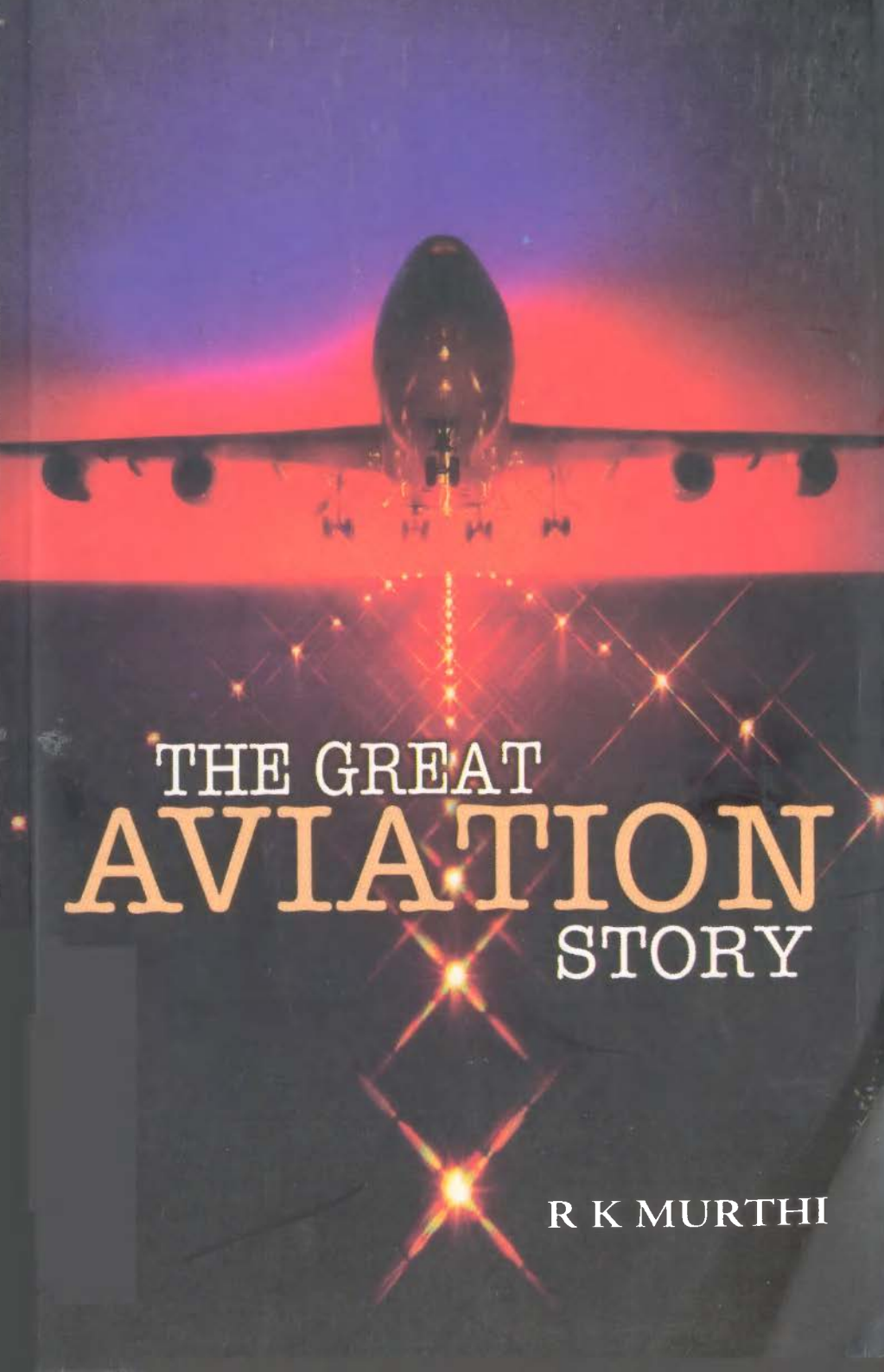
THE GREAT
AVIATION
STORY
R K MURTHI

Popular Science

THE GREAT AVIATION STORY

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Illustrations

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To my granddaughters
Saira and Sarika

Contents

Preface

In 1783, men first soared into space, riding a hot-air balloon. It was the result of pioneering work by Joseph Montgolfier and his brother Etienne, of Annonay, France. They realized that a balloon, filled with hot air, gained the required upward thrust for flight because hot air is lighter than the air around us.

Could an object, heavier than air, defy gravity and fly? That question remained unanswered, for over 120 years. This was a time well spent. During these years, many people in Europe and the United States experimented with kites and gliders. These experiments proved that objects heavier than air could fly. But nobody knew how to engineer a flying machine that would remain airborne.

Many people tried and failed. Failures, it is said, are stepping stones to success. Each failure brought out a few more insights into what more had to be done to make the dream come true.

Finally, two young men, Wilbur Wright and his brother Orville Wright, found the answer. They became the first men to fly a machine that was heavier than air. The machine was crude, unsophisticated, yet it flew.

That event marked the beginning of the great aviation story. Daring men and women explored the frontiers of the aircraft's range and speed by designing shapes and engines based on latest technological advances. The explorers have not reached the end of the road, either. They are still hot on

the chase of ways and means to take the aircraft to new records in speed, safety, style and elegance.

Aircraft, however, have one limitation. They can't take off or land almost anywhere. They need long stretches of runways. The search for an alternate machine that would take off and land vertically led to the invention of the helicopter.

Innovators are working on furthering the style, design and performance of the aircraft. They predict still more spectacular developments in aviation, in the years to come. Some say that sky is the limit. Others assert that even the sky can't set the limit to the future of aviation.

This book is history, with a difference. This is history, where facts have been touched up with the liberty of a creative writer. This presents the great story of aviation.

R.K. MURTHI

1

THE DREAM AND THE QUEST

Early man was perfectly at home on land. But water and air remained hostile.

Water could not hold him back where it was shallow. He just waded across. But he was scared to take on rivers in spate or lakes and seas. It took him quite some time to learn to swim. By flexing his limbs, he stayed above water and steered himself across. But this was tiring.

He watched logs of wood floating in water. That gave him an idea. He sat atop a log. It stayed afloat. He rode a log and forded a river in spate. It was easy. It did not tire him out. Thrilled by that experience, he shaped logs into small canoes. Canoes gave him room to sit and work the oars. He made boats of wood or reeds and sailed the high seas. Then came ships that sailed by wind power. Soon motor boats and steamships took man across high seas. Water didn't limit his movements any longer.

Man watched birds in flight. "If only I could be as deft as birds, wing my way to where I want to go!" he wished.

Man studied birds. Many facts came to light. He made a note of them: *"Every bird has wings. It flaps the wings and flies up or down. The kite flaps its wings, soars to great heights, spreads its wings, stops flapping them and glides gracefully"*.

His studies gave wings to his imagination. He shaped angels after the human form, and lent them wings. For he believed that wings held magical powers. Those with wings could fly.

Greek mythology tells us of Bellerphon. He rode Pegasus, the winged horse, and flew toward Mount Olympus, the abode of gods. This place was out of bounds for man. But Bellerphon ignored the rule. Zeus, the Greek god, sent shafts of lightning. Pegasus lost its wings and thus its ability to fly. It crashed to the earth, taking Bellerphon to his doom. He became lame and blind and wandered aimlessly till death.

Another tale tells us of Daedalus, a great inventor and engineer and a favourite of King Minos. But no one remains a favourite at court, forever. The King took offence, at a few casual comments of Daedalus, and sent him and his son Icarus into exile in the Island of Crete. Daedalus gathered feathers and used wax to glue the feathers together. He prepared two pairs of wings, one pair for himself and another pair for his son. He warned his son not to fly too high since the wax would melt in the sun's heat. The feathers would drop off, the wings would be damaged and flight would become impossible.

The two took off. Icarus kept right behind his father, for some distance. Then he let caution to the wind, dipped and rolled, had fun time. How high could he fly? He wanted to find out. He soared, higher and higher, and got closer to the sun. The wax melted. The feathers flew off and Icarus crashed to his death.

In Indian mythology, Ravana abducts Sita in the *Pushpak Viman*. We think of it as a flying chariot. In the famous work, *Arabian Nights*, there is the reference to the flying carpet.

These tales have their roots in man's desire to fly. Wings held the key to flying, man concluded. He worked on this idea.

In AD 1130, the Benedictine Monk Elmer of Malmsbury, Wiltshire, attached wings and took off from a mount. He crashed and broke his legs. He was lucky. Not so lucky was

Giovanni Battista Danti. In 1530, he tried to fly with wings, but came down a cropper. He paid for his misadventure with his life. Men like Elmer and Danti didn't know that wings, *per se*, don't give one the power to fly. He needs matching muscle power to lift him in the air and to flap the wings to keep him in flight. Scientists now know that no animal has that much muscle power.

Leonardo da Vinci, the famous artist, was an innovator too. He too wanted to fly. But he was not foolhardy. He noticed that objects, heavier than air, flew for very short duration. But gravity slowed them down and forced them to the earth. He studied the design of the boomerang used by the aborigines of Australia. He read about gliders, popular in China. He watched birds in flight. Slight movement of the wing or tail helped eagles glide in space on air currents without flapping the wings. Da Vinci sat down and drew pictures of wings and tails of various birds. He designed a birdlike flying machine. Can a machine take off verticall ? He tried the airscrew machine, which is the forerunner of the helicopter. He tested the design of a parachute. Heavy objects drifted slowly to the earth when held by strings, above which spread huge canopies made of cloth.

In 1670, Francesco de Lana-Terzi guessed that objects needed immense buoyancy to resist gravity. He designed a "ying mac' ine wi ' a ship's hull, a mast and

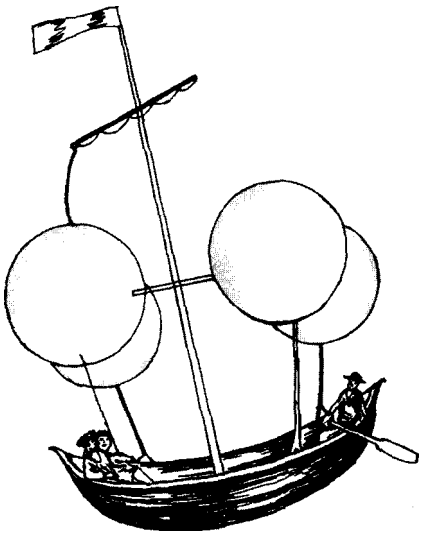

Fig. 1.1: Francesco de Lana-Terzi's flying machine

four globes out of which air had been pumped out to make them lighter. It didn't fly. But he was on the right track (Fig. 1.1).

Man didn't have enough muscle power to flap the wings fast enough to gain buoyancy. Could machine provide the power needed to fly?

Sir George Cayley got a bright idea. "Success in flight would come", he said, "by making a surface support a given weight by the application of power to the resistance of air" (Fig. 1.2). In 1853, he built a glider. Its wing surface was 200 square feet. It had three pair of wings and a tailpiece. The wings curved more on top than on the bottom. (This design was backed by Bernoulli's principle. An object, with a flat base and a curved top, reduces air pressure on top. This results in upward thrust). Cayley mounted the glider on wheels. It had room for a man. Cayley's coachman got on to the glider. The glider was pulled fast across a vast open ground. It gained the speed needed to take off.

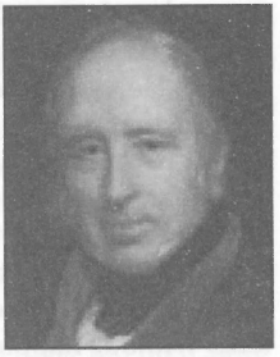

Fig. 1.2: George Cayley

Fig. 1.3: Otto Lilienthal

William Henson hailed him 'The Father of Aviation'. He improved the design of Cayley by adding two pusher propellers and managed a short flight. He dreamed of air travel to Egypt and beyond. That ended as a pipe dream. He moved to America and spent his life advocating further research into aviation.

Alphonse Pen produced working models, powered by twisted rubber motors. They had only one flaw. They

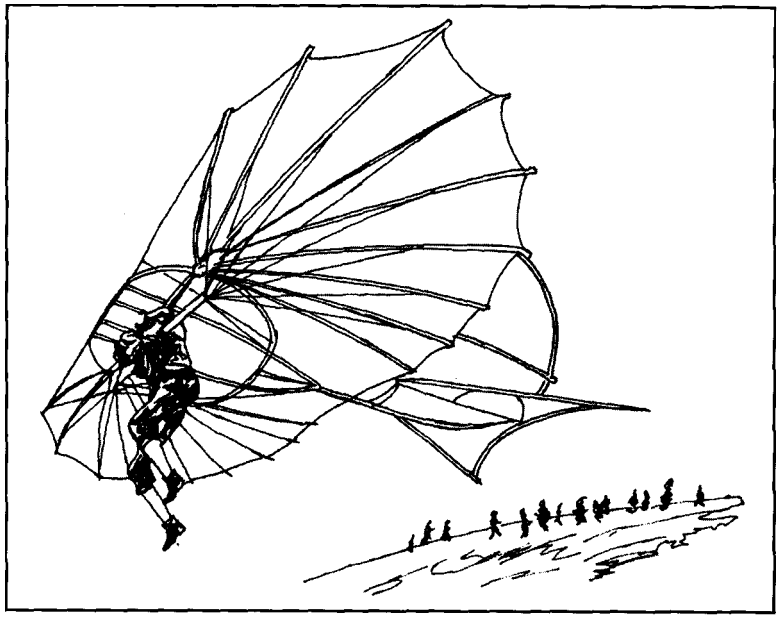

Fig. 1.4: Otto Lilienthal's design bears a close resemblence to the hang glider that are popularly used today.

didn't remain stable while taking turns. For that he needed moving wings. Otto Lilienthal (Fig. 1.3) shaped gliders whose wings could be bent and manipulated to maintain stability. He prepared a 'Flying Hill' of bricks, about 12 m high, to serve as his launching pad. He said he could fly regardless of wind's direction. He made over 2000 flights. His flights were photographed (Fig. 1.4). All went well till 9 August 1896. On that day, Otto took off in the glider. He soared into space. Suddenly the air current weakened and the glider lost movement. Otto shifted his weight, hoping to gain support for the glider from the air current. The glider nose-dived. Otto suffered grievous injuries and died that night. His last words were: "Sacrifices must be made".

In 1896, Samuel Langley made two models. They gained lift with the help of a houseboat steaming down the Potomac River. The models flew well under normal conditions. In 1903, Langley built a full-size machine. It had a wingspan of about 15 metres and was powered by a gasoline engine. Langley tested it twice, once in October and again in December 1903. On both occasions the engine failed. The flying machine was dumped into the river. Langley came very close to success. But success eluded him.

Yet within a few days of Langley's unsuccessful attempts, two young men, Wilbur Wright and Orville Wright, sons of a priest, reached the winning post.

2

WRIGHT BROTHERS IN THE RIGHT

Father Milton Wright, the Bishop of Dayton, Ohio, fumbled with the latch of the wicket gate with one hand while clutching a fairly large- sized parcel in the other. His sons Wilbur and Orville noticed him, raced to the gate, lifted the latch and held the gate open.

"Thank you, my boys", Father Milton Wright beamed a happy smile, handed the parcel to Wilbur and said, "That is for you, boys". Wilbur and Orville ripped the packet open. They screamed with joy when their eyes fell on the toy helicopter. They played with it. Its movements roused their curiosity. Their quest for more information on flying led them to mythological stories and from there to reports and records of the work of pioneers who had taken the quest forward.

On an earlier occasion, Father Milton had gifted bicycles to the two boys. Cycling had become an obsession with them. They cycled the countryside, sped along the alleyways. They hardly found time for regular studies.

"What do you propose to do?" Father Milton asked them, once it became clear that they didn't do well at school.

"We plan to open a cycle repair shop", Wilbur replied.

"Whatever you do, try to be the best. Be honest in your dealings. Be friendly to people. Earn a good name", the Bishop gave his assent.

Wilbur and Orville set up a shop. They always did a good job. They were polite to the clients. Their charges were reasonable. So their business flourished.

In their spare time, they fabricated more efficient bicycles. They had easy access to wheels and spokes and ribs to create new designs. Often they rode their new designs, over long distances, getting a measure of the resistance that wind exercised, when the vehicles moved fast. These escapades gave them clear insight of wind force and air currents. This knowledge stood them in good stead when they set out on the quest to fly.

They got a copy of the book, *Progress of Flying Machines* by Chanute and read it several times. It taught them how to prepare models of kites and gliders.

In May 1900, Wilbur wrote to Chanute, "For some years, I have been afflicted with the belief that flight is possible to man. My disease has increased in severity and I feel it will soon cost me an increased amount of money, if not my life".

Chanute encouraged him to continue the work.

The Wright brothers spent all their spare time, testing gliders. They conducted more than a thousand test flights. Some of these tests were in wind tunnels, specially made to match the behaviour of gliders under varying wind conditions. These experiments taught them the importance of the direction of the wind and the speed of the air current in controlled flight. Their success would depend on choosing a suitable site where wind conditions would be favourable.

From the United States Weather Bureau, they obtained a list of 'windy, treeless, level' sites. They examined the suitability of each of the sites. Finally they selected the sandy Kill Devil Hills, 6 km south of Kitty Hawk, North Carolina.

On 5 September 1900, Wilbur and Orville rode to the site and set up camp. Wilbur observed birds in flight, for several days. He noted how birds adjusted to wind direction and air currents. They tilted the wings to change flight path or to take turns. That gave him the idea for moveable wings. "Thus the balance could be controlled by utilising dynamic reactions of the air instead of shifting weight",

Wilbur noted. This led to 'wing warping', a concept in use on aircraft even today. Wilbur and Orville patented this design later.

"Can't we mount a gas-driven internal combustion engine on a glider? It should work", Wilbur turned to Orville and Charles Taylor, a friend. He was also a good mechanic, who helped the brothers in their experiments.

"It should", Charles replied, spontaneously.

"It should, if the engine is light and hardy", added Orville.

The three men searched for long for a suitable engine. None was available. So they set down to fabricate an engine. They cast the engine's body and the crankcase out of a single piece of very thin, light aluminium-copper alloy. It was a four-cylinder 12 hp engine, fuelled by gasoline.

Wilbur and Orville prepared the blueprints for the airplane and started fabricating it. It was a model with four wings. (That made it a biplane. Monoplanes have two wings). The wings were made of wood and covered by tough linen. Reinforced wires joined the wooden struts. The wires ran from a cradle-like device, on the lower wing. The cradle provided room for the pilot. It served as the cabin. He could lie in this cradle and shift his weight around to move the tips of the wing up or down. A tail rudder was added to provide stability while taking turns. Two pusher propellers were linked to the engine by bicycle chains.

At last, the brothers were ready to fly the crude contraption. They called it, *The Flyer*. Preparations began in right earnest for the flight. Hard wooden rails were laid on the sloping hills. On it rested a trolley with wheels. The airplane was loaded on it. A cable connected the trolley to a pulley on top of a tower. Its free end ran over the pulley and was held down by weights. Once the weights were removed, the trolley would slide down the slope, pick up speed and provide the necessary thrust for the aircraft to get airborne.

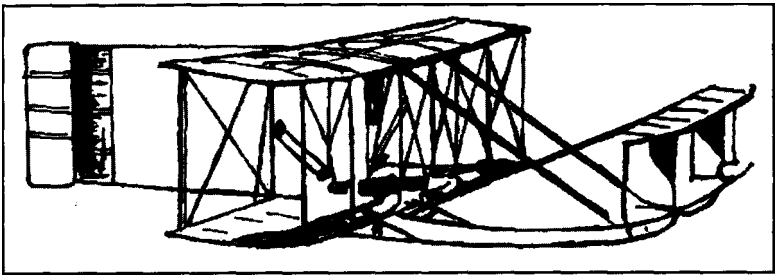

Fig. 2.1: The Wright brothers' *Flyer* (1903)—first man-carrying powered sustained flight.

On 14 December 1903, Wilbur climbed on to the lower wing and lay flat on his stomach. His hips slid into the padded wing-warping cradle. Orville made the last-minute adjustment to the motor. The propellers provided immense thrust. Orville and a friend, Will Dough, released the weights. The trolley rolled on, picked up speed. Orville ran beside the plane, balancing it with one hand.

The Flyer lifted off (Fig. 2.1). Wilbur pulled the elevator sharply upward. (The elevator is the control mechanism that helps the pilot gain or lose height according to need. Lay men refer to the elevator as the rudder.) The aircraft surged to a height of 4.5 m before losing height. Wilbur was not quick enough to turn the rudder down. The aircraft sank to the ground, its nose up in the air. It had been in the air for just 3.5 sec. In the excitement, Wilbur forgot to shut the engine off when it hit the ground. *The Flyer* dug deep into the sand, splintering a strut and also a brace of the elevator.

This was too brief a flight to bring cheer to the two men from Dayton. They set out to repair the aircraft and make it fit for another trial. It took them two days.

"We are ready", Orville looked up, picking a few strands of wire that lay on the sand dune.

"Tomorrow will be our day", Wilbur came from under the belly of the aircraft, after making the final check of the wheels.

"I'll alert John Daniels, Will Dough, Adam Etheridge and Bob Westcott to be present. This time, the aircraft, I hope, will stay up for a longer duration", Orville expressed his wish.

That night, they could not sleep. Their thoughts hovered around the grand show, scheduled for the morrow. They tossed around in their beds, dreaming of the future.

Gusty cold winds marked the dawn. But, by 10 a.m., the wind speed fell to about 30 kmph. Orville, Wilbur and the four witnesses hurried over to *The Flyer*, which rattled in the wind. "Heads I win. And tails you go", Wilbur pulled out a coin and tossed it up. The coin spun in space, came down and rested 'Tails up'.

"Congratulations, Orville. You fly first today", Wilbur smiled at his younger brother.

Orville climbed on to the lower wing, lay flat on it, and pulled the bicycle chain that started the engine. The

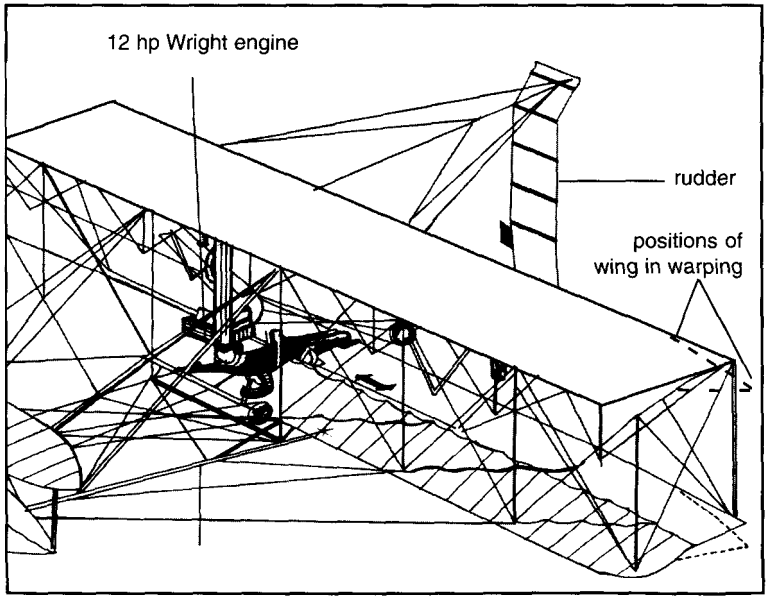

Fig. 2.2: The wing warping system.

propeller roared. The plane purred with life. Wilbur ran long, while Bob Westcott clung to a stopwatch. Daniels adjusted the camera, ready to record the historic flight. Etheridge and Will Dough removed the blocks in front of the skids of the trolley. The trolley picked up speed. The aircraft's propeller rotated fast, giving the necessary thrust. *The Flyer* rose with a shudder. Soon it gained a height of about 3.3 m. For 12 sec it remained airborne, covering a distance of 36.3 m (Fig. 2.2).

The aircraft was taken back to the starting point. Now Wilbur got on. He flew a distance of 53 m. The timing could not be recorded. Orville flew next, covering 55 m in 15 sec. On the fourth attempt, Wilbur flew 200 m in 59 sec.

Next day, *The Virginia-Pilot* reported the event in headline:

> FLYING MACHINE SOARS IN TEETH OF HIGH WIND OVER SAND HILLS AND WAVES AT KITTY HAWK ON CAROLINA COAST.

The sub-heading read:

> NO BALLOON ATTACHED TO IT. TWO YEARS OF HARD, SECRET WORK BY TWO OHIO BROTHERS CROWNED WITH SUCCESS. WITH MAN AS PASSENGER HUGE MACHINE FLEW LIKE BIRD UNDER PERFECT CONTROL.

The report began with the words, "The problem of aerial navigation without the use of a balloon has been solved". It described Wilbur as 'well-groomed, raven-haired and swarthy with piercing blue eyes'. Orville was 'sandy-haired, with sparkling blue eyes' (Fig. 2.3).

It was a small beginning. Yet it was a major triumph. Years later, Orville noted, "I would hardly think today of making my first flight on a strange machine, even if I knew that it had already been flown and was safe. After these years of experience, I look with amazement on our audacity in attempting flights with a new and untried machine".

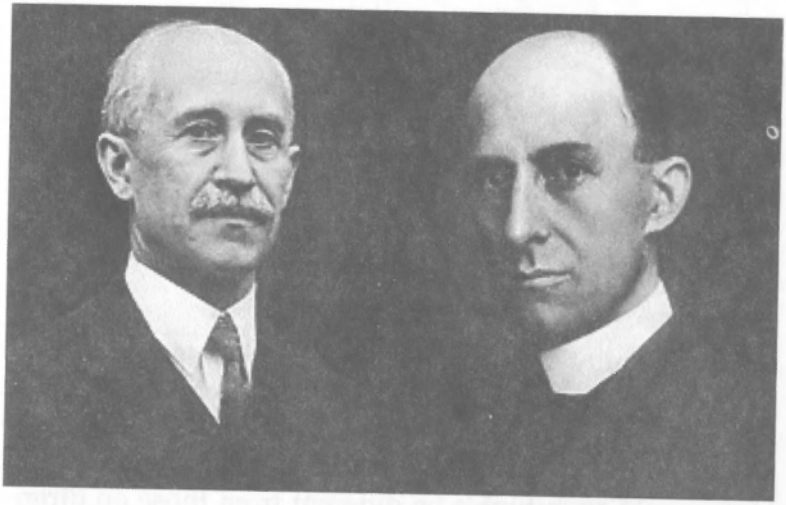

Fig. 2.3: Wright brothers

Who would have heard of Wilbur and Orville if they had not been audacious and had lacked the courage to try the untried? If they had not dared, the credit for such a flight would have gone to Alberto Santos-Dumont. But that is another story.

3

CROSSING THE ENGLISH CHANNEL

Santos-Dumont had already won the Deutsche prize of 1,00,000 Francs, flying an airship (balloon), around the Eiffel Tower (Fig. 3.1). He now turned his attention to gliders and kites. Could he install a motor and steer them along? How would such flights be different from those on dirigibles (balloons powered by motors)? The possibilities seemed immense. So Santos-Dumont resolved to master the art of flying a giant kite, powered by a motor. He read all available material on kites and gliders. Soon he was familiar with their designs.

Among his friends were professors and engineers. They educated him on the role of aerodynamics in designing kites. They suggested a box-type kite. The frame would be made of wood. The body would be covered with muslin. The engine would be suitably mounted. The kite would fly tail first.

Santos-Dumont spent a huge sum, designing the kite. Alas! He didn't know that the Wright brothers had beaten him in the race for honours. In September 1906, he was ready to fly a giant box-shaped kite. It had two sets of wings and was mounted on bicycle wheels. This, the designer said, would facilitate smooth landing. An eight-cylinder Antoinette engine was installed. The kite got airborne. It flew, tail forward, for 8 sec, covering a distance of 11.3 m. The landing was smooth. On 12 November 1906, Santos-Dumont repeated the experiment. He flew 155 m in 22 sec.

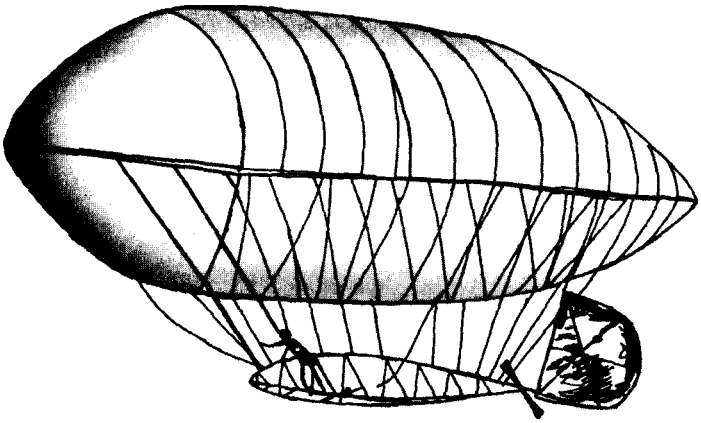

Fig. 3.1: Santos-Dumont's airship

This won him a prize of value Rs. 20,000. (Quite a tidy sum, in those days.)

Everyone hailed him as a pioneer. Santos-Dumont believed he had created history. He basked in the limelight, but this euphoria did not last long. He learnt of the Wright brothers and of their flight, at Kitty Hawk, in December 1903. He had struggled against all odds, only to come second in the race. That was a severe blow.

But he was the first man to circle the Eiffel Tower in a dirigible. That gave him some consolation. It assured him a place in the roll of honour in the history of aviation.

In 1909, Lord Radcliffe of *The Daily Mail*, London, offered a prize (value about Rs. 1 lakh then) to the first man who flew an aircraft across the English Channel. Many young men considered the offer, but backed out when they became aware of the grave risks.

No standard aircraft was available. So anyone who wanted the prize money had to prepare a flying machine on his own. Few people had the skill and the money to do that. Moreover the weather over the English Channel was

unpredictable. Gusty winds and spiralling air currents could toss the aircraft around, tear it apart; or the engine could get flooded with gasoline and stop working.

The risk was worth taking, thought Louis Bleriot, of France (Fig. 3.2).. Flying was his hobby. He was a daredevil. Many were the tumbles that he took during his previous flights with kites and gliders. He had broken his skull; pulled his calf muscle; limped for a fortnight after being thrown out of a glider, as it came in to land; received hard knocks and severe bruises on several occasions. These painful experiences, however, did not dampen his love for flying. He returned to fly after periods of enforced rest, after the mishaps.

Fig. 3.2: Louis Bleriot

Bleriot heard about the prize. He designed a monoplane. (Each wing had a span of 7 m), mounted on three wheels, two in front and one in the rear. A three-cylinder Anzani engine provided the power. It was ready by the middle of July 1909. Bleriot made plans to take off from the open ground at Le Baraques, Calais.

Hubert Latham, a leading flyer of France, too was after the prize money. He set out from Sangatte near Calais on 19 July 1909. The engine developed trouble while flying over the Channel. It spluttered, coughed, went into convulsions and then ceased to work. The aircraft lost height. Latham landed on choppy waters. A French naval vessel rescued him. He tried and failed.

Latham would try again, thought Bleriot. He was still on crutches, after a recent accident. Yet he decided to take the challenge. He told his friends, "It's only a short flight. It shouldn't take more than forty minutes. So please keep watch. When the weather holds good, I shall fly".

Bleriot was still in bed at 3 a.m. on 25 July 1909, when he was woken up by sharp knocks on the door. He sat up in bed. The pounding on the door continued. It took Bleriot some time to get hold of the crutches, adjust them and hobble to the door. Framed against the door stood a friend.

"Good Morning. We've been told that the weather shall hold today. So..." the friend walked in.

"Wonderful. I shall be ready in a minute", Bleriot hurried to the bathroom.

Bleriot took the monoplane, the BLERIOT XI, on a test flight, circled the ground twice and came back for gas. After filling the fuel tank, he restarted the engine. His friends crowded near the cockpit. He shook hands with them. As they drew back, he pulled the throttle. The aircraft rolled on, picked up speed and took to the air gracefully (Fig. 3.3). The men on the ground cheered. Someone checked the time. It was 4.35 a.m.

The aircraft flew at a height of 75 m. A French naval ship sailed the Channel, keeping an eye on the aircraft. It was assigned to help Bleriot in case his aircraft developed trouble and he was forced to land on the waters.

Bleriot felt right on top of the world as the aircraft flew

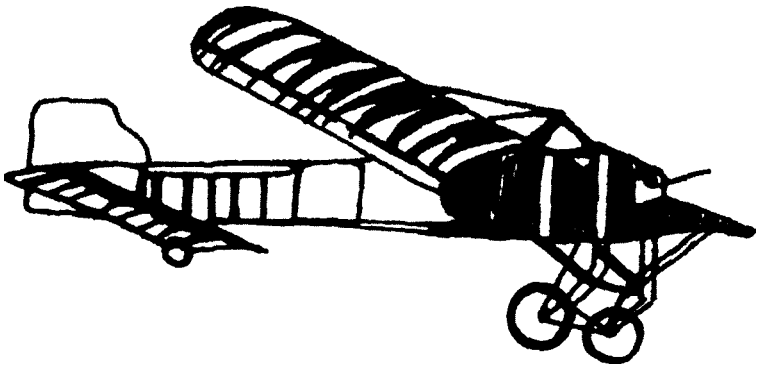

Fig. 3.3: First flight across the English Channel by Louis Blèriot in 1909.

over the Channel. He flew so fast (64 kmph) that the ship was left far behind. He had no compass and did not know whether he was heading in the right direction. He was half way through when the engine hissed. It was getting heated. A nameless fear gripped him. Would the engine fail him, force him to down his aircraft in the waters of the Channel?

He felt a blob of water on his cheek. He reached out for it, and his hand became wet with raindrops. The rain came just in time. It cooled the engine. The aircraft flew on, without any further trouble. Bleriot sighted the cliffs of Dover, to the west of his flight path, and changed the direction. The aircraft now pushed against the wind, headed toward Dover. Bleriot touched down on a green field, at Northfall Meadow, just behind Dover Castle. (It was close to the spot from where two balloonists, Dr Jeffries and Blanchard, had undertaken the first balloon flight across the Channel, more than hundred years back). Bleriot won the prize and the laurels.

A month later Bleriot entered the Great Air Meet at Reims in France. He competed with more than 30 pilots. But he lost. Glenn Curtiss of the United States recorded a speed of 77 kmph and won top honours (Fig. 3.4). It was one more feather in Glenn's cap. Earlier he had bagged prizes offered by the Scientific American and the New York Aero Club.

The organisations wanted to find out how much control man had gained over the aircraft. Could anyone fly on a day, specified in advance? Could he cover a distance of at least 1 km? Such a man deserved the prize. Curtiss accepted the challenge. He announced in advance that he would fly on 4 July 1908 (National Day of the United States).

But, 4 July 1908 turned out to be a wet and rainy day. Yet a large crowd collected at the venue. They waited, with umbrellas, raincoats and parasols protecting them from the rain. It rained the whole day. Only around sunset did the

sky clear. Curtiss climbed into the cockpit of his plane, the *June Bug*. He started the motor, opened up the throttle and nudged the aircraft into flight. He groaned when the flight ended after covering less than 1 km. He tried again. This time, he covered nearly 2 km. Sweet were the fruits of success. Curtiss savoured his victory. He had proved that one could fly at any time of one's choosing.

Fig. 3.4: Glenn Curtiss

Could the aircraft help national defence? Experts studied the possibility. But they didn't bring a sense of urgency to the task. For the world was at peace. There were minor skirmishes, but they didn't streak the sky with war clouds. An assassination whipped up the power needed to herd in the clouds to darken the scene.

4

WINGS INTO WAR

In 1914, the Archduke Ferdinand of Austria was assassinated. The tragedy rocked the whole of Europe. War clouds gathered. Efforts to avert a war failed. The Astro-Hungarian Empire, Germany and Turkey, formed a group. Pitted against them were the Allies, composed of Britain, France, Russia, Italy, Japan and the United States. First World War broke out.

Nations at war have, since time immemorial, adopted many strategies to gain their ends. Among them, the effort to gather information about the enemy's strength and formation remains vital. It was so during the First World War too.

Field scouts fanned out, sneaked, as close as they could, to the enemy lines. They stayed beyond the firing range of the enemy, watched through telescopes and gathered information.

Manual scouting almost ended when machine guns, invented by Hiram Maxim, came into use. The enemy defended his camps with machine guns. The scouts could not get close enough to gather information.

On earlier occasions, balloons had been used for aerial survey of enemy positions. Could not aircraft perform the job better? The possibilities seemed immense. Both sides started working on this idea. The existing aircraft were redesigned. Additions and alterations made them sleeker, faster and easier to fly. The cameras on board recorded

enemy formations and camps while the aircraft flew at heights well beyond the range of guns on the ground. Aerial reconnaissance became the order of the day.

How could enemy snooping be stopped? Instructions were issued to designers of aircraft to come up with ways and means to stop the predators. They considered various options and finally came up with a single-seater fighter aircraft, equipped with guns, to intercept and down enemy aircraft, engaged in aerial survey.

This was just the beginning. Soon came a brilliant idea. Can't single-seated aircraft fly over enemy territory and drop bombs? That marked the birth of bombers. New designs improved the speed and manoeuvrability and fighting power of the aircraft.

Fig. 4.1: Rolland Garros

The air was no longer a safe place. In March 1915, Raymond Saulnier invented a bullet deflection device (BDD). It was tacked to the propeller of a monoplane. Powered by a rotary engine of 110 hp, it had a maximum speed of 165 kmph and flew at an altitude of 2000 m. The BDD timed the gun to fire when the

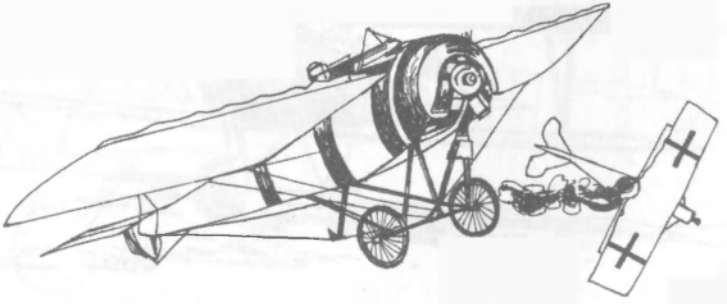

Fig. 4.2: Rolland Garros fighting German aircraft.

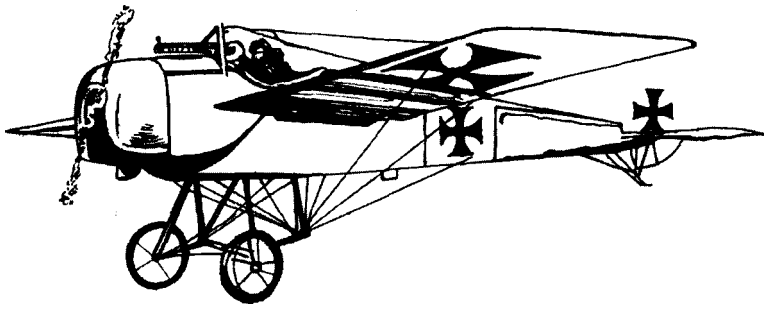

Fig. 4.3: Fokker monoplane

rotating blades were not in the way of the gun. This device proved very effective. Roland Garros (Fig. 4.1), a French pilot, used this device to shoot down three enemy aircraft during one mission (Fig. 4.2).

The Germans were not far behind. They developed the *Fokker,* a small aircraft (Fig. 4.3). Its top speed was 130 kmph. A fleet of 50 such aircraft went into action against the Allies. They turned out to be a real scourge. Aerial bombing caused severe damage to people and property. The English and the French reeled under the attack.

German designers produced special types of aircraft to serve specific needs. Training for pilots became scientific

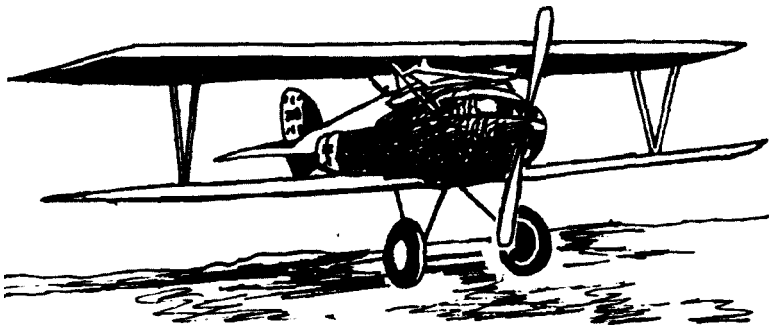

Fig. 4.4: The Albatros

and systematic. Pilots mastered the art of flying in formation. This led to development of Squadrons with defined duties. Repair centres were also set up. Germany continued to make headway in exploiting the air power.

Britain and France found the answer to the *Fokker* aircraft in new designs. In 1915, Capt. Geoffrey de Havilland produced the D4-2. It could fly at a speed of 140 kmph. The Fokker could not match it in speed and dexterity. The Germans, in turn, improved on the French aircraft *Neuport* and produced *Albatros* D-1 (Fig. 4.4). It had dual machine guns, with double the fire power, mounted near the cockpit. The Albatros carried out attacks on Britain in April 1917. (Historians refer to the period as Bloody April). England lost 151 planes; Germany just 51. German bombers, called Gothas, carried out aerial bombing even during the day. The Allies were unequal to this assault. The chances of holding back Germany looked bleak.

Then came the turn of fortune. The United States joined the Allies. Britain designed the *Sopwith Camel,* an excellent fighter aircraft (Fig. 4.5). The Bristol Fighter and Spad XIII were two new aircraft that strengthened British air strength. Germany refined the Fokker to produce the Fokker D VII,

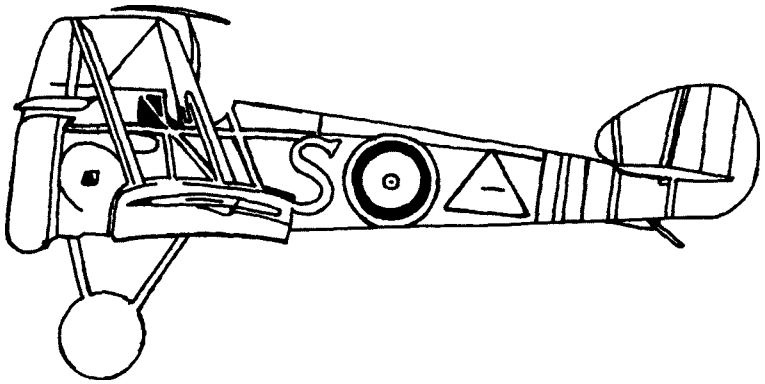

Fig. 4.5: The Sopwith Camel

with a maximum speed of 192 kmph at an altitude of 7,000 m.

Most of the aircraft had limitations. The Gothas were tail-heavy. So pilots had trouble keeping the aircraft steady at landing. The lower wing of the Albatros twisted easily while the aircraft dived. All aircraft shared one danger. Often the fuel tank caught fire. Pilots didn't have parachutes. So they could not bail out when their aircraft were hit. They faced a fiery end. Often they shot themselves before the fire got to them.

The War proved the importance of air power in war. The men who headed Britain's War Office realised this and held meetings to debate the issue. These deliberations led to the formation of the Royal Air Force on 1 April 1918.

That marked the culmination of a small, hesitant start made in 1908. In the same year, on 16 October, the first British Army Plane, designed by Cody, flew a distance of 410 m. That was just a flash in the pan. After the flight, a cost study was undertaken. The project had cost over 2,500 pounds. That was considered too high. Further work on the aircraft was shelved and the factory shut down.

However, within a year, Britain received a new jolt. Louis Bleriot flew across the English Channel. That flight was an eye-opener for the British. For centuries, the people had looked upon the English Channel as a God-given defence, a natural moat. It had warded off attacks by sea, on several occasions in the past. Bleriot's crossing of the Channel marked the end of the Channel's invincibility. The Channel could not provide any defence against air attack.

Around this time came reports of progress by France and Germany in aviation. Bleriot, Deperdessin, Morane and Farman, four French companies, took the lead in the production of aircraft. Britain could buy French aircraft. But that would leave Britain dependent on the French. Self-reliance became the need of the hour.

The old factory was restarted. Geoffrey de Havilland, who had the requisite expertise, joined the factory as designer and test pilot (Fig. 4.6). He developed the two-seater biplane model B.E. 1. It was improved and developed as the B.E. 2 (Fig. 4.7).

Fig. 4.6: Geoffrey de Havilland

The formation of the Royal Air Force came months before the World War broke out. In the brief span, the newly designed fighter aircraft hunted down enemy submarines and ships, and carried out heavy bombing of enemy installations and formations.

The War ended. The Allies won. Peace returned. Human development needed more funds. Investment in defence came in for pruning. Would it affect the progress of aviation? It could have but for the farsightedness of Winston Churchill (he later became Prime Minister of England and

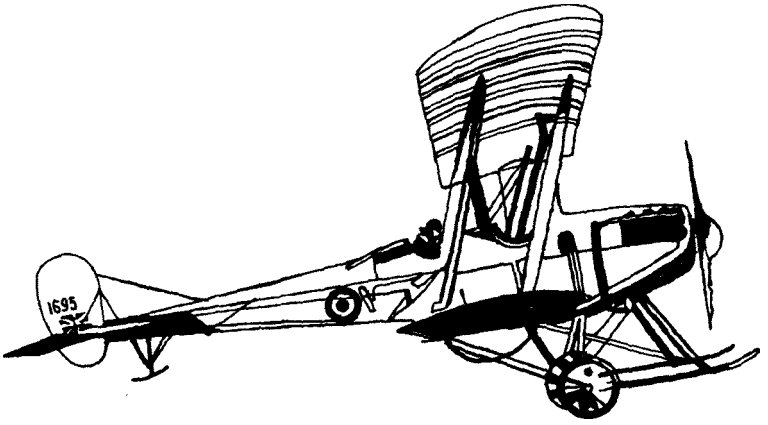

Fig. 4.7: The B.E.2 fighter aircraft.

led the nation to victory in the Second World War), who was the Secretary of State for both War and the Royal Air Force (RAF). He backed the RAF to the hilt, encouraged establishment of schools to train pilots. Mock fights and air stunts won public backing to the Air Force.

The pilots did not remain idle. The RAF saw action in campaigns against tribals in British colonies. It flew in to contain troubles in Iraq in 1922. In 1928, tribal groups of Afghanistan, led by Kabibullah Khan, rose in revolt. The men surrounded the British Legation at Kabul and took 586 people as captives. How could the captives be rescued? The terrain was mountainous, rugged, mostly snow-covered. Wild winds swirled around. The Royal Air Force was assigned the task of airlifting the captives. The pilots rose to the occasion. The operation was truly hazardous. The weather was unpredictable. The terrain was hostile. Yet the pilots completed the rescue, despite ceaseless gunfire from the ground.

Each successful operation gave a stimulus to research in aircraft design. Powerful engines and new designs enhanced the speed and range of aircraft. The First World War had given a big boost to aviation.

5

ACROSS THE ATLANTIC

Peace claimed its victims. The victims were young, daring fighter pilots. They were demobilised, knocked out of action. But the knocks did not leave them down and out. Many of them found new areas of activities.

John Alcock and Arthur Witten-Brown had served the Royal Air Force as fighter pilots (Fig. 5.1). They did not like being grounded. How could they get a chance, once again, to fly?

Alcock heard, while spending an evening at the club, in late 1918, with a friend, of a prize of 10,000 pounds offered by the *Daily Mail* to the first person to fly non-stop across the Atlantic.

"This is one flight I can undertake. If only I can find a sponsor, who gets me an aircraft and also provides funds to equip it..." Alcock didn't complete the sentence.

"That shouldn't be a problem", the friend mumbled.

"So, where do you see a problem?" Alcock said edgily.

"It's a mission fraught with danger", the friend warned.

"That's the least of my worry", Alcock smiled wryly.

Fig. 5.1: John Alcock and Arthur Witten-Brown.

"I'll make a bid, if I get necessary backing", Alcock replied.

He discussed the matter with Arthur Witten-Brown, a former RAF fighter pilot, and asked, "If I ask you to fly with me?"

"I'll jump at the offer", Brown responded with joy.

"That's a deal", Alcock reached out for Brown's hand.

A checklist of possible patrons was prepared. This list helped them find support for their project.

Which aircraft should they fly? They remembered the Vickers Vimy biplane, which they had flown during the war on bombing missions. It was a large plane, powered by two Rolls-Royce engines. It had speed and strength.

"We'll have to fly from the American end", pointed out Brown.

"I know. Air currents make a flight, across the Atlantic, heading toward Europe, easier", Alcock smiled.

The two got hold of a bomber, dismantled it and carted it, in sections, to St. John's, New Foundland, and set up camp (Fig. 5.2). The site for assembling the aircraft lay at an open ground called Mundy's Pond. The two secured assistance of a handful of enthusiastic mechanics and reassembled the aircraft. They attached additional fuel where the aircraft once carried bombs. Some space for storage of fuel was provided in the wings too (Fig. 5.3).

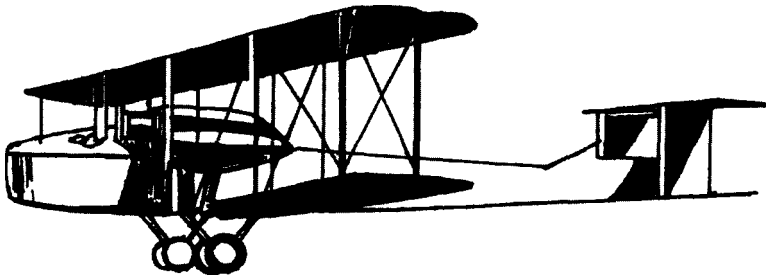

Fig. 5.2: Vickers Vimy bomber

While these preparations were under way, the American Navy launched a hopping flight across the Atlantic. Curtiss co-ordinated the technical details of the flight. Lt. Commander J.H. Towers led the group of four seaplanes.

Seaplanes and flying boats take off and land on water. Due to lack of runways, normal airplanes could not operate as passenger carriers. The seaplanes and the flying boats, therefore, were used extensively to transport people around till about 1950.

The seaplanes set out on 8 May 1919. One of the planes developed problems and dropped out. The others, after a few halts, reached Lisbon on 20 May. A week later, they flew to Plymouth, England. It was not a non-stop flight. So Alcock and Brown were not unduly upset.

Cause for worry came from another source. At St John's, two daring pilots, Harry G. Hawker and Mackenzie Grieve, were making the final preparations to fly a single-engine Sopwith biplane across the Atlantic. They set out on 18 May 1919. Alcock and Brown cursed their fate. Had they come so far, only to be beaten in the race by their competitors? That thought nagged them, while they waited for further reports of the flight of the Sopwith.

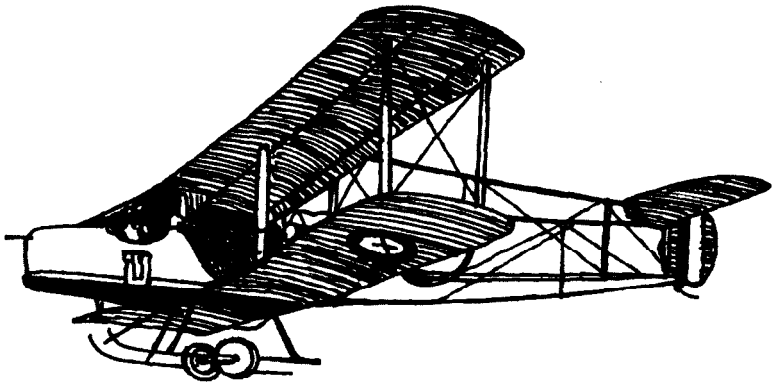

Fig. 5.3: Vickers Gunbus

Harry G. Hawker and MacKenzie Grieve flew toward the Irish coast. The engine coughed and spluttered after covering about 1,800 km. The deep blue stretch of the sea menacingly closed in as the plane lost height and tumbled into the waters. A tramper rescued the bobbing men from the waters. Thus ended their bid for the prize.

The news lifted the spirits of Alcock and Brown. They hurried with the final preparation.

14 June 1919 was a bright sunny day. Reports indicated that the weather would hold, for some time. Of course, nobody took such predictions seriously. The weather could turn bad, suddenly, without warning. The two pilots got into the cockpit. Alcock started the engine. He pulled the throttle. The aircraft raced along the bumpy, uneven field. The wings, laden with fuel, drooped. The aircraft lifted off, sluggishly, just a few feet before it reached the block of trees that circled the field. The aircraft skimmed inches above the trees.

For a couple of hours, the aircraft was nudged faster by the tailwind. That gave an added 64 kmph to the normal cruising speed of 145 kmph of the aircraft.

The first setback for the fliers came when the radio conked off. Thus the plane's communication line was snapped. Soon, the airplane began to rattle. A quick check by Alcock made him shiver. The exhaust of the right engine had cracked. It was quivering as if mad, while tongues of flame danced around the crack. For a moment, Alcock thought it marked the end of their mission. Then hope surged up. He told himself, "We've weathered many a storm, during the days in the RAF. So, even this threat may pass".

It did pass. But soon the plane ran into massive air turbulence. Vertical air currents spun the plane, viciously. The plane lost height. It came as close as 20 m of the sea. Alcock pulled at the stick, frantically. The plane quivered. Then its nose rose and Alcock and Brown sighed in relief. The plane regained altitude.

John Alcock steered the plane above the clouds and the fog. The plane faced a new danger. Sleet and snow hit the plane. The roar of the engines was loud. The two men could not even talk to each other, find out how they could face the threat.

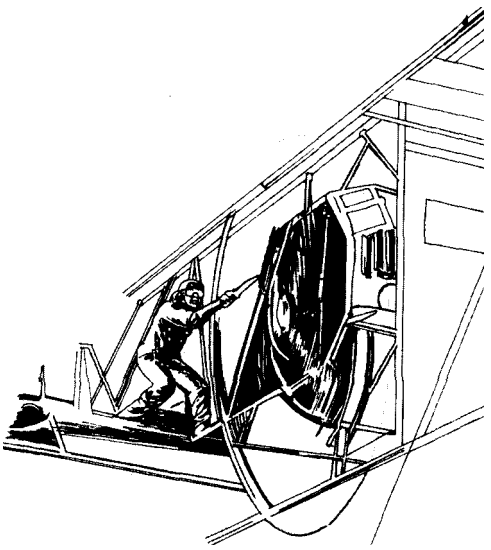

Fig. 5.4: Brown scraped the blocks of ice that coated the engine.

Brown acted on his own. He grabbed a knife and climbed out of the cockpit, crawled over the right wing, got close to the engine and scraped the blocks of ice that coated the engine (Fig. 5.4). Back he went to repeat the operation with the second engine. It was a very risky operation. A sudden gust of wind, a surge of air current would have sent Brown plummeting into the icy waters, below.

Alcock decided to fly at a lower altitude. The fog had cleared. For seven hours, the weather tested the limits of endurance of the pilots.

At last, it was day. Visibility was good. Brown scanned the scene ahead of him. Suddenly the southern tip of Ireland came into view. Brown could not contain his joy. He screamed, above the roar of the engines. But, Alcock could not make out what he was saying. He could only notice Brown holding out the hand, pointing toward a hazy curved line beyond the waters. The sea seemed to be kept back by the hazy line. Beyond the line lay land, the Irish coast. That

awareness touched his lips with a thin smile.

Alcock checked the maps, read the compass and made quick calculations. The plane was heading toward the small town of Clifden, some distance off Galway, the original target the pilots had set.

Alcock circled the land. Brown spotted a vast 'open ground'. Alcock started the descent. The aircraft touched down, in the centre of a muddy patch. The wheels of the aircraft lay buried in mud. Quickly, the two men on board the aircraft got out, splashed their way through the mud and reached firm ground. "That's it", Alcock hugged Brown. The two stood, with tears of joy streaking down their cheeks. It was their moment of triumph. They had crossed the Atlantic without a halt in between.

This triumph made them heroes. Wherever they went, large crowd mobbed them. Young boys and girls crowded around them, seeking autographs. Cameras clicked, catching their profiles on films for eternity. They received the prize money. That cheered them. But happier still were they when the King of England knighted them, at a special function at the Buckingham Palace.

6

ONE MAN'S COURAGE

The success of Alcock and Brown was historic. Now came the question: Could anyone fly the Atlantic solo? Charles Lindbergh accepted the challenge (Fig. 6.1). He made all preparations and arrived at New York in May 1927. He was keen to fly his aircraft, the *Spirit of St. Louis,* across the Atlantic, all the way from New York to Paris, solo. He had set his heart on it. But bad weather had forced him stay put for about a week. All through the night of 20 May he tossed in his bed. He could not get a wink of sleep.

Many friends asked him why he wanted to stake his life on the risky venture. He laughed off their fears. "I've designed this plane. It can carry enough fuel to last me for the journey. I may have some to spare too, at the end of the journey. As regards my decision to fly solo, well, I'd be better off with more gasoline than an extra man", said Lindbergh.

"Yet, it's risky", said his friends.

That was true. Rene Fonck, a veteran of France (he had been a fighter pilot during World War I), had tried and failed. His plane crashed at take off. Noel Davis and Stanton Wooster, two Americans, died in a mishap during a test flight. Charles Nungesser and

Fig. 6.1: Charles Lindbergh

Francois Coli, two war heroes of France, took off from Paris on May 8, 1927. They vanished into thin air. Nobody knew what happened to them.

These failures didn't scare Lindbergh. They only spurred him on, strengthened his determination to go ahead with his plan.

He was just 25. He was ready to dare and act. He wanted to be the first to fly an aircraft, solo, across the Atlantic. It was truly a quest he loved. Success would bring him name and fame. There was also the lure of the prize money ($25,000), offered by a rich hotel magnate Raymond Orteig.

These were factors that weighed with him. But hardly anyone guessed why he was so hell-bent on executing this plan. Years later, he shared it with the whole world, "I have never been aware of the need to prove myself... . My impression is that I have done what I have done because I enjoyed doing it or because I thought it led to some desirable or necessary end".

He fell in love with flying after he watched an air show at Fort Meir. "How exciting would it be to soar freely, up in the air, like birds?" thought Lindbergh. From then on, flying became a passion. Lindbergh chose flying as a career. He told his father of his decision. The old man demurred, "Flying is dangerous and you're my only son". Lindbergh pleaded. Finally, the old man agreed.

Lindbergh's mother was more understanding and supportive. She patted him and said, "If you really want to fly, that's what you should do". Lindbergh danced with joy.

From then on, nothing could hold him back. He trained to fly. There was money in flying. He earned his living, carrying passengers around. He hopped around, flying mail. In between he found time to practise parachute jumping.

Every success in the field of aviation thrilled him. Each report fired his imagination, gave wings to a desire.

He resolved to strike yet another milestone in the history of aviation.

But what could he do? The answer came to him while flying an airmail sortie in the fall of 1926. Suddenly he remembered the prize money offered by Orteig to one who flew an aircraft solo across the Atlantic, all the way from New York to Paris and set a new record in the annals of aviation.

One major problem stood in his way. He didn't have enough funds to take on this project. All that he could raise were $2,000. He needed more than $35,000, to get an airplane and to make other preparations.

Where would the funds come from? There were many rich businessmen and industrialists who often sponsored such endeavours. They had the money and the will to give liberally to help the daring.

Lindbergh approached a few rich friends and acquaintances. He explained what he had in mind. He handed over to them detailed break-up of the funds he needed and justified every item of expense.

Many people showed interest initially. Most of them, however, shied away. Finally, Harry Knight and Harold Bixby of St. Louis gave him the green signal.

The search for the ideal airplane began right away. Lindbergh was clear of what he wanted. He noticed that earlier attempts by experienced pilots, who flew double-engine aircraft, had failed. He decided, then, to fly a single-engine airplane. He decided on a Ryan monoplane.

He sent a wire to Ryan, the airplane builder of San Diego:

CAN YOU CONSTRUCT A WHIRLWIND ENGINE PLANE CAPABLE OF FLYING NONSTOP BETWEEN NEW YORK AND PARIS? IF SO, PLEASE STATE COST AND DELIVERY DATE.

Ryan discussed the finer details. Lindbergh explained "I would like to carry maximum fuel. I've to fly a distance

of about 3,500 miles (5,400 km) nonstop. If I run short of fuel, I'll be in trouble".

"What about safety?" Ryan asked.

"Safety at the start of my flight means holding down weight for the take off. Safety during my flight requires plenty of emergency equipment. Safety at the end of my flight demands ample reserve of oil. It's impossible to increase safety at one point without detracting from the other", Lindbergh defined his analysis of safety.

Ryan understood. Lindbergh was giving maximum attention to safety at the end of his flight. He was hinting that he would sacrifice safety at take off and during flight to ensure he reached his goal. He would take as much fuel as he could. If some safety equipment had to be offloaded, so be it. The radio set, used for communication, became the first casualty. That provided space for 35 kg of fuel. The sextant was discarded. "I'm on a solo flight. Where will I've the time to adjust and read the sextant?" he asked.

Reducing weight became an obsession. Lindbergh ripped spare pages off his notebook. He cut holes in the world map, clipping out places not on his route. He procured special lightweight shoes. He didn't take a parachute along. That gave room for 9 kg more of oil. He cut down on the food and water supplies too. He carried only five sandwiches and a quart of water. That was very frugal fare for a long flight of about 35 hours. Lindbergh knew it. Yet he opted for it, saying, "If I get to Paris, I won't need any more; and if I don't get to Paris, I won't need any more".

The fuel tank went in front. It blocked his vision. Lindbergh didn't consider this a major problem. In those days, the airspace was uncluttered. No aircraft flew the route. However as a measure of caution, he fixed a periscope. It poked out on the left side. The view taken by the periscope was displayed on the instrument panel. Lindbergh believed that he would be safer, with the fuel tank in front of him. A

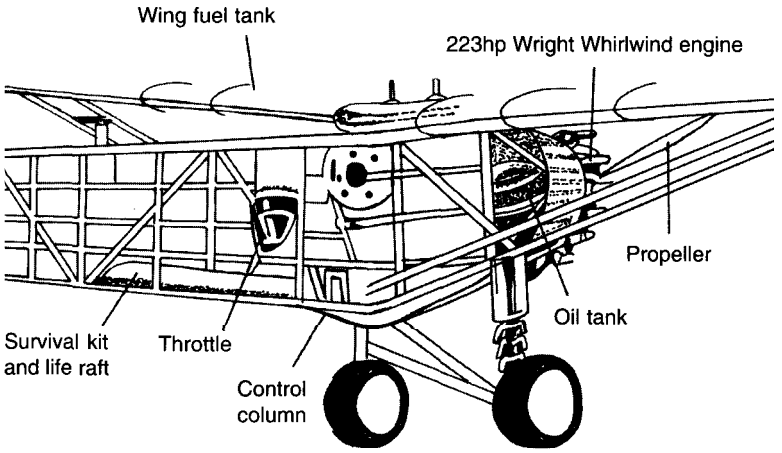

Fig. 6.2: The mechanisms in *Spirit of St. Louis*

clock, a compass, an altimeter and an air speed indicator were the other equipment he had on board (Fig. 6.2).

At 2.30 a.m., on 20 May, Lindbergh looked out through the window. The star-studded sky winked at him. Was it a signal to him to set out on his historic flight?

He jumped out of bed, took a quick bath before driving down to New York Airport. He checked the airplane, the *Spirit of St. Louis*, before taking in fuel (Fig. 6.3). "Load it up to the last ounce", Lindbergh grinned.

He got into the cockpit, started the engine, pulled the throttle. The aircraft started off, slowly. It picked up speed, but till it neared the end of the runway, it looked as if it might not get airborne. The ground crew gasped in fright. But the miracle happened. To the relief of everyone, the aircraft lifted off, just at the last moment. It flew inches above electric poles and trees, before gaining height.

A mild easterly wind held course. Lindbergh headed toward Nova Scotia, and thence to Cape Breton Island. Heavy rain, fog and turbulent weather made flying

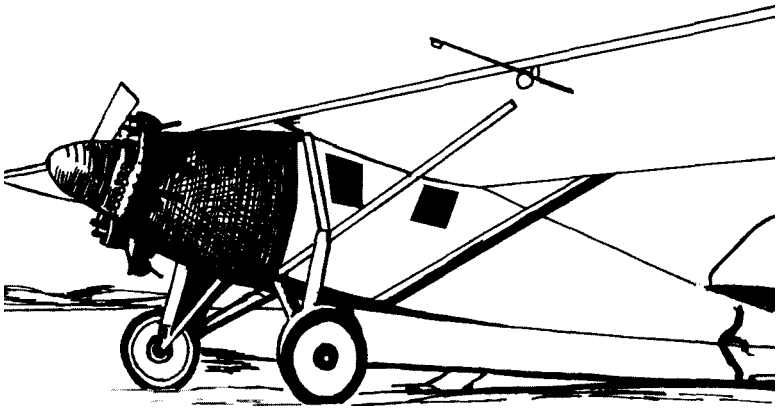

Fig. 6.3: *Spirit of St. Louis* from the front.

difficult. For a moment, Lindbergh was tempted to consider whether he should call off his mad plan and seek security at St. John. Beyond St. John lay thousands of miles of sea. Once he left St. John behind, he would have no option but to fly ahead to his destination or be ready to be dumped into the Atlantic.

With grim determination, he circled St. John and flew out toward the sea. He sighed in relief. He saw the advantage that this choice held out. "A pilot, who has 2,000 miles of sea ahead of him, can't park his plane on a cloud bank to weather out a storm or heave over a sea anchor like the sailor and drag along slowly down wind. He's unable to control his speed like the driver of a motor car in fog. He has to keep his craft hurtling through air, no matter how black the sky or binding the storm", he told himself.

He rose to 10,500 feet (3,250 m) to get above the fog. The air around was very cold. Icy clouds were all around. "They enmesh intruders. They're barbaric in their methods. They toss you in their hailstones, poison you with freezing mist. It would be a slow death, a death one would have long minutes to struggle against—climbing, stalling,

diving, whipping, always downward toward the sea", Lindbergh recollected about this experience. Quickly, he got out of the icy clouds. He descended before ice coated the wings and made the airplane heavier.

After 17 hours of flying, Lindbergh felt terribly sleepy. His eyelids drooped. He pulled the window so that ice cold wind hit his face. He slapped himself. Once he dozed off. The plane took an ugly roll, jerking him out of sleep. He saw illusions—of bottomless seas, of towering mountains, of rolling cascades. He feared of straying off the route.

The sun rose. With it came a sense of relief and confidence for Lindbergh. He had been airborne for 24 hours. The sleepiness vanished. He felt fresh and full of energy.

He flew on. Two hours later, he saw a seabird in flight. Then he saw a few native boats, sailed by fishermen. For Lindbergh that was a welcome sign. Land could be close by. Was he heading toward the Irish coast? He flew lower, hoping to find out from the fishermen on the boats. He shouted, "How far is the Irish cost?" Nobody heard his call.

After circling around the boats for a few minutes, Lindbergh realised it was a waste of energy. He was burning up fuel on a futile quest. Swiftly, he changed course and headed toward his goal. Soon, he flew over the Irish coast. He was two hours ahead of schedule. That meant he had enough fuel to fly beyond Paris. Should he fly to Rome?

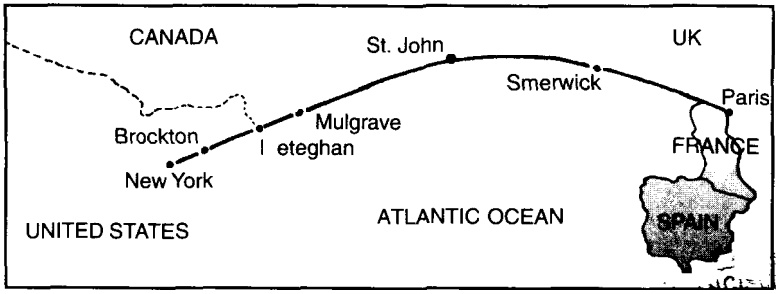

Fig. 6.4: Lindbergh's route across the Atlantic

For a moment, he toyed with the idea. Then he gave it up. He had set out for Paris. To Paris would he go (Fig. 6.4).

Joy filled his heart as he neared Paris. In ecstasy, he told himself, "The *Spirit of St. Louis* is like a living creature, gliding along smoothly, happily, as though a successful flight means as much to it as to me. We love this flight across the ocean, not I or it".

The airplane circled the airport, lit by a thousand lights (Fig. 6.5). However, darkness obscured the aircraft till it descended and came within the range of the lights. The touchdown was smooth. Lindbergh's solo flight across the Atlantic had taken 33 hours and 39 minutes.

A large crowd encircled him as soon as he got out of the cockpit. "Thousands of men and women were breaking down fences and flooding past guards", he recollected in his memoirs.

Walter S. Ross described the scene, "Lindbergh opened the door to climb out, but he didn't set foot on ground.

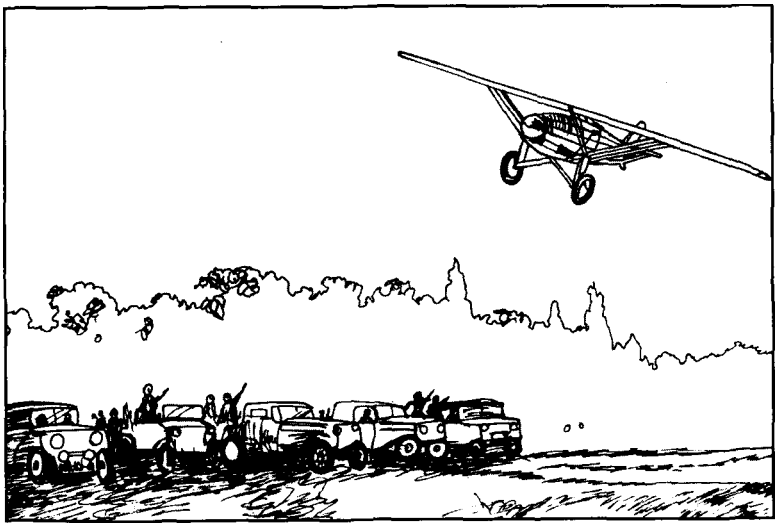

Fig. 6.5: The darkened runway in Paris was illuminated by the headlamps of cars.

Hands reached out and pulled him out. He was spread-eagled on top of the crowd like a captive tortoise". Two French pilots, Detroyat and Delage, quickly snatched the soft leather helmet of Lindbergh and made a tall American, who was standing a little away, wear it. The crowd mistook him for Lindbergh and encircled him. That gave the chance to the two pilots to lead Lindbergh away to a Renault car waiting to take him away.

He received a hero's welcome in European capitals. President Coolidge honoured him with the Distinguished Flying Cross. Time-Life Books, in their series, *This Fabulous Century*, covering the period 1920-1930, wrote, "When a lanky, soft-spoken youth named Charles Lindbergh made the first solo airplane flight nonstop from New York to Paris, America pulled out the stops. As he was escorted up Broadway, jubilant crowds showered the returning hero with 1,800 tons of shredded paper".

The accolade was his by right. He had flown solo across the Atlantic, proved that man could overcome every challenge that came his way. However there was still one challenge to be met. Nobody had flown across the Atlantic, from Europe to America.

In May 1927, a Parisian newspaper carried a report, claiming that the *L'oiseau Blanc*, piloted by Francois Coli and Charles Nungessser, of France, had crossed the Atlantic, flying East to West. This turned out to be wrong. The aircraft vanished shortly after take off. There was no trace of the aircraft or the men on board. Undaunted by this tragedy, Hermann Koehl, a former German Air Force pilot, undertook the flight. The Junkers Airplane company placed an all-metal low-wing W-33 monoplane at his disposal. Baron Gruenther von Huenfeld offered financial support on condition he was taken along as passenger. James A. Fitzmaurice, an Irish pilot with immense experience agreed to be the copilot.

The aircraft, called *Bremen*, took off, shortly after dawn, on 12 April 1928, from Baldonnel Airport, near Dublin. Strong headwinds slowed down their progress. Throughout the night, the aircraft was adrift in fog. Even after the day broke, the fog held on. The plane drifted too far north. Then came a blizzard. For four hours, the plane was tossed around. When it abated, the engine developed a leak. Koehl checked. The fuel gauge hovered around the empty mark. New York, their original target, was far away. So the pilot opted to land at Greenly Island, a barren stretch between Labrador and New Foundland. The three men had flown the Atlantic, from East to West. They had put yet another challenge down under.

Then came the daring dame, Amelia Earhart. She proved that women could match the men in grit and tenacity.

7

LADY LINDY

"There's a call for you", the telephone operator, at Denison House, Boston, informed Amelia Earhart, a social worker.

"I'm too busy to attend to the call just now. Ask whoever is calling to try again", she told the operator.

"But", said the operator, "he says it's urgent."

Reluctantly, she picked up the receiver. Over the phone crackled a male voice, "Hello, you don't know me. My name is Railey... Captain H.H. Railey. Could you come to my office for an interview?"

"Not till I know what it's all about", Amelia shot back.

"I'm thinking of a flight across the Atlantic. Would you be interested?" the man enquired.

Amelia's heart instantly gained a faster beat. This sounded too good to be true. Amelia had done some flying. She believed that the true skill of a pilot lay in how one handled the airplane. She showed her control, at air shows, while performing breathtaking stunts.

Despite all these she had never thought of flying across the Atlantic.

"I'll come", she told Railey.

The two met. Railey was taken in by her confidence and bearing. She reminded him of Charles Lindbergh. He rolled the name, in his mind, "Lady Lindy". That name stuck.

He told her of two experienced pilots, Wilmer Stulz and Louis Gordon, who would be flying a Fokker tri-motor

Fig. 7.1: Amelia Earhart

called *The Friendship*. Would she like to go along with them? "It's a chance of a life time. You'd be the first woman to fly the Atlantic", Railey pointed out. Amelia agreed.

On 27 June 1928, *The Friendship* set out on the historic flight from Trepassey Bay, New Foundland. The plane ran in and out of fog and clouds, storms and cold icy winds. The radio didn't function properly. One of the engines caused problems. The pilots got a scare when the fuel gauge indicated that the plane would remain airborne only for a couple of hours more. But luck favoured them. They touched down at Burry Port, in South Wales, England. They had covered 3420 km in 24 hours 40 minutes.

Amelia became, overnight, a celebrity (Fig. 7.1). However, much she tried to share the credit with Stultz and Gordon, she received more accolades than the other two. President Coolidge sent her a message, "TO YOU THE FIRST WOMAN SUCCESSFULLY TO SPAN THE NORTH ATLANTIC BY AIR THE GREAT ADMIRATION OF MYSELF AND THE UNITED STATES".

Amelia asked herself, "What have I done to deserve all this?" The Editor of *Flight*, the leading British aviation magazine, expressed the same thought, "Well, the first lady passenger has crossed the Atlantic, by air, although what special merit there is in that is not altogether easy to set.... The crossing of the Atlantic as a passenger doesn't seem to us to prove anything in particular".

Amelia resolved, then, to prove herself. That chance came four years later.

One day, in 1932, Amelia and her husband George Putnam were having breakfast. She lifted her head, smiled

and asked George, "Would you mind if I flew the Atlantic solo?"

He smiled. "If you want it, dear", he replied. He felt elated at the spirit of adventure of his wife.

"I'm awfully proud of you. You could have tried to dissuade me. You trusted my judgement. You know I won't attempt anything that I didn't think I could do", she stretched out her hand tenderly. He pressed it warmly. That was the seal of approval.

Amelia consulted Bernt Balchen, a close friend, who was good at readying an aircraft for such a flight. Balchen reshaped the wings and the cabin to take in more fuel tanks so that the plane could take 1400 litres of fuel and fly a distance of 5100 km without refuelling. The plane was equipped with a drift indicator, and a set of compasses.

Amelia practised flying solely by instruments. She spent hours with a friend learning how best to draw fuel from various tanks so that the weight would remain balanced all through.

On 20 May 1932 (the date is significant. On this date, in 1927, Charles Lindbergh had started on his historic crossing of the Atlantic), she set out from Harbour Grace, New Foundland. The first test of her ability came within an hour. The altimeter failed. That was a major blow. She would never know the height at which she was cruising. Without that knowledge, it was difficult to fly by the instruments.

Within 4 hours came another problem. The exhaust pipe began to rattle. The vibrations made the flight eerie. Amelia peeped back and saw flames around the exhaust. Doubts began to creep in her mind. Should she turn back? She killed that thought, instantly. The plane flew into heavy clouds. To avoid them, Amelia ascended, only to find herself in the grip of icy winds. The plane slowed down, as ice gathered on the wings. Without warning, the plane began to spin.

During the spin, the plane lost about 940 m of height. Amelia recollected later, "How long we spun, I do not know. I do know that I did my best to do exactly what one should do with a spinning plane and regained flying control as the warmth of the lower altitude melted the ice. As we righted and held level again, through the blackness below I could see the whitecaps, too close for comfort".

From the icy region, the plane slipped into the clutches of clouds. Lower down lay fog. Each one was an enemy to the plane's progress. Yet Amelia held on, all through the night.

Dawn came. With it came new problems. She turned on the reserve fuel tank. Then she noticed the leakage in the fuel gauge. Drops of fuel dripped into the cockpit. That was truly scary. The fire raging around the exhaust could ignite the dripping fuel. The plane could go up in flames. The vibration too was severe.

Amelia decided to end her flight as soon as she sighted land. Soon the plane flew over a railway track. After a few passes, she landed in a long sloping meadow. She climbed out of the plane. A farm worker ran to her. She asked him, "Where am I?" He replied, "In Gallegher's pasture". (This was in Londonderry, Ireland. Paris, her original destination lay far away. However that didn't matter. Amelia had crossed the Atlantic solo.)

"Have you come from afar?" he asked.

"From America", she replied.

She received a tickertape welcome, wherever she went. In London, she became the toast of the town. Paris spread the red carpet for her. In Belgium, the King and the Queen decorated Amelia with the Chevalier of the Order of Leopold. America honoured her with the Distinguished Flying Cross.

No longer could anyone twit her as a 'passenger'. She had truly lived up to the name, 'Lady Lindy'. She was the

first woman (and the second person) to fly solo over the Atlantic.

"I admire your courage", an admirer told her.

"How can Life grant us the boon of living... unless we dare the soul's dominion? Each time we make a choice, we pay with courage to behold the restless day, and count it fair", she noted.

Amelia could not sit on her laurels. There were new fields to be explored. Five years after her historic flight across the Atlantic, she decided to fly round the world, to take the longest possible route East to West. "Roughly it is from San Francisco to Honolulu; from Honolulu to Tokyo; (or Honolulu to Brisbane); the regular Australia-England route as far west as Karachi; from Karachi to Aden; Aden via Khartoum across Central Africa to Dakar; Dakar to Natal; and thence to New York on the regular Pan American route", she wrote to President Roosevelt.

A Lockheed *Electra*, a ten-seater aircraft, was chosen for the mission. The seats were removed. About half the cabin was filled with additional fuel tanks. It was equipped with modern gadgets to aid flight and communication. These included a periodic compass, a bubble sextant, a Pioneer Drift indicator, three chronometers, altimeter, air speed indicator, temperature gauge and a Benedix Direction finder as also flares, smoke bombs and special maps prepared to help the flight over regions, so far not clearly charted.

President Roosevelt directed the US Navy to 'do what we can'. The Navy instructed the coast guard cutter *S.S. Itasca*, stationed at Howland, to maintain radio communication with the aircraft when it headed toward the narrow strip of land.

Amelia was fully conscious of the risks. She wrote to her husband, George Putnam, "I know that if I fail or if I am lost, you will be blamed for allowing me to leave on this trip; the backers of the trip would be blamed and everyone

connected with it. But it's my responsibility and mine alone".

On 1 June 1937, she set out from Miami, on the *Electra.* Fred J. Noonan was her navigator. The flight progressed, as per schedule. They reached Lae airport at Papua New Guinea, covering 35,000 km. There were two more laps, from Lae to Howland and Howland to Hawaii, a distance of 11,000 km to go.

On 2 July the plane took off from Lae Airport of Papua New Guinea for Howland Island, 4,200 km away. The time was 10 a.m. local time (12.30 p.m., 1 July, Howland time). The plane was expected to reach Howland Island in about 18 hours.

Howland is a narrow strip of land, about 32 km long and 1.2 km wide. Its greatest height above sea level is 4.5 m. It remains a speck in the ocean. The Naval ship *S.S. Itasca* waited at Howland. It remained in constant radio communication with the aircraft.

At 7.40 a.m. (Howland time) the aircraft contacted the ship. "Gas running low. We are flying at an altitude of 1,000 feet (300 m)". At 8.45 a.m. came the last message. "We are in line of position 157-337. We are listening on 3210 kilocycles".

That was the last message from the plane. Then it vanished into thin air.

What happened? Had the plane overshot the mark and crashed? If so, why was the wreckage of the plane not found around Howland, where a combing operation was organised? Or was there something more to it? Nobody knows. All that remains are the memories of the triumphs of Lady Lindy, the first lady of aviation.

8

ABOVE THE ICECAPS

Adventure was what Lt. Commander Richard E. Byrd of the American Navy sought. Young and spirited, he loved to pit his strength against angry seas and howling winds. When he had had his fill of these, he turned to the polar region.

The year was 1925. Spring was in the air. Byrd was busy at his office. Spread before him were a few wireless messages. He was studying them when a very senior naval officer knocked at the swinging door and walked in. Byrd stood up, saluted him and politely held his hand toward a vacant chair.

"Have you heard of Donald B. Macmillan's scheduled expedition to the Poles? The main task of the expedition is to locate unknown islands in the icy region, around the North Pole", the senior explained, while taking the seat.

"It would be fun to be part of that expedition. I envy the members of the team", Byrd sighed.

"You must then envy yourself", the senior laughed.

"In what way, Sir?" Byrd's voice quivered with excitement.

"Accept my congratulations, Rich. The Naval High Command has nominated you to head the aviation activities of the expedition. I shall relieve you of your present duties, this weekend. You'll get in touch with Donald, prepare the plan for aerial survey of the remote region," the senior stood up, shook hands with Byrd and strode off.

The expedition sailed off from Wiscasset, Maine, US,

heading north, on 20 June 1925. It was Byrd's first visit to the polar region. Wherever he turned he saw snow. The entire area wore a cloak of pure white. The air was clean and refreshingly cold.

Byrd fell in love with the terrain. He flew into the icy wilderness, conducted surveys and returned with excellent inputs.

During the trip, he heard of Roald Amundsen, a pioneer of expeditions to the icy continents. In 1911, Amundsen had reached the South Pole, after trekking the vast expanse of snow. In 1925, he undertook a flight to the North Pole. With him went Lincoln Ellsworth. The two flew up to 160 km off North Pole in an aircraft. They were heading toward the target. Then came trouble. The winds became vicious. Mist and sleet caused low visibility. The engine of the aircraft coughed, shuddered and then conked off. So Amundsen and Ellsworth were forced to give up the mission.

Their failure roused Byrd's interest. He decided he would try.

On return home, after the end of the Expedition, Byrd contacted Easel Ford, son of Henry Ford, and John D. Rockefeller Jr. He shared with them his grand plan. He had the skill and the confidence. All that he needed were funds. If Ford and Rockefeller backed his program, he would earn laurels for his country.

Was it not a hair-brained idea? Why should they pour money into a seemingly impossible task? They raised a million questions. He had an answer for each one of them. His enthusiasm won them to the cause. Byrd received the nod. Ford and Rockefeller promised to finance his expedition.

Then began the search for a suitable aircraft. Byrd inspected a number of models, available in the market. Finally, he set his eyes on a Fokker transport aircraft. He made necessary changes in the structure. Chief among them was

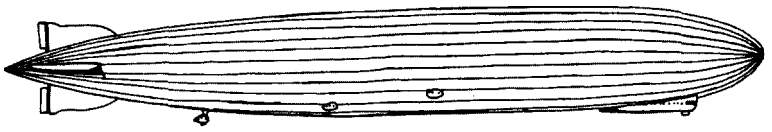

Fig. 8.1: Count Zeppelin's dirigible

the fixing of skis to serve as landing gear. Byrd named the aircraft *Josephine Ford,* in honour of Ford's daughter. He engaged the services of Floyd Bennett, a veteran pilot. The two reached Kings Bay, Spitsbergen, on 29 April 1926.

Amundsen was also there. He was planning a flight over North Pole by a dirigible, called *Norge.* (A dirigible is a balloon powered by a motor (Fig. 8.1.) It was specially equipped for the polar flight. The members of the team were Ellsworth and Umberto Nobile. Nobile was an expert balloonist.

Which team would fly over North Pole first? It was anybody's guess.

It was 9 May 1926. Byrd turned the drum containing the lubricant over a raging fire, so as to thin it. Bennett was busy chipping and pounding the snow so as to provide a level ground for take off. At last they were ready. They got into the cockpit. Bennett pulled the throttle. Byrd asked, in a hushed tone, "Remember, on three previous attempts, the aircraft had skid into snow banks. The skis got splintered. Now the aircraft has crude skis, made out of boat's oars. Will they hold?" "You bet", Bennett concentrated on the task of getting the aircraft airborne.

The aircraft rolled over the patch of level snow. It ran, swaying from side to side. Bennett fought the drag. Then he felt the upward swing of the plane, reached out for Byrd and clutched Byrd's palm. "We didn't skid. We're now flying," Bennett could not contain his joy.

The *Josephine Ford* headed north. All went well till the aircraft was about 160 km short of the target. Bennett was at the controls and Byrd at the log. Then they heard a hissing sound. Bennett examined the engine and spotted an oil leak in the engine.

"That can prove dangerous", said Bennett.

"I know. But we have come close enough to our goal. We can't go back, now. This is our only chance to create the record and to steal the honours", Byrd argued.

"Let us do or die", Bennett said, in a grim tone, making yet another check of the leaking engine.

Byrd sat, stern and silent, checking the position of the aircraft from time to time, with the help of the compass. Then he shouted, "We've done it, we're flying over North Pole. Circle the spot once and then we'll start our return trip".

"Congratulations", Bennett let a smile light up his face.

The aircraft limped back to Kings Bay, after a flight of 15 hours 30 minutes, covering a distance of about 2,470 km. They were the first men to overfly the North Pole.

Among those who greeted Byrd and Bennett were Amundsen and his two colleagues. Amundsen warmly hugged Byrd, held him close and mumbled, "You have beaten us. But my men and I are full of admiration for you".

Byrd plunged into more exciting travels.

On 29 June 1927, he set out, along with three companions, on a flight across the Atlantic. The Fokker monoplane, named *The America*, took off from New York. Byrd planned to fly to Paris, emulating the feat of Charles Lindbergh. But dense fog hung over Paris. The aircraft could not land. The pilot set the aircraft toward the Channel coast. The fuel gauge hovered around the empty mark. Left with no choice, the pilot decided to land. It came down in the surf near the village of Ver-sue-Mer.

Within months of this triumph, Byrd began to feel

restless again. He wanted yet another challenge. He thought of flying over the South Pole. If he succeeded, he would become the first man to have flown over both the Poles. He organised an expedition to the Antarctica. It was broad-based. Some members of the party would survey the land. Byrd would undertake a flight over South Pole.

The base camp was established at the Bay of Whales on top of the Ross Ice Shelf. Byrd named the camp *Little America.*

He chose a Ford Tri-motor aircraft with an all-metal body. It had been tested and found to be hardy and tough. Byrd named it *Floyd Bennett,* after the pilot who had flown the *Josephine Ford* in 1926. (Bennett had since died.) However it got a nickname *Tin Goose.*

The aircraft set out on the historic flight on 29 November 1929. Bernt Balchen piloted the flight. Harold June came in as the radioman, to maintain the communication line. Ashley McKinley handled the aerial camera. Byrd kept logs and monitored the aircraft's position.

The aircraft climbed sluggishly, because of the heavy load of fuel on board. The engine made loud notes. So the men could not talk to each other. They tied a long wire. Messages were written on paper, tied to the wire that was pulled forward or backward when messages were to be exchanged.

The aircraft approached the Queen Maud range of mountains. The peaks stood out. Some of them were about 4,200 m high. The pilot tried to gain altitude to clear the peaks. But the aircraft did not respond to the command. Balchen turned to the team members, made them understand the need for quick action. Byrd raised his head from behind the log book. He stared, with shock, at the peaks of the mountains, which stood in the way. He rolled a barrel of fuel out. McKinley helped in dumping yet another barrel. In all 500 gallons of fuel dropped out of the aircraft. It

was then the turn of food cartons to go overboard.

Smiles lit up their faces when the aircraft rose and cleared the peaks. Around noon, Byrd made some calculations, checked the readings of the compass, wrote, "We're over South Pole", and sent the message, over the wire, to others.

Balchen circled the area, once, got hold of an American flag, bound it to a stone, picked up from the grave of Floyd Bennett, and sent the flag floating down to the South Pole.

Harold June wired to base camp about the success of the mission. Soon the whole world heard about this great feat.

The US Navy promoted Byrd to the rank of Rear Admiral. The US Congress honoured him. Asked to comment about his success, Byrd shot back, "One gets there and that is all there is for telling. It is the effort to get there that counts".

An effort, equally thrilling, was carried off successfully by a British team on 4 April 1933. The team flew over Mount Everest (8,648 m). Two Westland planes took off from Lalbagh Airfield in Eastern India. The planes had open cockpits. The men protected themselves with goggles and helmets and leather jackets, gloves and boots, carried parachutes and heated oxygen cylinders. Pipes ran from the cylinders to the masks so that the men on board could breathe normally. A dust haze hung over the airport. The two aircraft lifted off at 8.15 a.m. Soon they rose to a height of 5,790 m. The settings here were cool and clear. The aircraft headed toward Mount Everest, about 80 km away. The men got a grand view of the snow-clad peaks, glistening in the sun.

Trouble struck as the planes zoomed higher. Clydesdale, the pilot of the lead plane, struggled for breath. The pipe carrying oxygen got tangled. His vision became blurred. Severe cramps gripped his feet. Clydesdale clutched,

frantically, at the emergency oxygen tube. Col Blacker, the leader of the Expedition, stepped in to help. He held the tube while the pilot inhaled deeply. Clydesdale now felt better. Colour returned to his cheeks. Blacker resumed his photo mission.

Bonnet was the cameraman on board the second plane. While adjusting the camera, he accidentally stepped on the oxygen pipe. It cracked. Bonnet tied a kerchief round the crack and continued to click shots of Everest, which now lay very close. But he fainted. McIntyre, the pilot, quickly grabbed the camera, took a few shots, while getting closer to Mount Everest.

The planes flew through the snow plume blowing over Mount Everest at about 10 a.m. Five minutes later, the planes cleared Mount Everest. McIntyre brought the aircraft down to lower heights, immediately, to help Bennett regain his breath.

These flights were historic. For they were flights over the world's most perilous regions. They were flights over ice caps.

9

SECOND WORLD WAR AND AFTER

The First World War ended, but not man's interest in aviation. Britain, France and the United States continued investment in the field. Aircraft held the key to faster mode of travel and transport. The prime need was to improve on speed and design, comfort and safety. Industrial houses realised the commercial possibility. They provided financial backing to engineers and designers and researchers. The experts came up with ideas and projects aimed at further development of new aircraft. All of them displayed abiding interest in taking aviation to great heights.

Civil aviation began with cargo transport and mail. Then it got on to transporting people. The designs of aircraft changed rapidly. Aircraft gained smart new look. They were sleek, better shaped to fly faster and smoother. Introduction of coolant instead of water and in-line cylinders led to leaner snouts. This meant considerable reduction in the drag.

In the United States, three companies, Douglas, Lockheed and Boeing, came up with new designs. Boeing 247 (Fig. 9.1) had 'low wings, twin engines' and was shaped elegantly to reduce air resistance. It took off on its maiden flight, with ten passengers on board, on 8 February 1933. It flew at a speed of 240 kmph. On 17 December 1935, the DC 3, produced by Douglas (known to us as the Dakota) carried 21 passengers and cruised at a speed of 290 kmph.

Britain and France too developed commercial aircraft.

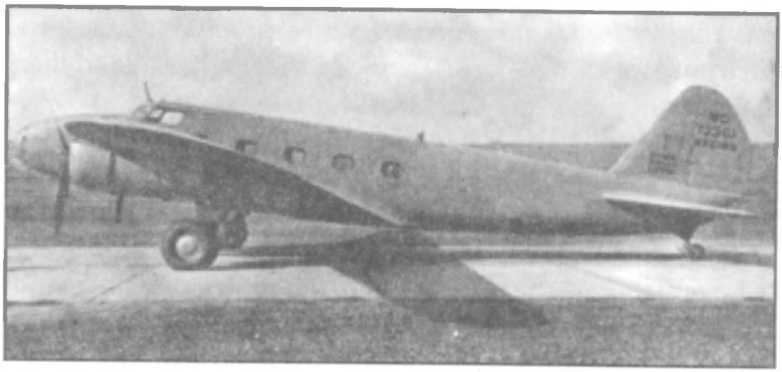

Fig. 9.1: Boeing 247

The designs underwent sea change. New material, new designs and new fuels were tested. Those that stood the test were incorporated into the next lot of aircraft. Wooden spars and fabric covering and wire bracing gave way to thin metal sheeting, stretched over frames suitably shaped to reduce air resistance. The quest for greater speed led to the clean, more streamlined monoplane. These planes proved their superiority, winning the Schneider Trophy Races (these were open to all nations), in 1927, 1929 and 1931.

The search for greater speed and efficiency continued. The piston engine limited the speed of rotation of the propellers. A new form of propulsion had to be found. It took the seekers time to remember a basic law, defined by Sir Isaac Newton. He had asserted that action and reaction are equal and opposite.

This is demonstrated easily. Blow into a balloon till its swells up. Hold the air in by pressing the mouth with the fingers. Take the fingers off, quickly. The balloon flies backward, taking a zigzag path.

Frederich Stamer and Fritz von Opel (both of Germany) and Frank Whittle of England saw the cue that Newton's law held, almost at the same time. They developed the turbojet engine. Air entered the engine through the air intake. It

was compressed, before fuel was injected and burnt to produce hot gases. These gases worked the compressor and then rushed out, providing the thrust for the aircraft.

Experiments with the internal combustion gas turbine showed that the speed of rotation to the blades of the turbine increased manifold. However, the design churned up a new problem. The high speed of rotation resulted in very fast overheating. The available metal frames could not stand this heat. That problem demanded more study. Nobody showed the will or the confidence to undertake this study. The potential of the turbine engine was not readily accepted. So further work on this idea did not gain priority. Not till the Second World War broke out in 1939!

At the end of the First World War, in 1919, a Peace Treaty was signed. The defeated nations were barred from working on military aircraft. So said the Treaty. No treaty remains valid forever. Not the Treaty of 1919 either. It ended with the rise of Nazism in Germany. Hitler came to power, presenting a new agenda. He wanted to make Germany a Super Power. For that he needed a modern defence force.

In 1934, he started rebuilding the nation's military capability. The Air Force, the Luftwaffe, was modernised. New aircraft with advance techniques like the Dornier and the

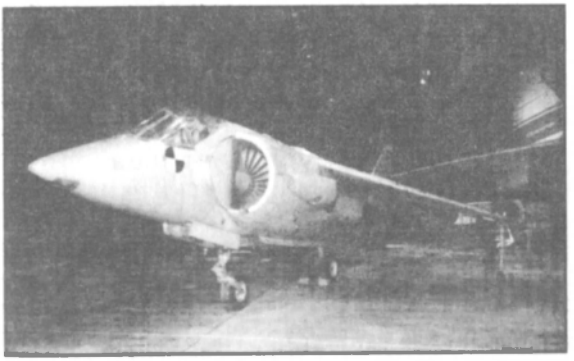

Fig. 9.2: The Hawker

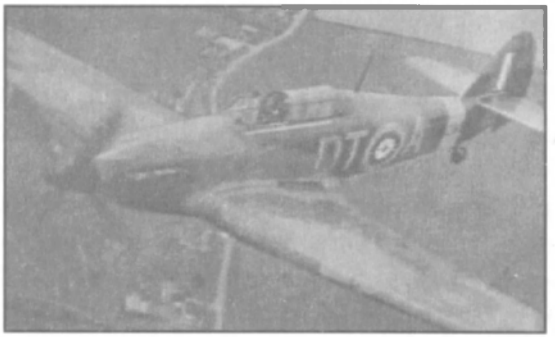

Fig. 9.3: The Hurricane

Condor were developed. In 1935, Hitler told the world that he had built up modern aircraft with immense speed and range. He proved his point in 1938. The Condor, with 26 passengers on board, made a record breaking round trip to New York and back.

Germany modernised its Air Force. It produced JU 52, suitable for bombing missions. Then came the BF 109, Germany's fighter aircraft. It was the best among piston-engine fighter planes. Britain came up with the Hawker, the Hurricanes and the Spitfire to counter the danger (Figs. 9.2 to 9.4). The US developed the Hawk 75 and then the P-36 and P-40 fighters.

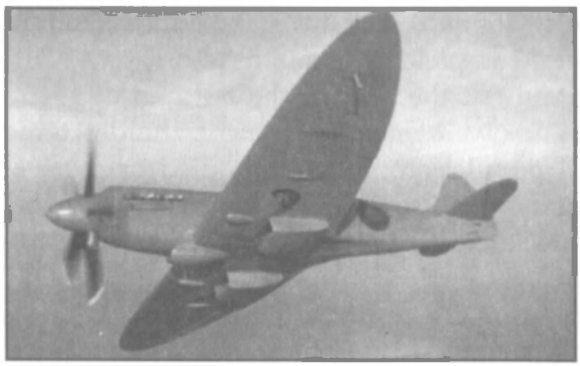

Fig. 9.4: The Spitfire

Both sides watched, with bated breath, the gathering war clouds.

In 1938, Hitler quietly added Austria to his Empire. Czechoslovakia was his next target. Both Britain and France protested. Hitler decided to go slow and lulled the fears of Britain and France with false assurances. The Munich Pact was signed. It assured the sovereignty of Czechoslovakia. But this proved to be a brief reprieve. It only deferred the take over of Czechoslovakia by a few months.

Finally, on 1 September 1939, the Germans started a Blitzkrieg (Lightning War) on Poland. The German air power proved deadly. Within three weeks, Poland surrendered. Hitler's forces targeted Belgium, Holland, Norway, Denmark and then France.

Britain was next in the line of fire. However, the nation was not totally unprepared. It replaced Chamberlain with Winston Churchill. He was the man to lead the nation in the crisis. He surveyed the Air strength, released funds to produce modern fighter aircraft and bombers and invited companies with the skill and expertise to help the war efforts.

Initial advantage in air battles lay with Germany. The Royal Air Force suffered heavy loss of men and aircraft in daylight attacks on enemy warships or on military establishments. Germans shot down the outdated aircraft before they could complete their missions.

Britain felt the heat in the autumn of 1940. German fighters and dive-bombers swarmed in hordes, targeted even the civil population. Thousands died or received severe burns and wounds. Churchill breathed strength into the nation, declared that the nation would defend itself to the very last.

This was no rhetoric. The people backed their leader to the hilt. Manufacture of fighters and bombers became paramount. Thousands of young men enlisted in the Air Force.

Many women worked at the assembly lines. Their efforts thwarted Germany's hope of an early victory. But the War was far from over.

The entry of aircraft carriers marked the next stage of aerial war. (Aircraft carriers are ships with huge runways on the deck. They also have room to house fighters and bombers. The ships sail close to the terrain or target on land chosen for attack, put in anchor at a safe distance from the shore. The aircraft take off from the deck, carry out the assigned task and return to the carrier. The aircraft fly minimal distance. So they escape early detection by the enemy. Selection of targets for attack becomes easier. That increases the margin of safety and also the success rate of the air strike (Fig. 9.5).) The Allies inducted aircraft carriers in a big way. German submarines swung in to check them before they got into position to launch attacks. The British Navy succeeded, on most occasions, to detect and destroy the U-boats. In this battle on the seas, the hunter often became the hunted.

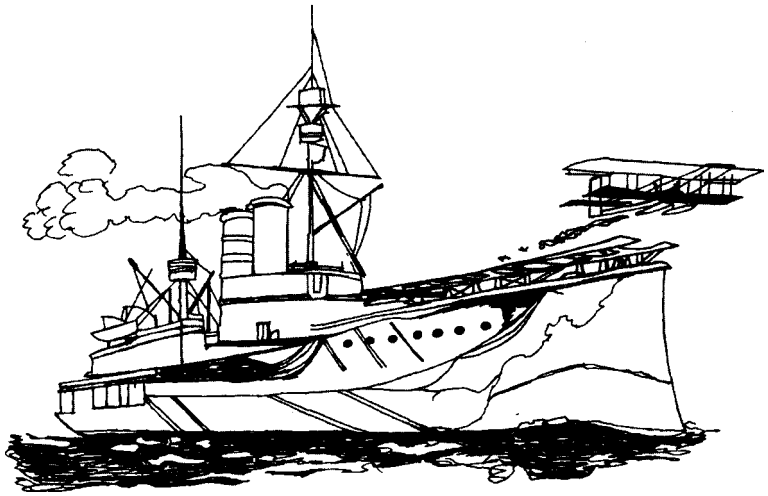

Fig. 9.5: The first flight from platform on cruiser.

The tide changed when Japan sent its bombers to destroy US ships at Pearl Harbour, on 7 December 1941. That drew the US into the War. US Air Force planes hit the enemy in the West and the East by unleashing its air power. Factories in the US worked, round the clock, to turn out aircraft with marked superiority. The P-51 Mustang fighters were more dexterous and manoeuvrable, while engaged in air battles. B-17 bombers could fly, at high speed, into enemy territory and drop around 2750 kg of incendiaries and explosives. B-29 and the Grumman F6F Hellcat too were inducted into the war. They were sleek and fast. They managed to duck and dodge the enemy interceptors and complete their missions.

Germany reeled under the concerted assault. However, Hitler's hopes revived with the development of the successful testing of the world's first operational jet aircraft, the Meserschmitt (Me-262). That was the last flicker of Germany's fortune. The Allies pressed forward. They closed in on Berlin. Germany surrendered. Hitler chose to take his own life.

The Air Force had played a major role in the final victory. Churchill complimented the men: "Never in the field of human conflict was so much owed by so many to so few".

After the end of the War, old warplanes were retrieved for civil use. But interest in the development of military aircraft did not weaken. The emergence of the Soviet Union as a Super Power made it imperative for the Americans to be in the race. This confrontation, known as the Cold War, continued till the collapse of the Soviet Union.

Many German scientists and engineers moved to the United States and to the Soviet Union. Their services took aviation to great heights.

Armament industry received a big boost. It became the key to economic development too. MIG-15 of the Soviet

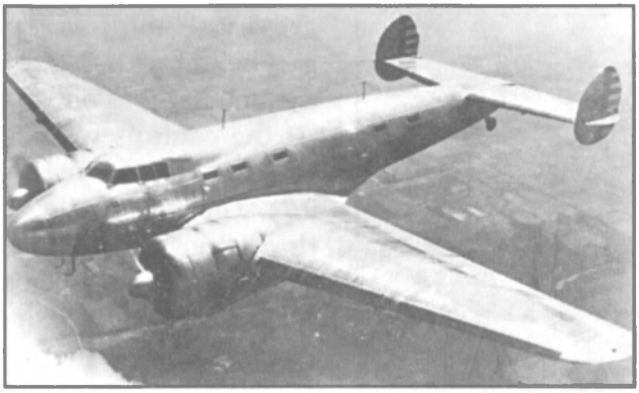

Fig. 9.6: The Lockheed XC 35

Union and F-86 Sabre of the United States saw action in the Korean War.

In the meanwhile, the turbo jet engine proved its worth. This boosted civilian flights. In June 1947, Panam started world service with L-749 Constellation, produced by Lockheed (Fig. 9.6). Boeings too commenced civilian flights. In 1952, Britain introduced the jetliner, The Comet. Boeing 707 appeared on the scene soon after. In the 1960s, aided by computer, Boeings designed improved versions, B-727 and B-747.

Civilians with enough funds demanded small aircraft that they could own. This led to the development of small aircraft like the Cessna and the Piper.

No aircraft flew faster than the speed of sound (this is defined as Mach). Could any aircraft attain a speed more than 1 Mach? Jet powered aircraft seemed capable of breaking the speed limit. Several attempts were made, by intrepid flyers. But they failed. Finally on 14 October 1947, a B-29 soared into air space over the Majove Desert in Nevada. On board was an orange Bell X-1, a small rocket-powered aircraft, powered by methyl alcohol and liquid oxygen. It had stubby wings and could withstand 18 times the force of

Fig. 9.7: Charles Yeager

gravity. The aircraft soared to a height of 11,000 m. Then the Bell X-1 was air dropped. At the controls was Captain Charles 'Chuck' Yeager (Fig. 9.7). The aircraft flew faster than the speed of sound. Chuck Yeager had created a record. Now the Concorde flies at speed of more than 2 Mach.

Every time a barrier is broken, a new challenge comes into focus. This time, the challenge revolved around the question, "Can anyone fly an aircraft non-stop around the world?"

10

AROUND THE WORLD IN NINE DAYS

It was 14 December 1986. The afternoon sun was weak. It could not kill the chill in the air over the Mojave Desert of California where the Edwards Air Force Base is located. However the cold did not dampen the enthusiasm of the men who scurried around the tarmac, in a state of excitement. The centre of their attention was 'a weird and wonderful aircraft called *The Voyager* which looked like a deformed letter of the alphabet and carried its fuel in wings which could flex 30 ft (9 m) either way'.

It was a strange looking aircraft, no doubt. Yet it seemed just right for the grand trip round the world, nonstop, that Dick Rutan and his girlfriend Jeana Yeager had planned.

The idea for this daring trip was born about six years back while Dick, Jeana and Dick's brother Burt sat at a bar, one evening.

Dick had been a fighter pilot. He had seen action in Vietnam, carried out several bombing sorties before his plane was downed. Luckily he was dumped into the South China Sea and picked up by a US rescue boat. After he retired from the Air Force, he joined his brother Burt, who was improving and experimenting with new designs for aircraft. Dick tested the new machines. Often he performed stunts at air shows. At one such show he met Jeana. She was an ace skydiver and was preparing to fly helicopters. They became friends and then lovers.

Dick and Burt remembered their days in Oregon and

California, of their childhood obsession with flying, of the happy times they had designing and flying toy planes. The talks veered round to the challenges that aviation offered. Dick referred to a record set by US pilots in 1962. They had flown, non-stop, a distance of about 12,500 miles (20,000 km).

"That record can be broken," Burt lowered his voice.

Both Dick and Jeana looked up. Then came a funny idea. How about circling the earth non-stop in an aircraft? Burt calculated the distance that the aircraft would have to cover. It came to anything between 40,000 to 42,000 km. That was double the distance (slightly over 20,000 km) recorded by Air Force pilots in 1962. Yet Burt felt it could be done. He said he would design a special aircraft. It would have to be light, yet strong and sturdy. It would carry enough fuel to power the flight around the earth. That would make the aircraft a virtual 'flying fuel tank'.

Dick looked at Burt, winked at Jeana and grinned, "Jeana and I shall fly the aircraft, try to girdle the earth non-stop". Dick later recollected, "I knew from that instant that we were going to do the thing or die trying".

Burt had built several sail planes and sports aircraft. He took just a few minutes to mentally conceive a design of the aircraft that could possibly make the round trip possible. He pulled out a paper napkin and drew the design on it. Dick and Jeana examined it. They felt a little uneasy about the weird design, but they kept their fears to themselves. Burt detailed his plans. Over the weeks, the design started gaining clarity. Burt spoke of using graphite fibre and aluminium frames to make the aircraft very light. He estimated its weight at about 900 kg.

Room for fuel gained top priority. The aircraft would need to take along 3,100 kg of aviation fuel. Burt said he would fix 17 fuel tanks. They would be placed wherever space could be found—under the wings, in the fuselage,

even in the outrigger booms that firmed up the wings. That set severe pressure on space. The squeeze on space led to a cockpit, hardly 7.5 feet by 3.5 feet (2.3 m x 1.1. m). Here, Burt grinned, Dick and Jeana would have to work, eat, sleep and relax, spend around 10 days. Irene Rutan, mother of the two boys, took one look at the cabin and snapped, "You didn't design that with people in mind". Burt softly purred, "No, Ma, I didn't. I designed it to go round the world".

To reduce weight, Burt cut down on the oxygen needed to keep the fliers in comfort while flying at altitudes ranging from 8,000 to 12,000 ft (2,400 m to 3,600 m) to the minimum; scrapped insulation needed to make the aircraft soundproof, cut down on heavy fuel gauges. Burt, however, offered to power the aircraft with twin engines. That was the only concession he offered.

Dick and Jeana winced at the hardships that they would have to face. It was not going to be easy, they agreed. Records could not be broken nor created the easy way.

Burt estimated the cost of the aircraft at $2 million. That was a fabulous sum. Where would the funds come from? Burt had gained a reputation in the field of aviation. That stood him in good stead when he passed the hat around for financial and material help. Every donation was hailed as assistance coming from a VIP (Voyage Important People). Many corporate bodies donated instruments, tools and gadgets to equip the aircraft.

It took the team six years to produce the weird aircraft. It was named *The Voyager*. It cost the team less than $2 million. Burt joked, while showing his creation to the member of the press, "It would have been $400 million if a Pentagon contractor had built on a cost-plus and over-time basis".

In July 1986, Dick and Jeana carried out a test flight, flew a distance of 18,600 km, non-stop. It took them four and a half days and just half the fuel on board to complete the flight. This success emboldened them.

They waited for setting out on the historic flight round the earth. Burt carried out rigorous check of every part of the aircraft. Finally he declared it airworthy.

The date for the final takeoff was announced.

On 14 December 1986, Dick and Jeana shook hands with friends and officials on the tarmac and climbed into the cockpit. Dick sat behind the controls, started the engines, waited till they gained enough thrust and then let the aircraft cruise along the runway. The aircraft picked up speed, but the wings, heavy with fuel, dipped and dragged. Burt who was following *The Voyager,* in a spotter plane, got a shock. *The Voyager* was not gaining the requisite lift even after covering most of the runway. A crash seemed inevitable. He warned Dick over wireless to abort the flight. But the message did not go through. Burt watched, his heart in his mouth, when the miracle happened. The aircraft rose in the air with just about 200 metre of runway to spare. Burt's hopes rose, only to sink almost instantly when he noticed that the tips of the wings had been damaged. He advised Dick to sever the tips off. That was a risky operation. But Dick managed to reach out of the cockpit, donning a parachute, and clip the damaged tips off.

The first day's flight was smooth and uneventful. The wings, even though chipped, did not pose a problem. On the second day, while over the sea near the Philippines, the aircraft faced a cyclone. Dick swerved, kept out of the eye of the cyclone with wind speed of 75 miles (120 km), taking a longer route, often gaining extra speed from the tailwinds. Then came a new danger. The aircraft had to be steered through a narrow corridor that lay between hostile Vietnamese airspace and dangerous weather pockets. The pilots managed to get through, safely. On the fourth day, the aircraft flew over Kandy in Sri Lanka. The pilots enjoyed the grand sight of sunset from their lofty flying perch. They flew over Africa on the fifth day. Weather forecasts

indicated air turbulence at lower levels. So Dick and Jeana flew at 20,000 ft (6,000 m), using both engines to gain the required lift.

The deafening noise produced by the aircraft was wrecking their mental balance. The constricted space troubled them. Time seemed to stretch into infinity. Every hour they spent on the aircraft seemed to be as long as a day. They wished they had room enough to stretch their legs. They craved for a good long undisturbed sleep. But these luxuries lay beyond their reach. That often left one or the other of them sulking, at times, and often, in bad mood. There were times when they cursed themselves for being so foolhardy. Once, even Dick, who usually never grumbled, let the guard down and told his brother, Burt, who was monitoring the flight from the ground: "I'm tired. I want to go to bed in California. Vector me home". But Jeana cheered him, told him that they were almost home, more than halfway through! When fair weather held, the two joked, sang together old ditties, felt confident of completing the mission. But often the weather turned foul; or the aircraft developed trouble. They however clung on, determined to do or die.

They received a fright during the last lap of the journey. The gauges indicated that the rear engine was getting overheated. What had caused the trouble? It didn't take them long to realise that they had not replenished its oil supply in time. They took quick remedial steps. The engine began to behave normally.

Every passing day made life more miserable. How the two wished their ordeal would end! Yet this was an ordeal they had chosen to face willingly. They could not drop out, midway. They had covered more than four-fifths of the girdle. "This too would pass", they drew courage.

While flying over Brazil, the aircraft ran into a turbulence, heeled over, one wing pointing at the sky above, one at the sea below. Dick and Jeana were tossed around for a

considerable period. They worked at the controls, managed to lift the aircraft beyond the turbulence. Bad weather over the Caribbean forced them to reroute the flight over Panama and the West Coast of Mexico.

Finally, on the ninth day after take off, *The Voyager* zoomed over the sky, touched down at the Air Force Airport at Mojave Desert. The tyres screeched when the brakes bit into them and forced them to stop whirling. Then the aircraft came to a dead stop.

Dick quickly grabbed a cowboy hat, set it at an angle on his head and emerged from the cramped cockpit, flashing the victory sign. Right behind him appeared Jeana, beaming a smile that reflected the abiding joy within. Instantly the two were sucked into a cheering crowd of admirers and friends, and reporters. Thousands of flash bulbs blew their tops off recording the tumultuous scenes at the airport.

It marked their finest hour. They had flown an aircraft, girdled the earth non-stop and thus created a record. This record would remain forever. Dick struck the right note, after the historic flight, "Life is an opportunity. It's only limited by what you can dream about".

Ronald Reagan conferred on Dick, Jeana and Burt the Presidential Citizen's medal and noted, "When we saw you coming home—so ungainly yet so graceful—well, that's about the best present America could have had". Dick replied, with a merry chuckle, "This is done by individual citizens of this great country who had the freedom to pursue a great dream".

The three had truly made a great dream come true.

11

INDIANS GET AIRBORNE

Indians were late entrants to the field. But we have made up for lost time, to a large extent. Of course, we are still much behind the developed nations. Finance stands in the way, not lack of spirit or enthusiasm or commitment. Yet many Indians have overcome the limitations, created aviation history. It is impossible to refer to all of them. However the feats of three Indians, detailed in this section, make us swell with pride.

The first Indian to dare to fly was Jahangir Rattanji Tata. He was drawn to it when he was hardly ten. He stood at the beach, on the French Coast, close to where he lived with his parents and let his eyes rivet on a small plane in flight. The drone of the aircraft became louder as it came near, started to descend and touched down on the sand. The pilot hopped out of the cockpit.

"Uncle", Jahangir screamed when he identified the pilot, Bleriot, a neighbour and a family friend. He was the first man to fly across the English Channel. Jahangir held him by the hand and looked at him with admiration. "How I wish I too could fly!" the boy turned hopefully to the elder.

"Meet me here tomorrow at 10. I shall take you on a joy ride", said Bleriot.

Next day the boy had his first flight. "Some day, Uncle, I shall fly my own plane", said the boy.

"Why not!" Bleirot gave the boy an encouraging nod.

"Can I fly planes?" the boy asked his parents, later in the day.

"Of course! Flying can be a hobby," his father, Ratanji Dadabhai Tata, held him in a warm hug.

In 1929, Jahangir received the pilot's licence. In 1930, he made a bid for the Aga Khan Trophy, offered to the first Indian who flew solo from India to Britain or from Britain to India, in the shortest time. Jahangir (better known as JRD), entered the race, took off in a *Puss Moth* aircraft and flew West, heading for Britain. Around the same time, another young man, Aspi Engineer, set out from Britain and headed for India.

JRD ran short of fuel, while flying over Egypt, and force-landed in the desert. He trekked to an outpost at Rutbah Wells, once an important stop on the Imperial Airways' route, gathered fuel and returned to resume the flight. At the next stop, on the desert route, he met Aspi Engineer. JRD greeted him warmly. Aspi grinned, but his eyes wore a beaten look.

"What is troubling you, Aspi?" JRD asked.

"I need spares, but where will I get spares in this desert? I think I have to drop out of the race", Aspi scowled.

"Cheer up, Aspi. I have some spares with me. Come, take what you want", JRD gently picked up Aspi's hand.

Aspi jumped with joy, thanked JRD, picked the spares he needed, carried out the repairs and tested the engine. "Good luck", said JRD.

Soon both resumed their flights. JRD headed West; and Aspi flew East. Both completed the trip. But Aspi recorded better timing and won the race.

"I owe my success to JRD", he said. "But for those spares, I would never have made it".

Aspi was at the airport when JRD landed at Karachi. JRD stepped out of the cockpit and ran into the warm hug of Aspi. His eyes opened wide when Aspi asked him to

accept a guard of honour, presented by a group of boy scouts. Aspi had specially brought them to the airport to make the welcome memorable. That was perhaps the best homecoming that JRD ever had!

Many years later, JRD noted, "I am glad that Aspi won because it helped him into the Air Force". Aspi rose to high ranks, retired as the Chief of the Indian Air Force.

JRD joined the family's business house (Fig. 11.1). In between, he took time to fly planes. Around that time, the Imperial Airways planned a flight between London and Calcutta via Karachi. A friend, Neville Vintcent, a dare devil flier from Britain, saw a golden chance. He suggested to JRD, "Why don't you start an airline service linking Bombay with Karachi?" JRD discussed it with Uncle Dorab. "No", roared the old man. But JRD kept up pressure. Finally he received the green signal. Tata Aviation service was formed.

Fig. 11.1: JRD Tata

The service started with a solo flight by JRD on 15 October 1932. He took off from Karachi, in a single-engine *Puss Moth*, flew solo, bringing mail to Bombay. It was a historic flight. The Airlines grew in strength. In 1948, it became Air India International. After nationalisation, the government appointed JRD as the Chairman.

In 1982, he celebrated the fiftieth anniversary of his first flight, flying the same route in a De Havilland Leopard Moth. That was indeed a record.

Vijaypath Singhania, a 49-year-old industrialist of Kanpur, chose another track to create a record. He too loved flying, knew how aviation had grown through the years since the

flight by the Wright brothers in 1903.

One day, while going over the records in aviation, he felt depressed. 'India does not have any aviation records', he moaned. How he wished someone would accept the challenge and create aviation history? Then it struck him. Why shouldn't he himself accept the challenge?

Easier said than done. But Vijaypath was equal to the task. He resolved to carry out the plan. His search for possible records to create or break led him to the feat of Brian Milton, a journalist. Milton had flown a microlite aircraft, solo, from Britain to India, in 34 days. Could he fly the distance in lesser number of days and thus create a new record? That seemed a target he could achieve.

He looked out for a microlite aircraft that would serve him well. Finally, after going round Aircraft factories all around the globe, he chose an aircraft manufactured by a British firm. It weighed just under 150 kg (6.4 m long; wingspan 10 m and maximum sped of 60 knots). He named it *L'esprit d'Indian Post.*

Preparations began in right earnest. The aircraft was readied for the 9600 km flight to Delhi. The maximum distance that the single engine aircraft could fly, non-stop, was 960 kmph. The route and the scheduled halts enroute were meticulously chalked out. Medical facilities were lined up at the halts to provide for emergencies. Landing permits at various proposed stops were obtained. Due note was also taken of the dangers posed by the turbulence over the Mediterranean Sea and over the Gulf of Oman.

On 15 August 1988, Vijaypath took off from Biggin Hill, outside London. Clouds blinded him while he flew over the Alps. He had to descend below the clouds, fly rather very low, hardly 100 m, along the coast of Italy, to avoid the mist. The fuel tank cracked and gave some anxious moments. But he safely landed at the next stop and set it right. While crossing the Mediterranean, he had his life jacket on and

carried a shark repellant. "Every time I would spot a ship, I would start calculating how long it would take the vessels to reach me if I fell", he joked.

The aircraft ran into a crosswind and was tossed around, giving him many anxious moments. Overflying the Saudi desert, the plane got caught in sandstorms. It required all his skill to steer the plane through. When he landed, the wind was so strong that the aircraft came to a dead stop in just under 4 m. Occasionally technical snags delayed his plan. At one stage, he was behind the time set by Milton by about two days. But he made up for lost time, thanks to some fine weather. He landed at Ahmedabad, 21 days after taking off from London, to a rousing reception. He had beaten Milton's record by 11 days.

The nation hailed his feat. JRD was at the tarmac of Safdarjang Airport, on 11 September, to welcome him. Milton too was present. He complimented Vijaypath on breaking his record. Vijaypath had raised India's image.

Harji Malik was one of the first Indians to be commissioned in the Royal Air Force. After independence, the Indian Air Force came into being. It played a major role in defending the nation. The officers and men displayed exceptional gallantry on the battlefield. Among them the name of Flying Officer Nirmaljeet Singh Sekhon stands out (Fig. 11.2).

It was 14 December 1971. India was at war with Pakistan. A Gnat detachment was moved to Srinagar. A 25-year-old ace pilot, Sekhon, who had flown the Gnat on several missions, was standing at the window of the duty room at Srinagar. He drew the collar closer as the chill wind wafted in. Then he heard the deafening scream of the siren. He noticed four

Fig. 11.2· Sekhon

Pakistani Sabres zooming toward the airport. Behind these planes came two more. The enemy aircraft bombed the airport. Four of the ten aircraft held at the airport were damaged.

"I will get you, for sure", Sekhon swore, while he sped to the hangar. He neared one of the gnats that had not been damaged. He found Srawan Singh, an airman, bleeding, badly hurt, yet boldly checking the aircraft, and asked him, "Is this aircraft fit to fly?" The man nodded his head.

Sekhon got into the cockpit. "Take my advice. Don't go after them. There are six of them. You can't hunt them down", the man warned, before collapsing.

Sekhon started the engine. He got clearance to take off and was soon in flight. He went after the Sabres. He spotted two of them, flying low, almost scraping the tops of trees. He took them by surprise. His guns boomed before the enemy knew what was happening. The two Sabres were hit. They spun like leaves, caught in a storm, and crashed.

Sekhon steadied the Gnat at a height of 200 m and looked out for the remaining four Sabres. He knew that he no longer enjoyed the advantage of taking them unawares. He saw in the rear mirror three Sabres coming after him. He quickly set the Gnat on a back roll. The enemy pilots didn't anticipate that move. They banked to the right. Sekhon got just enough time to shoot one of them down. The other two regrouped and charged. This time Sekhon could not avoid a direct hit. The tail of the aircraft burst into flames. The engine went dead. The left wing caught fire and fell off. Sekhon took a deep breath as the plane started to plunge. Then his eyes lit with joy. He noticed the tracers fired by ack-ack guns on the ground, tearing the bellies of the Sabres. He was still savouring this sight when his plane hit the ground. Sekhon died with a smile on his lips.

The nation honoured him with the Param Vir Chakra.

12

HELICOPTERS

Aircraft needs to pick up immense speed, on the ground, before it can get airborne. The speed at which air runs over and under the wings (Bernoulli's principle), provides the upward thrust. Higher speeds generate more powerful thrusts and thence more lift.

Aircraft have giant wheels. The runways at modern airports are very long. The pilot starts the engine, revs it up and waits for the engine to gain enough power and thrust before he pulls the lever. The aircraft gains speed. More speed and still more speed! Then, suddenly, the nose of the aircraft tilts up. It cuts its way through space. The nose moves further up. The aircraft gets bodily lifted. The steep climb ends, once the aircraft gains the height it needs to cruise. The pilot presses a control button. The wheels retract and slip snugly into the body of the aircraft.

Runways are essential to put an aircraft in flight and permit it to land back. The aircraft is of no use where this facility does not exist. At such places, the helicopter comes into play (Fig. 12.1). The helicopter has a main rotor and a tail rotor. They are mounted on top of the frame. The main rotor provides the lift. The tail rotor checks the tendency of the helicopter to pull in a direction opposite to that set by the main rotor. The rotors rotate at very high speed, force the air to part and provide the necessary lift.

The helicopter can move in any direction or simply hover over one place by suitable adjustment of the angles

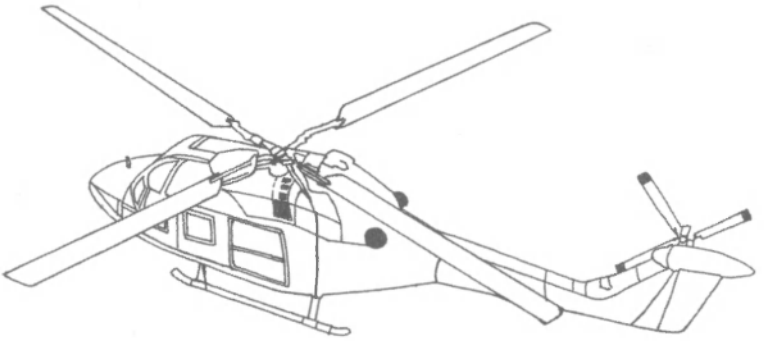

Fig. 12.1: The Helicopter

of the blades of the main rotor and the tail rotor. The adjustments are made with the help of pedals and levers.

The basic idea for the helicopter goes back to 12th century China. A toy-maker shaped a slim elegant shaft with holes from wood. Into the holes, he inserted and fixed small arms, shaped with care. The toy looked like a huge screw. The man added three propeller-like wings attached to one end. A firm tug at the free end of a string that wound round the central rod sent the toy into a spin. This spin produced the lift and made the toy fly.

Leonardo da Vinci, one of the greatest artists of all times, was a genius (Fig. 12.2). His interests were varied. He loved to paint. Da Vinci spent hours, observing birds in flight. He drew pictures of birds in flight, studied the anatomy of birds to find out the secret of flight. This quest led him to the details about the old Chinese toy. He worked on the design and

Fig. 12.2: Leonardo da Vinci

drew the blueprint for a machine that resembled a giant screw. He called it, 'Helipteron', by combining two Greek words, *Heli* (means spiral) and *Pteron* (wings). Da Vinci believed that it could fly. But how could it draw power to stay airborne? He thought four men could work the bars, attached to the airscrew. He left it at that.

Centuries later, Lomonosov, a Russian scientist, put a crude form of the helipteron in flight in 1754. In 1843, Sir George Cayley spent time to fabricate a flying machine that would take off vertically.

Louis and Jaques Breguet were siblings. They flew kites, spun out boomerangs that returned to them after short flights. Then they read about the helipteron. They assembled crude replicas with whatever they could lay their hands on. This childhood interest led them into the field of flight, once they were on their own. Charles Richet, another young man, joined them. The three spent all their spare time on the design of the helicopter. They called it the Gyroplane. The rotors whirled very fast. In 1907, the machine rose by 0.6 m on the first attempt. On the second try, it lifted itself bodily to a height of 1.6 m.

In the same year, Paul Cornu came up with a more effective design. It had twin rotor blades, powered by a gasoline engine. The helicopter lifted itself and Paul up in space. It rose to a height of 0.6 m and stayed aloft for about 20 seconds. In the next trial, the helicopter rose up, taking Paul and his brother too aloft.

These were small beginnings, faltering steps taken by the pioneers. It took three more decades before the helicopter truly entered the field of aviation. Heinrich Focke, a German technologist, studied the work done by the pioneers. He improved on the designs. He carried out tests with his machines. Finally he felt confident that he had a design of a helicopter that would fly as freely as an aircraft.

In 1938, Heinrich announced that he would hold a

public demonstration in Berlin. Huge crowds gathered to watch the air show. The helicopter stood at the centre of a wide open ground. Hanna Reitsch, a daring young dame, was at the controls. Heinrich went round, making last minute checks. Finally, sure that everything was in perfect working order, he signalled to Hanna. She started the engine. The deafening sound of the rotors, whirling madly, resounded in the air. People craned their necks to get a better glimpse of the grand show. The helicopter rose in space. It was incredible. The machine kept gaining height. On and on to record a height of 2,400 m! It flew forward at 120 kmph; and backward at the speed of 32 kmph. It covered a distance of about 225 km. The helicopter came of age, on that historic day.

From then on, its growth was phenomenal. It developed more range and speed, and found its place in civil and military operations.

Helicopters airlift wounded soldiers from forward lines to base hospitals; fly in to drop men and material in difficult terrain, that are not accessible by road; maintain the supply line to forward posts. Helicopters are found active in war zones and disaster stricken areas. They carry out survey operations and weather studies. On ceremonial occasions, like the Republic Day, they fly low along or around the venue, drop flowers that make the scene truly colourful.

Helicopters were held in readiness, on 24 July 1969, to pick up the astronauts when Apollo 11 Command Module touched down on the high seas. The helicopter hovered above the space capsule. It dropped a flotation ring to the capsule and pulled up the astronauts.

In India, helicopters fly supply missions to several forward posts in the Himalayas. These missions are dangerous. Pilots steer the helicopters between mountain ranges. Often wild winds rock the helicopters. It demands immense

courage to carry out such missions, especially when the posts lie close to the enemy lines and danger of sniper fire always exists.

Naval helicopters undertake several specialised tasks. They carry out reconnaissance flights. Anti-submarine helicopters use sonar devices. They spot enemy submarine and drop depth charges to explode near the submarine. If the hit connects, the submarine's hull gets cracked or it is forced to surface. These sonar devices send out wave pulses into the waters and wait for the reflected echoes. They show up as a blip on a TV screen. Experts study the image and decide if it is a whale or a submarine. This decides the course of action to be taken. Naval helicopters rescue fishermen who drift at sea during cyclones.

Daring are those who man the helicopters. One instance comes to mind.

It was 13 October 1992. Tourists were in high spirits when they boarded the cable car to take them to the Timber Trail resort on the hilltop, close to the Shimla-Kalka highway. The cable car slid across, providing a grand view of the gorge, about 2,500 m below. One moment the car was gliding, smoothly. Next moment, two of the wires of the cable car snapped. The car tilted, dangerously. Those in the car clutched the bars or held on to each other, while the car swung like a leaf in a storm. Fear gripped them. Would the remaining six wires hold on? Or would they snap and dump the car, with the tourists, into the gorge?

The local police immediately sought help from the IAF and the Army. The IAF station at Sarsawa received the call about two hours after sunset. It was too late to launch rescue operation. The trapped tourists spent the night, on board the dangerously hanging car, hoping against hope that they would survive the ordeal.

Next morning, Air Force helicopters flew in. They studied the terrain and the strategy for the rescue. Several

attempts were made to land a commando on the cable car, break into the car and winch the trapped people. But strong winds aborted every attempt. Should they wait till next morning?

"No", said Major Ivan Casto, one of the commandos chosen to land on the car and to carry out the rescue.

"Have you any idea of the risk? The winch comes in the way", one of the team members pointed out the danger. (The winch is a roller that has steel cable wound round. Very much like the spool with the string whose free end is tied. The turn of the spool decides how much string the kite gets.)

"I know", said Major Ivan Casto.

"We will be forced to cut the winch if you or the cable that takes you down to the car touches a cable of the car. That will send you hurtling in space, crash in the valley. What hopes have you of survival if that happens?" said the pilots who would stay on the helicopter and try to keep it stable and steady.

Casto pursed his lips and said firmly, "Let us get going".

It was around 5 p.m. The helicopter took off, hovered directly over the cable car. The winch lowered Casto to the top of the cable car. He broke the glass panes of the cable car. The tourists beamed a welcome smile. His presence worked wonders. He got down to work immediately. A father and his four-year-old son, strapped on to his back, were hauled up first. Four more persons were winched to the helicopter before darkness fell.

The operation was suspended for the day. Casto spent the night in the cable car. His presence worked wonders. Those who remained in the cable car now looked relaxed. Rescue operation was resumed next morning and completed by 10.30 a.m. It marked one of the finest hours for the army commandos and the helicopter pilots.

One could recollect hundreds of such daring feats in which gallant men on board helicopters performed death-defying acts. Each of them confirms the power of courage. Truly has it been said, "Courage conquers".

13

DARE DEVILS

Courage conquers, we said. Every pioneer displays courage of a high order. Each one is a dare devil. Each feat is unique. A quick survey of the history of aviation leads us to more names and events. Let us take note of some of the men and events that made aviation history.

The first name that comes to mind is of Sir George Cayley. He tracked down the forces that needed to be controlled before one could fly. These were 'lift, drag, thrust and gravity'. He developed the controlling mechanisms to counter-balance these forces and thus provide balance to the flying object. He shaped the horizontal rudder (or elevator), experimented with multiple-wing designs, thought of the propeller. For over forty years, he worked. Finally, in 1849, he decided to test fly his tri-plane glider. He strapped a 10-year-old boy on to the glider and tested it at the open grounds close to his home Brompton Hall. The glider soared in space.

Lindbergh flew across the Atlantic solo and created an endurance record. The round the world trip in *The Voyager* by Dick and Jeana set another endurance record. Charles Kingsford Smith tried a different type of endurance (Fig. 13.1). He became

Fig. 13.1: Charles Kingsford Smith

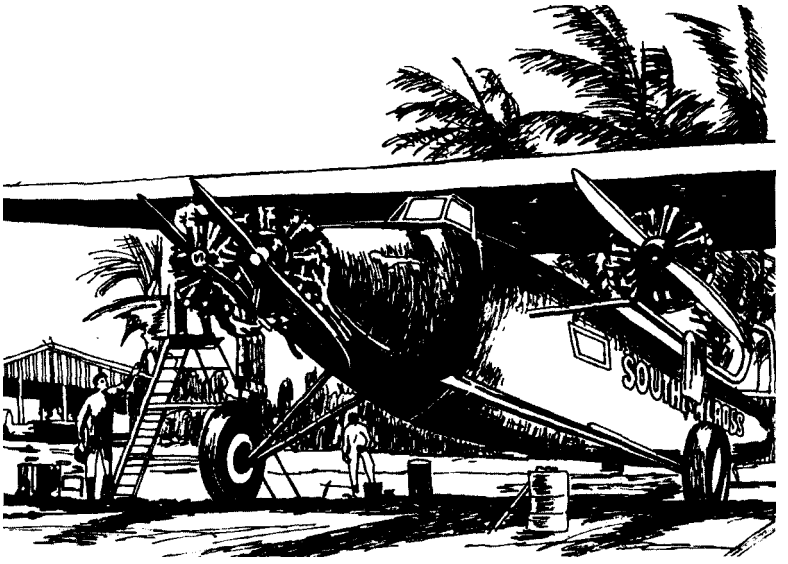

Fig. 13.2: The record-breaking flight round Australia

the first man to fly across the Pacific. He set out, with three others, in May 1928, from Oakland Airfield, US, and landed at Brisbane in June (Fig. 13.2). For him it was a dream come true.

Amelia Earhart was not the first woman aeronaut. That glory belongs to Jeanne-Genevieve Garnerin who soared in space in a balloon. She also was the first parachutist. Mrs. Cromwell Dixon was amused when her 13-year-old son invited her to fly an 'air bicycle'. He told her that she had only to pedal with all the power at her command and she would be taken into flight. She tried that in 1909. She pedalled hard and the machine took to flight, carrying her along. Therese Peltier, a French sculptor, was the first woman to fly an aircraft solo. Raymonde de Laroach was the first licensed pilot. She received the licence in 1910. Eighteen years later, Lady Mary Heath flew an aircraft from Cape Town to London. In 1932, Maruyse Bastie of France flew alone, remained airborne for 38 hours and created a record.

Flight opened up immense opportunities for the adventure seekers.

In 1911, the first major long-distance air race was organised. The route was Paris-Belgium-Holland-England (over the Channel) and back to Paris. There were 43 entries; and 12 different types of aircraft. Nineteen participants completed the first lap. Nine crossed the finish line. Three lost their lives and six were seriously injured. The races, held annually, drew a lot of enthusiastic participants.

In 1913, the Michelin Cup Race set down a challenge for pilots. They were required to cover specific distance and maintain an average speed of 50 kmph. At the Gordon Bennett Trophy, held in the same year, Jules Vedrines' aircraft recorded a speed of over 160 kmph. It took another seven years to double this speed record. Flying a 300 hp engine, Sach Lecointe registered, at Etampes, speed of over 320 kmph. In 1922, Billy Mitchell broke this record and won the Pulitzer race with a speed of 350 kmph. The quest for speed finally led man to the Concorde (Fig. 13.3). In 1995, the Concorde flew round the globe, taking short halts at Touclouse in Southern France, Dubai, Bangkok, Guam, Honolulu and Acapulco in Mexico before returning to New York, in less than 33 hours.

The quest for more speed demanded improved designs. Often the newly designed aircraft crashed. Accidents took a heavy toll of men and material. But mishaps did not deter the daring. Many young men explored the limits to which the aircraft would go along with them. They performed loops and turns, dipped and rose. Large crowds gathered to watch stunt shows.

Charles Willard, a Harvard graduate, trained under the ace flier and aircraft designer, Curtiss, before he turned to stunt shows. He came to be known as the Wizard. In 1910, he commanded $1,000 per flight. Many others took to stunt shows. But most of them died in accidents. A common say-

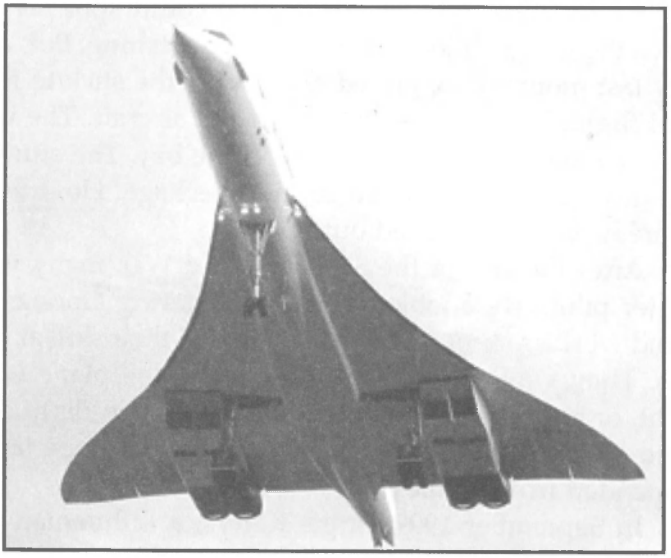

Fig. 13.3: The Concorde

ing, in those days, read: "There are plenty of bold flyers; and plenty of old flyers, but hardly any bold old flyers".

In 1913, at a public show, Edouard Pegoud performed death-defying loops in space. The aircraft gracefully arched and turned around, yielding to the command of the pilot. The Press reported the show.

Lincoln Beachey, who revelled in performing spirals and dives with planes, read the news. He decided to try the stunts. He set before Curtiss his plan. He wanted a specially reinforced bi-plane that could stand the strain of sharp loops. The first model crashed. The second one stood the trials. It had a top speed of over 165 kmph. Lincoln Beachey scheduled his show for 14 March 1915. He took off from San Francisco, climbed over the bay toward Alcatraz, reversed course and performed a series of loops, losing height with each one. Back he climbed to 1100 m and dived straight down.

He dropped so low that people could spot his head above the wings. It looked as if he was crashing. But, at the very last moment, he pulled sharply on the stick to regain level flight. That was too much for the aircraft. The wings broke away. The aircraft crashed in the bay. The stuntman was alive, but was trapped in the wreckage. He drowned before he could be pulled out.

After the end of the Second World War, many young fighter pilots were jobless. The more daring among them found work as stunt pilots. They showed their skill at carnivals. They walked on the wings, while the plane was in flight, or jumped from plane to plane while in flight or got on to aircraft from running cars, ambling up rope ladders suspended from jennies.

In September 1999, Jurgis Kairys, a Lithuanian pilot, displayed a rare stunt. He flew an SU-26 plane at a speed of about 300 kmph under 10 bridges spanning the Neris River at Vilnius, the capital of the Baltic State. It was a risky show. The bridges are just 6 m above the waters. That did not deter Jurgis. It took him just under 20 minutes to complete the show. Asked what more he had in mind, Jurgis joked, "The only thing that remains to be done is to fly under all the bridges upside down". Speaking about this show, Jean Louis Monnet, Chief Executive of the International Air Sport Federation, said: "As far as I know, this was the first stunt like this in the world".

In India, the Air Force often organises special air shows. On Republic Day, the aircraft perform stunts over Raj Path. They loop around, fall freely through space, swiftly turn, regain height and vanish into the sky. The aircraft fly in formation, yet not once do they get into the flight path of each other (Fig. 13.4).

A different form of challenge came in with the arrival of ultralight crafts. In 1960, Francis Rogalli developed a lightweight plastic arrowhead shaped flexible wing. He called it

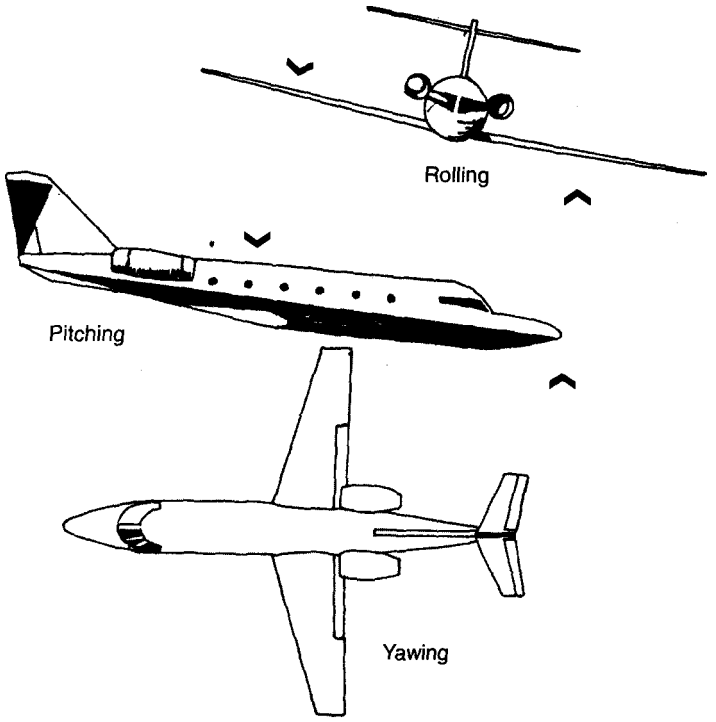

Fig. 13.4: Aircraft manoeuvres

para-sail. It was meant to be a gliding type of parachute for lowering pieces of cargo from high-flying aircraft. It did not find favour with the defence agencies. Acceptance came from an unexpected quarter. Gliding experts picked it up. They rigged a sort of trapeze, spread fabric to form the wing and added a few wires to control flight by shifting weight on trapeze. Thus began the sport of hang gliding. In the mid 1970s, they added small engine and propeller to the craft.

The glider has no wheels, no landing gear. The man riding the glider runs into the wind and takes off. Often the lover of gliding takes the glider to the top of a slope and runs down picking up speed till the glider gets airborne.

Himachal Pradesh holds annual hang gliding competitions before winter really sets in. Hang gliding has become very popular world over.

Is there any room for heady excitement, while we stay on the ground? Radio controlled sailplanes provide this facility. These parasails are very light. Hardly 2 kg, including the radio, placed in a little black box in the nose of the plane! The person on the ground operates the control and defines the flight path.

People who fly the machines, be it an aircraft or helicopter or glider or parasail, constantly improve designs to break established speed or endurance records. They believe that when it comes to development, even the sky doesn't set limits.

14

THE FUTURE IS NOT OURS TO SEE

Innovators know that the future is not theirs to see. The future needs expansion of the vistas of knowledge. That is what they do, continuously. They explore virgin territory that lies currently outside the bounds of knowledge. They dare the untried. Thus they become pioneers.

What further developments await aviation?

Aircraft will become sleeker and lighter thanks to special adhesives. They make it possible to bond material—aluminium, plastic foam, carved and evened out and covered with fibre glass—better. These materials make the aircraft stronger and lighter. Moreover, they give scope for new shapes to aircraft, shapes that reduce resistance of air by directing the airflow round the plane and not into it. That leads to better speed, lesser fuel consumption. Work is on to harness new material to make the engine lighter and more fuel-efficient. New energy sources—liquid hydrogen, electric power, solar energy and even atomic power—are being tried out.

How will these changes benefit us?

Does it not cheer us to note that some day, in the future, we may be flying our own aircraft! That is no tall story. Look at cars on Indian roads? Did anybody imagine, twenty years back, that the common Indian could own a car? Yet, now, the car is within the reach of the middle class. In the developed nations, smaller planes are owned and used extensively, by citizens. Today is their day. Tomorrow will be ours.

All those who drive through the congested roads of major cities share one dream. *If only cars could take to flight,* whenever there is a terrific traffic jam! Boeing is working on just this dream vehicle called the electric flivver. It is an airplane-cum-car that takes off easily when it finds itself stuck in the traffic. Once it gets beyond the stretch of the road that is jammed, it returns to the roads and runs like any normal car. Its gets lift with the help of rotors, fixed on top (very much like the helicopter).

This idea is being extended to develop aircraft that can fly faster than sound and can take off from anywhere. Named, *The Transonic Business Jet,* this plane will have variable sweep wings. These wings, as their name indicates, will sweep forward and backward. They will adjust to the centre of the lift of the aircraft when it flies faster than the speed of sound. While cruising, the wings will be reset at right angles to the fuselage. The plane will be fuelled by liquid hydrogen. Its maximum speed will be about 2,600 kmph.

Ever seen a flying saucer? We are not talking of the saucer that flies in space after we aim it at someone who annoys us. Flying saucers are what aliens, out there in space, use to visit our earth. Or so say those who believe there are intelligent life forms out there, in distant galaxies. It is this shape that Boeing finds ideal to serve city commuters. Powered by heavy flywheels that spin in opposite direction, it can take off and land vertically, operate from parking lots in major cities.

Boeing is also working on an amphibious plane. One that can operate from land and water!

These reports cheer us. Then comes another question. Will air travel become faster? Faster than the Concorde that covers the London-New York route in about three hours? The answer is YES! Research is on to fly aircraft at speeds

ranging from 4,800 to 12,800 kmph. These aircraft shall fly at altitudes 30,000 m to 39,000 m, where the earth's gravity is only five-sixth of that on the ground. The aircraft will use jet fuel at speeds up to 5,760 kmph. Then, the turbo engines will shut down, and jet engines, using liquid petroleum, will take over.

In July 2002, Boeing designed a super-efficient aircraft that looks like a giant bat. It has no fuselage or tail, just a huge wing, with a belly that has space to accommodate 480 passengers. The aircraft is so designed that its structure provides the lift. So it will take 32% less fuel and bring the cost of air transport down.

Lockheed has plans to produce a cargo aircraft. It will carry 1,80,000 kg of cargo non-stop to any place on the earth, flying at a speed of 800 kmph. It can fly for weeks, as it will be powered by nuclear energy.

For transport of cargo, another unusual idea is being explored. It is an aircraft with thick wings that shall hold the cargo. The flat bottom of the wing will stay a few feet above water. The craft will fly low, carrying 1,98,000 kg of freight, at a speed of about 480 kmph.

On 30 July 2002, Australian scientists launched a hypersonic 'scramjet'. It has a revolutionary new engine. The oxygen in the air enters the engine and ignites hydrogen fuel. The aircraft, it is claimed, can fly at speeds of over Mach 8.

These changes will certainly improve civilian transport. They will be suitably adjusted to serve military purposes too.

At the same time, aircraft specially designed for defence purposes are in the pipeline. Fighters will carry powerful bombs and guided missiles more easily. Rockwell International launched a bomber, controlled by the pilot on the ground. The idea is catching on. An army general noted, "In the 21st century, we will definitely rely more on pilotless

aircraft to place people out of harm's way".

Can laser beams propel an aircraft? Scientists at the Tokyo Institute of Technology experimented with laser-powered paper airplane. They are now getting ready to fly tiny pilotless planes. Ultimately they plan to propel planes at several times the speed of sound at high altitudes, where the air is too thin for jet engines to operate. Laser beams from satellites or high-altitude balloons will propel the aircraft.

Laser produces high intensity coherent light waves. Waves remind us of radars that detect aircraft in flight. Can an aircraft evade detection by radar? It can, once we know how the radar works. Radar sends out radio pulses into the flying object. The waves are reflected back to the radar station. The blip on the screen helps identify the aircraft.

Scientists took note of this fact. Could they distort the reflected radio pulses and thus make it hard for radars to detect the flying object? Then came an idea. An object that has only curves, no flat surface, scatters the waves and disperses them in all directions. The scientists exploited this scientific principle. However, this idea gave very limited success. Then came the idea to make all the surfaces of an aircraft as plane as possible, with no surface at an angle that would reflect the waves back to radar. They also developed special paints for the aircraft. These paints absorb some of the radar waves. The end product is the Stealth aircraft.

High altitude surveillance is vital for national defence and for earth study. Lockheeds plans a High Altitude Powered Platform. It will carry cameras and instruments to watch troop movements or identify military installations or estimate crop growth or warn about locusts or shifting weather patterns. It will be powered by solar energy.

In July 2001, Helios, a solar powered plane that shall fly for months on end, maintaining a height of 30,000 m, was tested at Hawai (Fig. 14.1). "It is powered by its

shadow", John Hicks, the programme's manager, joked. Made of carbon fibre, it weighs about 800 kg. It undertakes unmanned flights. It is controlled from the ground. It flies at a very high altitude, far above the clouds. So all day long, it gets sunlight that powers its flight.

Fig. 14.1: The Helios

Remember Burt Rutan who designed the *Voyager*? In December 1986, Dick Rutan and Jeana Yeagar flew the aircraft, round the globe, non-stop and created history. Now (in January 2005), Steve Fossett—the first person to circumnavigate the globe solo in a balloon—is all set to perform a similar feat. He will be flying the aircraft *GlobeFlyer*—solo—designed by Burt. The flight is expected to be completed in 70 hours.

These are developments that we know of. But quietly, silently, secretly (driven by commercial or defence interest), many more advanced designs are taking shape.

What does aviation hold for man, in the days to come? The future is not ours to see. But we have a hunch. One based on reason and logic. Aircraft manufacturers are taking advantage of latest technologies. This is a continuous process. So we can confidently predict the future, say that the aircraft of tomorrow will be faster, more comfortable and sleeker than the ones around now.

On that hopeful note, we end the Great Aviation Story.

Appendix

October 1783	Jean-Francois Pilatre de Rozier makes man's first (tethered) ascent, in a hot-air balloon manufactured by Joseph & Etienne Montgolfier.
December 1783	The first manned flight in a hydrogen balloon is made by Jacques-Alexandre-César Charles & Marie-Noel Robert.
1849	Sir George Cayley (England) builds a triple-winged glider that carries a 10-year-old boy on the world's first manned flight by a heavier-than-air craft.
1853	Cayley builds the first glider capable of carrying a fully-grown person (designs published the previous year). It was test-flown by Cayley's coachman.
14 December 1903	The Wright brothers create history with their first flight.
1907	Paul Cornu of France builds the first helicopter to leave the ground carrying its pilot.
1908	Samuel Cody of USA makes Britain's first officially recognised aeroplane flight.
25 July 1909	Louis Bleriot of France makes the first powered flight across the English Channel.
1911	Eugene Ely makes the first landing on a ship, which was at anchor.

1914	The St Petersburg-Tampa Airboat Line (Florida, USA) becomes the first airline (with the exception of Delag, 1909) to establish a scheduled service. The first full meal is served on an aeroplane, on the Sikorsky airliner *Ilya Mourometz I* over the USSR.
1 April 1918	Britain's Royal Flying Corps (army) and Royal Naval Air Service are amalgamated to form the Royal Air Force, the first air force independent of its nation's army or navy.
February 1919	Deutsche Luft-Reederei of Germany begins the first sustained daily passenger services.
March 1919	Lignes Aeriennes Farman of France begins the first regular international passenger services.
June 1919	Alcock and Brown of Britain make the first non-stop trans-Atlantic flight, and the first successful delivery of trans-Atlantic air mail.
20-21 May 1920	Lindberg's historic solo flight across the Atlantic.
9 May 1926	First flight over North Pole by Byrd and Bennett.
1927	Charles Lindbergh of USA makes the first solo non-stop trans-Atlantic flight.
1928	Charles Kingsford-Smith & Charles Ulm (both Australians) make the first trans-Pacific flight.
29 Nov 1929	First flight over South Pole. Byrd is the leader.
1930	Ellen Church of USA becomes the first air hostess, for Boeing Air Tranport, which becomes part of United Airlines in 1931.
20-21 May 1932	Amelia Earhart becomes first woman to fly solo across the Atlantic.

15 October 1932	JRD Tata's historic flight from Karachi to Bombay (Mumbai).
4 April 1933	First flight over Mt. Everest.
1939	Pan American Airways inaugurates the first trans-Atlantic airline service.
14 October 1947	Supersonic Aircraft, faster than the speed of sound, takes flight.
1969	The Boeing 747 'Jumbo Jet' is introduced as the first wide-bodied airliner.
14 December 1971	Indian Flying Officer N.S. Sekhon daringly chases and hunts down enemy aircraft and becomes a martyr. The nation honours him with the highest bravery award, the Param Vir Chakra.
1976	Concorde becomes the first supersonic passenger airliner to go into service.
14-22 December 1986	Flight round the world non-stop.
14 October 1992	Daring rescue by helicopter pilot, Major Ivan Casto of stranded passengers on a cable car.

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In 1783, man soared into space, riding a hot-air balloon; as hot air is lighter than the air around us. Could an object, heavier than air, defy gravity and fly? In 1905, the Wright brothers found the answer and flew a machine heavier than air. That marked the beginning of the great aviation story. Since then, aircraft's range, speed and capability have increased manifold. So have their areas of application. Work is currently on to achieve spectacular advances in aviation, including a solo flight round the earth, in less than 70 hours! These achievements prove that even sky can't set the limit to the future of aviation.

This book presents the story of how the man's great dream of flying came true, how the technological advancements affected the evolution of aircrafts, and how it changed the course of history.

R.K. Murthi heads the publication wing of the Children's Book Trust and is the Secretary-General of the Indian Society of Authors (INSA). He is a leading figure in the fields of science and information communication, children's literature and humour. Shri Murthi won the NCERT Award for Children's Books in 1985 and again in 1997. In 1999, the Indo-Soviet Cultural Society honoured him for his lifetime contribution to the field of Literature for the Young.

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