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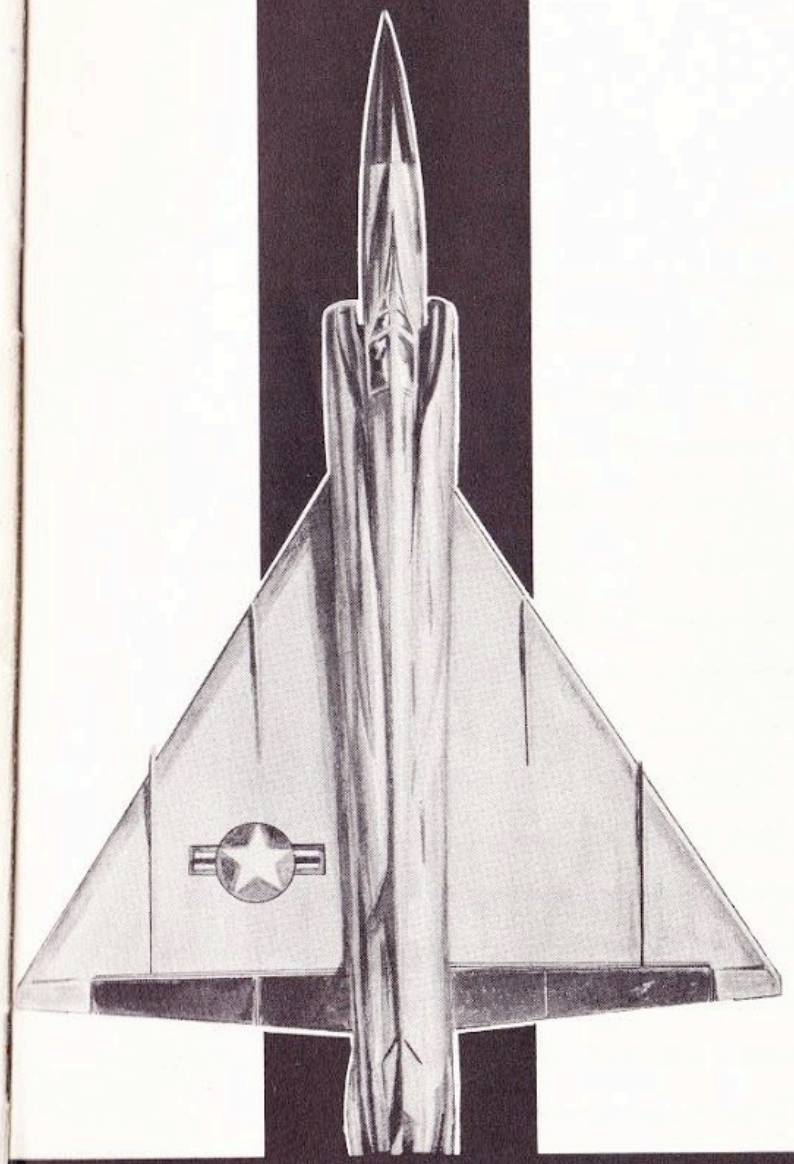
AIRPORTS AIRWAYS AND ELECTRONICS



WORK BOOK

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PREFACE

The exercises and activities prescribed in this workbook will help you attain the purposes of each lesson. These purposes will be brought to your attention by your instructor. No excercise is to be attempted until your reading assignment has been completed. Do not attempt the exercises until you have made preparation after planning with the instructor and paying heed to his presentation at the first lesson session. Do not hesitate to use every method at your command in order to obtain essential information. Observe, read, ask questions of your instructor and the resource people that visit your classroom. You will note that lessons are numbered in accordance with a natural sequence and not with reference to a particular workbook; for example, the first lesson of the workbook: Aircraft in Flight is Lesson VII; that of the workbook: Power for Flight is Lesson XIV. This procedure is also used to identify the lesson plans of the several booklets of the Instructor Guide series.

By means of a key your instructor will help you correct Exercises 1, 2, and 3 of each lesson. Since it has not been possible to key the responses to Exercise 4, the quality of these should be appraised during discussion by students and instructor.

HAROLD E. MEHRENS, Editor

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AIRPORTS, AIRWAYS, AND ELECTRONICS

Lesson XXII

EXERCISE NO. 1

(You have 5 minutes to complete this exercise.)

1. Place a *T* in the blank space preceding a true statement; place an *F* in the blank space preceding a false statement.

a. F The Federal Government has aided considerably in airport construction over the last 25 years.

b. F Today there are about 700 airports of all types serving the cities and towns of this country.

c. T Over the last 50 years there has been a correlation between aircraft and airport growth.

d. T The first improved landing surfaces were usually of the cinder and gravel variety, with lengths of about 1500 feet.

e. F Today, runways can be expected to support aircraft weighing around 500,000 pounds.

f. F The first scheduled night flight from North Platte, Nebraska, to Chicago was made in 1931.

g. F Designated airways lead from airport to airport, and are clearly outlined by lines drawn on a chart.

h. T The early light beacon, designating airways, had route identification and on-course lights installed on the towers.

i. F By 1940 there were about 4000 miles of air routes defined by four-course radio ranges.

j. F A new type of radio range, replacing the four-course low frequency range, uses equipment based upon the medium frequency part of the radio spectrum.

EXERCISE NO. 2

(You have 10 minutes to complete this exercise.)

1. Fill in the blank spaces with the word, or words, that properly complete the statement.

a. In 1928 there were 1300 (the number) airports of all types in the United States.

b. Today there are about 7000 (the number) airports of all types serving the cities and towns of this country.

c. The federal 1946 of airport act, an act authorizing a maximum expenditure of one hundred million dollars per year for airport improvement and construction, established the first substantial airport aid program.

d. In a few years, jet propelled transports, landing at speeds around 125 mph, will require runways up to 8000 10,000 feet long.

e. An airport of some type can now be found at intervals of 15 to 30 miles along most designated airways.

f. Lighting of airways by powerful electric searchlights was begun in 1922.

g. Today over 400 low frequency radio ranges are in operation.

h. The radio range that is replacing the four-course low frequency range is called the low frequency omni-directional range.

i. Two main reasons why the omni-directional range cannot replace the four-course range immediately can be broadly classified as economy and education reasons.

j. By 1956 about 500 radio range stations using equipment based on the very high frequency section of the radio spectrum had been installed along our airways.

EXERCISE NO. 3

(You have 5 minutes to complete this exercise.)

1. Draw a circle around the number preceding the phrase which is best to make the statement a correct expression.

a. The first scheduled night flight, carrying mail from North Platte, Nebraska, to Chicago, Illinois, was made by:

1. Wiley Post
2. Amelia Earhart
3. Jimmie Doolittle
4. Jack Knight

b. The first radio range stations operated on:

1. Low frequency
2. Medium frequency
3. High frequency
4. Very high frequency

c. The first research project in the use of radio in airplanes carried out in this country was undertaken:

1. In 1921 at Langley Field, Virginia
2. In 1926 at Massachusetts Institute of Technology
3. In 1919 at the University of Maryland
4. In 1927 at California Institute of Technology

d. In 1930 there were about 1800 airports of all types in this country. Those that were lighted and could accommodate night flying numbered about:

1. 300
2. 600
3. 900
4. 1200

e. Today an aircraft landing at about 100 mph requires a runway of approximately:

1. 1500 feet
2. 5000 feet
3. 6000 feet
4. 10,000 feet

EXERCISE NO. 4

(You have 15 minutes to complete this exercise.)

1. Make a list of all the facilities that you might expect to find on today's modern civilian airport.

2. Give your own definition of an airway. What functions do the modern airway perform?

3. Discuss the advantages of an airway defined by radio range stations over one defined only by rotating beacons.

Lesson XXIII

EXERCISE NO. 1

(You have 5 minutes to complete this exercise.)

1. Place a *T* in the blank space preceding a true statement; place an *F* in the blank space preceding a false statement.

a. F Aeronautical charts are concerned primarily with airways. Little information regarding airports is found on aeronautical charts.

b. T Airport lighting information can be found on aeronautical charts.

c. T Commercial broadcasting stations are depicted on aeronautical charts.

d. F On aeronautical charts a "Prohibited Area" is one where invisible hazards to air navigation exist.

e. T Airways marked by LF/MF range stations are designated by colors red, green, blue, and amber, and a number.

f. T VOR airways are called Victor airways.

g. T Points along an airway at which aircraft in flight, when under IFR flight rules, must report their position to radio communication systems are indicated by a solid color triangular symbol.

h. F If the name of the VOR range station at Gardner, Massachusetts, were Gardner Radio, we would know it had no voice facility associated with it.

i. T VOR is the abbreviation for Very High Frequency Omnirange.

j. F VOR airways are shown on aeronautical charts in red, while LF/MF airways are shown in blue.

EXERCISE NO. 2

(You have 10 minutes to complete this exercise.)

1. Fill in the blank spaces with the word, or words, that properly complete the statement.

a. red and green airways extend in a general easterly-westerly direction.

b. A Caution Area is an area where visible hazards to air navigation exist.

c. VOR airways which carry an even number extend in a general east-west direction.

d. If a voice broadcast is included in the service provided by a range station the word radio will follow the name of the airport near which the station is located.

e. On aeronautical charts, all water aerodromes depict an anchor inside the circle or circles designating the facility.

f. An aerodrome designated by two concentric circles is a land, military airport.

g. Flight Information Manuals are published by Fed. Aviation Agency.

h. Omni-directional ranges reveal to the pilot the magnetic bearing of the aircraft from the omni-range station.

i. Runway information found on aeronautical charts deals with field elevation, lighting conditions, type of runway surface, and length of longest runway. An airport described by the code "52 L H 100" has a runway 10000 feet long.

j. The elevation of the above runway is 52 feet above sea level. The runway has a hard surface.

EXERCISE NO. 3

(You have 5 minutes to complete this exercise.)

1. Draw a circle around the number preceding the phrase which is best to make the statement a correct expression.

a. On aeronautical charts you will see the word RACON used in association with navigational aids. This word means that the facility is a:

1. Radio beacon
2. Radar beacon
3. Radio range
4. Radio communications station

b. An aeronautical chart indicates those areas in which air traffic is controlled through the use of the color:

1. Red
2. Green
3. Blue
4. Amber

c. Information relative to runways that is found on aeronautical charts usually does not include:

1. Runway elevation
2. Runway length
3. Runway width
4. Type of runway surface

d. The color designation of north-south LF airways will be:

1. Red or green
2. Green or blue
3. Red or blue
4. Blue or amber

e. An aerodrome depicted on an aeronautical chart by two concentric circles with an anchor in the middle is a:

1. Water, joint civil and military airport
2. Water, civil airport
3. Water, military airport
4. Joint water and land, military airport

EXERCISE NO. 4

(You have 15 minutes to complete this exercise.)

1. List, in general terms, all the information concerning a particular airport that you might expect to get from an aeronautical chart.

2. List, in general terms, all the information concerning a particular airway that you might expect to get from an aeronautical chart.

3. List, in general terms, all the information concerning a particular radio facility that you might expect to get from an aeronautical chart.

Lesson XXIV

EXERCISE NO. 1

(You have 5 minutes to complete this exercise.)

1. Place a *T* in the blank space preceding a true statement; place an *F* in the blank space preceding a false statement.

a. T The principles of radio make modern aviation possible.

b. F Inductance is the property of an electronic circuit that enables it to store up an electrical charge.

c. T The lines of magnetic force always radiate from a primary coil in the form of circular waves.

d. F Edison invented the vacuum tube.

e. T A very small current through the grid of an electron tube causes a very large current to flow from the plate of such tube.

f. T Small changes in the electrical charge on the electronic grid produces very large changes in the plate circuit.

g. F The most important uses of the triode are to contribute resistance, capacitance, and inductance to the circuit.

h. T A transformer is a form of induction coil.

i. T Ultrasonics is a new technological field employing the principles of electronics.

j. F Transistors are made from barium titanate.

EXERCISE NO. 2

(You have 10 minutes to complete this exercise.)

1. Fill in the blank spaces with the word, or words, that properly complete the statement.

a. A radio transmitter changes sound waves to audio waves.

b. The radio transmitter also causes radio fre. waves to carry the audio impulses through space.

c. Magnetic lines of force around a bar magnet or coil take a circular path from one of the poles of the magnet to the other.

d. The property of a circuit that tends to oppose a change in the direction of an existing current is called inductance.

e. The fundamental principle of the electron tube is that the heating of a metal causes it to give off electrons.

f. An American, Lee DeForest, added an element to the vacuum tube called a grid.

g. The three most important uses in radio of the vacuum called a triode are oscillation, amp., and detection.

h. The first oscillator was developed by Hertz in 1899.

i. A very small device, called a transistor, which does much of the work of the vacuum tube, has recently been developed.

j. The device that enables you to tune your radio to the desired frequency is called a variable condenser.

EXERCISE NO. 3

(You have 5 minutes to complete this exercise.)

1. Draw a circle around the number preceding the phrase which is best to make the statement a correct expression.

a. Electro-magnetic oscillations are called:

(1) Radio frequency waves
2. Electrons
3. Audio waves
4. Control circuits

b. Magnetic lines of force crossing a secondary coil induce voltage and alternating movement in such a coil only when:

1. The primary and secondary coils are adjacent one to another
2. The primary and secondary coils are a considerable distance apart
(3) Building up or collapsing
4. Emanating from a radio transmitter

c. The device that provides capacitance in a circuit is called a:

1. Resistor
2. Coil
3. Transformer
(4) Condenser

d. The vacuum tube element of greatest significance, a control of electron flow, is:

1. The coil
(2) The grid
3. The filament
4. The plate

e. The frequency of the radio waves of a circuit is controlled by the relationship of:

1. Inductance to resistance
2. Current to voltage
3. Inductance to capacitance
4. Resistance to capacitance

EXERCISE NO. 4

(You have 15 minutes to complete this exercise.)

1. Draw a schematic diagram of a radio transmitter (see page 20.)

2. Draw a schematic diagram of a radio receiver and describe the stages of sound transmission by radio.

Lesson XXV

EXERCISE NO. 1

(You have 5 minutes to complete this exercise)

1. Place a *T* in the blank space preceding a true statement; place an *F* in the blank space preceding a false statement.

a. F The principal function of an airport is to provide facilities for passenger comfort.

b. T Among airport operations might be included a flight school.

c. FT Fixed base operations include airport businesses conducted by airlines.

d. T The airport administrator performs tasks which range from the collection of rentals to the construction of airport buildings.

e. F Fifty per cent of airline employees are pilots.

f. T Without federal government services, modern air transportation could not exist.

g. F A pilot in flight who desires information about weather conditions which lie ahead of him must request such information from the Weather Bureau.

h. T Airport surveillance radar shows the PAR operator the glide path position of an incoming airplane.

i. T The pilot of a landing aircraft may use an electronic device called a localizer.

j. TF Control areas may be expanded to include areas near airports over which aircraft fly on IRF.

EXERCISE NO. 2

(You have 10 minutes to complete this exercise.)

1. Fill in the blank spaces with the word, or words, that properly complete the statement.

a. Some behind-the-scenes airport activities are called airport operations.

b. Fewer than 10% per cent of airline employees are pilots, and fewer than 2.5% per cent are mechanics.

c. Federal government services are provided air transportation because aviation is important both to our national emergency and defense.

d. A pilot planning a flight to a distant airport needs to know about the weather prevailing at the airport of his destination.

e. Weather reports are broadcast at intervals 15 and 45 minutes past the hour.

f. Flight assistance service is no further from the pilot than his transmit receiver.

g. One of the most important air traffic control facilities located at a major airport is the control tower.

h. When weather obstructs visibility at the airport, approach ~~traffic~~ control is operated by the control tower.

i. An electronic device which gives the bearing and distance of an aircraft from the airport is called airport surveillance radar.

j. All air traffic within control areas is supervised by air traffic control centers.

EXERCISE NO. 3

(You have 5 minutes to complete this exercise)

1. Draw a circle around the number preceding the phrase which is best to make the statement a correct expression.

a. One of the most important services housed in airport terminal buildings is:

1. Weather observation operations
2. The post office
3. The insurance vending machine
4. The airline passenger agent

b. Control tower operators never instruct pilots to:

1. Taxi into take-off position
2. Taxi to the ramp after landing
3. Take off
4. Check engine performance

c. The air route traffic control centers supervise air traffic:

1. In control zones
2. Within control areas
3. Only along the federal airways
4. By means of the control tower

d. Airline communication services, as do the CAA and the Weather Bureau, in the best interests of aviation safety use:

1. Only electronic communication systems
2. Only land-line communication systems
3. Both electronic and land-line communication systems
4. Only ground-to-air radio

e. The primary purpose of an airport is:

1. To provide flight assistance service
2. To house Weather Bureau facilities
3. To provide take-off and landing area for aircraft
4. To provide passenger accommodations

EXERCISE NO. 4

(You have 15 minutes to complete this exercise.)

1. Write a paragraph describing the air traffic control facilities you would expect to find in operation at an airport.

2. After discussing with resource personnel the airport needs of your community, draw a plan for an airport indicating where terminal buildings and hangars should be located, specifying length of runways, construction materials and the like.

Lesson XXVI

EXERCISE NO. 1

(You have 5 minutes to complete this exercise.)

1. Place a *T* in the blank space preceding a true statement; place an *F* in the blank space preceding a false statement.

a. T Modern electronic devices have completely surplanted other aids to aviation.

b. F Modern electronic aids to aviation are operated by the CAA, Office of Federal Airways.

c. T By means of radio and the communication stations along his route, pilots may ask for and receive instructions from traffic control centers.

d. T Modern aircraft radios operate on frequencies between 108 and 150 megacycles.

e. T Radio ranges actually tell the pilot where the airway is located.

f. F The LF/MF radio station has no single advantage over the VOR station.

g. F Unlike television broadcast signals, VHF radio signals do not follow a line of sight direction.

h. T The VOR receiver is a kind of stopwatch and calculating machine which uses radio signals as a basis for its computations.

i. F Using only one VOR station, a pilot whose aircraft is equipped with a VOR receiver can fix his position accurately.

j. T Electronic devices not only make possible landing and take-off operations but also they mark the thousands of miles of airways of continental United States.

EXERCISE NO. 2

(You have 10 minutes to complete this exercise.)

1. Fill in the blank spaces with the word, or words, that properly complete the statement.

a. Electronic devices make possible Traffic Control along airways.

b. The outer ILS marker is located on the range course line approximately appx 2 miles from the end of the runway.

c. A device used to solve in-flight navigational problems automatically is called a Course Line Computer

d. When tacan and VOR are used together, a pilot can pinpoint the position of his aircraft without recourse to more cumbersome methods.

e. Sometimes outer markers and inner markers are used to indicate to a pilot his position in flight.

f. As the distance from an LF/MF radio range station decreases, its beam narrows and its signal becomes stronger.

g. LF/MF radio range signals are broadcast on frequnecies from 200 to 415 kilocycles.

h. VOR signals are broadcast on frequencies between 108 and 118 megacycles.

i. Directly over the LF/MF radio range station is a cone of silence.

j. Some military radio communication stations operate on frequencies about 200 megacycles.

EXERCISE NO. 3

(You have 5 minutes to complete this exercise)

1. Draw a circle around the number preceding the phrase which is best to make the statement a correct expression.

a. The easiest way for the pilot of an aircraft equipped with a VOR receiver to find his position along his route is:
1. To tune in on the proper low frequency range station
2. To tune in on the proper omni-range station
3. To plot bearing lines from two VOR stations
4. To search for familiar landmarks

b. Before a pilot using his VOR receiver can find his position enroute, he must:
1. Also use a Course Line Computer
2. Plot bearing lines on an aeronautical chart
3. Tune his DME to the proper MF frequency
4. Request information from flight service

c. The curvature of the earth obstructs VOR signal reception by aircraft flying at low altitudes. This means:
1. That some LF/MF range stations will remain in operation
2. That all aircraft must operate at high altitudes
3. That booster stations will supplement VOR stations
4. That radar control will be exercised over all aircraft in flight

d. Localizers are electronic devices which give the aircraft pilot:
1. Horizontal guidance
2. Vertical guidance
3. Lateral guidance
4. Holding pattern information

e. The DME operates on a frequency of:
1. 75 megacycles
2. 118 megacycles
3. 1000 megacycles
4. 200 megacycles

EXERCISE NO. 4

(You have 15 minutes to complete this exercise.)

1. Draw a schematic diagram illustrating radar aid to airport traffic—showing the airport, the approach channel, and appropriate markets.

2. Write a brief explanation of the principles underlying the operation of the very high frequency omni-range.

Lesson XXVII

EXERCISE NO. 1

(You have 5 minutes to complete this exercise)

1. Place a *T* in the blank space preceding a true statement; place an *F* in the blank space preceding a false statement.

a. T Air traffic rules prevent serious traffic conflicts during heavy flow of air traffic.

b. F Only air traffic at airports is governed by regulation.

c. F All aircraft operating VFR are required to have radio receivers.

d. F Air traffic rules are concerned only with the expeditious flow of air traffic; never with proper aircraft equipment.

e. T Air traffic rules sometimes pertain to special pilot skills.

f. F A pilot who fails to exercise good judgment is in violation of air traffic regulations.

g. T An aircraft flying over or near an airport is governed by rules that may not apply when it is flying along an airway.

h. T Control area regulations do not apply to the air space below 700 feet above the earth's surface.

i. T VFR is a symbol which stands for visual flight rules.

j. F A pilot in flight observing a flashing green light from the control tower knows that he is cleared to land.

EXERCISE NO. 2

(You have 10 minutes to complete this exercise.)

1. Fill in the blank spaces with the word, or words, that properly complete the statement.

a. A pilot on the ground observing a steady green light from the tower knows that he is cleared for takeoff.

b. A pilot in flight observing a steady red light from the tower knows that he must continue circle.

c. Air traffic information is conveyed by both radar signals and light signals.

d. Regulations govern air traffic both at airports and along airways.

e. The regulations governing air traffic are prepared by the F. A. A.

f. Civil aeronautics flight rules require the exercise of good pilot operating practices.

g. Differences between the sets of regulations governing flight operation in different areas are dictated by differences in the amount of traffic prevailing.

h. All movement of aircraft within the airport's control zone must be cleared.

i. When the rotating beacon of an airport is lighted during the hours of daylight, it means that weather conditions are below VFR minimums.

j. At night, to attract the attention of the control tower, the pilot of an aircraft not equipped with radio should turn on his landing lights.

EXERCISE NO. 3

(You have 5 minutes to complete this exercise)

1. Draw a circle around the number preceding the phrase which is best to make the statement a correct expression.

a. At airports which have control towers in operation, airport traffic control is exercised.

1. Only during IFR weather conditions
2. 24 hours each day regardless of weather conditions
3. Only during IFR weather conditions and VFR weather conditions during hours of darkness.
4. Only during hours of darkness

b. A body of air regulations based upon analyses of practical flight situations governs aircraft operations. These regulations were prepared by:

1. The Civil Aeronautics Administration
2. The Civil Aeronautics Administration and the USAF
3. The Civil Aeronautics Board
4. The Department of Defense

c. The pilot of an aircraft equipped with an aircraft radio, who desires taxi information, tunes his receiver to the following frequency:

1. 118.1 through 121.3 mc
2. 123.7 or 126.5 mc
3. 75 mc
4. 121.7 or 121.9 mc

d. The pilot of an aircraft not equipped with radio, arriving at a strange airport, may obtain information concerning the proper traffic pattern by:

1. Light signals from the tower
2. A segmented circle
3. A tetrahedron
4. A windsock

e. The pilot of an aircraft not equipped with radio, approaching an airport during hours of daylight, observes that the rotating beacon of the airport is lighted. He properly concludes that:

1. He is cleared to land
2. He must circle the airport until he receives a green light signal
3. Weather conditions are below VFR minimums
4. The airport is closed to all aircraft operations

EXERCISE NO. 4

(You have 15 minutes to complete this exercise.)

1. Prepare a chart modeled after that on page 42, *Airports, Airways and Electronics,* explaining traffic control light signals and their meanings.

2. List the radio frequencies over which the pilot receives traffic control information. Bear in mind that traffic control is exercised over such aircraft movements as taxiing, take-off, and landing.

Lesson XXVIII

EXERCISE NO. 1

(You have 5 minutes to complete this exercise.)

1. Place a *T* in the blank space preceding a true statement; place an *F* in the blank space preceding a false statement.

a. F "On the top flight" may be undertaken only by aircraft operating VFR.

b. T It is required that VFR flights in control areas keep clear of clouds.

c. T Excepting elsewhere than in control areas, aircraft may not operate under 700 feet above the earth's surface.

d. T Victor airways are defined by VOR.

e. F Green and red four-course airways are east-west airways.

f. F Odd numbered Victor airways are north-south airways.

g. F Among the items of information reported in the flight plan is the estimated ground speed of the aircraft at cruising altitude.

h. T Under proper conditions, VFR flights can be operated legally without the knowledge of ATC.

i. T A pilot may cancel an IFR flight plan any time he is operating in VFR weather conditions.

j. T The quality of pilot judgment is the most significant factor in safe aircraft operation.

EXERCISE NO. 2

(You have 10 minutes to complete this exercise)

1. Fill in the blank spaces with the word, or words, that properly complete the statement.

a. When the ceiling in a control area is under 1000 feet, an aircraft operating legally at a cruising altitude of 800 feet will be governed by IFR procedures.

b. An aircraft operating elsewhere than in a control zone, at an altitude of 950 feet, may, if the ceiling is 1000 feet or over, employ VFR procedures.

c. An aircraft operating IFR outside a control zone, at an altitude of 5000 feet on a course of 90 degrees, is not obeying the air traffic regulations.

d. An aircraft operating VFR at 2000 feet, on a heading of 60 degrees, is operating illegally.

e. An air traffic clearance is issued by ATC authorizes

f. Operation of aircraft, under an air traffic clearance, must be conducted under the full supervision of the clearance.

g. A service of air traffic control that supervises the departing and arriving IFR flight is called approach control.

h. Successful IFR landings depend upon the skillful use by both controllers and pilot of proper information.

i. A pilot must conduct himself to respect and follow the air traffic control.

j. Records show that air collisions occur most often when weather conditions are excellent.

EXERCISE NO. 3

(You have 5 minutes to complete this exercise.)

1. Draw a circle around the number preceding the phrase which is best to make the statement a correct expression.

a. IFR procedures must be employed by pilots flying in a control area when the visibility is:

1. Two miles.
2. Three miles.
3. Four miles.
4. Five miles.

b. VFR flight can be legally conducted above a well defined cloud formation:

1. Under no circumstances.
2. When the pilot can reach or descend from his cruising altitude and still remain 2000 feet from the cloud formation.
3. Only when the ceiling is 1000 feet.
4. Only at altitudes below 3000 feet.

c. At altitudes at or under 700 feet above the earth's surface, aircraft flying VFR outside a control zone:

1. Must never approach a cloud formation closer than 1000 feet.
2. Are operating in violation of civil air regulations.
3. Must never approach a cloud formation closer than 500 feet.
4. Must fly clear of clouds.

d. An IFR flight operating at 7000 feet is in violation of civil air regulations when it is:

1. Eastbound upon a colored airway.
2. Eastbound upon a Victor airway.
3. Northbound upon a Victor airway.
4. Westbound upon a colored airway.

e. An air traffic controller can plot a flight accurately and plan the flight movement in terms of the prevailing flow of air traffic:

1. Only when VFR procedures prevail.
2. Only through the use of electronic equipment.
3. By means of information given on the flight plan.
4. When the pilot makes position reports at 30-minute intervals.

EXERCISE NO. 4

At this point, if you have any questions about the material covered in the previous seven classes, you should bring these to the attention of the instructor. This period should be devoted to discussing all questions which you and other students desire to have answered.