AIRLINE
CAREER
TRAINING

CENTRAL TECHNICAL INSTITUTE

KANSAS CITY, MO.

LESSON NO. 3

TODAY'S AIRCRAFT

AIRLINE CAREER TRAINING

A comprehensive course of instruction designed for ambitious men and women seeking a successful career in the field of Air Transportation. Prepared and edited by members of the resident teaching staff, Airlines Training Division, Central Technical Institute.

TODAY'S AIRCRAFT

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KEEP YOUR EYES ON THE GOAL

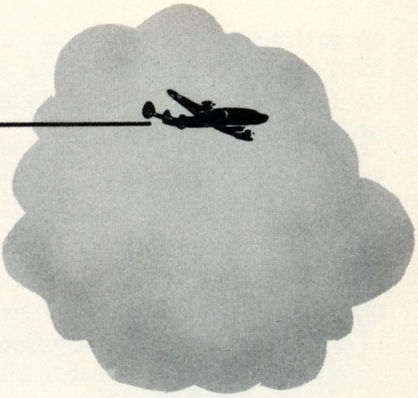
The men and women who have accomplished the most in this world were those with ambition and a definite goal. The desire to reach this goal was the starting point of all achievements.

Hard work alone is not the answer — Neither is a goal by itself a recipe for success. It takes the combination of the two, plus a plan of action. A goal without a plan is like a ship without a rudder; — the progress and direction depends entirely upon outside influences.

You have selected your goal; — the plan is in operation. Now it is up to you to see that you are not distracted, nor your plan of action interrupted by outside influences.

> Henry Ford, dreaming of a horseless carriage, went to work with what tools he possessed. He followed his plan of action for success and put more wheels into operation than any man who ever lived, simply because he never lost sight of his goal.
>
> Thomas Edison dreamed of a lamp that could be operated by electricity. He began where he stood — put his dream into action, and despite more than 10,000 failures, he stood by that dream and goal until he made it a reality. He could have been influenced very easily to change his plans but he never lost sight of his goal.
>
> The Wright Brothers dreamed of a machine that would fly through the air. Now we see evidence all over the world that their dreams, their plans, and their goals were sound.

Don't let anyone or anything steer you away from your goal. Don't let your plan or direction be interrupted or upset. Keep your eyes on the goal and move in a straight line toward it.



TODAY'S AIRCRAFT

YOU'LL be breaking into the exciting airlines industry before long.

Since that's the case, it's high time that we took a concentrated look at the machine that stands in the exact middle of Aviation — the airplane.

We're not going into advanced aeronautics or aircraft design in this lesson; we're not going to burden ourselves with a great deal of technical information on engines and controls.

That isn't necessary in your job.

Instead, let's just learn some of the basic things you'll want to know about airplanes to make your job easier — more interesting.

As you probably realize, the airplane in its present development is just about the most complex machine man ever devised. For our purpose, however, we can separate the airplane into these sections:

1. The Fuselage or Body
2. The Wings
3. The Tail Assembly
4. The Landing Gear
5. The Engines

We'll examine each of these sections briefly so that we can come up with a pretty good idea of what an airplane is and what it does.

The Fuselage

As an airline employee-to-be, you'll probably be particularly interested in the Fuselage or body section of an airplane, because this is the "bread-and-butter" portion of a commercial plane.

We can divide the Fuselage, generally, into these parts:

1. The Crew Compartment
2. The Passenger Compartment
3. The Cargo Compartment

Most of the Fuselage, of course, is given to the cabin — the compartment which contains the passenger seats.

The Cabin

The cabin of an airplane represents something of an unusual problem in design, because every square inch of space has to be utilized. It is also necessary to know in advance the type of service the plane will be used for.

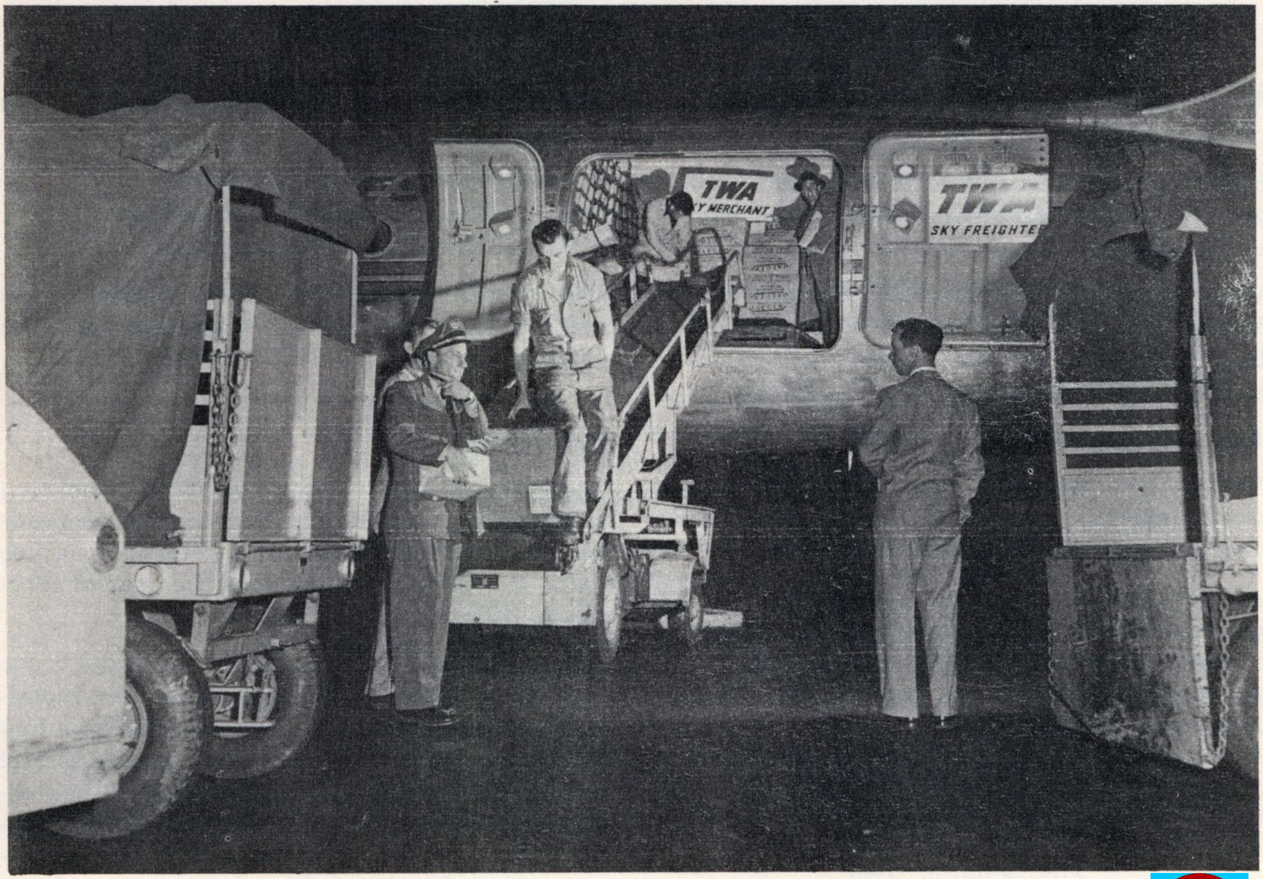
If the airplane will be used exclusively for first class travel, passenger comfort and roominess are important considerations. The traveling public that pays first class fares demands first class accommodations. They insist that such accommodations on the airplanes be just as comfortable — or even more so — than the accommodations they'd use in any other manner of travel.

For that reason, after experimenting with seating arrangements for airplanes, the manufacturers have just about standardized passenger seats for first class planes. Cabin interiors now will customarily have two rows of double seats, separated by an aisle. The total number of seats will depend upon the need of the airline and the safety regulations of the CAB. One of the local service airlines may carry a large volume of air freight and thus require as much space for cargo bins as possible. Such an airline would probably have only 21 seats in their DC-3 planes. Other airlines may have as many as 28 seats in their DC-3's, depending, of course, on their needs.

Since the advent of Air Coach or Air Tourist service, it has been necessary to design a number of planes exclusively for this type of service. The CAB tells the airline the minimum number of seats they must have in an airplane in order to qualify for Air Coach service. In designing an airplane for this kind of usage, many companies provide the maximum number of passenger seats because the greater number of seats that can be placed in the cabin, the greater will be the passenger "pay-load"; the greater will be the revenue from passenger fares every time that plane flies fully loaded.

To accomplish this, there will normally be a row of two seats on one side of the aisle and a row of three seats on the other. The seats are not quite so roomy but are still adequate. The aisles of the planes are narrowed also. This doesn't mean, however, that seats can be jammed into every foot of cabin space and passengers crowded sardine-wise into them. The flying public is willing to sacrifice the comfort and roominess features of the first class planes in order to obtain the savings of the Air Coach fares. The passenger who flies on Air Coach planes will usually get to his destination just as quick as the one who uses the first class flights.

The most recent innovation in airplane design is to have a portion of the plane with accommodations for first class travel and another portion for Air Coach. This type of arrangement is not new in the field of transportation as railroads have been doing it for years.



Heavy luggage and cargo are loaded into the rear Cargo Compartment of a TWA Sky Freighter.
Photo courtesy Trans World Airlines.

One of the things you'll enjoy about the cabin of a modern passenger airliner—whether you're a member of the crew or traveling by air on the free passes that are a feature of airline employment — is its luxurious styling, healthful pressurization and effective lighting — it's the last word.

Commissary truck loads plane with food to be served in flight while
a Hostess displays typical Airline luncheons.
Photo courtesy Trans World Airlines.

While we're on the subject of pressurized cabins, let's take a minute to point out that pressurizing a cabin accomplishes two things. First, it eliminates discomfort when the plane changes altitude; second, a plane with a pressurized cabin can fly at higher altitudes where there's better weather and less traffic.

Heavy luggage is stored in the cargo or baggage compartment, but lighter luggage may be carried into the cabin; small items such as purses, make-up kits, jewel boxes and so on.

Seats

The seats themselves represent a high point in travel comfort. Cushioned in foam rubber, they'll recline to any angle to suit the comfort of the individual passenger. Many airlines, looking to the complete comfort of the passenger, have equipped seats with foot extenders so that passengers can recline practically at full length for complete rest during night flights.

Commissary

Either at the front or at the rear of the passenger compartment, you'll find the Commissary, where the Hostess prepares meals or snacks in flight. This little galley is a marvel of compact efficiency and you'll appreciate its scientific design and arrangement.

We'll explore the Commissary in more detail later on in these lessons; for now all we need to know is that it's located directly ahead of or behind the passenger cabin.

Cargo Compartment

Almost as important as the passenger cabin — from the point of view of income — are the cargo compartments of today's airplane.

Loading the mail into the forward cargo compartment of a DC-6.
Photo courtesy Braniff International Airways.

When we think of modern air travel, we almost automatically think in terms of passenger transportation. We lose sight of the fact that all of the scheduled passenger airlines still hold Post Office contracts to fly air mail. Government

Expert cargo handlers fill the cargo section of a Stratocruiser.
Photo courtesy United Air Lines.

revenue still contributes a substantial amount to the income of the airlines. Air Express and Air Freight are big items for the large airlines.

That's why, in commercial aircraft design, special attention goes to the problem of allotting sufficient space to these cargo compartments.

In most passenger planes used by the airlines, we find three locations where cargo may be stowed. Cargo may be carried well forward in the fuselage between the crew compartment and the passenger cabin, or well to the rear of the fuselage, or in compartments or "belly bins" located in the underside of the fuselage.

New Idea

The newer, larger airliners that are constructed with "belly bins" are loaded by means of an elevator which is lowered from the bottom of the fuselage. Ground crews load cargo on the elevator platform and the platform is lifted automatically into the underneath side of the fuselage.

Another addition to the modern airliner of today is the "Speedpak." The Speedpak may be defined as a detachable compartment, a bin that may be attached or removed from the underneath side of the fuselage when necessary. This Speedpak can carry an approximate load of five tons and is raised and lowered by means of an elevator like the above platform.

These are quick efficient ways to load cargo and save many of those valuable moments when baggage or cargo must be loaded or unloaded during an intermediate stop on a plane's flight.

Even though we have been discussing the cargo compartments of a passenger plane, let's not forget that many airlines have aircraft that are designed to carry nothing but cargo.

Crew Compartment

Forward of the passenger compartment you'll find the Crew Compartment or Cockpit. As a passenger, you usually don't have the opportunity to examine the Cockpit; as an airline employee, you'll have many opportunities to look it over.

We haven't time — and there's no need — to examine in detail the maze of instruments, dials, meters and other gadgets you'll find here. Let's

you the direction in which the plane is flying.

GYRO HORIZON—a fascinating gyroscopic gadget which creates an artificial horizon for the Pilot to enable him to keep the plane on an even keel when the real horizon is invisible.

The Crew Compartment of a DC-6. This Pilot is wearing a new device to practice instrument flying.
Photo courtesy Braniff International Airways.

concentrate on just a few of the more important instruments the Pilot uses in flight. For example, there's the:

ALTIMETER — a clock-like affair that shows you how high above sea level you're flying. Incidentally, this is pronounced with the accent on the second syllable, like this: al - TIM - eter.

AIR SPEED INDICATOR—which corresponds roughly to the speedometer on an automobile; it tells you the plane's speed through the air.

COMPASS — you're probably familiar with this instrument which simply tells

OIL PRESSURE GAUGE — a dial which shows you the pressure of the oil in the plane's complex lubrication system.

RADIO DIRECTION FINDER—a radio receiver combined with a compass to indicate the direction from which radio signals are received. A Pilot can determine his exact position by tuning the RDF to radio beacons along his route.

RATE OF CLIMB INDICATOR—tells the Pilot how fast—in feet per minute—his plane is climbing or descending; it keeps him from climbing or descending too rapidly.

TACHOMETER—an instrument which measures the revolutions per minute at which the propellers are turning. With the Tachometer (pronounced tack-OM-eter) the Pilot can tell exactly how much power he has on the plane's engines.

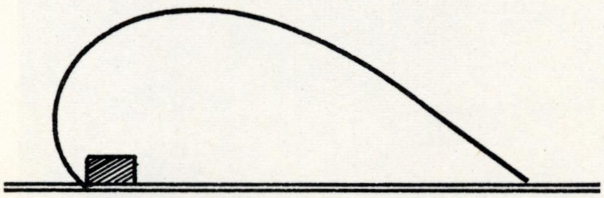
After we've examined the other working sections of the plane, we'll return to the Crew compartment for a quick lesson in flying!

Now Relax!

Let's take a minute to conduct a simple experiment.

Get a sheet of paper just about the size of this page and put it on any flat surface — your desk or table will do. Now weight one end of it with a heavy object of some kind — try an ordinary ruler.

Now lift the unweighted end of the paper back over the weighted end and put it as far back of the weight as possible. If you look at it from the side, you'll discover that you've created a shape that has almost the same contour as the wing of an airplane.



Take a piece of paper and arrange it like this to prove Bernoulli's law.

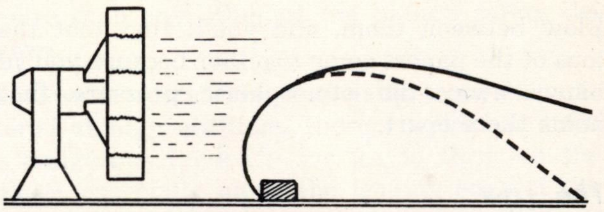
Now blow directly at the rounded edge of the wing-shaped paper.

What happens?

The paper isn't flattened, as you'd suspect. Instead, the free end of the paper rises in the air. The harder you blow, the more the paper will rise.

Know why?

Because you've blown away a weight of air that was holding down that free end — the atmospheric pressure that was holding the free end of the paper to the flat surface. When you direct a force of wind against the rounded surface of that paper, you're blowing the atmospheric pressure away.



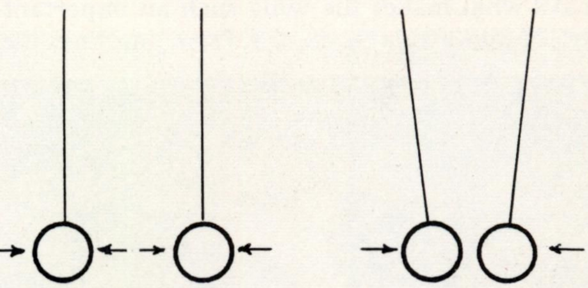
Here's what happens when you direct a stream of air at the paper.

That's why the free end of the paper, relieved from the weight of air pressing down on it, will tend to rise.

You don't believe it? Then try this one.

Take two round objects — apples will do — and suspend them from strings so that they hang about two inches apart. Remember that it's atmospheric pressure that's holding these two objects apart.

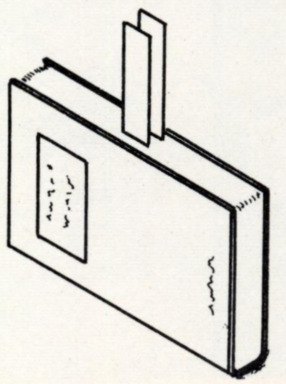
Now blow smartly into the space between the two apples. You'll see that they come together — because you've blown away the atmospheric pressure that separated them.



Blow smartly between two suspended objects. What happens?

Once More

Put two slips of paper into the pages of a book so that you can hold them vertically about an inch apart. Atmospheric pressure is holding the tops of these slips apart.



Arrange two slips of paper in a book like this and blow between them. What happens?

Blow between them, and you'll find that the tops of the papers come together because you've blown away the atmospheric pressure that holds them apart.

The Law

What you've been proving with these little stunts is Bernoulli's Law, an old principle of Physics. Just for the record, Bernoulli's Law states that the pressure of a fluid stream such as air is inversely proportional to its velocity or speed. That is, where the velocity of an air-stream is greatest, the pressure exerted will be the least.

All you need to know about Bernoulli's Law is that when you blow on a piece of paper shaped like the wing of an airplane, the wing tends to rise in the air!

That's the principle of **lift** which is embodied in the wing of an airplane.

That's what makes the wing such an important part of the airplane; in the final analysis, it's the wing that gets the plane off the ground and keeps it in the air while moving.

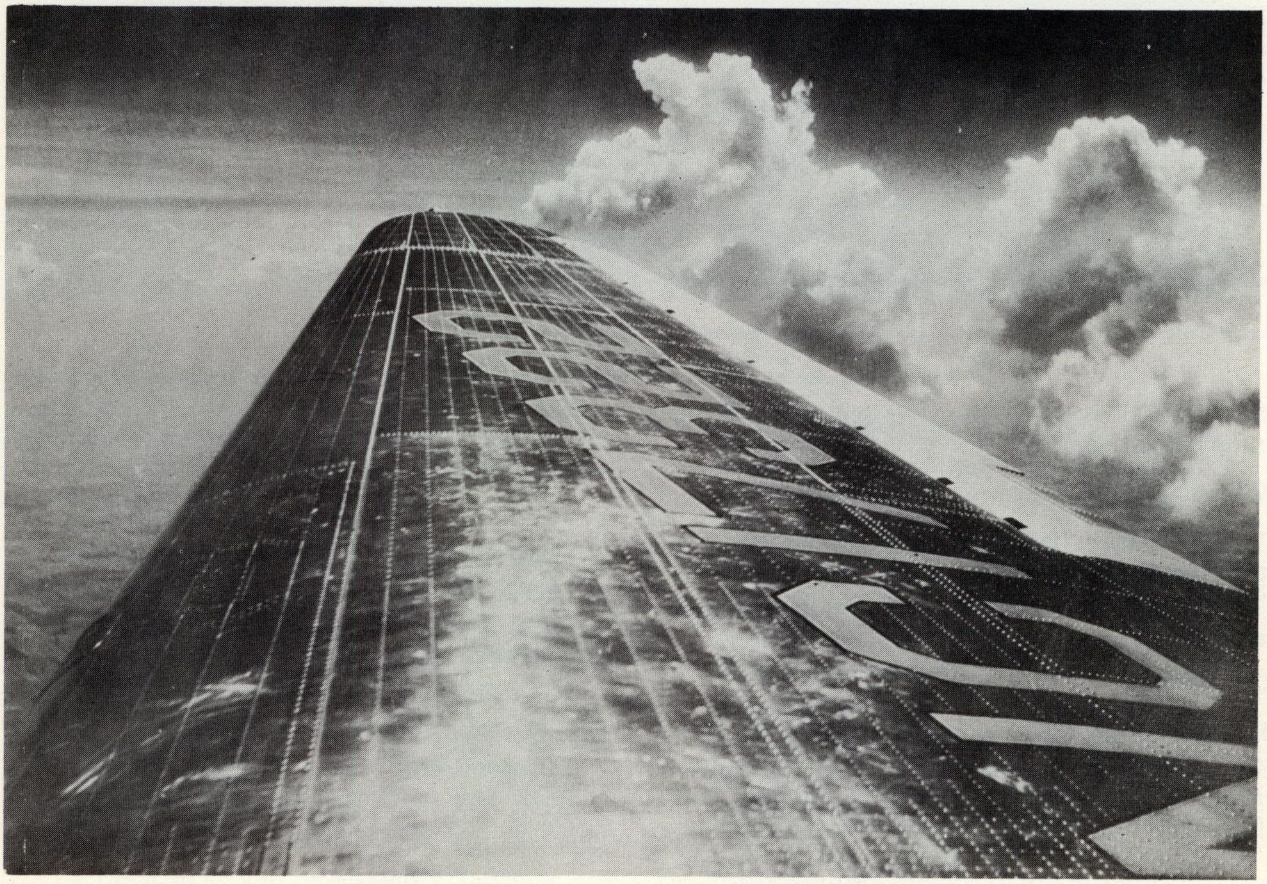
Basic Design

The wings of all passenger airliners have the same basic design. They aren't completely flat, but rounded like the piece of paper you used in that first experiment a few minutes ago. Airplane wings taper gracefully from the center sections where they join the fuselage to the rounded tips at each end.

The wing span — the length from tip to tip — will vary, of course, with different types of commercial aircraft, but it will always be equal to or greater than the length of the fuselage.

As you probably realize, the wing does most of the heavy work for an airplane. That's why the wing must be rigidly built and strongly braced with spars to withstand great pressure.

Old time planes used a maze of external braces and struts to keep the fragile wings from tearing loose from the fuselage. The gigantic air-



The leading edge of an airplane's wing is smoothly rounded. The trailing edge contains the Aileron, shown in white at the right.

craft used today, however, employ the Cantilever Wing which has no external braces or struts.

Wing Edges

The forward edge of the wing — the leading edge — is smoothly rounded. The rear edge of the wing is called the trailing edge. Part of the trailing edge is rigid and part is movable. This movable section in the trailing edge is the Aileron — we'll see what it does when we return to the Crew Compartment.

The massive wings of modern aircraft, as we have already seen, supply the lift which is necessary to get the planes into the air. The wings are, perhaps, the most important single element in the construction of a plane.

De-Icers

Along the leading edge of the wing you'll find the de-icers, which Pilots appreciate perhaps more than any other of the plane's safety devices.

At low temperatures, especially those encountered at high altitudes, there always had been a dangerous tendency for ice to form on the plane, especially along the leading edge of the wings. Ice formation made the plane difficult to control and accounted for many of the crashes during the early days of aviation.

Something had to be done. That's when ingenious engineers developed the de-icers.

One type of de-icer is a flexible rubber covering over the leading edge of the wing. Underneath this rubber covering is an air pump. When air is pumped in, the cover ripples, the ice cracks and the terrific force of air over the wings carries it away.

The Thermal De-icer is also in popular use — it's a simple system whereby the leading edge of the wing is heated, thus preventing the formation of ice.

A good view of an AAL Convair in flight. Aircraft wings contain fuel tanks. Cargo is stowed fore and aft in the fuselage.
Photo courtesy American Airlines.

Fuel Tanks

The wings of modern airplanes are so enormous that they can easily contain the massive fuel tanks needed to keep a plane in flight.

Flaps

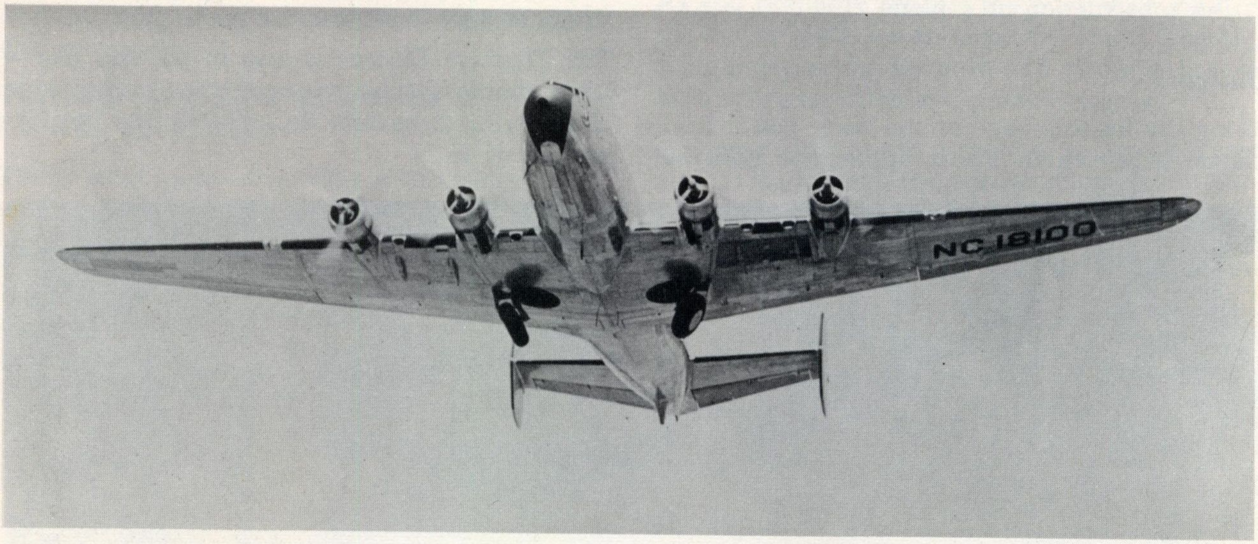
Underneath the trailing edge of the wings are the flaps, the plane's brakes.

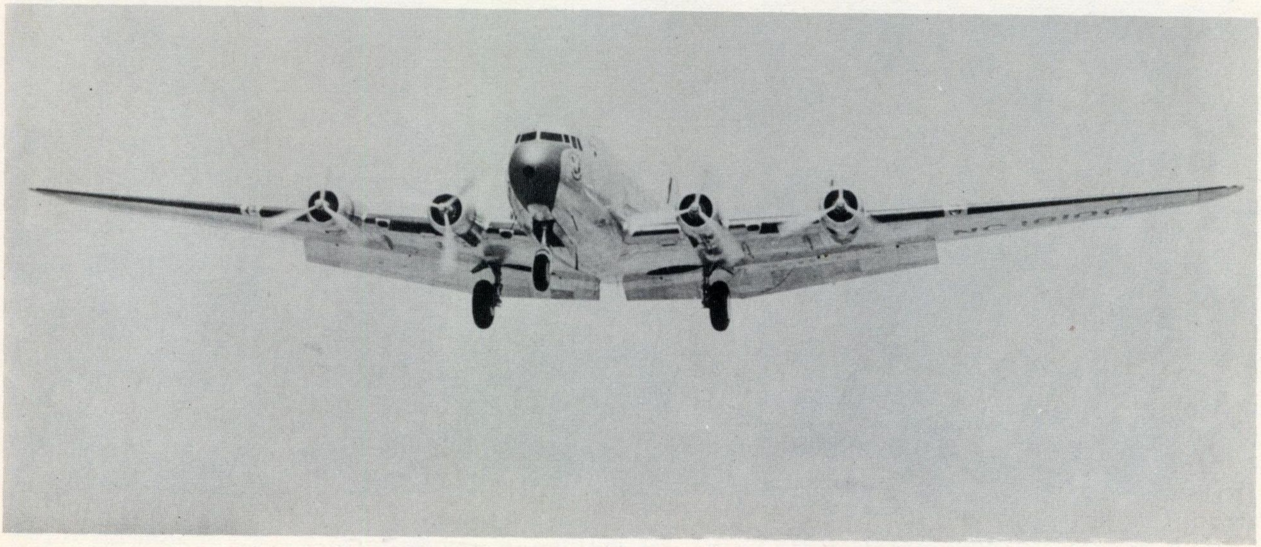
Did you ever watch a bird in flight? Watch him when he starts to land and you'll see him drop his tail feathers to slow his speed before he alights.

That, in effect, is what the flaps accomplish. Planes have to slow their speed in order to land safely, so when the Pilot approaches the landing runway, he'll lower the flaps. They set up resistance to the wind, generally act as a drag and brake the plane into a safe landing speed.

Landing Lights

The plane's landing lights are usually set into the leading edge of the wings. Sometimes they're retractable — mounted under the wing. Usually there are two — sometimes more, depending upon the size of the plane — powerful spotlights, focused to throw a strong light several hundred feet ahead of the plane. These landing lights, of course, offer greater ease and safety to the Pilot who lands a plane at night.





Two interesting photos of a plane. *(Above)* Seen immediately after take-off with the landing wheels beginning to retract. *(Below)* Seen with wheels and flaps down for a landing.

Tail Assembly

At the end of the fuselage, you'll find the complete tail assembly, which is known technically as the "Empennage."

The basic tail assembly — there are variations which we'll skip for now — consists of an upright vertical fin and a small horizontal wing.

The Rudder

About half of the upright fin — gigantic in the larger planes — is rigid; the other half is movable. This movable section is the rudder. Controlled by pedals in the Crew Compartment, it turns the plane left or right.

This picture of a Constellation in flight gives a good view of the tail assembly. Photo courtesy Trans World Airlines.

Elevator

The small horizontal wing in the tail assembly is also made of two parts — one rigid, the other movable. The rigid portion is called the Stabilizer; the movable section is called the Elevator. The action of the elevator, as we'll see later in this lesson, causes the plane to go up or down.

Landing Gear

From what we've seen of airplanes so far, you can understand why the landing gear assembly would make an important contribution to safety and comfort in flight. Modern passenger airliners are multi-ton machines; consequently, the landing gear assemblies must be so designed to support this enormous weight safely and comfortably during takeoff and landing.

For many years commercial airliners used landing gear which consisted of two large wheels under the wings and a smaller wheel under the tail.

Tricycle Gear

As planes grew larger and as aircraft design advanced, however, the style of landing gear was changed to include two wheels under the

The DC-3 still uses the old-style landing gear: Two wheels under the wings, the third under the tail.
Photo courtesy Southern Airways.

The DC-6 uses the tricycle landing gear: Two wheels under the wings, the third under the nose.
Photo courtesy Braniff International Airways.

wings and the third wheel under the nose instead of the tail. This "tricycle" gear is now used in all large commercial aircraft except the DC-3, which still uses the third wheel under the tail.

Landing gear is retractable; it can be drawn up into recesses in the plane so that the huge wheels will not offer wind resistance to the plane in flight. Just as soon as the plane safely clears the ground, the Pilot retracts the landing gear; it remains recessed in the plane until time to approach the next landing strip.

Incidentally, you'll be interested in the fact that the enormous wheels in the landing gear assembly can be braked when the plane hits the runway to bring it to a stop. Each of the two wheels can also be braked separately, which enables the Pilot to steer the plane when it taxis along the ground at a slow rate of speed.

Engines

Let's not go too deeply into engines at this point. If you've ever thrilled to the rich roar of an airplane engine, you'll know the immense power these machines generate. If you've ever examined the huge bulk of a modern airliner, you know why such power is necessary.

Aviation engineering has made tremendous strides in a comparatively short time to bring the airplane engine from the tiny sputtering creation of the Wright brothers, to the magnificent 3,500 horsepower planes in common use today.

Now, with the advances recorded in jet propulsion methods, a new era in aviation engineering is opening. The refinements achieved in jet engines and their application to commercial air transportation bring rich rewards in speed, efficiency and safety.

Propellers

While the plane's engines generate all the power, it's the propeller that puts all this power to work. Again, just for the record, let's identify the propeller as the blade that's fixed on the end of the engine crankshaft.

When the engine runs, the propeller spins, biting into the air to create the thrust that's needed to get the plane off the ground. Small private planes still use the two-bladed propeller, but the airlines have all adopted three or four-bladed, variable pitch propellers.

Variable Pitch

The variable pitch propeller is a masterpiece of delicate engineering. When a propeller has variable pitch, it means that the Pilot can change the angle of the blade to accord with flying conditions.

For example:

At the moment of takeoff, a great deal of power is required to get the plane off the ground. Consequently, the Pilot sets the propeller blades so that they bite into the wind at a small angle.

In level flight, the Pilot doesn't need all that power, so he adjusts the blades to cut into the air at a greater angle. This helps to conserve power and save fuel — an important consideration in airline operations.

If an engine were to fail in flight, the Pilot can "feather" the propeller of the dead engine to keep the flat side of the blade parallel to the direction of flight. This decreases wind resistance and eases the burden carried by the other engines.

And finally, the reversible pitch propeller serves as a brake to slow the speed of the plane when it's taxiing to a stop.

For the moment, that's all we'll need to know about the various parts of a typical piston engine commercial airliner. Get to know the names of these parts so that when you first come into direct contact with airplanes in your work you'll know an Empennage from an Altimeter. Later, you'll learn about the newer turbo-prop and turbo-jet airliners.

Incidentally, do you know one from the other now? Fine! Let's go on!

Let's Fly!

Now let's go back to the Crew Compartment and have a quick lesson in flying. Remember that our purpose here is simply to acquaint you with the simple mechanics of flying. When a Pilot invites you to ride "up front" on a flight, don't volunteer to fly the plane just on the basis of what you'll learn here!

The high speed camera slows down the 3-bladed, variable pitch propellers on this DC-3.
Photo courtesy United Air Lines.

The actual instruments for maneuvering an airplane are the Control Column, the Control Wheel and the Rudder Pedals.

The Control Column — what the old timers called the "joy-stick" — is located just ahead of the Pilot's and Co-pilot's seats. A Control Wheel — like the steering wheel of an automobile except that it's open at the top — is attached to the end of each of the two branches of the control column so that either Pilot or Co-pilot can operate the controls.

On the floor just ahead of the seats are two sets of Rudder Pedals — one for each flier.

To Climb

To make a plane climb, the Pilot pulls back on the control column. This action lifts the elevator in the tail assembly. The air passes over this elevated surface; the tail of the plane is forced down; the nose rises.

To Descend

To make a plane descend, the Pilot pushes forward on the control column. This moves the elevator down; the wind forces the tail of the plane up; the nose of the plane descends.

When he reaches the proper altitude, the Pilot returns the control column to the neutral position; the elevator returns parallel with the rest of the stabilizer; the plane flies on an even keel.

To Turn Right

To turn his plane to the right, the Pilot presses the right rudder pedal. This moves the rudder in the tail assembly to the right; the force of air carries the tail of the plane to the left; the nose of the plane turns to the right.

To Turn Left

When he wants a left turn, the Pilot presses the left rudder pedal. This moves the rudder to the left; the tail swings to the right; the nose turns to the left.

After he's made his turn, the Pilot releases the rudder pedal; the rudder returns to position and the plane resumes steady flight.

Banked Turns

To make a turn with the rudder alone is cumbersome because the speed of the plane will make it "skid" through the air for quite a distance before the turn is completed.

To eliminate this difficulty, the Pilot uses the Ailerons — remember the movable section in the trailing edge of the wing — to help him make his turn by banking.

You've seen how curves in highways are banked to enable motorists to get around them without trouble. A car hitting an unbanked curve at high speed is liable to skid right off into the pasture; on a properly banked turn, the incline prevents this tendency to skid.

Same thing with airplanes.

Banked Right Turn

When a Pilot wants a right turn, he presses the right rudder pedal, with the results we've just seen. At the same time he turns the control wheel to the right. This raises the Aileron in the right wing and lowers the Aileron in the left wing. The action of the air on the wings causes the right wing to dip and the left wing to rise.

This puts the entire plane in a position where it's resisting the skid caused by the rudder and the turn is accomplished neatly and quickly.

Banked Left Turn

A left turn is just the opposite of this; left rudder pedal depressed, control wheel turned to the left. This brings the left wing down, the right wing up, the rudder to the left. The plane will bank into the left turn gracefully.

Review!

Here's a handy summary of control positions for the simple maneuvers we've described:

CLIMB: Control column back, rudder pedals even, control wheel center.

DESCENT: Control column forward, rudder pedals even, control wheel center.

RIGHT TURN: Control column neutral, right rudder pedal forward, control wheel right.

LEFT TURN: Control column neutral, left rudder pedal forward, control wheel left.

Look — you're flying!

Let's Go Back

In order to really appreciate the sleek silver airliners we see so commonly today, we've got to track back just a few years and examine the crude ships that were first used to carry passengers by air.

Ford Tri-Motor

Way back in 1923, for example, a pioneer aviation enthusiast named William Bushnell Stout began building the first all-metal plane. Hard-pressed financially, but equipped with the determination so characteristic of the pioneers, he finally solicited enough money to build his first plane.

It was a noisy rattletrap of a plane according to our standards, but to Stout it was a proud achievement. He hastily called in Henry Ford, one of his backers, to show it to him.

Ford inspected it, decided that it had possibilities. He engaged Stout as Chief Engineer and started to produce the plane — then known as the Ford Tri-Motor — in his factories.

The Ford Tri-Motor played an important part in the development of passenger travel by air; there's no question about it. For years this plane gave good, reliable, safe service.

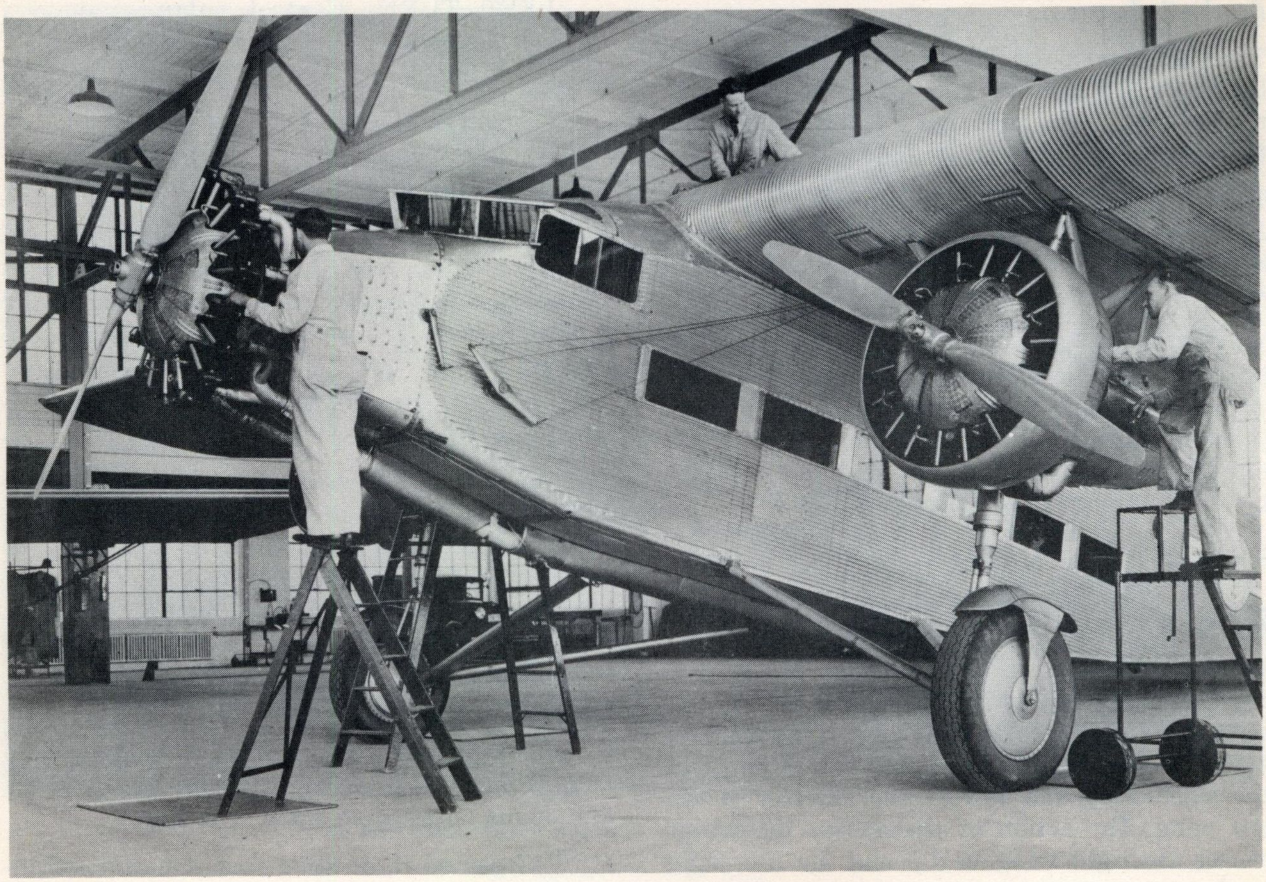
One thing the Ford didn't provide, however, was passenger comfort; it was much too noisy. As other passenger planes developed, Ford dropped out of the commercial aircraft picture.

The Ford was a rugged old kite; even now you still hear of them being used in isolated mining operations and other similar activities.

Anthony Fokker

At just about the same time, the great early designer, Anthony Fokker, built a tri-motored ship similar to the Ford and for many years the Fokker and the Ford carried the bulk of air travelers.

The Fokker wasn't quite so noisy as the Ford, but it had a major drawback in that its wings were made of wood. This created a serious



This is the Ford Tri-Motor, a reliable old work-horse. A few of these are still in operation in remote areas.

maintenance problem because the wings were difficult to check for wear. The only safe inspection method was to tear down the wing completely when the ship came in for overhaul; that was a costly proposition.

Boeing

In 1927, the great name of Boeing came into prominence in aviation when William E. Boeing produced his first plane — the Boeing 40 — to fly mail on government contract.

The "40" was a single engine, two-winged plane designed specifically for mail flying. The Pilot flew from an open cockpit located well back on the fuselage. Directly in front of him was an enclosed passenger cabin with two seats. Ahead of this tiny cabin was the mail compartment.

In these days we have private planes with more spacious accommodations than those, yet the Boeing 40 was hailed as a major achievement. Boeing built twenty-five of these planes and flew them successfully for many years.

Boeing first entered the passenger aircraft field when he introduced the Boeing 80. This was a tri-motored plane with expanded passenger accommodations; it established remarkable records for safety and reliability. The three-motor arrangement was expensive to operate and the Boeing 80 disappeared from popular use in 1933.

The Curtiss Condor

Glenn Curtiss was still active in aviation at this time and he made an important contribution to commercial passenger flying with his "Condor."

The Condor was a two-winged plane which embodied the first attempts to sound-proof the cabin for passenger comfort.

Trouble with the Condor was that it just couldn't get very high in the air. As a result, it had to be used only in restricted areas where great altitude was not required. The Condor could not keep pace with progress in plane design and it soon dropped out of the picture.

The DC's Appear

Boeing's 247 appeared in 1933 and this plane again contained many new, progressive features. An all-metal, one-winged plane, it was fast, economical and reliable. The airlines clamored for them; at one time there were seventy Boeing 247's in commercial use — a remarkable record for those days.

To compete with the Boeing 247, Douglas introduced the first of the famous DC line of airplanes. The DC-2 appeared in 1934 and immediately electrified the industry by flying from Los Angeles to New York City in 13 hours and 4 minutes. This feat put the DC-2 into serious competition with the Boeing 247 and set the stage for the growth and development of the magnificent aircraft in use today.

When you go to work for an airline, you'll find that your company is flying one or more of these commercial models:

The DOUGLAS DC-3. The "workhorse" of the airlines; it's been widely used by just about every line in the business. You've probably seen them or have ridden in them.

The DC-3 is a twin-engine ship. It's 64 feet 5 inches long, 14 feet 3 inches high and has a wing span of 95 feet. It can carry up to 28 passengers.

The DC-3 is a popular commercial airplane because it's economical to operate and yet carrries a respectable pay-load of passengers and cargo. The DC-3 is gradually being replaced in the trunk airlines by larger and faster planes, but is still being used by all local service airlines.

The DOUGLAS DC-4. This is a larger, more powerful version of the DC-3. The DC-4 was introduced in 1942 and saw extensive service during World War II as the C-54.

The DC-4 is 93 feet 7 inches long and stands 27 feet 7 inches high; it has a wing span of 117 feet 6 inches. It's a four-engine ship which gives it tremendous power but makes it rather expensive to operate for the pay-load it can carry.

Normal passenger capacity for the DC-4 is 50.

The DC-4 is a good, fast, comfortable ship but it's an awkward intermediate size. The airlines which need ships larger than the DC-3 are tending now to the DC-6 and DC-7 instead of the DC-4.

The DOUGLAS DC-6. This plane is a very popular member of the Douglas family.

A four-engine ship, the DC-6 is just a little larger than the DC-4. It's 100 feet 7 inches long, stands 28 feet 8 inches high; it stretches 117 feet 6 inches from wing tip to wing tip.

With this slight difference in size from the DC-4, the DC-6 has that important extra passenger capacity. Under normal circumstances, the DC-6 will carry up to 60 passengers.

The next plane introduced by Douglas was the DC-7. Here again, the basic design was changed but slightly. The wing span of the DC-7 is exactly the same as the DC-6, but the plane is 108 feet 11 inches long — over 8 feet longer than the DC-6. Even though the plane is larger than the DC-6, there is little change in the passenger seating capacity. The DC-7 is a luxury plane with a beautiful interior. Perhaps the most important change of all over the DC-6 was the increase in speed. This plane has a cruising speed of 365 miles per hour and soon after its introduction to commercial aviation set a number of speed records.

The BOEING 377 is the big sister of the "Strato-" family. Known as the "Stratocruiser," the Boeing 377 was first put into operation in 1948.

The Stratocruiser is a giant — 110 feet 3 inches long, 38 feet 3 inches high, with a wing span of 141 feet 3 inches!

This also is a luxury liner, featuring double-deck cabin, lounges and sleeper accommodations for passengers on overseas flights.

As a day plane, the Stratocruiser will accommodate up to 81 passengers; on night flights, it will take 45 passengers.

CONSOLIDATED-VULTEE'S CONVAIR first went to work commercially in 1947. Like the DC-3, it's not a spectacular plane, but it's a hard-working, economical ship that delivers plenty of safe, reliable service.

The Convair is of medium size: 74 feet 8 inches long; 26 feet 11 inches high; 91 feet 9 inches wing span. Powered by two engines, the Convair will accommodate up to 40 passengers.

The MARTIN 202 also appeared first in 1947; it resembles the Convair in size and performance.

The 202 is 71 feet 4 inches long, 28 feet 5 inches high, 93 feet 3 inches wing span.

Powered by two engines, the Martin 202 will carry up to 40 passengers.

The Martin name is also represented in the commercial aircraft picture by the Martin 404 which is largely an improved model of the 202.

The LOCKHEED CONSTELLATION appeared in 1945; it's a slick, sleek airplane.

The Constellation is a big ship: 95 feet 1 inch long, 23 feet high, with a wing span of 123 feet. It's a striking plane, with its shark-like fuselage and enormous triple-tail assembly.

The Constellation was the first commercial airplane to cruise over 300 miles per hour.

There have been improvements and changes in the Constellation just as there have been in all of the other commercial airplanes. The Super-Constellation was larger and faster than the original Constellation. The latest model of the famed Constellation to be introduced is the Super-G, a still larger and faster plane than the Super-C. Although larger and faster, the Constellation retains its basic dolphin shape design and triple tail which makes it easy to identify.

The "TURBO-PROP" VISCOUNT. After one of the finest advance publicity jobs the airline industry has observed, Capital Airlines inaugurated service with their new Viscount Airplanes in 1955. Capital called this plane "A New Concept In Flight." Capital states that the Viscount introduces for the first time, a silence and smoothness that comes from an almost complete lack of vibration. It was stated further that the plane was so free from vibration in flight that you could stand a coin on edge and it would not topple over.

The Viscount is powered by "propeller turbine" engines, commonly referred to as "turbo-prop" engines. You're going to hear a lot about "turbo-prop" engines and you'll want to know how they differ from the piston engines that have been powering airplanes since the start of commercial aviation. In the "turbo-prop" engines, the power comes from gas turbine engines that operate the compressors and control the propellers. Although the power comes from gas turbines, the "turbo-prop" still is driven by propellers as the name implies. Later in this lesson you'll learn about airplanes that are jet propelled.

The Viscount has a wingspread of 93 feet 8½ inches and is 81.2 feet long. It cruises at a normal speed of 335 miles per hour but is capable of cruising 385 miles per hour at maximum speed. It's a medium size airplane, insofar as seating capacity is concerned, being equipped with 48 passenger seats.

Next time you visit an airport served by Capital Airlines or Trans-Canada Airlines, have your eyes and ears open for the Viscount, a very fascinating and unusual airplane.

The New Era

More jets: Capital Airlines led the way in the new era of domestic U.S. flight by introducing the Viscount in 1955. This airplane was manufactured by a British concern and, as you would expect, the U.S. companies would not be content to let a foreign company get ahead of them!

In 1955, information was released concerning the Lockheed "Electra," the first U.S.-built turbo-prop airliner. The "Electra" will cruise at more than 400 miles per hour, considerably faster than the Viscount. It has a wingspan of 95 feet and is 101 feet 4 inches long, and has a seating capacity of 64, plus six in lounge.

Not to be outdone, Douglas and Boeing — two other famous names in aviation, are building jet transports for use by commercial airlines.

The Douglas jet transport is the DC-8 and has a cruising speed of 550 miles per hour and a seating capacity of 80-125 passengers. It is a huge plane with a wingspan of 134 feet 7 inches and a length of 140 feet 7 inches. It has a range sufficient for non-stop trans-atlantic and trans-continental service.

Boeing is a company with much experience in the manufacture of jet transports, although they were originally used for military purposes. By making necessary changes, they have a commercial airline version known as the Boeing 707.

This plane is very similar in size and performance to the DC-8. It also has a cruising speed of 550 miles per hour as does the DC-8. It has a seating capacity of from 80-135 passengers but is slightly smaller in dimensions with a length of 140 feet 7 inches and a wingspan of 134 feet 7 inches. It has the same maximum range as the DC-8.

This is a Martin 202 on the ground at the National Airport in Washington, D. C. Photo courtesy Allegheny Airlines.

A photo of a Lockheed Constellaton shown high over Kansas City, Missouri. Central's school building is circled at the lower left. Photo courtesy Trans World Airlines.

Artist's sketch of the Lockheed "Electra"— first U. S. built turbo-prop airliner. Photo courtesy American Airlines.

These are the airplanes of today. You'll work with them, you'll fly in them; you'll be proud of them!

Here's something important to remember:

When you look at planes like these, you think that we've reached perfection; you think that there just couldn't be any further improvements in passenger aircraft.

And yet — right now — in the minds of aviation engineers and designers — on drawing boards in aircraft factories from coast to coast — are blueprints, plans and specifications for airplanes that will make today's planes crude by comparison.

New design and new propulsion methods will develop commercial airplanes that will stun your imagination.

Why?

Because commercial aviation is the most-alive, the fastest growing industry in the world. Its equipment has to advance to keep pace with it.

And think of this:

In a very short time, you'll be a vital part of the exciting airlines industry, because you'll be qualified to take your place among the men and planes we've described in these pages!

The most important consideration in the operation of an airline is "Safety." The airline industry could not have developed to the giant it is today without an outstanding safety record. As a future airline employee, you'll want to know what makes it so safe. The subject of your next lesson is "Why Flying is Safe."

Notes and Memos

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