests are made by psychiatrists at the time of the candidates' entry into the service as members of the flying crew. But hardly anything else is done during the service career that follows. In fact, there is no consistent attempt anywhere as yet to watch the inner development of the pilot.

Psycho-analysis and the necessary corrective actions may be found invaluable in the prevention of serious aviation accidents.

Frustration, worries, depression and fatigue lower the efficiency of a pilot and thereby the safety margin. Lack of sleep and excessive flying dulls his mental capacity. Accidents can then occur in a most unthinkably stupid manner.

WORLD FLYING ACCIDENTS

From a study of air accidents in the world, two peak years are found—1947 and 1951. The rate was very high in these two years. The maximum number of accidents in 1947 may be attributed to the unsettled condition of civil aviation in which there was much gambling and irregularities. The 1951 accidents, were, however, mostly due to a different reason.

A careful study would show that most of t' airline accidents in that year were due to inclement weather conditions. It was not that the weather was particularly bad, nor was it that the quality of pilots deteriorated that year.

Statistically one can see that the growth of

airline operations in 1951 was very extensive and there was thus fresh enthusiasm on the part of the operators for adventuring into the fields of commercial aviation in all weather conditions in foreign countries.

Flying has made the world a much smaller place than it was previously. In the aviation world there is similarity of thought among flying men. The idea of flying in all weather seems to have prevailed worldwide among operators and pilots in 1951. This spirit to know the unknown and to venture to fly under all weather conditions was the root cause of many accidents. The fall in the rate of accidents has been very sharp since 1952. New experiences were gained and by now most airline pilots know to a great extent the limitations of flying in various types of weather. And rightly enough much of the hazards are thoughtfully avoided today.

ACCIDENTS IN INDIA

In India also, 1947 was a year of many accidents owing, more or less, to the same reasons mentioned for those in 1947 in other parts of the world. But the other peak year in India was 1950 and not 1951. This was so on account of the tragedies that followed as the inevitable result of the great partition of India into three parts.

Stoppage of trade between India and Pakistan, prohibition of through transhipment of surface transports across East Bengal and the riot in East Bengal brought such chaos that the whole aviation strength of the country was directed to cope with the situation. An extensive use of civil aviation was made to heal the wounds of the tragedy.

A summarised account of the air accidents in India is given here.

	1946	1947	1948	1949	1950	1951	1952
Total accidents	23	61	46	30	61	37	Statistics not available. This year had considerably fewer accidents, amounting to a total of 19.
Accidents to scheduled and non-scheduled air transport.	6	24	16	5	18	5	
Fatal air transport accidents (included in the above).	1	3	2	2	12	2	
Total passenger-miles flown per accident, by scheduled passenger aircraft.	12,213,148	12,896,868	42,110,533	53,915,083	38,447,379	98,101,135	

From the above mileage one can see that the progressive trend towards betterment fell very abruptly in 1950 and thereafter a sharp rise in passenger-miles flown per accident is noticed since 1951. The year 1952 was still better and it is hoped that 1953 will also have a much safer record of civil flying.

These statistics point to two factors :

(a) air accidents are related to the condition of the civil aviation organisation of the country, and

(b) the social and political circumstances of the country also bear a relation to it.

Peak years of air accidents of any country may be thus theorised.

There is one important point in India's favour. The inherent quality of the Indians with their cultural heritage of a peace-loving nature, is a great asset in the making of safe and good civil pilots.

HOW ACCIDENTS OCCUR

Taking a record of 20 airline accidents from all over the world, supposed to have occurred due to Pilot Error, the following facts were observed.

1. 45 per cent of the total were in conditions of bad weather.
2. 15 per cent due to fatigue on the part of pilots.
3. 15 per cent due to not checking the cockpit.
4. 10 per cent due to poor navigation.
5. 5 per cent due to not running up the engines.
6. 5 per cent due to inexperience.
7. 5 per cent due to careless flying.

These were the obvious direct causes.

We must go much more deeply into the subject to ascertain how many of these were actually due to the pilots' faults. In other words, we have now to differentiate between accidents caused due to Direct Pilot Error and those due to Indirect Pilot Error. As the basic facts were not obtainable, a personal estimate was made according to which 45 per cent were found to be due to Direct Pilot Error and 55 per cent due to Indirect Pilot Error, involving others behind the scene. Another important point was observed from the flying experience of the pilots, about 65 per cent of airline accidents involved pilots having flying experience between 3000 and 5000 hours. This further proves the psychological side of flying accidents.

Many accidents in conditions of bad weather could have been avoided if ICAO had a definite ruling regarding the approach of an aircraft to its destination where adverse weather existed or when the weather *en route* was bad. The pilot is left to decide for himself in such critical matters. There is a great controversy on this point. It is generally felt that the Air Traffic Controllers, with their appropriate knowledge of weather conditions, should be the sole judges to decide whether an aircraft should take off, land or fly through when hazardous weather exists, and they should also be the authorities to divert the aircraft as the circumstances demand.

THE REMEDY

Indian civil aviation was once reported to be the safest in the world in proportion to the amount of flying carried out. But for the lapse in 1950 due to unfortunate reasons, it still holds a fine record of safe flying. Even then some may ask, "But how to root out this Pilot Error?"

Probably as long as man remains man, this factor of human error on the part of the pilot or of anyone else concerned with flying can never be exterminated completely. We can, by all means, bring it down to the humanly possible lowest limit by enforcing a proper system of checks and rechecks and an extremely high standard of all-round efficiency.

We must strike the problem at its root. We have to go more deeply into the affairs of civil pilots and others directly concerned with their flying. Do they serve under the best social and professional conditions? Are they trained the right way? Are they disciplined? Do they have proper living conditions, rest, leave and security for the future? Resort must be made to these questions to rectify the drawbacks.

Simplification of the pilot's technical work as much as possible, delegation of some of his responsibilities to the Air Traffic Controllers, who should include one or more experienced pilots at each airport in conditions of adverse weather, and a rigid enforcement of the government rules of the country both for individuals as well as for operating companies, may very substantially reduce air accidents.

Above all, we should obtain honest and efficient work from all those employed in civil aviation by assuring them security and settled living in a congenial social atmosphere. Then only can flying hazards be reduced to the minimum.

Chapter 14

ASTRONAUTICS—AN ASPECT OF FUTURE AVIATION

In the quest of the ever increasing human knowledge of this mysterious universe, many scientists of the Western countries before the Second World War were directing their attention towards the possibilities of flight in space by rocket. Increase of speed to reduce space and lessen time has preoccupied man's mind throughout the process of his evolution. He now intends to conquer space and fly to the other ends of the earth, in minutes instead of hours and days, and possibly to the moon, Mars or other heavenly bodies.

Even in the first few years of this century there was a general belief that man would never be able to fly heavier-than-air aircraft. But today, after only fifty years from the first successful aeroplane flight by Wilbur Wright in 1903, we are flying aeroplanes carrying as many as 200 passengers with a range of several thousand miles.

In the march of science what seems impossible today is thus likely to be achieved tomorrow. The same holds good for man's endeavour to fly in rockets.

The science of space flight is termed as Astronautics, that is, flying in the upper regions of the earth's atmosphere.

Our earth is surrounded by layers of atmosphere. The region next to the earth's surface is called the troposphere, which extends up to an approximate height of about seven miles.

Meteorological phenomena of winds, clouds and other climatic changes generally take place in this zone. Next to this layer is the tropopause, having an approximate thickness of two to three miles, separating the troposphere from the region known as the stratosphere. The stratosphere extends to a height of about fifty miles above the surface of the earth. Then comes the upper stratosphere, the Kennely Heaviside and other layers.

Astronautics deals mostly with the regions about ten miles above the earth's surface and beyond, that is, the region of the stratosphere and above. The stratosphere is generally free from clouds, storms, snow and ice. It has no seasonal and climatic changes, and has a constant temperature, the average being about 55° Fahrenheit below zero.

The only known aircraft which can possibly carry man into these regions is the rocket. (The rocket and jet propulsions are virtually the same in principle except that they vary in the kinds of fuel used. Rocket fuel needs no oxygen from the atmosphere as the mixture itself contains the required percentage of oxygen; but in the case of jet propulsion the fuel needs oxygen from without to produce the propulsive power. Rockets are a subdivision of jet propulsion.)

From time immemorial rockets containing powder fuel have been used generally for fireworks. More than a thousand years ago the Chinese used them for shooting arrows. During the Napoleonic wars Sir William Congreve introduced rockets as a fighting weapon, but it was not till as late as 1903 that the world of science came to realise the principle of rocket propulsion. Previous to that it was universally thought that the rocket shoots up as a result of the exhaust gas

pushing against the air. This was as fallacious as the belief in the olden days that the earth was flat.

THE BIRTH OF ASTRONAUTICS

In 1903 Konstantin E. Tsiolkovsky, a Russian, showed theoretically in his famous book, *The Rocket in Cosmic Space*, that a rocket travels forward owing to what is termed reaction propulsion (or rocket propulsion) and that it is at its maximum efficiency in a vacuum. In 1919 Professor Goddard of America proved this theory practically. And thus came about the birth of astronautics, a science still in its infancy.

Reaction propulsion is similar in effect to that of the recoiling action of a gun. When a gun is fired, the projectile with the gas rushes out through the nozzle and the force of a certain amount of exhaust gas is expended in the direction of fire. An equal and opposite force of gas then moves the gun in the opposite direction.

In the case of a rocket, spherical waves of force are set up by the exhaust gas in its combustion chamber as soon as an explosion takes place therein. They exert pressure on the walls of the chamber. In a completely enclosed chamber the radiating forces, trying to move the body in all directions, would be neutralised by equal and opposite forces and therefore would have no effect on the body. But if an outlet is provided, the line of force which tends to move the rocket in the direction of the outlet is completely lost by the escaping of gas. The counter component force (i.e., the force which acts in the opposite direction to the outlet) now is free to take effect and it moves the rocket ahead. If the escaping gas is resisted, the counter component force is reduced and consequently the

speed of the rocket drops. The air offers some such resistance and decreases the speed of the rocket in this manner.

In the stratosphere, which is almost a vacuum, there is nothing to hinder the progress of a rocket. Hence it attains its maximum efficiency and travels faster than when in the troposphere. That is the theory. The main problem now is to construct a rocket powerful enough to shoot itself outside the zone of the earth's pull and rise high up into the blue, thousands and thousands of miles away from the earth.

Progress in the construction of stratosphere rockets has been rather slow. The stratosphere rocket has little similarity with the one used for signalling or fireworks. The former has fins, tail plane, parachutes, fuel chambers, combustion chambers, nozzles and several other gadgets. In a modern stratosphere rocket, liquid fuel is fed continuously into the combustion chamber and when iginition takes place there the suddenly expanded gas acts as the propellant. By virtue of its action the combustion chamber is named the Reaction Motor. It should be noted that rockets and jet propulsion engines are all classified as Reaction Motors.

Professor Oberth of Germany suggested a rocket with two stages of fuel supply to overcome the difficulty of too rapid an acceleration at the start. In this design a fuel of low power in the first stage and an extremely powerful fuel in the second stage were to be used.

Professor Goddard, on the other hand, preferred a rocket consisting of a mechanism combining the principles of the rocket and the turbine, which might be named the turbine rocket. He suggested that the rocket blast in the beginning of the trip may be used to rotate propellers

through a mechanism of turbine blades. This arrangement would be used at the commencement of the flight and also for travelling in the dense atmosphere. On reaching higher altitude the propellers would be disconnected and then the rocket propulsion would be utilised directly.

At the outset of astronautics experiments were made with powder fuel. These proved a failure and were finally abandoned. Attention then turned to liquid fuel. Although no fuel that can fulfil the requirements of astronautics has yet been discovered, research is in progress and a certain amount of success, indeed very insignificant, has been achieved.

After laborious research and experiments made by scientists of various countries, liquid mixtures such as, liquid oxygen and alcohol, liquid oxygen and petrol, and also liquid oxygen and liquid hydrogen were found most suitable as rocket fuels. These fuels are difficult to handle, particularly the mixture of liquid oxygen and liquid hydrogen, which was seldom used.

German rocket experts extensively used the mixture of liquid oxygen and petrol. The boiling temperature of this liquid is (—) 183°C. Its isolation from the intensively hot combustion chamber of the rocket involves supreme difficulties.

The first great problem that is against the development of space travel in rockets is this one word FUEL. The fuel is still to be discovered which is sufficiently powerful to propel an interplanetary rocket beyond the force of the earth's gravity. No such fuel is yet in sight, but there is hope in the hearts of scientists that the problem of fuel will be solved if the energy locked up in atoms can be utilised. As evident from the atom bomb, a tremendous amount of energy is

stored in atoms. The atomic energy of a glass of water is said to be so powerful that it could easily propel the Queen Mary across the Atlantic.

Besides astronautics, experiments with rockets have also been made for meteorological and other observations in the upper reaches of the atmosphere, for mail carrying purposes and for carrying passengers.

As regards the observation of the upper atmosphere by rocket, progress is yet slow.

The project of mail carrying by rocket was first tried by Friedrich Schmiddle. In 1931 he set up a rocket postal service between two Austrian towns a few miles apart. Shortly afterwards a similar postal service was established over the Harz mountains in Germany by Herr Gerhard Zucker. None of these services were of revolutionary importance but they certainly laid the foundation of hopes for a system of rocket postal services in the future.

EXPERIMENTS WITH ROCKETS

Experiments with mail carrying rockets were also made in India by the Indian Air Mail Society, Calcutta. They conducted their experiments mainly in conveying mail from ship to shore and vice versa. Their dreams, however, did not materialise.

In the history of rocketry there has been only one instance when a man is reported to have made a rocket ascent. In 1936, Otto Fischer, a German, is said to have been shot up six miles into the air within a twenty four feet steel rocket and returned to the earth safely. As an arrangement for landing, his rocket contained a huge parachute which opened automatically on the downward journey.

Of all the countries, Germany before the War was the most enterprising in the development of rockets of all kinds. Some of her rocket experts stand out conspicuously in the annals of rocket flights. The success attained by the Germans in the development of rockets was unique. They made interesting experiments on rockets and much progress was also made by them.

Max Valier in 1928 was the first to drive a rocket propelled car. Two months later Von Opel, the maker of Opel cars, attained a speed of more than one hundred miles per hour in his rocket driven car. Shortly afterwards, in 1928, the first rocket-propelled aircraft flight took place in Germany. Piloted by a German, it flew for nearly a mile. A railway car propelled by rockets attained a speed of one hundred and forty nine miles per hour. In 1929, a rocket driven sledge designed by Max Valier attained two hundred and fifty miles per hour on ice. Progress of rockets in this line of man's every-day use is fairly well marked.

ROCKET BOMB

During the War the Germans produced two unprecedented weapons, namely, the Flying Bomb or V-1 and the Rocket Bomb or V-2. The former, the Flying Bomb, was a pilotless, jet propelled monoplane which was about 25½ feet long with a wing span of 17½ feet. It had a cruising speed of 360 miles per hour with a range of 125 miles ; some were even known to have flown a distance of 170 miles from the starting point. Weighing 7000 pounds in all, it contained 2000 pounds of high explosives in the nose. The bombs were so constructed that by means of a clock work mechanism the elevators automatically locked in a certain position at a predetermined

time, which was set according to the time required to reach the target. In this condition the nose dropped and as a result the remaining fuel ran out, thereby stopping the engine.

The Rocket Bomb was driven by rocket propulsion, as the name implies. It had a speed of 3,000 miles per hour, and like the Flying Bomb, it contained 2000 pounds of ultra high explosives in the nose. Weighing 12 tons, it was 46 feet in length, five and half feet in diameter and had a horizontal range of 200 miles. Being very much faster than the speed of sound, its approach could not be heard before it crashed on the ground. These bombs were launched upward at a precalculated angle which differed for different targets. Reaching a height of about 60 miles above the earth's surface, the bomb then came down on the target, describing a parabolic path.

We are not aware of the scientific activities of different countries regarding the progress of rocket flight, but one thing is certain that scientists are now clamouring to use atomic energy for rocket propulsion. In Russia recently a rocket is said to have been shot up to a height of 240 miles above the earth's surface at a speed of about 4,000 miles per hour.

PROBLEMS OF INTERPLANETARY FLIGHTS

Innumerable obstacles stand in the way of astronautics. Besides fuel, there are the problems arising out of speed, gravity, cosmic rays, extreme heat and cold, oxygen, food, navigation and landing.

For the carriage of passengers in a rocket, the question of speed is of vital importance. Astronautical rockets for interplanetary flights will be required to have an ultra high speed like 25,000 miles per hour or so. But if the rocket is acceler-

ated suddenly to such a tremendous speed its occupants would instantly be crushed to death. Man's capacity to bear pressure due to the fast acceleration of a moving body is limited. Constant speed, no matter how high, does not affect man in any way. He has no sensory organ to conceive uniform speeds. We are affected by the rate of change of motion only. We revolve around the sun at the fantastic speed of 65,000 miles per hour, yet we do not perceive that because the speed is more or less uniform. The rocket, therefore, must be accelerated gradually, keeping within the bearable limit of man's capacity and thus attain the high speed required.

The force of gravity also affects astronautics very seriously, first of all, in getting the rocket beyond the reach of the earth's gravity. If by some means gravity could be nullified, rocket flight would become much simpler. But such thoughts are still dreams.

There is yet another difficulty of unknown limitations. During the greater part of the journey almost an entire loss of gravity would be experienced. How man would react in the state of being "no weight" is not as yet known to us.

The danger of exposure of the human body to cosmic rays and other extremely short wave radiations presents another obstacle to space flights.

The problem of food and oxygen is also of a vital nature. High up in space there is a total absence of oxygen. A constant supply of this indispensable substance has to be maintained throughout the journey and there is no way of knowing whether the atmosphere at the destination, if any, is breathable or not.

An interplanetary journey, even to the nearest planet, Mars, would take months to complete.

The shortest distance between the earth and Mars, when the latter comes on a straight line in between the sun and the earth, is 50,000,000 miles. A rocket with a speed of 25,000 miles per hour would take 83⅓ days to reach Mars. Adding ten days for a holiday at the destination, the journey out and back would be about six months. The rocket with a load of oxygen sufficient for the whole period must therefore be a huge affair. Pills of super concentrated synthetic foodstuffs would also have to be prepared to help solve the problem to some extent.

Then there is the danger of collision with meteors which are in abundance in the region above the earth's atmosphere. Even a small meteor of the size of a table tennis ball has such great velocity and heat that it may destroy the rocket on impact. The chances of collision with a meteor are rare, but the danger is there all the same.

Navigation for these interplanetary flights involves much research and calculation in astronomy. The relative position of every planet is changing daily by thousands of miles. This fact brings in a big complication. It would be rather embarrassing to the pilot, after travelling through millions of miles of space, if he did not find the destination where it should be.

Queerest of all are the problems of landing and refuelling at the destination and the take off on the return flight from there. But man in his stubborn quest for the mysteries of the universe will always march on and on until he reaches his goal.

We as human beings cannot but stop for a moment to think of the darker side of these gigantic efforts of man.

Science is for the progress of man. A

heart filled with selfishness and hatred will always motivate him to strike his fellow human beings to suit himself. Success of rocket flight into space may yet bring about another source of human conflict, or it could be a cause of wars between our earth and other planets. Let us cherish the dream that man will by then have stored sufficient good sense that he may correctly reap the fruits of his scientific inventions to his own benefit, and not for the annihilation of his fellow human beings.

Chapter 15

NATIONALISATION OF AIRLINES IN INDIA

When on the 14th March 1953 Jagjivan Ram, the Communication Minister, announced the intention of the Central Government to introduce a bill in Parliament for the nationalisation of India's scheduled air services, both internal and external, it was a surprise to many who were directly interested in the running of such services.

Many opposed it. It was said from some quarters that the immediate direct result from nationalisation would be a heavy reduction of technical men. It was stated that the nationalised airlines would incur a heavy loss and that the cost of operation would be higher under the government. The same source also opined that airlines in India needed flexible management and among other things personal initiative of a high degreee, which the government organisations would not provide.

Others opposed it on the ground that nationalised organisations were inefficient, fervently quoting examples from the conditions of the state owned railways and some provincial state bus services. There were also others who criticised the scheme as being inopportune.

These views were not in conformity with facts. Moreover such opinions do not take into account the problems of India's poverty and the ensuing economic readjustment. Nationalisation, however, is a historical process. Even in our own land we have a remarkable example of a

country being ruled by a private organisation, the East India Company. They obtained a charter from Queen Elizabeth to trade in India and thereby colonise and rule her for England. They had their private armies. It was the common practice in many countries of Europe and Asia in the early and middle ages to maintain private armies.

In modern times also there were private armies of the war lords in China before the revolution. But what happened to them—the mighty colonizers, the mighty armies? Why did they all gradually succumb to the forces of state ownership? Was it not a historical necessity?

State ownership of the Indian Railways is criticised by some as being a symbol of government inefficiency, probably not realising the very foundation of state ownership which aims at rendering the maximum benefit to the maximum number of people. If our state railways are bad, it is not so because the principle of nationalisation is bad. The source of the trouble may be within ourselves. This is one way of looking at the problem. There are yet other considerations.

The economic condition of the people has a great bearing on the actual state of affairs in the railways. India, reduced to an extreme poverty stricken condition, cannot have superbly organised and efficiently run state railways without first improving the lot of the people. The root cause of the trouble is therefore very deep and it cannot be eradicated superficially.

But, are the Indian State Railways as bad as they are often pictured? We should ask ourselves this and go backward to trace their history wherein also we shall find the same historical process in motion. However, before we go into

the history of Indian Railways, it is desirable to point out one great change that we have noticed in the railways in recent times, being run by the national Government.

During the British rule the railways were primarily meant for the administration of the Empire and, although the highest income was earned from the third class passengers, more care was taken for those of the first class. The third class passengers, who formed the overwhelming majority, always travelled somehow, being huddled up together like cattle. To the British it was an act of mercy that we were given the railways as a modern means of travel. One can clearly draw a line between this situation and that of today. Although the conditions are yet to be improved in many aspects of the railways in India, one can, even now, with all the faults of our national Government, find a heartening change for the better.

Today special through trains exclusively for third class passengers are run on trunk routes. The lower class compartments are being progressively transformed to provide more amenities. In British days even the inter class did not have fans, whereas such amenities are now provided in modern third class compartments. The system of reserving lower class seating accommodations, the abolition of Hindu Pani and Muslim Pani and separate refreshment rooms for Hindus and Muslims and such other hallmarks of divide and rule arrangements have been very wisely effected.

From October 1953 the Central Government is gradually abolishing first class compartments. Though these efforts are not yet vigorous the approach is on the right line. The resulting effect brings more benefit to the common people.

Going into a brief history of the Indian

State Railways, one finds somewhat similar conditions existing in it as those of the airlines in India prior to nationalisation. Like the airlines, railways in India also originated as private enterprise. Invariably, all the railways were owned by British firms with their Boards of Directors sitting in the United Kingdom.

The first Indian rail line laid was a small stretch of 22 miles between Bombay and Kalyan under the name of G.I.P. Railway in April 1853. In August 1854 the second railway line was laid, the E. I. Railway line between Calcutta and Pandua.

Between the time when the first railway was laid and 1868, the construction and ownership of railways in India was entrusted to British firms under state guarantee of a minimum profit of four and half to five per cent on the total capital invested.

In addition, the Government of India provided the necessary land free of cost, reserving a right to purchase the railways after 25 years on agreed terms. Under this arrangement, by about 1869 the Government incurred a total loss of Rs. 17,000,000, equal to more than Rs. 150,000,000 today.

Exactly in the same way scheduled airlines in India were subsidised in various ways at various times and also the flying clubs, which are still subsidised. The Government of India up to the time of nationalisation of the scheduled airlines had paid Rs. 15,000,000 in the way of susidy to them. The airlines concerned were said to have been running at a loss of Rs. 6,000,000 a year.

In view of the heavy losses on the railways the Government took over their ownership and management hitherto run by companies. This

agreement prevailed till about 1880. It was then found to be unsatisfactory and the state owned railways, together with new railway construction work was handed back to company management. The Government, however, retained the right to take them back again at any suitable time. This arrangement worked until 1921.

Similarly, the first state owned airline between Delhi and Karachi also became a failure due to the lack of public support.

In 1921 a Railways Enquiry Committee under the Chairmanship of Sir William Acworth was formed to enquire into the affairs of railways management. It advocated complete state ownership as well as management.

Accordingly, by an act of the Legislative Assembly in 1923, the East Indian Railways came under state management in January 1925. The G.I.P. Railways followed suit in 1926, and within a few years all major railways came under direct state management.

In much the same way, the scheduled airlines in India have come under state ownership and management since 1st August 1953 in persuance of the Air Corporation Act passed by the Indian Parliament in May 1953. This was an outcome of the findings of the Enquiry Commission set up by the Government of India in February 1950 under the Chairmanship of Justice Rajadhyaksha.

The Commission was not in favour of nationalisation, but in view of the unsatisfactory conditions of most airlines as reported by them and the formulated policy of the Central Government, the latter took the decision of nationalisation.

Nationalisation of scheduled airlines in India, is much the same in character as that of the United Kingdom. They also have two

Corporations. One, the British European Airways, looks after the internal scheduled services and those to European countries; and the other, the B.O.A.C., runs the international scheduled services. Both these corporations are in the care of big business magnates. It is interesting to note that B.O.A.C. was organised in 1940 in persuance of an act of the British Parliament, having acquired Imperial Airways and British Airways. The former company was established in 1923 by merging of about ten British air companies existent at the time.

The Indian Airlines Corporation and Air India International are organised on the same line. Like the British arrangement, the non-scheduled companies in India were also not taken over by the Government.

Nationalisation of airlines in India is not a complete fact as yet owing to the exclusion of charter companies. This is somewhat paradoxical.

Charter companies are mainly concerned with freighting and they deprive the Indian Airlines of the income from a substantial portion of freight. This liberalisation is contrary to the interest of the nationalised airlines. Since the principle of nationalisation has been accepted, all airlines should be brought under it for the maximum profitable utilisation.

In our newly formed airlines the sphere of operations can be increased in various ways as briefly enumerated below.

(a) Nationalised airlines can operate on a much smaller expenditure. Therefore passenger fares and freight rates can be reduced.

(b) They can take in hand some problems of perishable food supply as permanent fea-

tures in many parts of India. Supply of fish, meat, vegetables, eggs, fruits and milk products can be effected, together with the carriage of mail and a limited cheap fare passenger accommodation wherever possible.

(c) In future when everything is set in motion, flying medical units can be arranged and specialists may be flown to even remote places with the help of helicopters or otherwise.

(d) Agricultural experts and units may be flown as a regular feature to various parts of the country.

One can find many more of such useful work which may be undertaken by the state airlines entirely in the interest of the nation.

The present nationalisation of airlines in India foretells a new era of economic reorganisation. It is a part of the beginning towards the utilisation of national industry for the prosperity of the people. The Central Government in its Five Year Plan has earmarked Rs. 95,000,000 for the development of the nation's airlines.

Those who work for the two airline corporations are proudly conscious of these facts. This nationalisation has brought them more dignity and greater responsibility. Under private organisations there were many difficulties. There was no standardisation on many basic needs of the employees. There was, in fact, no tradition in our airlines.

Feelings now are different. All sections of employees of the air transport organisations are now astir with hopes of better living and working conditions. In the turmoil of the change-over from private to national airlines, there may be temporary setbacks owing to extraneous cir-

cumstances. We may be frustrated in the initial phase, but let us not lose faith in ourselves and in the prospect of the people of this vast land. The storm will pass and the sky will clear. This nationalisation will not fail.

Chapter 16

AIRCRAFT AND AIR ROUTES

For the internal air services which are run by the Indian Airlines there are today 96 aircraft in all, comprising 72 Dakotas (twin engined), 3 Skymasters (four engined), 12 Vikings (twin engined) and 9 other aircraft. Air routes of the Indian Airlines are at present operated by Dakotas and Vikings. The Skymasters have no scheduled routes and they are not likely to have any in future. They are generally used for charters, mainly international.

Both these operating aircraft, the Dakotas and the Vikings, are produced no longer and hence they will have to be replaced sometime in the future by new types of aircraft.

Private airline operators prior to nationalisation, were discussing this important matter among themselves. To minimise operational costs they were planning to buy only one type of aircraft which could operate on the main routes. Out of the several types available, the eyes of the operators were generally fixed on two—the Vickers Viscount and the Convair 340. The latter is a conventional piston type of twin engined American built aircraft. The Viscount is a four engined turbo prop British aircraft.*

Since India's air transport organisation has undergone a radical change, this matter is now being reviewed from a new angle.

Operations of Indian Airlines are conditioned by some exclusive factors as regards the choice of aircraft.

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*Particulars of these aircraft are appended at the end of the book.

Some of the conditions are:

(1) Long range aircraft are not economical on most routes.
(2) The number of available passengers is limited, therefore;
(3) Large aircraft of the size of Skymasters and such are not profitable at present.
(4) Many operating airfields are short and rough.
(5) Freighting and the carriage of passengers are limited.
(6) High speed aircraft are not an advantage on short haul routes owing to the expenses they involve; the time thus saved is insignificant.
(7) All routes cannot be operated by the same type of aircraft.
(8) Too many different types of aircraft will not be economical.

Judging from all angles, to operate on scheduled routes, Indian Airlines at present requires two different types of transport aircraft. For the purpose of the selection of these aircraft let us classify the existing and possible air routes into two groups.

Group A

(a) Calcutta-Bombay, Calcutta-Delhi, Calcutta-Madras, Calcutta-Gauhati, Calcutta-Rangoon.
(b) Bombay-Delhi, Bombay-Madras-Colombo, Bombay-Karachi, Bombay-Colombo.
(c) Delhi-Madras, Delhi-Karachi, Delhi-Kabul.

All these routes may be operated by aircraft having about 35 seating accommodations.

Group B

(a) From Calcutta:
Calcutta-Gauhati-Tezpur-Lilabari-Jorhat-Mohanbari;
Gauhati-Rupsi-Coochbehar-Bagdogra-Muzaffarpur-Patna-Kathmandu, by aircraft operating from Gauhati;
Calcutta-Patna-Benares-Allahabad-Kanpur-Lukhnow-Agra-Delhi;
Calcutta-Bagdogra (frequencies to be varied according to seasons);
Calcutta-Dacca;
Calcutta-Chittagong;
Calcutta-Agartala-Khowai-Kamalpur-Kailashahar-Silchar;
Calcutta-Agartala-Belonia;
Calcutta-Raipur-Nagpur;
Calcutta-Bhubaneswar-Vishakhapatnam;
Gauhati-Silchar-Imphal, by aircraft operating from Gauhati.

(b) From Bombay:
Bombay-Bhavnagar-Ahmedabad-Karachi;
Bombay-Bhavnagar-Rajkot-Jamnagar-Bhuj;
Bombay-Keshod-Porbander;
Bombay-Ahmedabad-Jodhpur;
Bombay-Belgaum-Mangalore-Cochin;
Bombay-Poona-Hyderabad-Bangalore;
Bombay-Aurangabad-Nagpur;

(c) From Delhi:
Delhi-Lahore;
Delhi-Bhopal-Nagpur;
Delhi-Jaipur-Jodhpur;
Delhi-Jammu-Srinagar-Leh.

(d) From Madras:
Madras-Hyderabad-Nagpur;

Madras-Bangalore-Coimbatore-Cochin-Trivandrum-Tiruchirapalli-Madras. (Two aircraft proceeding to same destination from Madras, one clockwise and the other anticlockwise, and returning to the point of origin.)

Madras-Bangalore-Mangalore;

Madras-Kurnool (when airfield is ready)-Vishakhapatnam.

The aforesaid routes can be operated by small aircraft having about 18 to 20 seats. Such aircraft must be—

(a) Cheap to operate.
(b) Capable of carrying a good deal of freight.
(c) Easily convertible into complete freighters.
(d) Having low landing and take off speeds.
(e) Easy to maintain.

When details are worked out the route patterns as described above may undergo many changes due to various other considerations; more routes may also be added to the ones existing or suggested. In certain cases two aircraft may be sent out to the same destination, one flying clockwise and the other anticlockwise, provided traffic and operational advantages are achieved by such arrangements. Moreover, routes must be developed in a gradual process under the force of necessity.

All operations of scheduled services of both the groups are to originate from the four main bases of Calcutta, Bombay, Delhi and Madras, with the exception of a few routes from Gauhati as stated previously.

In the route pattern of Group B one will notice that the services between Calcutta-Bombay via Raipur, Nagpur and Aurangabad and those between Delhi-Madras via Bhopal, Nagpur and Hyderabad are subdivided between the bases at

the extremeties of these routes. This is suggested for operational advantages. All four aircraft are to meet at Nagpur and, to avoid inconvenience to passengers and extra work in transhipping the load at Nagpur, the crew only will return to their bases but the aircraft may be flown right through to the opposite ends. Such arrangements may be suggested for a few more routes. It will save night stop expenses.

In order to execute the route systems mentioned in Groups A and B profitably, the Night Air Mail services will have to be abolished. Co-existence of the latter in the proposed scheme is not economical.

All 72 Dakotas and 12 Vikings sooner or later have to be replaced by one or more types of aircraft which are most economical and suitable for the peculiar requirements of internal air services in India. This is an expensive as well as a vital matter for Indian civil aviation. If a wrong choice is made the economy of the country as a whole will suffer. It would not be wise to be hasty in this matter.

As stated before, we should not have too many types of aircraft on air transport services in India, because such a set up always involves extra expense and many technical difficulties. At the same time we cannot just do with one type. There is a need for more than that, but the number of types must be restricted to the barest minimum. And as it stands today, the economic and operational position does not permit more than two types of aircraft for Indian air transport services.

Then we have to consider the actual types of aircraft to be bought. In fact, among the new types of aircraft available there is actually none suitable for the need of Indian civil

air transport. The Vickers Viscount and the Convair are the two which are nearest to our requirement of the larger version. The smaller version is even more scarce. Of all aircraft the Dakotas are still the most suitable and the best for the Indian skies.

No final decision regarding the selection of future aircraft for Indian air transport organisation has been made as yet. This matter is still under active consideration by the authorities. Many technical and operational details have to be considered before a final decision is reached.

In consideration of the present economic situation it may be appropriate to buy a few of the larger version of aircraft for use on the internal air services, as per routes in Group A, in conjunction with the existing Vikings. When the Vikings are finally put out of service, more of the above aircraft may then be brought in.

New aircraft of the smaller version, as required for Group B routes, may be imported at a later period. But in the meanwhile it would be economical to use the Dakotas to their last days.

The famous Dakotas can still render us profitable service. They are presumed to have a fairly long life yet. In India the maximum total flying time of a Dakota is about 17,000 hours; whereas in the United States of America they have flown for over 60,000 hours each with a wonderfully safe record of flying.

The position of Air India International is different. It is guided almost entirely by standard international consideration. But even in its case some factors cannot be disregarded. India's economic and industrial conditions for some reasonable time yet will probably not permit of any radical change of civil aircraft from

the ordinary piston engines to the most modern jet aircraft.

On the other hand, India is many years behind in aircraft production. To possess the latest type of jet aircraft for her air transport is accordingly inconsistent without a parallel development of this more complex side of aviation.

EPILOGUE

Many years ago, in my childhood, when I first saw an aeroplane I was not impressed. Being merely a son of a humble school master, my ambitions were different and never did I entertain the idea of being a pilot. The last war, however, upset my destiny. It gave me an access into this "heaven born profession." The possibility of a grand prospect lured me into the flying circle and I soon found myself a pilot in the Indian Air Force Volunteer Reserve.

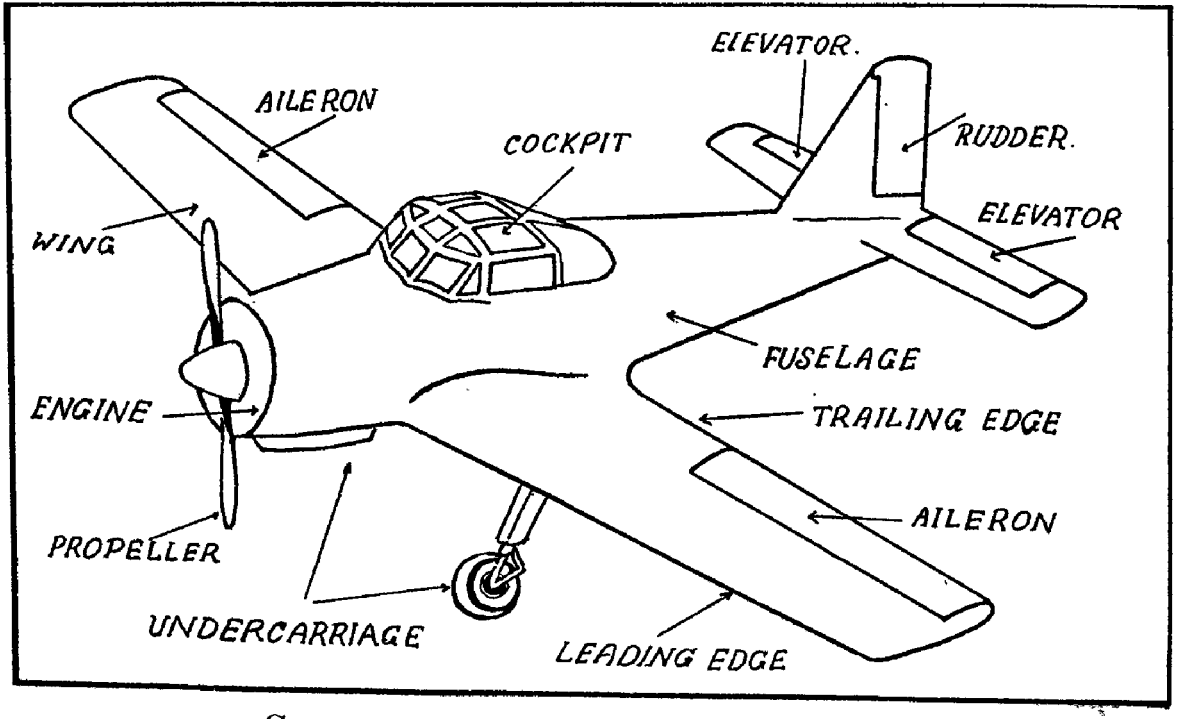
Much water has flown down the Ganges in the meantime. The war and the following calamities ravaged the country from end to end. Millions were drowned in the sea of miseries that followed. This beautiful land of ours became a stage for the display of the wildest and most senseless orgy of murders, loot, arson and mass evacuations. Against this background of miseries, brought about by those who had no respect for humanity, our civil aviation expanded considerably. This growth was not sound. It was built on false ground.

Through years of affliction the position has now changed. The civil air transport in India today is the nation's property. And we, the men of civil aviation, are the architects of this national enterprise. Side by side with those who toil in the fields, those who work in the mines, factories, docks, railways, ships and in other professions, we have our share of labour in building this vast country of millions.

Our ideals may be blurred by faulty management of our aviation. Complacency may

set in deeply in our hearts. But nothing shall overrun the mighty will of the people to progress, to seek and to strive. Long live our Great People and our Civil Aviation in their service.

APPENDIX



Component Parts of an Aeroplane

SOME TYPES OF AIRCRAFT

TRAINER AEROPLANE

It is specially constructed for flying training. It has duel controls and most of the important instruments duplicated.

FIGHTER PLANE

A fighter plane is a defensive aerial weapon of war. It is fast and highly manoeuvreable.

BOMBER PLANE

This is an offensive aerial weapon used to bomb targets in enemy territory. It is much larger than the former.

HELICOPTER

A helicopter is a type of aircraft which can fly straight up and straight down, as well as fly forward. It can also fly backward and sideways, or hang motionless in the air like a kingfisher. A helicopter obtains its lift from the rotor which revolves horizontally above its body.

The lift as well as the forward, backwards or sideways motion is produced by the rotor merely by tilting it forward, backwards or sideways, respectively.

Owing to the revolving rotor, the body of the helicopter itself tends to revolve in the opposite direction along a vertical axis. This tendency is known as the torque pull and to counteract it a small propeller is placed vertically at the tail of the helicopter.

GYROPLANE

The gyroplane is a predecessor of the helicopter. In addition to the rotor (above the body) it has a propeller on the nose. The propeller gives the forward motion and the rotor the lift.

JET PLANE

This is an aeroplane propelled by jet propulsion (see pages 116 and 117). It has no propellers. The Comet is a jet plane.

PARTICULARS OF SOME AEROPLANES

DC 3 OR DAKOTA (C-47)

U.S.A. built.

Twenty-one seater passenger plane powered by two Pratt and Whitney R-1830 engines, each developing a maximum of 1200 H.P.

Empty weight : 17,200 lbs. (average).

Maximum gross weight (for passenger aircraft in India) : 26,200 lbs.

Cruising speed : 160 m.p.h. (average).

DORNIER X

Built by Germany in 1930, it was a flying boat with 12 engines and it could carry 169 passengers. She crossed the Atlantic in August 1931.

Fully loaded weight : 105,000 lbs.
Cruising speed : 130 m.p.h.

SUPER CONSTELLATION

U.S.A. built.

Powered by four Wright Cyclone engines, each developing a maximum of 2,700 H.P.

Empty weight : 69,000 lbs.
Pay load : 29,500 lbs.
Maximum take off weight : 120,000 lbs.

Maximum cruising speed : 327 m.p.h.
Landing speed : 95 m.p.h.
Service ceiling : 25,000 feet.
Accommodation : 106 passengers can be seated.

STRATOCRUISER

U.S.A. built.

Powered by four Pratt and Whitney R-4360 Wasp Major engines, each developing a maximum of 3,500 H.P.

Petrol capacity : 6461 Imperial gallons.
Empty weight : 83,500 lbs.
Normal take off weight : 145,000 lbs.
Maximum speed : 375 m.p.h. at 25,000 feet.
Landing speed : 93 m.p.h.
Service ceiling : Over 30,000 feet.
Take off run to clear 50 feet : 1800 yards.
Landing run : 1880 yards.
Accommodation : 2 decks—standard arrangement accommodates 81 passengers.

GLOBE MASTER (C-124)

U.S.A. built. Military air transport.

Powered by four Pratt and Whitney R-4360 Wasp Major engines, each developing a maximum of 3,500 H.P.

Maximum gross weight : 175,000 lbs.
Pay load : 50,000 lbs.
Accommodation : 2 decks—can accommodate 200 troops with their field equipment.

SAUNDERS ROE PRINCESS FLYING BOAT

British built.

Powered by ten Bristol Proteus turbo prop engines.

Empty weight, fully equipped : 190,000 lbs.
Pay load : 40,000 lbs.

Weight fully loaded : 315,000 lbs.
Maximum speed : 380 m.p.h.
Still air range : 5,500 miles.

B 36

U.S.A. built. Heavy bomber.

Powered by six Pratt and Whitney R-4360 Wasp Major engines, each developing a maximum of 3,500 H.P.; plus four turbo jet engines producing a thrust of 5,200 lbs.

Maximum gross weight : 358,000 lbs.
Maximum bomb load : 84,000 lbs.
Maximum speed : 435 m.p.h.
Stalling speed : 95 m.p.h.
Service ceiling : 45,000 feet.
Maximum designed range : 10,000 miles.
Take off distance to clear 50 feet : 1665 yards.

CONVAIR 340

U.S.A. built.

Powered by two Pratt and Whitney R-2800 engines, each developing a maximum of 2400 H.P.

Maximum fuel capacity : 1458 Imperial gallons.
Empty weight : 29,486 lbs.
Maximum gross weight : 47,000 lbs.
Cruising speed : 284 m.p.h. at 18,000 feet.
Take off distance to clear 50 feet : 1200 yards.
Pressurised and air conditioned.
Passenger accommodation : 44.

VICKERS VISCOUNT 700

British built.

Powered by four Rolls Royce Dart 504 turbo prop engines, each developing a maximum of 1400 H.P.; plus 365 lbs. of jet thrust.

Maximum fuel capacity: 1720 Imperial gallons
Fuel used: specially treated kerosene oil.
Empty weight: 32,330 lbs.
Maximum pay load: 12,500 lbs.
Maximum gross weight: 52,500 lbs.
Service ceiling: 30,000 feet.
Maximum cruising speed: 331 m.p.h. at 25,000 feet.
Take off distance to clear 50 feet: 1350 yards.
Passenger accommodation: 40.
Pressurised and air conditioned.

HERON SERIES I

British built.

Powered by four Gypsy Queen series 30 direct drive unsupercharged engines, each developing a maximum of 250 H.P.

Maximum gross weight: 13,000 lbs.
Empty weight (with radio): 7,985 lbs.
Maximum pay load with fuel tanks full: 3,078 lbs.
Petrol capacity: 201 Imperial gallons.
Cruising speed: 165 m.p.h.
Fuel consumption at the above speed: 42 Imperial gallons.
Heron Series I has fixed undercarraige.
Accommodation: 14 passengers (normally).

PRESENT METEOROLOGICAL ORGANISATION FOR AVIATION IN INDIA

For the purpose of meteorology India is divided into five regions with their headquarters, which are called the Regional (Main) Meteorological Offices, at Calcutta, Bombay, Madras, Delhi and Nagpur.

These are also the Principal Forecast Centres. They keep a 24 hour watch and receive observational data from the observatories in their respective regions by high priority land line telegrams. The Regional (Main) Meteorological Offices are connected with the Central Meteorological Communication Centre (M.C.C.) at Bombay by exclusive teleprinter channels. They also have exclusive teleprinter communication with their Dependent Meteorological Offices.

It is so arranged that the Regional (Main) Meteorological Offices transmit the data collected from the observatories in its region to the Meteorological Communication Centre (M.C.C.), Bombay, by meteorological teleprinter channels. M.C.C. then in turn re-transmits these data to "Weather Central" at Poona and to other Regional (Main) Meteorological Offices.

A Dependent Meteorological Office, otherwise known as the Dependent Forecast Centre, maintains forecast watch from dawn to dusk and prepares weather charts for two or three synoptic hours. They generally supply forecasts for distances within 300 miles. If sufficient advance information is given, a Dependent Forecast Centre can obtain any forecast for distances greater than this from its Principal Forecast Centre concerned. Ahmedabad, Allahabad, Hyderabad, Lucknow, Vizagapatam, Bangalore, Jodhpur, Barrackpore and Gauhati are Dependent Forecast Centres. Dependent Meteorological Offices receive the data from their respective Regional Meteorological Offices.

In addition to the above arrangements for the distribution of meteorological data obtained by the Regional (Main) Meteorological Office, wireless telegraphy is also used. For this purpose the Indian Meteorological Department

maintains the following Meteorological Synoptic Broadcast Centres:

(a) All-India Meteorological Broadcast Centre (AIMBC) at Delhi. This station particularly broadcasts all India data for foreign countries and also obtains observational data from foreign countries.
(b) Regional Meteorological Broadcast Centre at Calcutta broadcasts its regional data.
(c) Regional Meteorological Broadcast Centre at Madras broadcasts its regional data.
(d) Meteorological Broadcast Centre at Poona also broadcasts regional data.

Principal Forecast Centres prepare synoptic charts on receipt of the data from all the other regions in India, and from the adjoining countries and seas. Inferences of weather are then made from the various meteorological charts. These centres can supply flight forecasts at short notice.

With effect from the 1st January 1953, six synoptic observations are taken at the following hours of 0000, 0300, 0600, 1200, 1800 and 2100 G.M.T. Of these 0300 and 1200 hours G.M.T. are the main synoptic observation hours. Pilot Balloon observations (for upper air) now are taken at 0200, 0900 and 2000 hours G.M.T. and the Radio Sonde observation is taken at 1500 hours.

For the requirement of aviation, hourly current weather reports in Aero Code are transmitted by wireless telegraphy from important aerodromes, including diversionery airfields. Six hourly terminal forecasts for important aero-

dromes are now broadcast from Delhi, Dum Dum, Santacruz, Nagpur and Madras.

From the 1st March 1949 AIMBC (All India Meteorological Broadcasting Centre), New Delhi, transmits synoptic data from selected stations in India, Ceylon, Pakistan, Burma, Indo-China, Malaya, Siam, Syria, Lebanon, Trans-Jordan, Palestine, Arabia, Iraq, Iran, Turkey, East Africa, Russian Turkestan, Australia and the Indian Ocean; and analysis broadcasts based on 0300 and 1200 hours G.M.T.

Presently Indian Meteorological Organisation includes :

Surface Observatories : 275
Pilot Balloon Observatories : 50
Radio Sonde Stations : 12
Radio or Radar Wind Stations : 6
Storm Detecting Radar : 1
Current Weather Observatories : 41

INTERNATIONAL AND NATIONAL REGULATIONS IN FORCE IN INDIA

The following international regulations relating to aviation are now in force in India.

(a) Convention on International Civil Aviation (Chicago), 1944, and the annexes thereto published by the International Civil Aviation Organisation with certain minor reservations and with the exception of Annex 1—Personnel Licensing, which has not as yet been implemented in India.

(b) The International Air Services Transit Agreement, 1944.

(c) The Carriage by Air Convention signed at Warsaw.

(d) The International Tele-Communications Convention (Atlantic City, 1947); and the Radio Regulations annexed thereto.

India is also a signatory to the International Sanitary Convention for Aerial Navigation.

The following national regulations are in force in India.

(a) The Indian Aircraft Act, 1934.
(b) The Indian Carriage by Air Act, 1934.
(c) The Indian Aircraft Rules, 1937.
(d) The Indian Aircraft (Public Health) Rules, 1946.
(e) Part IX (Customs) of the Indian Aircraft Rules, 1920.

All these national acts and rules are contained in the Indian Aircraft Manual.

The annexes of the ICAO were brought into force as follows :

(Annex 1 Personnel Licensing—not yet in force)
,, 2 Rules of the Air—15th September 1948.
,, 3 Meteorological Codes—15th September 1948.
,, 4 Aeronautical Charts—1st November 1948.
,, 5 Dimensional units to be used in air-ground communications—15th September 1948.
,, 6 Operation of Aircraft—International Commercial Air Transport—15th July 1949.
,, 7 Aircraft Nationality and Registration marks—1st July 1949.
,, 8 Airworthiness of Aircraft—1st September 1949.
,, 9 Facilitation of International

Air Transport—1st September 1949.

Annex 10 Aeronautical Tele-Communications—1st March 1950.

,, 11 Air Traffic Services—1st October 1950.

,, 12 Search and Rescue—1st December 1950.

,, 13 Aircraft Accident Enquiry—1st September 1951.

,, 14 Aerodromes—1st September 1951.

,, 15 Aeronautical Information Services—Being adopted.

AIR NAVIGATION

The basic purpose of air navigation is to enable an aviator to determine the position of his aircraft, the direction and distance to the destination and the time to reach the same. Academically it is derived from nautical navigation.

In clear weather over land an aircraft is quite often navigated from place to place by means of map reading. This method involves checking of position of the aircraft in relation to prominent landmarks *en route*. A visual comparison of this position on the ground to that on the map with reference to the required path (or track) of the aircraft will tell the air navigator his deviation from the track. He will then, if necessary, alter course—which is steered by a compass—to reach his destination.

If the flight time between two known landmarks (which are marked on the map) is noted, the ground speed. that is, the actual speed of the aircraft over the ground, may then be easily calculated by simple mathematics. The air navigator uses computors for all such calcula-

tions of speed, course and many other navigational matters to save time.

The above method of navigation may not always be applicable. When ground objects are not visible or while flying over unpopulated desert or the sea, some other method has to be employed. In the foregoing case corrections of courses were made on visual judgement.

In the other form, which in fact is the proper air navigation, the navigator has to precalculate the course to steer, the ground speed, the estimated time of arrival (E.T.A.) over the destination and so on, by taking into consideration the wind effect the aircraft is likely to experience and the speed of the aircraft. The direction and speed of the wind which are used in the calculation may be those supplied by the meteorologist or those actually found by the navigator while in flight. He is thus always working ahead to make good the remaining distance to the destination.

In the above process of navigation the navigator is required to find at intervals his actual position on the surface of the earth normally by any of the three means—visual observation of terrestrial objects, observation of heavenly bodies or radio and radar aids. Every new position thus found provides the navigator with much useful information. It will tell him how much alteration of course, if necessary, is to be made. He will also know the wind velocity experienced in the past and, therefore, the ground speed and the E.T.A.

Modern radio aids for approach and navigation of aircraft have simplified the work of the air navigator to a large extent, and they have brought about a definite improvement in the system of navigating an aircraft from place to place.

Radio Compass, Radio Range, Loran, Gee, Decca, VOR/DME (VHF Omni-Range with Distance Measuring Equipment) are some of the navigational aids for aircraft. Approach aids, which are used to approach an airfield for landing, particularly in adverse weather, include among others, Instrument Landing System (I.L.S.) and Ground Controlled Approach (G.C.A.—a Radar apparatus). With the help of such approach aids an aircraft can land in conditions of obscured visibility as in the case of low clouds or even fog up to a certain limit.

The Radio Compass, which in principle is an Automatic Direction Finder, is extensively used in India. When this apparatus is in operation its indicator points to the station which is tuned in on the set. The pilot then simply follows the direction of the needle to arrive at the destination.

There may be occasions when the radio aids may fail. It is then that the conventional air navigation is most helpful as ever like an old faithful friend.

STATISTICAL DEFINITIONS

PASSENGER-MILES

Passenger-miles is the distance flown with passengers multiplied by the number of passengers.

(The product may be said to be the number of miles flown for one passenger; or, it may also mean the number of passengers carried for one mile of flying.)

TON-MILES

The combined total weight of passengers

with allowable baggage, mail, freight and excess baggage multiplied by the miles flown.

i.e., Total Load × Miles Flown = Ton-Miles.

SEAT-MILES

Number of seats available multiplied by miles flown.

PASSENGER LOAD FACTOR

Total passenger-miles flown divided by the available seat-miles. It is generally given in percentage.

(It may be said that under normal conditions an airline can operate profitably with a passenger load factor of 65 per cent.)

COST PER MILE

The total cost of operation divided by the miles flown.

COST PER TON-MILE

The total cost of operation divided by the total ton-miles flown.

ADDITIONAL INFORMATION

On the 1st October 1954, the number of pilots, engineers, navigators, etc. in India were :

Pilots	
A Licence	443
A1 Licence	1
B Licence	470*
Pilot Instructor's Licence	30
Engineers	
Total	687

*It was 601 on the 1st August 1953.

Navigators

First Class	7
Second Class	60

Radio Officers

Total	195
Number of aircraft holding current certificates of registration	620
Number of aircraft holding current certificates of airworthiness	188

FIRST INDIAN 'B' LICENCE PILOT

P. M. Kabali :
Date of issue of licence—16th March 1930. He was the Managing Director of Air Services of India during the post-war years.

FIRST INDIAN GROUND ENGINEER

T. N. Khatri :
The licence was issued in 1931.

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8. Jane's All The World's Aircraft 1952-53.
9. Encyclopaedia Britannica.
10. The Encyclopedia Americana.
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