AIRLINE CAREER TRAINING

CENTRAL TECHNICAL INSTITUTE

KANSAS CITY, MO.

LESSON NO. 4

WHY FLYING IS SAFE

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.

WHY FLYING IS SAFE

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ENTHUSIASM

If you **act** enthusiastic you will **be** enthusiastic.

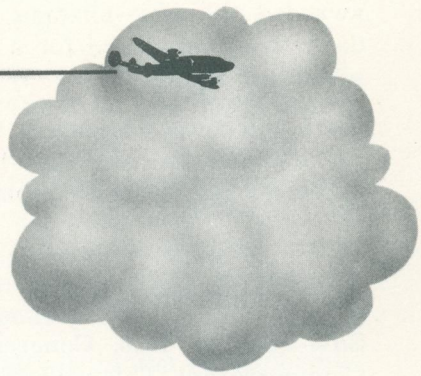
The magic of enthusiasm can work for you. A person of lesser ability but with enthusiasm will often outstrip one of first-rate ability without enthusiasm.

There is a distinct difference between enthusiasm and noise. Noise is an outward expression while enthusiasm comes from within. Enthusiasm is by far the highest paid quality on earth; probably because it is so rare — yet it is one of the most contagious. If you are enthusiastic you radiate this same quality and your friends catch a part of this same spirit.

Be excited about what you are doing. Talk with enthusiasm — Study with enthusiasm — Live your lessons with zest and spirit. The field of Air Transportation is thrilling and exciting with new opportunities so don't fail to enjoy every minute of this course. We want you to be enthused with the possibilities it offers, excited about the future, vibrant with anticipation for a wonderful airline career.

When asked to give the secret of success for salesmen, Walter P. Chrysler made a very impressive statement about enthusiasm: He listed the various qualities such as ability, capacity, energy, etc., but added that the real secret was enthusiasm. — "Yes, more than enthusiasm," said Chrysler, "I would say excitement. I like to see men and women get excited. When they get excited about their work they get customers excited, and we get the business."

Don't try to hide your enthusiasm — display it with pride. It will help you to reach your goal.



WHY FLYING IS SAFE

"Aviation is not Unsafe, But Like the Sea, Is Terribly Unforgiving of Any Carelessness or Neglect."

FROM the very beginning of commercial airline history, the importance of safety was recognized by all concerned. Today, as always, the primary consideration in the operation of an airline is safety. Such factors as speed, passenger comfort, service, and on-time operation are secondary in importance.

The airline industry could not have developed into the giant it is today without the outstanding safety record it has enjoyed throughout the years.

In the early days of airplane operation, the public was skeptical of flying, feeling it was simply too dangerous. This problem no longer exists to any great degree, thanks to the fine safety records of the various airlines. There can be no doubt as to public acceptance of flying as being the safest, fastest, most comfortable, as well as the most economical way to travel.

Why Is Flying So Safe?

It just didn't happen. It was planned that way. It would take volumes to discuss all of the factors that contribute so greatly to airline safety. No attempt will be made in this lesson to include all of them. Rather, we'll concentrate on a few of the most important ones.

Take the Automobile

Back around the turn of the century, you know, when a few scattered automobiles existed throughout the entire country, no one had given any thought to regulating automobile driving for safety because the problem just didn't exist. Can you imagine what it would be like now — with millions of cars on the road — if we didn't have regulations for driving? Bedlam!

The development of the automobile and its increase in popular use soon made the responsible citizens of the country realize that some kind of control would be necessary for general safety.

That accounts for our present-day system of licensing automobiles and drivers, of speed limits, of traffic lights and stop signs, of highways divided into lanes — and the dozens of regulations and devices which are used now to promote safety on the highway.

Same for Airplanes

It's pretty much the same with airplanes.

When the first planes started to fly, aviationists thought very little about safety regulations. There were so few planes in the air that traffic was no problem at all. Flights were made by daylight only; no need arose for navigational aids. Flying was such an infant that little thought was given to the promotion of the safety factor in Aviation.

It wasn't until the future of flying was evident that the first steps were taken to set up the comprehensive system that now exists — the government that has taken flying away from the acrobats and stuntmen.

Need for Governmental Regulation

In the early 1920's, far-sighted legislators first noticed that some sort of governmental control would soon be necessary if flying were to grow beyond the barnstormer stage.

You'll recall that the Post Office Department awarded the first air-mail contracts in those days. That accounted for a certain amount of scheduled flying.

More and more passengers were being carried by airplanes, too, and they had to be protected by safety regulations of some kind.

Air Commerce Act

So — back in 1926, Congress passed the Air Commerce Act. This was an important piece of legislation so far as commercial aviation was concerned.

For one thing, the Air Commerce Act made the Secretary of Commerce responsible for regulating commercial flying. In discharging this heavy responsibility, the Secretary of Commerce took steps to license planes and pilots, to establish operating rules and regulations and to provide the aids to air navigation that were available at that time.

Of all the benefits realized by this act, one of the most important was the formulation of this principle: Regulation of flying was national in scope. Air space was declared common property and free to all.

The statement of this principle took the wind out of the claims of fatuous landowners who asserted that they owned the air above their properties. It also united the individual states, several of whom had widely divergent ideas on how commercial aviation should be regulated.

The Commerce Department did a magnificent job of regulating air traffic under the Air Commerce Act of 1926. The law was effective until 1938 when developments in the industry made new legislation necessary.

Grown-up Industry

In the 12 years from 1926 to 1938, aviation had grown from infancy to sturdy manhood. Airlines were flying tens of thousands of route miles; private plane ownership was growing; thousands of aircraft filled the skies every day.

The industry had outgrown its original system of control; a new system was needed.

Civil Aeronautics Act

Previous to 1938, the airlines were required to look to three different agencies for governmental regulations:

1. Post Office Department — Award of all air mail contracts.
2. Interstate Commerce Commission — Establishment of air mail rates.
3. Bureau of Air Commerce — Establishment and enforcement of aircraft, personnel, and operations regulations.

With the increase in volume of air transportation and related problems, the difficulties of proper administration under the divided governmental authority increased to a serious degree. It was with relief to the air transportation industry that a bill, introduced by Congressman Lea and Senator McCarran, in 1937, to combine and clarify governmental authority and regulations, passed both houses and became law. This bill established the Civil Aeronautics Act of 1938, which was later modified by the President's reorganization plans of 1939 and 1940.

Thus, the governmental regulation of air transportation became the responsibility of two coordinated agencies, jointly referred to as "Civil Aeronautics Authority." These two agencies were the Civil Aeronautics Board (CAB) and the Civil Aeronautics Administration (CAA). Today, the very efficient governmental regulation of air transportation is still accomplished through these two agencies.

Every airline employee should become familiar with the history and functions of these very important agencies that have contributed so greatly to the development of the commercial airlines.

Civil Aeronautics Board (CAB)

The CAB is composed of five members, appointed by the President with the confirmation of the Senate, one of whom is annually designated by the President as Chairman and another as vice-chairman. The members are appointed for a period of 6 years. Not more than three members may be of the same political

party. The Board exercises legislative and judicial powers which Congress has delegated to it. The CAB is responsible directly to the President.

CAB Powers and Duties

1. Issuance of certificates to airlines authorizing them to engage in inter-state and foreign commerce with mail, passengers, express, and/or freight. These certificates are issued, modified, and revoked according to the public convenience and necessity and according to the ability of the respective air carriers.

During the nine years between 1938 and 1947, literally hundreds of companies applied for air carrier certificates. The CAB groups applications together geographically and holds public hearings in which all interested parties are allowed to produce exhibits and witnesses in support of and against each air carrier's application. After such hearings conducted by one or more CAB representatives ("examiners"), the exhibits and testimony are further studied and the examiner gives his recommendations to the Board.

Each of the applicants is then given a chance to argue his case before the CAB in an oral argument. After further study of all testimony and arguments, the CAB issues a decision and grants route certificates as deemed necessary.

2. Establishment of mail, passenger, express and freight rates.

These rates are usually established after application by one or more carriers for a rate change. Hearings are held before the CAB and decisions rendered, based on testimony and knowledge of existing and predicted economic conditions. For example, an airline may apply to the CAB for an increase in mail pay. There will be a hearing and the CAB will decide whether or not the airline is entitled to such an increase.

The board does not have to wait for applications, however, to make rate changes. It can issue an order to the airline to furnish evidence why certain changes in their rates should not be made. In other words, if the CAB feels the airline is getting too high a rate, action may be initiated.

3. The encouragement and development of an air transportation system properly adapted to the present and future needs of the foreign and domestic commerce of the United States, of the Postal Service, and of the national defense.

4. The regulation of air transportation in such a manner as to best promote its development and safety.

5. The promotion of adequate, economical, and efficient service by air carriers at reasonable charges, without unjust discriminations, undue preference or advantages, or unfair or destructive competitive practices.

6. Establishment of airworthiness requirements that must be met by all aircraft used for civil purposes, flight crew license requirements, and airline operations procedure requirements. These requirements are usually subject to hearings before and after enactment, at which times all interested parties are heard.

7. Investigation of aircraft accidents and issuance of findings in order to fix responsibilities and evolve recommendations for avoidance of similar accidents.

The above powers and duties of the CAB are in legal sounding terminology as one would expect to come out of a law-making agency. It will help you to distinguish the difference between the CAB and the CAA if you will remember that the CAB makes the laws while the CAA puts them into effect.

Civil Aeronautics Administration (CAA)

The Administrator of this agency is also appointed by the President, by and with the advice of the Senate. The Administrator and his staff and field organization are responsible directly to the Secretary of Commerce for the following functions:

1. Development and maintenance of airways navigational aids, including radio aids, beacon lights, emergency fields, and instrument landing devices.

2. Enforcement of all aircraft airworthiness requirements, flight crew proficiency and medical requirements, and airline operation procedures requirements as issued by the CAB.

3. Establishment and administration of airport and airways traffic control procedures.

4. Research and development towards improvement in aircraft, engines, propellers, radio, and accessories.

5. Dissemination of technical and operational information obtained from domestic and foreign sources.

In order to accomplish the above responsibilities, the CAA employs inspectors, pilots, engineers, mechanics, radio technicians, control tower operators, airways traffic control operators and other related personnel.

Civil Air Regulations

Much of what the CAB has done to promote safety in flying is contained in the Civil Air Regulations, a rule book, so to speak, known as the CAR. The rules contained in the CAR cover just about every phase of flying, but for our purposes we can group them into three general headings:

1. The rules which govern the ability of the pilot.

2. The rules which govern the reliability of the plane.

3. The rules which govern air traffic.

The Pilot's Ability

Here again we don't have to go deeply into details.

What we're primarily interested in is that the acceptable airline pilot must be the cream of the crop.

Because the nation's airlines are intensely interested in efficiently maintaining the schedules on the routes they are designated to operate, and at the same time sustain a high safety record, they have established flight personnel requirements so high that only the best of pilots can meet them. With the huge sums

The Flight Engineer, First Officer and Captain of an Eastern Air Lines Constellation. Capable, experienced crews like these help to maintain the airline industry's splendid safety record.

airlines have invested in aircraft, they cannot afford to employ any but the best qualified pilots available.

He has to be in superb physical condition, for one thing; he must be kept that way by frequent physical examinations. At first sign of physical failure of any kind, he's removed from active flying until the failure is corrected.

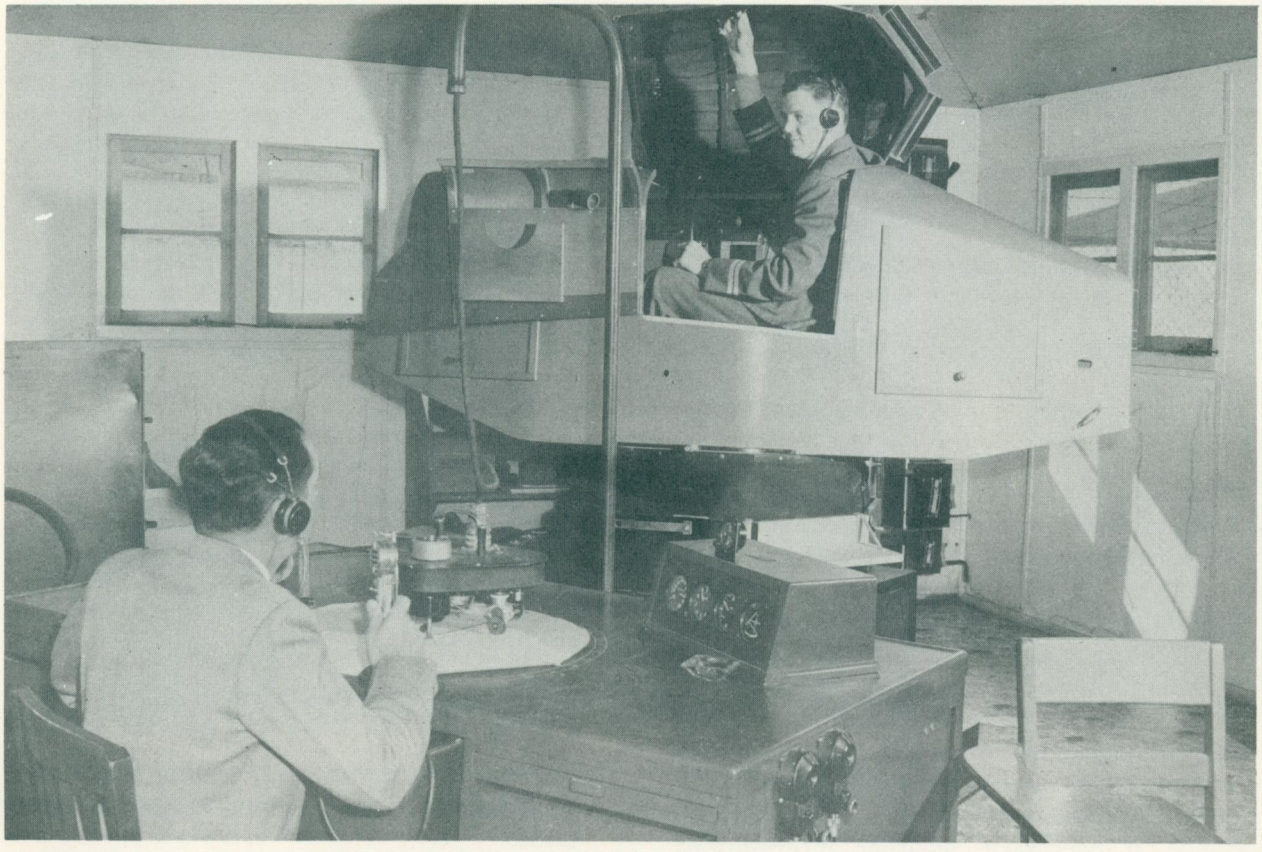
Airline Captains, as we'll see later, are the best in the business. They must have thousands of hours logged before they're promoted; they serve long terms of apprenticeship as third or second pilots before they're allowed to command a plane.

They're thoroughly tested and checked on air navigation; they know perfectly how to use the various aids to navigation we'll examine later in this lesson.

All in all, you can be sure that the Captain and the First Officer who sit at the controls of your plane are the best — physically, mentally and professionally.

Airline Flight Superintendent (Dispatcher)

Together with the captain of a flight, responsibility for a trip's safe operation is shared by the flight superintendent, or the flight dispatcher, the titles varying with different airlines.



All airline Pilots must have periodic checks in instrument flying.
Here a Braniff Captain prepares for a Link Trainer test.
Photo courtesy Braniff International Airways.

Pilots are restricted by Civil Air Regulations in the number of consecutive hours they may fly, to avoid the slightest possibility of strain or fatigue.

On the other hand, pilots must log a minimum of flight time every month to make sure that they're in good practice.

The airlines, for operational reasons, divide their route mileages into divisions, or regions. For instance, TWA, whose domestic routes extend from San Francisco and Los Angeles on the west coast, to New York, Boston, and Washington on the east coast, has divided its system into three regions — Eastern, Central and Western.

The Flight Superintendent begins his working day by conferring with the Flight Superintendent going off duty to familiarize himself with the past eight-hour operations.

Flight Superintendents are located within these regions and have jurisdiction over all company flight operations when such flights are flying or are on the ground within their respective regions. The Flight Superintendent discusses the entire operation with the captain of each outgoing flight and issues a flight clearance. Following the departure of a flight, he provides the captain with advisory messages consisting of enroute amendments to the original flight clearance, if necessary, weather information, and other data affecting the flight's operation. At each station the captain must receive a flight clearance before continuing his trip. A flight clearance is sent via teletype and arrives at each station before the flight concerned is ready to depart.

The flight superintendent must be 100 per cent on the job every minute he is on duty. His judgment must be sound, and he must be capable of being able to analyze intelligently the probable factors which may affect the routine operation of a flight. Flight superintendents are on duty twenty-four hours a day.

During his working hours, the flight superintendent's varied duties may include:

1. Releasing scheduled flights after satisfying himself that the trips will operate safely.
2. Holding or completely canceling trips due to existing or anticipated weather conditions.
3. Distributing equipment by ferrying aircraft to origination or enroute points in order to protect a scheduled operation.
4. Originating extra sections or charter trips. Most extra sections and charter trips are requested by the traffic department in order to handle surplus passenger and freight traffic.

Following the departure of all trips, the flight superintendent keeps in constant contact with

their progress. He can advise a captain to land, hold, or pass up a station if he thinks such action will contribute to a SAFE operation.

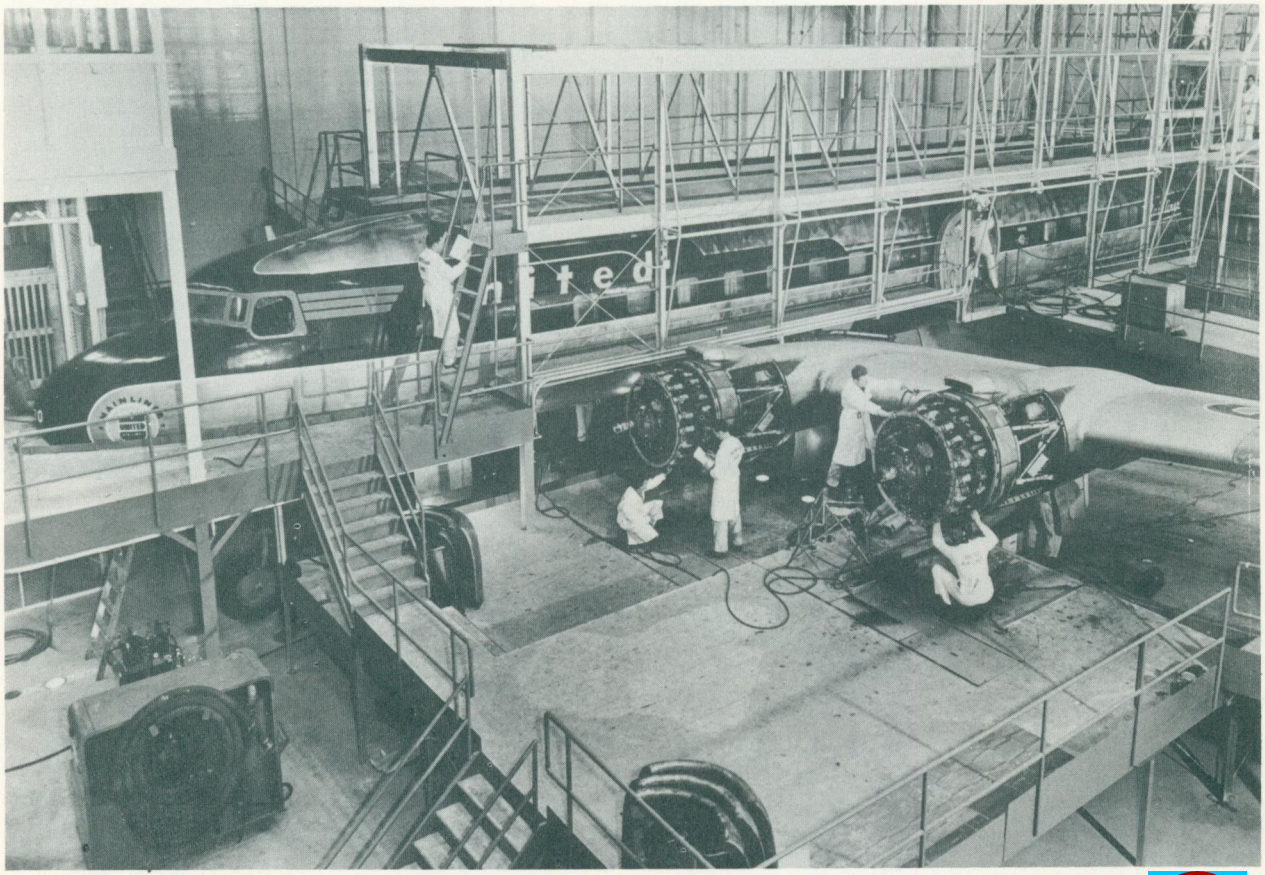
Reliability of the Plane

Just as important as the skill of the pilot is the reliability of the plane. First of all, it takes many, many years of research, engineering, development, and testing before a new plane is able to meet CAA requirements and thus be ready for airline use.

hauls by the airline maintenance departments, staffed by CAA certificated mechanics.

Safety

The single word above makes a paragraph all by itself, for its six letters spell out the keynote of every move made by the aircraft and engine mechanic (A&E) in the airline maintenance or overhaul shop. Safety begins with the airline mechanic, for without the men who not only possess the know-how, but the know-why of



Aircraft must be checked and inspected periodically. This is an overhaul dock where planes are virtually rebuilt. Photo courtesy United Air Lines.

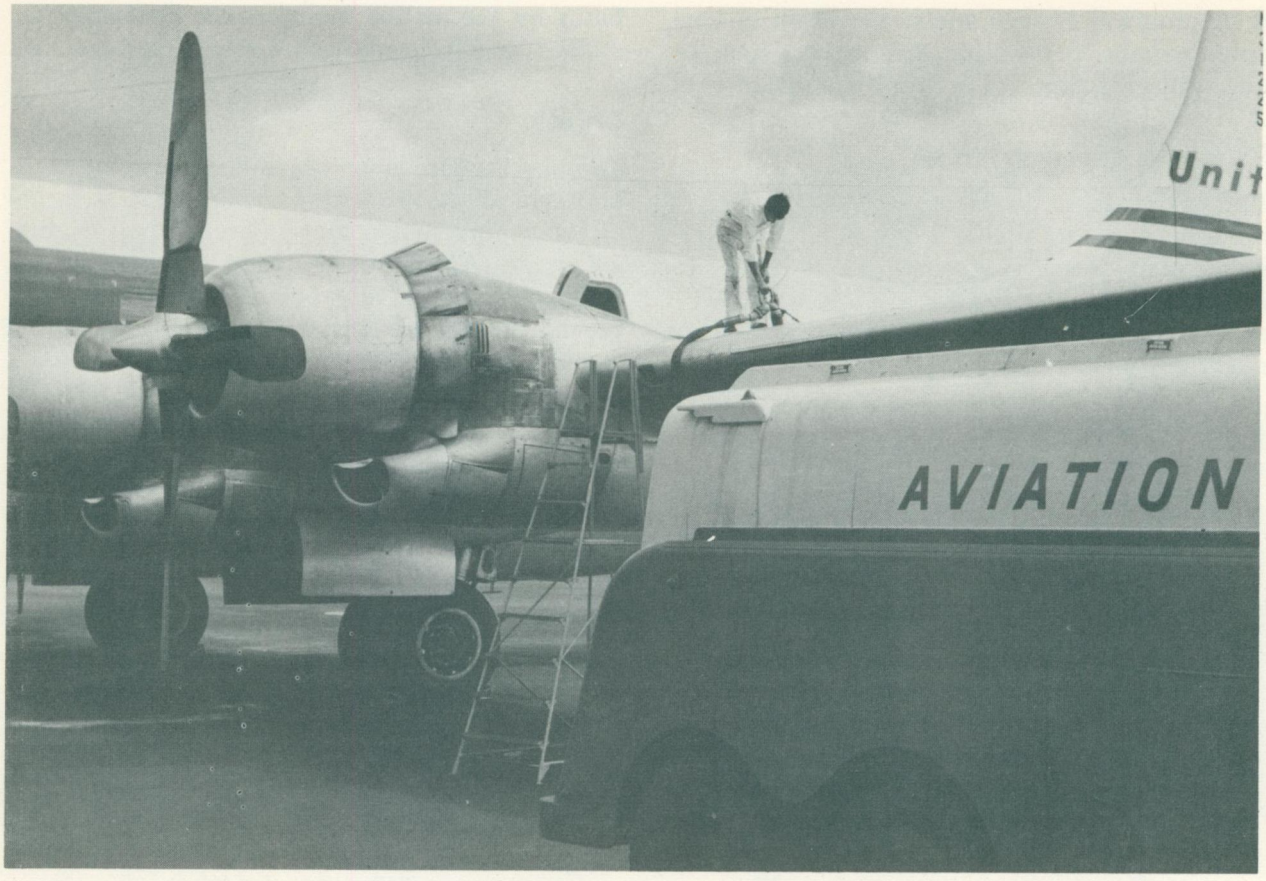
New types of planes are constantly being developed. Some are still on the drafting boards while others are in the manufacturing process. When a new type plane is turned over to an airline, you may be sure the CAA as well as the airline is thoroughly convinced the plane will be safe. No single safety factor has been overlooked.

The reliability of the plane is guaranteed by a system of regular checks, inspections and overhauls by the airline maintenance departments, staffed by CAA certificated mechanics.

Safety

The single word above makes a paragraph all by itself, for its six letters spell out the keynote of every move made by the aircraft and engine mechanic (A&E) in the airline maintenance or overhaul shop. Safety begins with the airline mechanic, for without the men who not only possess the know-how, but the know-why of airline maintenance, safety of airline operations cannot be obtained.

Practically every working move the airline mechanic makes in some way affects the safety of air travelers and flight crew members, and there are few other jobs that carry such tremendous personal responsibility. It is not surprising, then, that the airlines, engaged in the daily movement of thousands of human beings, mail, express, and freight, using equipment



The employee who re-fuels the airplane, like all other members of the Ground Service Crew, must be safety-minded.

costing millions of dollars, are so particular about the functioning of their maintenance shops and the caliber of employees working therein.

The airlines are predominantly interested in the mechanic who holds both an aircraft certificate and an aircraft engine certificate, as granted by the CAA. We will not go into detail, but it is well to remember that the requirements for certification are rigid. It takes aeronautical experience and aeronautical knowledge to pass the examinations which are practical, as well as theoretical.

Air Traffic

The rules which govern air traffic are just as inclusive and just as rigidly enforced as those which govern automobile traffic. We'll see much more about them in just a few minutes but for now let's settle on the idea that there are rules which govern the movement of aircraft and that they're strongly enforced.

That makes for safety!

Dangerous Flying

The government rules which eliminate dangerous flying practices are principally those which prohibit flying at altitudes less than 1000 feet, stunting or acrobatics over heavily populated areas and so on.

Private flyers, of course, were the most serious offenders against these practices, but the rules which prohibit them apply to all.

Rules like this give aviation a uniform blanket of safety.

The Administrator's Job

The Administrator of the Civil Aeronautics Authority, as previously stated, has the job of putting the regulations of the CAB into effect. Thus he makes his contribution to safety in commercial aviation by establishing:

1. Civil Airways
2. Air Route Traffic Control Areas
3. Air Route Traffic Control Centers
4. Control Airports
5. Control Zones
6. Airport Control Towers
7. Restricted Areas
8. Airways Beacons
9. Radio Range Stations
10. Radio Marker Stations

From what we've already learned about Aviation, we can see that the activities of these two sections of the CAA cover just about every factor that makes for safety in flying.

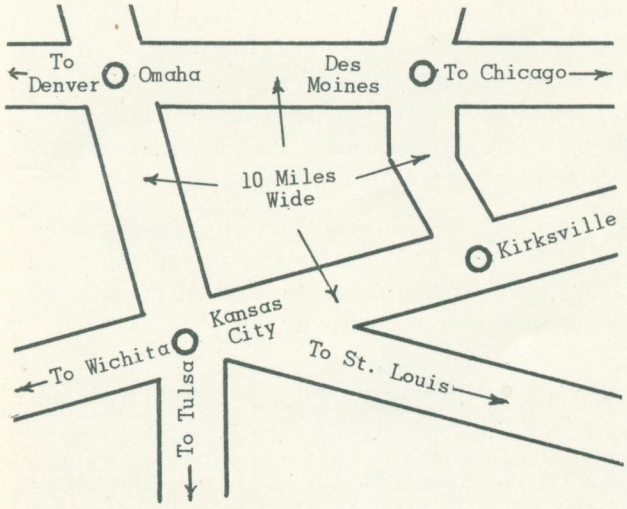
As an airline employee, you'll appreciate what the CAA has done to make flying safe for every one!

Let's look now at some of the safety devices operated by the Administrator of Civil Aeronautics.

Civil Airways

A Civil Airway is no more than an aerial highway; it's the air space above a straight line connecting two points on the surface of the earth.

When the CAA sets up a Civil Airway, it simply draws a straight line between two points — let's say Kansas City to Omaha — and over the line establishes the Kansas City-Omaha Civil Airway.



This will give you an idea of the Civil Airways branching out of Kansas City. The width of the Airways in this scale is exaggerated.

The width of the Civil Airway extends five miles on each side of the center line; thus all Civil Airways are ten miles wide.

Now it frequently happens that more than one airplane will want to use the same aerial highway at the same time. That might lead to collision, so the CAA establishes rules to prevent this possibility.

The CAA rules that planes flying east and north must fly at odd thousand-foot altitudes such as 3,000 feet, 5,000 feet, 7,000 feet, 9,000 feet and so on. Planes flying west or south must fly at even thousand-foot altitudes, such as 4,000 feet, 6,000 feet, 8,000 feet, 10,000 feet and so on.

With this system, you see, two planes flying in opposite directions on the same Civil Airway will always be separated by at least 1,000 feet of altitude from each other.

For easy reference and identification, these Civil Airways are classified by a color — green, amber, red or blue — and a number. Thus the Civil Airway from Vancouver to San Diego is called Amber Civil Airway Number One, abbreviated to "Amber One." The Civil Airway from San Francisco to New York is called Green Civil Airway Number Three—or "Green Three."

Each Civil Airway in the United States is easily identified by a color and a number.

Air Route Traffic Control Areas

To ease the problem of administering the regulations put out by the CAB, the country has been divided into individual Traffic Control Areas. There are 25 such divisions throughout the country. When a plane flies into any one of these Traffic Control Areas, it immediately comes under the jurisdiction of that area.

Air Route Traffic Control Center

The nerve center of each of these Control Areas is the Air Route Traffic Control Center — the ARTC which we saw at work when we accompanied Mr. Jones to Los Angeles a couple of lessons back.

There's a Traffic Control Center for each of the individual Control Areas. The Center is usually located at the busiest point within the area so

that it will be in the best possible position to exercise control over the aircraft operating in that area.

One of the most important functions of the Control Center is to maintain an accurate Flight Movement Board, which shows the location, altitude and course of every airplane flying in the area.

In addition, the ARTC acts as Communications Center for the aircraft within the boundaries of the area, passing on special instructions, traffic messages, and so on, to the planes in flight.

As we've already seen, the Pilot must file a Flight Plan with ARTC before taking off. This plan shows, among other things, altitude, speed, time of departure, estimated time of arrival at destination. Before approving the Flight Plan, ARTC checks the Flight Movement Board which it constantly maintains to make sure that this flight will not conflict with any others previously scheduled.

If ARTC finds that a filed Flight Plan will conflict with another flight already scheduled, ARTC suggests modifications which will keep the two flights safely separated. Naturally, the Pilot will accept ARTC's recommendations without question.

Control Airports and Control Zones

A Control Airport is simply an airport where the CAA has set up personnel and facilities for controlling the air traffic in that area.

The Control Zone is the area within a three-mile radius of the control tower, both in the air and on the ground.

When a plane of any kind — commercial or private, transcontinental or local — flies into the Control Zone of a Control Airport, it immediately comes under the jurisdiction of the Air Traffic Control Tower operator.

This man is an expert on air traffic; he's licensed by the Administrator of Civil Aeronautics. It's his responsibility to control the aircraft within his zone according to CAR regulations.

Airport Control Towers

Next time you visit an airport, take a look at the Control Tower and you'll find one of the busiest places in modern aviation.

The Control Tower is usually located in some elevated vantage point — the top of the Administration Building, for example—where the operator can command a clear view of approaching and departing planes, as well as the airport.

It's from this Control Tower that traffic is directly regulated by means of radio and light signals.

There are hundreds of flights that enter and leave a busy airport like La Guardia every day. Think of the confusion — and the actual danger! — if there weren't some central authority to give instructions.

The duties of the Control Tower operators are varied.

For example:

A plane coming into Omaha makes radio contact with the Control Tower when it's about 15 miles from the airport. What happens sounds like this:

OMAHA TOWER — THIS IS CENTRAL 16 OVER WESTON. LANDING INSTRUCTIONS.

CENTRAL 16 — THIS IS OMAHA TOWER. WIND ON THE FIELD IS NORTH 12 — ALTIMETER 3005 — TWO ARMY TRAINERS JUST NORTH OF FIELD — YOU ARE NUMBER ONE TO LAND — USE RUNWAY 36.

CENTRAL 16

Typical landing instructions like these, you see, give the Pilot everything he needs to make his landing safely. The Pilot keeps his radio tuned to the tower frequency so that he can receive whatever additional instructions are necessary.

When a plane's ready to leave the loading ramp the Pilot always contacts the tower for "taxi clearance" — permission to taxi the plane to the proper take-off runway.

OMAHA TOWER — THIS IS CENTRAL 16. TAXI CLEARANCE.

CENTRAL 16 — THIS IS OMAHA TOWER — WIND NORTH 20 — ALTIMETER 3005 — USE RUNWAY 36 — CLEARED TO TAXI.

CENTRAL 16

The Pilot then taxis the plane to runway 36 and again must call the tower for permission to take off.

After the plane takes off, the Pilot leaves his radio tuned to the tower frequency until he is outside the control zone.

Some private planes don't have two-way radio equipment. They're able to receive instructions by radio but have to acknowledge them by dipping their wings, moving the rudder and so on.

The Light Gun

When a private plane has no radio equipment at all, the tower gives instructions by means of a light gun — a tubed spotlight equipped with a gunsight so that the tower operator can beam it directly into the plane's cockpit.

By using red and green lights, either steady, flashing or alternating, the tower operator can give the Pilot whatever instructions he needs to land or take off safely.

More and more airports are insisting that all planes have at least radio receiving equipment — again to provide additional safety in flying — even to the point of refusing admission to planes which do not have it. Thus the flashing gun is rapidly disappearing from the larger airports.

This is the Control Tower at New York International Airport, where air traffic is regulated by radio and light signals.
Photo courtesy Pan American World Airways System.

Restricted Areas

Once in a while certain areas of the country are restricted; Pilots aren't allowed to fly over these restricted sections, which are called Restricted Areas.

Usually these restrictions are applied to the air over plants, munitions depots, proving grounds, experimental stations and so on.

These Restricted Areas are reported to Pilots in the weekly Notices to Airmen (NOTAM) which are issued by the CAA.

Airway Beacons

The lighted Airway Beacons which are such a great help to Pilots today date back to the early days of air-mail flying, when Pilots arranged with friends along the route to light bonfires to guide them.

Then, when Colonel Paul Henderson first started night flying in earnest, as we saw back in Lesson 1, he and his staff designed and put into operation the Airways Beacon system we know today.

Now airway routes are illuminated by rotating-light beacons, each of which has a characteristic sweep so that the Pilot can fly along the aerial highway at night in perfect safety.

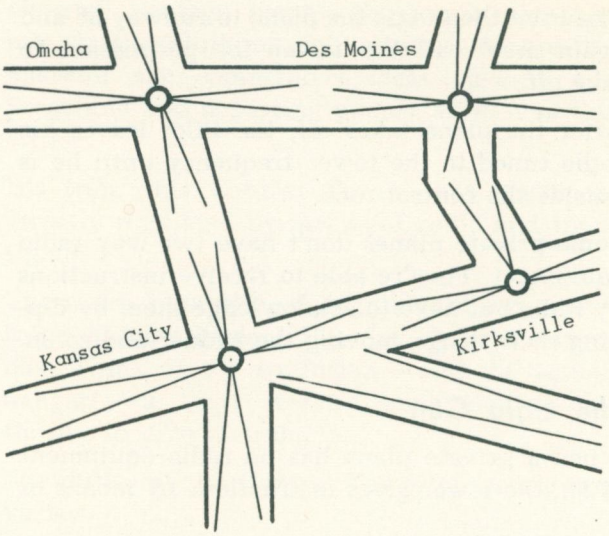
Radio Range Stations

One of the cleverest devices for helping the Pilot navigate his plane in darkness or in poor visibility is the network of Radio Range Stations now in use from coast to coast.

We're not going to get involved in a technical discussion of how these Radio Ranges work.

All you need to know is that such ranges are set up by the CAA at intervals of about one hundred miles along the Civil Airways. A Radio Range is a simple radio transmitter located at or near an airport.

Each Range Station sends out a characteristic signal which the plane's radio receiver picks up. By identifying the signal and measuring the strength of the signal, the Pilot can tell almost exactly where he is in relation to that particular transmitter.



This drawing shows some typical Radio Range Stations along established Civil Airways. Planes on the radio "beam" can fly in perfect safety no matter what the visibility.

When he's on perfect course, the Pilot hears a steady signal; as long as he stays on the right course, the "beam" will remain steady. As soon as he gets off course, the characteristic of the signal will warn him.

This system of radio signals and "on the beam" flying enables the Pilot to fly his course just as safely in the heaviest fog or blackest night as he can in perfect visibility.

Even when he's flying in good weather the capable Pilot will practice flying by the Ranges so that he'll have a highly developed skill to use when he needs it.

Radio Marker Stations

These Radio Range Stations we've just been talking about act as streets for the Pilot to follow in poor visibility. But in addition to having the street marked for him, he's got to have something to tell him how far along the street he's flown. He needs some "street corner signs."

That's what led to the development of the Radio Marker Station.

Located at regular intervals along the Radio Beacon Ranges, these Radio Marker Stations are transmitters which send out a signal high into the skies. When a Pilot flies over one of these Radio Marker Stations, he hears a characteristic signal which tells him immediately what station he's over.

In most commercial planes — the kind you'll be working with — an amber light on the dashboard flashes an identifying signal when the plane flies over a Marker Station. The Pilot then consults his chart which tells him his location.

The Radio Marker system is one of the slickest devices yet developed for the safety in flying that comes from reliable air navigation.

Landing Aids

You know, one of the greatest problems airline Pilots have to face is that of getting a plane safely to earth in bad weather when visibility is restricted — when he can't see the runway. All the great skill of the airline Captain is really put to the test when he's called upon to land in bad weather.

Flying in limited visibility isn't too bad these days when a Pilot can select a traffic-free altitude and let radio guide him along the beam to his destination. He can fly this way in complete safety.

But it's when he has to approach his landing without being able to see the landing strip until the last minute that calls for all his flying skill.

Landing "blind" is a problem which has plagued fliers from the earliest days. But once again the ingenuity of the engineers has come to the rescue, with the result that landing in restricted visibility is now nearly as safe as landing on a sunny day.

Let's see how this menace is being removed.

FIDO

Back in World War II days, the British were particularly plagued by the problem of having their landing fields closed in by the heavy fog so common to that country.

Obviously they couldn't maintain the heavy traffic schedules called for by the war if they couldn't get into their landing fields. So they came up with FIDO — a dramatic and spectacular method of dispersing fog.

Here's how it works:

Engineers outline the landing runways with hundreds of jets from which gasoline can be burned under high pressure. When a plane approaches the landing runway, these jets are lighted and, under pressure, the flames "burn off" the fog for several hundred feet overhead.

This, of course, gives the Pilot a clear field to land on.

Now they've found that they can use Diesel oil or kerosene — much less expensive than gasoline — just as effectively. This has reduced the cost of FIDO operation substantially, and the next few years may see it in extensive commercial use.

Ground Controlled Approach

Ground Controlled Approach—GCA—followed the development of Radar during World War II.

You probably know something about how Radar works — a radio transmitter sends out a strong radio signal; it hits an object in its path and bounces back to its source where it's picked up on a scope that looks something like a Television screen.

A series of these reflected radio signals covering a screen will form a silhouette of the objects in its path.

The GCA system calls for a radar installation at the airport, a radar operator familiar with aircraft landing procedures and two-way radio communications between the Pilot and the Radar Operator.

A plane approaches a landing field in zero-visibility weather. The radar operator picks up the silhouette of the plane on his radar scope; he establishes the plane's position.

He contacts the plane by radio and then directs the plane into the right course, the proper altitude and right speed to approach the landing runway. The Pilot simply follows instructions until he can actually see the runway and bring his plane to a safe landing.

Instrument Landing System

Instrument Landing System — ILS — is also in popular use to provide safety in difficult landing conditions.

In the ILS system, the Pilot does all the work. There's a circular ILS dial on his instrument

panel; this dial has cross-hairs etched on it — one vertical, one horizontal — to divide the dial into four equal sections. There are also two movable needles on the dial.

On the ground, the ILS system calls for a localizer transmitter, a glide path transmitter and a marker beacon transmitter. All you need to know about these for now is what they're called.

The Pilot approaching the landing strip watches the needles on the ILS dial. When the plane is perfectly lined up for the approach, the two needles coincide exactly with the cross-hairs. If the plane is too low or too high for correct approach, the horizontal needle will be above or below the horizontal cross-hair. If the plane is to the left or to the right of the proper glide path, the vertical needle will show left or right of the vertical cross-hair.

All a Pilot has to do, then, to make sure he's approaching his landing properly is to keep the needles right on the cross-hairs and he'll approach perfectly until he can actually see the runway and make his landing.

Pretty clever system, isn't it?

Government Meteorological Facilities

The U.S. Weather Bureau is not to be overlooked for its contribution to airline safety. As a national service, the Weather Bureau operates approximately 1000 weather stations throughout the country.

These offices collect, analyze, and disseminate weather information to many individuals and industries including the commercial airline industry. Over 50% of these stations are on duty 24 hours per day and send hourly reports to central locations. At the central offices, the coded reports are grouped into sequences of from 20 to 30 stations and both broadcast over CAA radio and sent out over CAA teletype circuits on hourly schedules. In addition to the hourly weather reports, approximately 150 of the stations analyze upper air information to obtain data concerning wind direction and velocity, as well as temperatures at various altitudes. This information is especially helpful to the pilot in deciding the best altitude for his flight.

At 150 main Airways stations, a staff of government meteorologists chart and analyze weather maps, issue forecasts, and consult with any pilots or others requesting information.

Why?

Maybe you've wondered why we've spent so much time in this lesson on the safety factor in aviation.

Here's the reason:

Public resistance to air travel has just about disappeared now. The speed and comfort of modern commercial aviation has converted hundreds of thousands of Americans into flying enthusiasts.

But no matter how enthusiastic experienced airline travelers may be, there's still a small segment of the American public who feel that flying isn't safe.

You've probably known people like that. They'll take a single highly-publicized airlines crash and build up a complete case against commercial aviation from it.

As an airline employee, you're going to have to convert people like that to flying. Naturally, you'll be able to sell them on flying if you can sell them on safety.

That's why it's important for you to know what's been done to promote safety in planes and the men who fly them through governmental regulation.

That's why you should know something about the amazing, fool-proof systems of air navigation now in use.

That's why you have to be familiar with the newest systems for landing planes safely in bad weather.

Airline passengers — and prospective passengers — will be asking you about these things — you've got to be able to give them the facts.

And you'll be proud, too, when you're able to quote your airline's safety record to doubtful passengers — hundreds of millions of passenger miles without a fatality. You'll be eager for the public to compare records like that with those of other forms of public transportation.

Here's something else you'll discover:

The safety factor in commercial aviation, developed so conscientiously throughout the years, is just one more reason why you'll be glad to be a vital part of the exciting, fast-paced airline industry.

Let's take a look at how an airline is organized . . . How you'll fit into the picture . . . The flow of authority and responsibility . . . The function of the various departments. The subject of your next lesson is "Airline Organization."

Notes and Memos

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