"Flight Training Instructions--T-34B" is published for the information, standardization of instruction, and guidance of all flight instructors and student naval aviators in this command. It will be used as an explanatory aid to the Naval Air Basic Training Command Primary T-34B Flight Syllabus. It will be the authority on the execution of all Primary T-34B Flight Syllabus procedures and maneuvers therein contained.

Recommendations for changes shall be submitted to the Chief of Naval Air Basic Training.

This publication has been reviewed and is approved this date.

W. B. STEVENS
Chief of Staff
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PREFACE

GENERAL

The "Flight Training Instructions--T-34B" manual is a Naval Air Basic Training Command directive in which the Chief of Naval Air Basic Training publishes information and instructions relative to the instructor and the student naval aviator. The manual prescribes the procedures, patterns, and maneuvers which are to be taught in the primary phase of training in the Naval Air Basic Training Command.

The manual is issued for the information and guidance of all instructors and student naval aviators operating T-34B aircraft within the Naval Air Basic Training Command. The information and instructions published in this directive will assist the instructor and the student to become acquainted, as quickly as possible, with the fundamental requirements of the Primary Flight Syllabus. It is very important that the factual material contained herein be digested and retained.

The process by which a student is transformed into a skilled naval aviator is both complex and demanding. It can be accomplished only by intensive instruction, in the air as well as in the ground school classroom. Success, for the most part, depends upon the student's attitude, cooperation, and attention to detail. The degree of skill attained by the student depends largely upon his ability to absorb, comprehend, and retain new material rapidly and how hard he is willing to work.

The officers and enlisted personnel in the Naval Air Basic Training Command are concerned with two main objectives—one, to train competent, well-qualified military pilots, capable of meeting the challenge of operational flying; and two, to produce efficient naval officers capable of meeting the test of leadership. Both of these objectives share equal importance.

Those students who cannot or who, by their lack of motivation or ability, fail to measure up to the high standards required throughout the various phases of training must and will be eliminated.

SCOPE

So far as is practicable, all information and instructions governing T-34B aircraft procedures and the execution of syllabus maneuvers, whether general or special in character, which are of more or less permanent application and which are issued or are to be issued by this or higher authority, will be published for inclusion in the manual.

It is every pilot's responsibility to be thoroughly familiar with the contents of the manual. Strict adherence to the manner of execution of maneuvers, patterns, procedures, and instructions herein promulgated is mandatory for all instructors and student naval aviators operating the T-34B aircraft within the purview of the Primary Flight Syllabus.

CHANGES

Changes, which will initially be in the form of advance change notices to be filed in the front of the manual, will be distributed as soon as they are approved by the Chief of Naval Air Basic Training. These changes will at the same time be submitted for printing, and printed changes designed for insertion on a page-for-page basis will follow the advance change notice as soon as is practicable. Upon insertion of page changes, entries will be made on the Record of Changes form, provided herein for this purpose.

The cover page of each printed change shall include a complete listing of those pages which are in force at the time that the printed change is inserted. This list shall be used to verify the accuracy of the volume and shall be retained for reference until a subsequent printed change is published. Page not listed, other than the cover page and the promulgation page, shall be removed from the manual and destroyed. Each page of a printed change will reflect adjacent to the page number the number of the change. For example, "1-4 Ch. 2." In the effective page listing, "O" will be used to indicate a page from the original printing of the manual, "1" will indicate a page from printed change 1, etc. Pages found to be missing should be requisitioned from the Training Officer, Naval Air Basic Training Command, Naval Air Station, Pensacola, Florida.
The paragraphs and subparagraphs indicated on the page inserts of a printed change by an arrow ( ) symbol will contain revisions and changes not previously published. This symbol will reflect the last change on a given page and will not be removed until a subsequent revision or reprint of that page. It is pointed out that "deletions" normally will not be indicated by the arrow symbol.
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CHAPTER I

INTRODUCTION TO FLIGHT TRAINING
INSTRUCTIONS--T-343

1-1 THE FLIGHT INSTRUCTOR

Each instructor realizes a large measure of professional pride in teaching each student to fly who proves himself to be deserving and competent. The instructor does his best to impart the knowledge and skill he possesses to his student. However, in the final analysis, it is the student who, by maintaining a high level of motivation, makes himself receptive to instruction and who, by cooperation and hard work, acquires the necessary skill and knowledge requisite to become a naval aviator. Because of this, a student should never allow a feeling of antagonism to develop toward his instructor. The very nature of flight instruction is conducive to the creation of nervous tension and moments of irritation which must be overlooked. All criticism proffered by the instructor to the student must be considered as being impersonal in nature and constructive in character. The instructor is an experienced pilot who is especially trained to analyze and correct any normal faults a student may show. His explanation may not be made identically to different students, and one instructor may vary from another in small details of instructing methods, but all are striving for the same end.

1-2 THE STUDENT NAVAL AVIATOR

1-2.1 GENERAL

1-2.1.1 The essential qualities of a good student naval aviator are: that he have a high sense of moral obligation for service to his country, that he possess a strong desire to be a naval aviator, that he be in excellent physical condition, that he have the ability to think logically, that he have the fundamental qualities of character from which the characteristics of good leadership may be developed, and that he be able to understand and carry out instructions. His inherent reactions and judgment must be of the high quality demanded of a naval aviator.

1-2.1.2 With these qualities as a foundation, the experience gained in each stage of flight training will provide the necessary knowledge for the student's development. In addition to improving the technique of his flying, this accumulative experi-
ence improves the student's judgment and enables him to solve more easily the many and varied problems with which he is continually confronted in the proper handling of an aircraft under widely varying conditions.

1-2.1.3 The student should feel free to approach his instructor at any time for consultation and advice on any subject affecting his flight training. However, before confronting his instructor with his problems, the student should make an intelligent analysis of them himself. A great many questions can be answered by the student's own use of logic.

1-2.2 PHYSICAL AND PSYCHOLOGICAL REQUIREMENTS

1-2.2.1 The technique of flying is highly physical and like many other acts of physical skill it is mostly a matter of coordination of hands, feet, and eyes. As far as the controls are concerned, the elementary technique of flying is not difficult to master, but because it is performed in an environment to which he is unaccustomed, the student may experience some difficulty in adapting himself. This readjustment may require considerable time, patience, and thought, but it will follow if the student applies himself.

1-2.2.2 The initial requirements in the development of coordination are a sound physical and psychological condition. The requisites are ensured by a rigid physical examination prior to commencing flight training. Subsequent maintenance of this condition is the student's own responsibility and requires the proper attention to exercise, diet, and sleep. Failure to appreciate this will inevitably affect his work in the air and on the ground. The so-called feel of a plane, erroneously attributed by some to only a favored few, is nothing more than proper perception of that which is seen, felt, or heard. Physical handicaps, whether major or minor, semi-permanent or temporary, will detract seriously from this sensation.

1-2.2.3 Physical ease and relaxation while flying make the difference between the pilot flying the plane and the plane flying the pilot. A proper sense of "feel" of the aircraft is essential. Just as a good horseman must be sensitive to the movements of his mount, so must the aviator be sensitive to the movements of his airplane. This cannot be achieved in any other way than by proper relaxation of all the body muscles and a light touch on the aircraft's controls.

1-2.2.4 In order to remain relaxed, a student should constantly be alert for involuntary tensing of his muscles, so that the development of confidence in the "feel" of the aircraft will become a natural physical condition as quickly as possible. Habitual tenseness will inevitably result in mechanical flying.

1-2.2.5 A student's mental attitude so greatly affects his nervous system and, in time, his physical condition, that it is very important that its significance be fully appreciated. As with a physical handicap, any mental distraction will also detract from the full use of the required senses. The failure to concentrate on what he is doing will retard the progress of the student; on the other hand, mental awareness greatly improves the ability of any student to learn.

1-2.2.6 It is important for all students to have some diversion of a healthy nature in order to get their minds away from the subject of flying, at least for a part of each day. This one factor, alone, will tend to relax the mind completely. Remember "A man who keeps his mind on his work progresses. A man who keeps his work on his mind goes crazy."

1-2.2.7 If, for some reason, a student begins to lose interest in his flight training and eagerly looks forward, during a flight, to his return to the students' ready room, something is wrong. He should discuss this attitude with his instructor or unit training officer.

1-2.2.8 The mental alertness of the pilot has a direct bearing upon safety in flight. Mental
laziness is the constant enemy of every aviator. The pilot, therefore, must continually plan ahead, anticipating every possible contingency and at the same time keeping his eyes on the operation of his engine through the instruments. Attention to flying should never be so confining that a careful, frequent check cannot be made of these conditions in order that intelligent corrective action may be taken in an emergency.

1-2.2.9 The student must have confidence in his aircraft, in his instructor, and in himself. To achieve the distinction and the satisfaction of flying safely, practically every impulse must be analyzed; this is of the greatest importance. And confidence, it should be remembered, is based on knowledge. The student must never extend either himself or his aircraft beyond known limits. Together with the analysis and control of his impulses, the student should study the flight instructions, always with the realization that this is a vital step toward acquiring confidence and appreciation of the limits of his ability. Every point that is not clear in the student's mind should be clarified by consultation with his instructor. By knowing, step by step, exactly what he is trying to do, and by thinking before acting, confidence can be gained more quickly. In this connection, it is of the utmost importance that the student be as deliberate as the circumstances permit and that he keep in mind, at all times, that a mistake resulting from haste is often more embarrassing than one resulting from slowness of action.

1-2.2.10 Another factor which can add to the confidence of a student is the safety of the present-day aircraft. The operation of standard aircraft is now inherently safe in that serious risks beyond the control of the pilot have been practically eliminated. Fire is an extremely rare occurrence. Collision is avoidable by proper alertness on the part of the pilot. Engines are reliable. Parachutes provide a ready means of escape which the pilot may use with complete confidence. With the above points in mind, it is readily apparent that the chance of an aviation accident is negligible from any cause other than the incompetence, disobedience, or poor judgment of the pilot himself. Remember that 70% of all fatal accidents are due to 100% pilot error.

1-2.2.11 There is one important aspect of confidence, however, which all student aviators or qualified aviators must always bear in mind, and that is the ever-present danger of developing over-confidence. This, being a human tendency, must be continually guarded against by anyone who flies, particularly those having limited experience. The instant that a pilot begins to lose that feeling of respect always due any aircraft, he has reached a stage when anything is liable to happen—and usually does. Good pilots are always apprehensive and will never deny having a healthy respect for any aircraft.
CHAPTER II
FLIGHT CLOTHING AND EQUIPMENT

2-1 INTRODUCTION

a. An important factor affecting a pilot's ability and alertness is his physical comfort while flying. Elimination of all enervating distractions resulting from uncomfortable flight equipment will add to his efficiency. Careful attention should be given to every detail connected with flight equipment.

b. All articles of clothing should fit properly and comfortably. The amount of flight clothing should be sufficient to keep the pilot warm but, at the same time, allow complete freedom of movement. Helmet, high shoes, flight suit, and leather gloves will be worn at all times when the student is in the aircraft for protection in the event of a crash or fire.

c. A student cannot learn if he cannot hear. Students should ensure that the ear holes in the flying helmet are located in the best position for hearing and that earphones, radio connection cords, and rubberized connections are clean and firmly secured. If the student has difficulty hearing or understanding his instructor in the air, he should inform him immediately. The instructor will help the student to overcome the difficulty.

2-2 PARACHUTES

2-2.1 GENERAL

2-2.1.1 Before the student actually commences flying, he should be come thoroughly familiar with the various items of equipment that are essential to his safety as a student pilot, and later, as a qualified naval aviator. The student should know when to use his equipment; why it is used; and most important, how it is used.

2-2.1.2 The parachute is one of the most important items of a student's flight equipment.

2-2.1.3 The development of the parachute had its real start during World War I. Military inventors set to work to design a manually operated free-type 'chute in order to reduce pilot mortality in combat. The modern parachute, however, was not fully developed until after the Armistice.

2-2.1.4 The back-type parachute is the most commonly used 'chute in the Navy today. However, depending on the type of aircraft you fly, you may use a seat-type 'chute, a chest pack, or an integrated harness. There are various kinds of back-type 'chutes. The back-type 'chute used in the Basic Training Command, Primary Phase, is the NB6.

2-2.1.5 The back parachute incorporates several new innovations hitherto not found in Navy personnel parachutes. First, the canopy has been changed from a 28-gore (triangular panel), 28-foot, flat circular-shaped unit to a 22-gore, 26-foot conical assembly, thereby reducing the bulk of the folded parachute. The container is a high-speed back-type 'chute using the pin-cone method of closure. There are four (4) pins holding the pack.
2-2.1.6 The parachute canopy is manufactured from high-grade nylon. The pilot 'chute is fastened to the peak of the main 'chute. Steel springs 'pop' this pilot 'chute from the pack when the rip cord is pulled. This pilot 'chute catches the air and draws the main 'chute from the pack. Although not essential, the pilot 'chute is an added safety factor. It speeds the opening of the main 'chute and assists in drawing the canopy away from the body of the wearer, regardless of his falling position.

2-2.1.7 The parachute is inspected by a qualified parachute rigger every 10 days and repacked every 60 days, or when necessary as determined by the frequent inspections.

2-2.2 PRE-FLIGHT INSPECTION

The pre-flight inspection of the parachute by the pilot is always of vital importance and should be accomplished in the following sequence.

STEP 1—Examine the parachute pack and harness assembly. Make sure there are no defects or signs of deterioration. Oil or acid stains are likely to damage the contents of the pack. Note the condition of the stitching and inspect the harness for weak spots in the webbing. Make sure there are no rusty or defective harness fittings.

STEP 2—Spread the hinge of each quick-disconnect snap and make sure that the quick-disconnect tension spring is not broken or missing.

STEP 3—Remove the parachute record card from the inspection card pocket and assure that the parachute has been inspected within the past 10 days and repacked within the last 60 days.

If any defects are discovered report them to the parachute issue room and get a new 'chute before leaving the ground.

STEP 4—Look closely at the hand pull (ripcord handle) pocket to ascertain that it holds the ripcord handle securely in position and that the pocket is firmly tacked to the webbing with nylon cord. Make sure that the ripcord handle projects from the pocket sufficiently to permit the ripcord
The Parachute ‘Pilot Chute’ handle to be easily grasped and withdrawn.

STEP 5—Make sure that the risers are tacked to the pack support straps with nylon cord. This tacking prevents the riser ends, inside the pack, from being pulled toward the top of the pack and tangling the shroud lines.

The Parachute, attaching snap fully open.

Parachute Packing Card

Parachute Packing & Inspection Record

STEP 6—Check the pack opening bands for tension and assure that the pack opening band hooks are properly secured.

STEP 7—Open the ripcord pin and cone cover by placing the fingers inside the cover and pulling gently up on the inside of each of the five snap fasteners. Check the pins to assure proper insertion in the cones. Also check the end pin for the safety tie. If the safety tie is broken, return the parachute to the parachute issue room. The parachute rigger will then inspect the ‘chute and tie a new thread if the chute is satisfactory. To re-snap the ripcord pin cover, pull the snap cones
2-2.3 PROPER USE OF THE PARACHUTE

2-2.3.1 The parachute is fastened to the body of the wearer by means of a harness which may be adjusted easily to provide both comfort and additional safety. To put on the parachute, grasp the right shoulder strap—using the right hand—just below the adapter (back of 'chute away from wearer). Keep the palm of the hand up. Now cross the left hand over the right hand, keeping the palm up, and grasp the left shoulder strap just below the adapter. Swing the parachute backward and to the right over the head, letting the harness drop down
over the shoulders. Snap on the chest strap and position the snap at the level of the breast bone. Adjust the shoulder straps at the adapters to straighten the side straps, and tighten the chest straps so that they form an angle of approximately 45 degrees. Now inspect the ripcord handle to make sure that it is free from binding. Snap on the leg straps. Make sure that the quick-disconnect snap hinges are completely closed. The leg straps should fit snugly enough so that a hand may be slid between them and the leg, when the wearer is in a standing position. However, be sure that the parachute fits snugly. Comfort and safety demand it.

2-2.3.2 When an emergency in the air has made leaving the aircraft a necessity, make your decision to bail out. Once this decision has been made, do not change your mind. If you have the aircraft under control, execute the following procedure:

STEP 1—Disconnect the lip microphone and earphone extension cords.

STEP 2—Check to see that leg and chest straps are buckled and that the parachute is properly fitted.

STEP 3—Open the cockpit canopy, using the emergency system.

STEP 4—Unfasten the seat belt and shoulder harness.

STEP 5—Slow the aircraft as much as possible.

STEP 6—Note the location of the ripcord handle on your parachute harness. Do not place either hand on the ripcord handle this time. Premature opening of the parachute, prior to leaving the cockpit or before completely clearing the aircraft, may cause the shroud lines and/or the parachute canopy to become entangled on the tail surfaces.
STEP 7--Leave the cockpit by diving outward and down toward the trailing edge of the wing.

2-2.3.3 Keep your eyes open and look around. When you are certain that you are well clear of the aircraft and that there is no danger of entangling the parachute, execute the following steps:

STEP 1--Straighten your legs and put your feet together. This will stop any rotation or tumbling of the body, reduce the opening shock, and prevent the shroud lines from tangling as the parachute opens.

STEP 2--Grasp the ripcord handle housing with the left hand, thumb behind the harness, and push away from the body.

STEP 3--Grasp the ripcord handle with the right hand and pull--HARD. Keep your eyes open and look at the ripcord handle as you pull it.

2-2.3.4 Two seconds after you have pulled the ripcord handle, you will feel a sharp tug as the canopy opens. Look up to see if the parachute canopy is fully open and spread. If a shroud line traverses the top of the canopy, or if the lines are twisted, manipulate the line until the fault is remedied. You will probably swing somewhat during the descent. Do not try to stop the swinging or slipping of the parachute; any such attempt on your part will probably only aggravate the condition. Such maneuvers are useful only to experts and are dangerous when attempted below 200 feet of altitude.

2-2.3.5 To observe your drift, crane your neck forward and sight the ground between your feet, keeping your feet parallel and using them as a drift meter. Face in the direction of your drift. You cannot steer your parachute, but you can make body turns in order to face the direction of landing. In other words, you can turn yourself so that you will be facing your direction of drift when your feet contact the ground. This is the safest and easiest way to land.

2-2.3.6 To turn your body to the right, reach up behind your head with your right hand and grasp the left risers. Reach across in front of your head with your left hand and grasp the other risers. Your hands are now crossed, the right hand behind, the left hand in front. Pull simultaneously with both hands; this crosses the risers above your head and turns your body to the right. Turns of 45 degrees, 90 degrees, or 180 degrees can easily be made by varying the force of the pull.
2-2.3.7 Start your body turn high enough in the descent to allow you to master the body turn technique. Once the turn is made, you will have perfect control. Hold the turn, or make it in easy stages, if necessary, so that finally you are facing downwind. Continue to hold the risers, whether they are twisted or not, until contact is made with the ground.

2-2.3.8 Remember, to turn right, put your right hand behind and grasp the opposite risers. To turn left, reverse this procedure.

2-2.3.9 In executing a normal landing, whether you have a body turn or not, keep your hands above your head, grasping the risers. Look at the ground at a 45-degree angle, not straight down. Looking straight down will blot out the horizon and give you an erroneous conception of height. Prepare for contact with the ground by placing your feet together and bending your knees slightly so that you will land on the balls of your feet.

Don't be limp; don't be rigid. But do relax. As soon as your feet make contact with the ground, fall forward or sideways in a tumbling roll. This will reduce the jar of landing by decreasing the rate of deceleration and distributing the impact force over a greater body area.

2-2.3.10 In high-wind landings, do two things: (1) carry out the normal landing procedures as described, including the body turn; (2) once you are down, roll over onto your stomach and haul in, hand-over-hand, the shroud lines nearest the ground. If you cannot do it in this position, roll over onto your back and try again. Pull in the lines until you grab the canopy. Then drag in the skirt of the canopy to spill the air and collapse the parachute.

2-2.3.11 Tree landings are, generally speaking, the easiest of all. If it is apparent that you are descending into a tree, let go of the risers and cross your arms in front of your face. This procedure will give you protection and afford you the opportunity of glancing downward between your arms. Keep your feet and knees together. If your parachute becomes entangled in the trees so that you are some distance from the ground, first consider your chances of being rescued. If rescue prospects are remote, disengage yourself from the harness and cut the lines and risers to make a rope for climbing down.

2-2.3.12 If you are going to make a water landing, start preparations at approximately 1,000 feet of altitude. Grasp the shroud lines and hoist yourself up in the harness until you can sit safely in the pocket formed by the back and bottom rear webbing of the harness. Unsnap your leg straps. When less than 100 feet above the water, unsnap the chest straps, but remain securely in the 'chute harness by keeping your arms crossed over your chest, grasping the vertical webbing on
each side of your 'chute. **Never** drop out of the parachute harness until your feet are in the water. Judgement of altitude over water is extremely difficult and impact with the water, after you have fallen any appreciable distance, will result in injury severe enough to endanger seriously, or preclude altogether, your chances of survival. When your feet touch the water, **not before** slip out of the parachute harness and inflate your life vest (if worn). The 'chute will blow clear, so that you avoid becoming entangled in it.

**2-2.3.13** If you do not have the aircraft under control and cannot regain control, it is, of course, important that you leave the aircraft as soon as possible. However, do not exit so rapidly that you forget to check the fit of your parachute and to disconnect all radio and safety harness fittings.

**2-2.3.14** The best way to bail out of the T-34B when it is in a nose-down spin is to leave the aircraft over the side which is to the outside of the spin. Should aerodynamic conditions make it impractical to exit toward the outside of the spin, go to the inside. But be especially careful to dive down and forward in order to avoid hitting the tail surfaces.

**2-2.4 CARE OF THE PARACHUTE**

**2-2.4.1** The longer you are a naval aviator or student pilot and the more flight experience you gain, the more you will value the parachute. The more horsepower or thrust that is present in the aircraft you are flying, the more you will realize that the greatest aid to pilot survival immediately under your control, either in combat or under conditions which preclude safely landing the aircraft, is the parachute which you so confidently have strapped to your back. Your confidence in that parachute is well founded—but only so long as you and your fellow pilots adhere to the following "common sense" rules of parachute care. "'Common sense' is what," as the old farmer said, "horses have that people need a lot more of."

**2-2.4.2** Never leave the parachute in any place where it may be exposed to rain or dew.

**2-2.4.3** Never lay the parachute on the hangar deck where it may come in contact with acid, oil, grease, or other substances which will weaken its fabric structure. Laying the 'chute on the ground should be avoided because of dampness and the possibility of destructive insects getting into the folds. If gas, oil, or battery acid is spilled on the parachute pack, it should immediately be opened in order to prevent the liquid from getting through the outside cover onto the canopy fabric. Oil and gasoline quickly rot the parachute fabric. Battery acid destroys it immediately.

**2-2.4.4** Never throw the parachute and never let it drop even a few feet, as this is apt to disarrange its mechanical features.

**2-2.4.5** Never handle the parachute in any manner which will distort the pack frame sufficiently to cause subsequent difficulty in opening.

**2-2.4.6** Never let the parachute get wet. A wet parachute opens slowly, and moisture will deteriorate the fabric. If you are caught in the
rain and your 'chute becomes wet, do not replace it in the parachute rack. Make a report of its condition to the proper personnel so that the 'chute' may be immediately dried and repacked. Rot and mildew will cause failure and you may some day be the victim of such neglect.

2-2.4.7 Handle the parachute carefully. Rough and improper handling of parachutes results in unnecessary additional work for the parachute riggers.
CHAPTER III
PRIMARY PRE-SOLO STAGE

3-1 INTRODUCTION

a. This is the first stage of basic training. After a short period of indoctrination at the synthetic trainers, you will be assigned an instructor. You will make your initial appearance, and each succeeding appearance, before your instructor a good one, bearing in mind that military courtesy and discipline are important factors in your training and will continue to be, so long as you are a member of the military service.

b. Feel at ease with your instructor. Remember that your instructor does his best with every student assigned to him. It is with professional pride that he guides the progress of his students and qualifies those who, by their diligence and ability, prove themselves to be deserving.

c. Your instructor is an experienced pilot who has been especially trained to perform his duties as a primary flight instructor; in many instances, he is a combat veteran. Never develop an antagonistic attitude toward him. Have confidence in his ability as a flight instructor and in your own ability as a student pilot.

d. Prior to your first flight, your instructor will introduce you to the T-34B "Mentor" primary trainer. He will reacquaint you with the procedures of the pre-flight inspection which you learned in the synthetic trainers. Follow through this inspection with him. Be sure to ask questions on anything about which you have any doubt. After the pre-flight inspection, your instructor will show you how to start the engine and go through the check-off lists. From this period on, you will be expected to perform these operations yourself.

e. Your first flight with your instructor serves two purposes. First, it gives you the opportunity to become acquainted with the sensations of flight and the performance of the aircraft; second, it allows you to become acquainted with the geographical areas in which your primary flight training will take place and to observe the general traffic rules for flight in these areas. Although it is too early, at this time, to concentrate on course rules and traffic patterns, try to follow what your instructor does. Try to pick out and fix in your mind the location of prominent landmarks, with relation to home base, bays, coastlines, rivers, outlying fields, roads, smoke stacks, etc. You will need these landmarks to orient yourself in the air. They may save you from becoming lost later in your training.

f. You will be handling the controls for only part of the flight. Don't try to learn everything about flying on this first flight, since, of course, this is obviously impossible. Relax. Look around.

g. Notice what your instructor does. Try to understand the common-sense planning behind the traffic procedures he follows. Notice how he is always aware of the presence and location of other aircraft. Above all, remember--RELAX!

h. You, the student, have, upon entering this phase of your training, but scratched the surface of the knowledge which will be your tool in the defense of your country. You are at the threshold of a skill which, relatively speaking, few young men of your era, or any era, have the privilege of experiencing. You are, for probably the first time, embarked on an undertaking in which success or failure depends entirely upon your own willingness to learn and your own ability to accomplish.

i. From this point, it is of the utmost importance for you, the student, to know thoroughly the basic procedures of every maneuver to be practiced prior to each succeeding flight. Knowledge is the instrument with which you will forge a firm foundation of self-confidence. From actual flight, you will gain the experience which will afford you the opportunity of developing your technique and acquiring the proficiency and skill necessary for the advancement to each succeeding stage of your training.

j. Study diligently on the ground, work hard in the air, and concentrate on the task which is yours. This is the only formula for which the product is achievement.

3-2 PRE-FLIGHT INSPECTION

3-2.1 GENERAL

3-2.1.1 The pilot who accepts an airplane for flight is the commanding officer of that plane and as such he is responsible for the efficient operation and safety of the aircraft, its equipment, and its crew.
3-2.1.2 The instructor is assigned as pilot in command on all dual instructional flights. Consequently, he is responsible at all times for the safety of the aircraft, its crew and equipment. For instructional purposes, the student will inspect the aircraft and complete the appropriate sections of the Aircraft Flight Report Form prior to each flight.

3-2.1.3 This inspection is made to ensure maximum safety and to increase the operational life of the aircraft, and incidentally, that of the instructor and student. Also, any damage which may be found can be reported and the aircraft placed in a "down" status. Any pilot who thinks that there is a possibility that a discrepancy exists which would make the aircraft unsafe for flight should "down" the plane, inform the plane captain of the trouble, and write a thorough and comprehensive description of the trouble on the Aircraft Flight Report Form in the space provided for such information.

3-2.1.5 Subsequent to each flight, any damage or malfunction should be thoroughly described in the space provided on the Aircraft Flight Report Form. It is, therefore, necessary that pilots make an inspection which will fulfill these requirements.

3-2.1.6 Your instructor will demonstrate the proper method of pre-flight inspection. Although in practice it will rarely require more than a few minutes, ample time for this inspection should be allowed prior to the scheduled take-off, in order to provide the time necessary to correct any minor deficiencies or get a different airplane. Acquire the inspection habit and execute it religiously. THE LIFE YOU SAVE MAY BE YOUR OWN!

3-2.1.7 When you have located your aircraft on the "line," approach the plane in such a manner as to stay completely clear of the propeller. Place the parachute in the cockpit and start your pre-flight inspection. Do not lay your parachute or any flight gear on any of the exterior surfaces of the aircraft.

3-2.2 PROCEDURE

3-2.2.1 Cockpit

a. Before starting the Exterior Pre-flight Inspection, perform the following eight-point safety check:

1. Fuel boost pump switch—OFF; fuel control valve—OFF.
2. Trim tabs set at "0°".
3. Mixture control level—IDLE CUT OFF.
4. Landing gear handle—DOWN.
5. Magneto switch—OFF.
6. Accelerometer—LIMITS: 5.5 POSITIVE, 2.5 NEGATIVE.
7. Battery switch—OFF.
8. Controls—UNLOCKED.

b. If on a solo flight, check the following items in the rear cockpit:

1. Seat cushion—Removed and stowed in rear compartment.
2. Safety belt—FASTENED AND TIGHT.
3. Shoulder harness—LOCKED AND TIGHT.
4. Radio extension cord—SECURED.
(5) Gyro compass—CAGED (if INSTALLED).

(6) Inspect for loose gear.

(7) Canopy—CLOSED AND LOCKED.

3-2.2.2 Trailing Edge—Port Wing

a. Inspect both the top and under side of the wing. Look for cracks, deep scratches, tears or breaks, wrinkles, popped rivets, and bulges in the skin of the flap, aileron, and wing surfaces; all of these may indicate structural failure. Be sure to check the under side of the wing for any holes that may have been caused by stones during landings and take-offs.

b. Check the movement of the aileron and the servo action of the aileron trim tab. With the aileron-tab control set at neutral in the cockpit, the tab should line up with the aileron when the aileron is aligned with the wing. Check the trim-tab linkage and particularly the aileron bellcrank rod for loose bolts, nuts, and cotter pins.

3-2.2.3 Port Wing Tip

a. Inspect the wing tip and aileron tip, especially the under side, for dents and scratches.

b. Check the condition of the navigation light.

3-2.2.4 Leading Edge—Port Wing

a. Examine the leading edge of the wing carefully for breaks or bulges and proper contour. Inspect the under side of the wing for any marks caused, for example, by the aircraft's running off a runway or for undue stress which may have been exerted on the wing during the previous flight.

b. Check the condition of the landing light and the pitot tube (be sure that the pitot tube cover is removed).

c. Remove the fuel cap, visually check the fuel quantity, and replace the cap securely. Parti-
cular care must be taken when removing the fuel
cap to prevent foreign material (such as the metal
scrapings caused by a dura key or screwdriver
used to lift the latch of the fuel cap, sand, gravel,
etc., which may have accumulated) from dropping
into the tank. The chain should be attached to the
cap and to the inside of the tank.

d. Finally, examine the cockpit-air intake
screen for obstructions.

3-2.2.5 Port Main Landing Gear

a. Examine the condition of the main gear
fairing doors. Be sure that the outboard door is
not bent or loose, and that the inboard door is
closed and flush with the bottom of the wing.

b. Check that the wheel well is free of ob-
structions. Make sure that the up-lock bracket
spring is attached to the up-lock bracket and the
rib of the wing. If it is broken or not attached,
the wheel will damage the top of the wing when the
landing gear is retracted.

c. Inspect the hydraulic fittings around the
wheel. Check them for leaks and check the con-
dition of the flex hose. It is advisable to feel the
hydraulic fitting which is located at the forward
dge of the wheel well. Any leakage at this point
does not fall onto the deck where it may be de-
tected, but leaks into the wing section.

d. Inspect the condition of the wheel strut
and check the oleo inflation. There should be approx-
mately 3 inches (four fingers) of polished oleo
strut showing.

e. Inspect the tire for proper inflation, cuts,
bruises, and excessive wear. Be sure that the
port wheel chock is in place.

f. Check the small roller on the scissors, it
should turn freely.

g. Inspect the apron beneath the engine nacelle
for excessive gasoline, oil, or fluid leakage;
check the underside of the fuselage for excessive
oil leakage.

3-2.2.6 Port Engine Section

a. Check the oil level. There should be 11
quarts. However, 10 quarts are sufficient for the
first flight of the day. The chain which attaches
the dip stick to the tank should be secure on both
ends. Replace the cap securely.

b. Inspect the engine for loose fittings, pulled
wires, and fuel or oil leaks. Check the visible
portions of the exhaust for cracks or holes.

c. Check for obstructions in the augmentor tube
(do not touch the tube; it may be hot).

d. After inspecting the engine, leave the cowling
OPEN. The plane captain will close and
secure the cowling after you have completed your
inspection. However, it is the pilot's respon-
sibility to see that the cowling is properly latched
prior to entering the cockpit.

3-2.2.7 Nose Section

a. Check the wheel well for obstructions, the
flaring doors for distortion and excessive loose-
ness. Be sure that the wheel-centering mech-
anism is in place so that damage will not occur
during retraction. Inspect the nose gear brackets
and retract rod carefully for looseness, bends, or
other damage.

b. Inspect the nose gear. Make certain that the
castering stop and its limit screws are not bent
or loose. Turn the nose wheel all the way to the
right; check the shimmy dampener rod for 1/16-
to 1/32-inch clearance between the rear cotter
pin and the cylinder. Center the nose wheel.
Check the shimmy dampener rod for excessive
movement in the cylinder. Check the oleo strut
extended approximately 5 inches and the tire for
proper inflation.

c. Move to the front of the aircraft. Remem-
ber to stay clear of the propeller.

(1) Standing in front of the aircract, note
whether or not it is "sitting level"; whether or not
one tire or oleo is low.

(2) Examine the propeller blades to make
sure that they are not cracked, nicked, or ser-
iously pitted. Do not move the propeller!

(3) Inspect the spinner retention nut for
tightness and that the cotter pin is properly in
place. Check the carburetor air filter for ob-
structions (freedom from dirt, etc.) and security
of the filter fasteners. Note the condition of the
red passing light.

3-2.2.8 Starboard Engine Section

a. Check the security of the fire extinguisher
access door. The fire extinguisher access door
is used as a means of quick entry in the event of
fire on the ground.
b. Except for the oil quantity, inspect the starboard engine compartment in the same manner as the port engine section.

c. Inspect the external canopy release handle for proper security (do not pull).

d. Open the battery compartment door and make sure that the retaining nuts on the battery are safety-wired. Inspect the battery drain hose for proper attachment to the battery outlet fitting; make sure that it is not twisted or pinched. When the battery compartment door is closed, check the alignment of the vent tube in the vent housing.

e. Check the battery drain jar for cracks. Make sure that the lid is on tight and that the three hoses are securely connected. The battery drain jar should be approximately half-full of white neutralizer.

3-2.2.9 **Starboard Main Landing Gear**

Same as port main landing gear.

3-2.2.10 **Leading Edge--Starboard Wing**

Same as leading edge--port wing, except for the pivot tube.

3-2.2.11 **Starboard Wing Tip**

Same as port wing tip.

3-2.2.12 **Trailing Edge--Starboard Wing**

Same as trailing edge--port wing.

3-2.2.13 **Fuselage--Starboard Side**

a. Make sure that the fuel vent standpipe, which extends from the under side of the fuselage, is bent forward approximately 15 degrees.

b. Make a careful examination for wrinkled skin and popped rivets.

c. Make sure that the holes in the static air vent are not plugged.

d. Check the omni antenna for security.

e. Check the emergency air bottle gauge for 2300–3000 psi.

f. Check first aid kit for security.

3-2.2.14 **Tail Section**

a. Inspect the horizontal and vertical stabilizers, elevators, and rudder, for dents, tears, cracks, or scratches.

b. Check the elevators and rudder for freedom of movement.

c. Check the trim tabs to make sure that the nuts, bolts, and cotter pins are secure.

d. Inspect the hinge fittings and control connections on the elevators and rudder for cracks and proper security.

e. Notice that the rudder tab has anti-servo action, that is, it moves in the same direction as the rudder. The trim tab should line up with the rudder when the rudder is aligned with the vertical stabilizer, since the tab control in the cockpit was set at zero.

f. Visually check the retaining nut which holds the VHF antenna to the top of the vertical stabilizer.

g. Check the navigation lights and the tail cone.

3-2.2.15 **Fuselage--Port Side**

a. Inspect the port side of the fuselage and static air vent in the same manner as on the starboard side.

b. Inspect the baggage compartment for security. This compartment will be empty for all training flights. Make sure that the baggage compartment door is closed and securely latched.

3-3 **PRE-FLIGHT AND POST-FLIGHT OPERATION**

3-3.1 **GENERAL**

3-3.1.1 Subsequent to the pre-flight line inspection, put on your parachute and helmet and get into the cockpit. When entering the cockpit, care must be exercised to prevent damage to the canopy rails. Do not sit, stand, step, or lay anything on the edge of the cockpit.

3-3.1.2 **Position in the aircraft**: Each time you fly, your position in the aircraft should be the same. Your seat should be adjusted to give your head a clearance of approximately six (6) inches from the top of the closed canopy. To obtain this desired position when seated in the cockpit, place the canopy open, clench your left hand into a fist and extend the first two fingers. Sit straight and in the center of the seat, head facing
forward. Adjust the height of the seat so that the extended fingers, placed on top of your helmet, will just touch the under side of the top forward rim of the canopy. Whether you are short or tall, your eye level in this position should be the same as that of all other students.

a. Once the seat has been adjusted for the proper height, the shoulder harness and safety belt must be secured. To do this, first lock the shoulder straps. Extend them far enough so that they will lie comfortably in the lap after being drawn over the shoulders. Perform a similar process with the seat belt. Thread the eyelet finger of the right seat belt first through the loop of the right shoulder harness strap, then the left, and then into the locking mechanism on the left seat belt strap. Firmly close the latching arm until the spring locks hold securely.

(1) Always tighten the seat belt straps first. Then tighten the shoulder harness. Check your flying suit collar. In the event it has been caught, pull it free so that it is over any or all straps. This will prevent the straps from rubbing against your neck when you move your head.

(2) When you have assured yourself that you have the proper adjustment, you may unlock the shoulder harness to perform the starting procedures. However, make certain that it is re-locked and checked prior to taxiing. The value and purpose of the shoulder harness will be destroyed unless it is locked at all times during which an accident might occur.

b. The rudder pedals are adjustable fore and aft by means of the hand crank located at the bottom edge of the instrument panel. The rudder pedals should be adjusted so that the brakes can be used with full throw of the rudder in either direction. Turning the crank clockwise adjusts the pedals forward; counterclockwise rotation permits adjustment aft.

3-3.2 STARTING AND WARM-UP PROCEDURE

3-2.2.1 Starting Procedure

a. Check inverter and master radio switch off.
b. Prior to starting the aircraft, extreme caution must be exercised to ascertain that the area around the propeller is clear. Do not attempt a start unless a lineman with a fire extinguisher is stationed immediately forward of the starboard wing.
c. When ready to start the engine, execute the following procedure:

   (1) Hold brakes.
   (2) Fuel valve handle -- ON.
   (3) Mixture control -- IDLE CUT-OFF.
   (4) Fuel boost pump switch -- ON.
   (5) Throttle--OPEN 1/4 INCH.
   (6) Propeller control -- FULL INCREASE RPM (FORWARD).
   (7) Visually clear the area about the propeller. Clench your right hand into a fist with thumb extended. Hold your fist in such a position, thumb up, that it is clearly visible to the lineman. When the lineman returns the "thumbs-up" signal, but not before, you are cleared to start the engine.
   (8) Battery switch--ON.
   (9) Starter switch--ON. (This switch is spring-loaded to the OFF position; therefore, it will be necessary to hold it ON.)
   (10) Ignition switch--ON. (Permit the propeller to turn for one blade before turning on the ignition switch.)
   (11) Mixture control--FULL RICH. (Advance the mixture control from the idle cut-off position to the full rich position at a moderate but smooth rate of movement immediately after the ignition switch has been turned on.)
   (12) At this point, the engine will start. As soon as it is running smoothly, release the starter switch and advance the throttle so that the engine will warm up at between 1200 and 1400 rpm.

   (a) If the engine does not fire after 5 to 10 seconds of cranking, or starts and then ceases firing, move the mixture control to the idle cut-off position. Clear the engine by cranking the propeller through four or five times with the starter, then repeat steps (7), (8), and (9).

   (b) After the engine is running smoothly, check the oil pressure. If the pressure does not start to rise within 10 seconds or reach 30 psi in 30 seconds, stop the engine. Secure the cockpit, report the condition to the lineman, and make the proper report in the appropriate section of the Aircraft Flight Report Form.

   (13) Master radio switch and VHF sensitivity switch--ON.

3-3.2.2 Warm-up Procedure

a. Warm up the engine at the rpm between 1200 and 1400 rpm at which smooth engine operation is obtained. Do not exceed 60 psi oil pressure during warm-up.

b. While the engine is warming up and before
leaving the checks, execute the following pre-flight check-off list, reporting each item checked to your instructor on the ICS (inter-communications system):

(1) "THIS IS (CALL SIGN SIDE NUMBER), READY FOR PRE-FLIGHT CHECK-OFF LIST, SIR."

Do not proceed further with the check-off list until the instructor has acknowledged the ICS check. On solo flights, perform radio communications check with the control tower as prescribed by local course rules.

(2) "CONTROLS UNLOCKED, RUDDER PEDALS AND SEAT ADJUSTED."

The flight controls will be moved to the full limit of their operation; and at the same time, their corresponding control surfaces will be visually checked for proper functioning. The stick will be moved all the way forward and all the way aft to check the elevators, then all the way to the port side of the cockpit and back to the starboard side to check aileron control. The rudder pedals will then be moved their full throw to check rudder control.

(3) "FLAPS CYCLED AND INDICATE UP." The flap indicator is connected to the left flap only. Therefore, it is necessary to check visually the operation of the flaps as well as the indicator as the flaps are lowered and raised.

(4) "TRIM TABS SET; 5 RIGHT, 3 UP, AND ZERO."

(5) "MIXTURE FULL RICH."

(6) "PROP FULL, LOW PITCH."

(7) "LANDING GEAR WARNING LIGHT CHECKED."

(8) "LANDING GEAR INDICATORS INDICATE DOWN."

(9) "EMERGENCY GEAR RETRACT SWITCH SAFETY WIRED."

(10) "GAS CHECKED, FULL RIGHT, FULL LEFT."

(11) "CARBURETOR HEAT COLD."

(12) "ALTIMETER SET TO ZERO."

(13) "ENGINE INSTRUMENTS NORMAL."

(14) "INVERTERS CHECKED AND ON MAIN."

(15) "GYROS SET AND UNCAGED."

(16) "LANDING GEAR EMERGENCY EXTENSION LOCKED DISENGAGED."

(17) "CIRCUIT BREAKERS ALL IN."

(18) "PITOT HEAT OFF."

(19) "PROP CHECKED, MAGS CHECKED, FUEL PUMP CHECKED."

(a) These three checks are performed separately but are reported simultaneously for the sake of expediency. The propeller check and magneto check are performed during the engine run-up. Before making the run-up, check for a minimum of 40°F oil temperature and 107°F cylinder-head temperature. Get a "clear to run up" signal from the lineman by clenching the flat with the forefinger extended, holding the forearm vertical and rotating the wrist. DO NOT increase power until the lineman returns the signal. When cleared, hold brakes firmly and advance throttle to 1800 rpm.

(b) PROPELLER CHECK: With the engine speed at 1800 rpm, move the propeller control aft, slowly and smoothly, to the detent. The engine speed should decrease to between 1600 and 1650 rpm. Permit the rpm to stabilize, then advance the propeller control to the full increase position. The engine speed should return to 1800 rpm. Cycle the prop six times on the first flight of the day and four times on each subsequent flight.

(c) MAGNETO CHECK: Advance rpm to 2000; turn the ignition switch to the right magneto (R) position, being careful not to turn it all the way to the OFF position. There should be a slight decrease in rpm. Then turn the switch back to the BOTH position. Hesitate momentarily to permit the rpm to stabilize. Then turn the switch to the left (L) position and note the decrease in rpm. Return the ignition switch to the BOTH position. The maximum permissible drop for either magneto is 75 rpm. This procedure may have to be repeated to accomplish a satisfactory check, since gusty wind conditions and/or a wind from the quarter may affect the accuracy of the check.

(d) FUEL PUMP CHECK: As soon as the magneto check has been satisfactorily completed, reduce the engine speed to 1000 rpm. The engine-driven fuel pump is checked by turning the
fuel boost pump switch off while watching the fuel pressure gage. The pressure should drop slightly but remain above 10 psi. Return the boost pump switch to the ON position.

(20) "IDLE MIXTURE CHECKED." With the engine speed at idle (600–700 rpm), move the mixture lever from full rich smoothly to idle cut off. Watch the tachometer as the mixture lever is moved aft. Just before the mixture lever is moved to the point where the engine ceases to fire, the tachometer should momentarily indicate a rise of no more than 30 rpm and then drop quickly. When the rapid decrease in rpm occurs, quickly return the mixture lever to the full rich position to prevent the engine from stopping completely. If there is no momentary rpm rise—the mixture is too lean. If the momentary rise exceeds 30 rpm—the mixture is too rich.

(21) "IGNITION GROUND-CHECKED." With the engine speed at idle, turn the magneto switch to the OFF position and then immediately back to BOTH. The engine should stop firing immediately and then catch again as soon as the switch is returned to the BOTH position.

(22) "CANOPY LOCKED OPEN, VISOR DOWN, SHOULDER HARNESS LOCKED, PARKING BRAKE IN; READY TO TAXI, SIR."

3-3.3 ENGINE SHUT-DOWN PROCEDURE

3-3.3.1 When the final landing has been accomplished subsequent to each flight, taxi back to the flight line and into the parking position. Do not attempt to park the aircraft without the assistance of a lineman.

3-3.3.2 When the aircraft is in the parked position on the flight line, close the throttle to the idle position (600–700 rpm), hold the brakes, and wait for the lineman to give the "cut!" signal. This is done with a pantomime slapping movement of the edge of the hand across the throat. When this signal is received, you are cleared to secure the engine.

To shut down the engine, execute the following procedure:

a. Raise the flaps.

b. Ignition ground–checked.

c. Operate at 800 to 1000 rpm for one (1) minute to allow cylinderhead temperature to stabilize.

d. Check inverters and radios--OFF.

e. Throttle closed.

f. Secure engine by cutting mixture, checking for rich or lean mixture.

g. After cutting mixture, shut off the battery, magneto switch when the propeller has stopped rotating, and gas --- OFF when the fuel pressure is 5 psi, or less.

h. Report to the Plane Captain, "Battery, mags, and gas -- OFF, controls locked, and the plane is UP OR DOWN."

3-4 CONTROLS AND THEIR OPERATION

3-4.1 GENERAL

3-4.1.1 This section will be devoted to a brief review of the functions of the various controls which can be operated from the cockpit. These controls may be grouped into three (3) categories: (a) power controls, (b) primary flight controls, and (c) auxiliary controls.

3-4.1.2 The three essentials for successful flight are sustentation, stability, and control. These three essentials are dependent, in turn, upon the inherent design of the aircraft and upon its speed through the air. If, for example, a point below stalling, speed is reached, successful flight ceases. For the treatment of the mechanics of flight, it will be assumed that the first two essentials have been established and only the problem of control remains.

The "mechanics of flight" is defined as the relationship between the movement of the control surfaces and the resulting change in the attitude of the aircraft. Intelligent study of the mechanics of flight, prior to the first instructional flight, is an important requisite to the mental and physical process of learning to fly. In order to emphasize the fundamentals of the mechanics of flight, each of the three control categories will be discussed in this section.

3-4.1.3 The power controls are the throttle, propeller lever, mixture lever, and carburetor heat handle. The throttle, propeller lever, and mixture lever controls are located on a quadrant on the left side in each cockpit. They permit the pilot to adjust the power output of the engine within its operating limitations. The carburetor heat handle is located immediately below the lower left corner of the instrument panel in the front cockpit only. It permits the pilot to control the temperature of the flow of air to the carburetor.
3-4.1.4 The primary flight controls are the control stick and the rudder pedals. These two controls operate movable surfaces located externally on the aircraft. The control stick operates the ailerons and the elevators; the rudder pedals control the movement of the rudder.

The primary flight control surfaces (ailerons, elevators, and rudder) are movable airfoils designed to be operated by the pilot in order to change the flight attitude of the aircraft.

3-4.1.5 The auxiliary controls are the aileron trim-tab wheel, elevator trim-tab wheel, rudder trim-tab knob, flap lever, and landing gear handle. The control surfaces and mechanisms which are operated by these controls may be further subdivided into two (2) types: (a) those which constantly affect the aerodynamics of the aircraft (aileron trim tabs, elevator trim tabs, and rudder trim tab) and (b) those which have an aerodynamic effect only under certain circumstances or conditions (flaps and landing gear).

a. The trim tabs are auxiliary flight-control surfaces used to relieve pressures on the primary flight controls. The trim-tab controls are located on the left console in each cockpit. Indicators are associated with each control which show the position of the related tab. For each change of airspeed or power setting, a change of trim is necessary, because of the change in the effects of torque and the change of lift created by the wings. Correct and constant use of the trim tabs is the secret of becoming a smooth pilot.

b. The flaps are auxiliary-flight control surfaces which increase the effective wing area, thus increasing both the lift and drag when in the lowered position. The flaps are electrically operated by a flap lever located on the left side in each cockpit at shoulder height.

c. The landing gear is of the electrically operated tricycle type. Wheels are fully retractable. They are operated by the landing gear handle located on the left sub-panel in each cockpit.

3-4.2 POWER CONTROLS

3-4.2.1 Throttle

a. The throttle controls the power output of the engine. This power, transmitted through the propeller, produces thrust which, in turn acts on the wings to create lift. When sufficient power is combined with the appropriate wing attitude, the forces of gravity, drag, and inertia are overcome and the desired performance is obtained. Pushing the throttle forward increases power; pulling it aft decreases power. If a constant nose attitude is maintained with relation to the horizon, a variation of power will control the gain or loss of attitude. This concept of control establishes a basic fundamental of the mechanics of flight with which you will be faced so long as you fly any type of powered aircraft. Power plus attitude equals altitude.

b. The throttle should be operated firmly but smoothly. Sudden, erratic movements of this control may impose undue stress on the engine, or flood it with gas, causing a "rich-out." Learn to fly with your left hand on the throttle at all times, unless it is operating some other necessary control.

3-4.2.2 Propeller Lever

a. The power generated by the engine is converted to a usable force called "thrust" by the propeller. The propeller on the T-34B is a constant-speed propeller; that is, it will automatically maintain a constant engine speed, regardless of the throttle setting, at any rpm the pilot may desire, within the scope of its normal operating limitations (1500 to 2600 rpm). By properly combining power (manifold pressure) and the blade angle of the propeller (revolutions per minute), the most efficient performance for any given state of flight can be obtained.

b. The engine speed, or rpm, is controlled by the pilot through the operation of the propeller lever in the cockpit. The propeller lever is connected to a governor system which maintains a selected engine speed by automatically varying the blade angle to compensate for varying engine loads, regardless of the attitude of the aircraft or its airspeed, within reasonable limits.

c. The engine is started and stopped in full increase rpm (low pitch). For take-offs, climbs, landings, and stall maneuvers, full increase rpm (low pitch) is used.

3-4.2.3 Mixture Lever

a. The amount of fuel per volume of air delivered to the engine is maintained by the carburetor. This fuel-air ratio may be altered by the pilot, within limits, to conform to certain desired conditions of engine performance, by changing the setting of the mixture lever. Moving the mixture lever to the full forward position produces the richest mixture; that is, the greatest quantity of gas per volume of air. Moving the mixture lever aft, produces a lean mixture; and,
pulling it all the way aft into the idle cut-off position stops the flow of fuel altogether.

b. During primary training, the mixture lever will remain in the full forward (rich) position at all times while in flight. This will prevent an inadvertent power failure during a take-off or wave-off, should the pilot forget to check the mixture full rich in the landing pattern, and also provide the coolest possible engine operating conditions at full power.

To stop the engine after flight, the mixture lever is moved to the idle cut-off position. This completely stops the flow of fuel to the carburetor. This method of "shutting down" permits the engine to run momentarily until all combustible fuel has been eliminated from the cylinders, thereby reducing the hazard of a fire or "hot prop."

3-4.2.4 Carburetor Heat Handle

a. This control operates two (2) doors located in the air intake duct behind the carburetor air filter. When the handle is pulled aft, it closes the door in the intake duct just behind the air filter and opens a door in the top of the duct. This operation stops the flow of filtered outside air from going directly to the carburetor and permits air which has entered the engine compartment through the two air intake scoops on either side of the propeller hub to enter the carburetor duct after being warmed by the engine. This air is unfiltered. Consequently, care must be taken, when operating near or on the ground, that small stones, dirt, etc., are not present when the carburetor handle is OUT.

b. Ice will normally not form in the carburetor. The fuel is vaporized downstream of the venturi, so the pressure-injection carburetor is relatively free from the danger of fuel ice. However, if fuel ice is suspected (the usual indication is a loss in manifold pressure), use carburetor heat and increase power to melt the ice. If throttle ice forms, use carburetor heat and avoid a constant throttle setting.

c. With the handle FULL IN, normal screened air enters the carburetor. Pulling the handle OUT admits unfiltered warm air from the engine compartment. When carburetor heat is used, there will be a slight loss of power (approximately a 1-inch drop in manifold pressure). The carburetor heat handle will be kept in the FULL IN position at all times except when icing conditions are believed to prevail.

3-4.3 PRIMARY FLIGHT CONTROLS

3-4.3.1 Ailerons

a. The ailerons are movable airfoils attached to the outboard trailing edges of the wings, are interconnected, and control the roll of the aircraft about its longitudinal axis. In flight, the wings will roll in the same direction as the movement of the stick, so that when the stick is pressed to the left, the aircraft will roll to the left (negative roll), and when the stick is pressed to the right, the aircraft will roll to the right (positive roll).

b. Rotation about the longitudinal axis is caused by the lift differential created as aileron surfaces move out of the streamline position. Moving the control stick toward a wing raises that aileron surface, causing that wing to go down, and, in effect, causes the aircraft to turn in that direction. The wing with the raised aileron goes down because of decreased lift, and the wing with the lowered aileron goes up because of its increased lift. Thus, the effect of moving either aileron is greatly increased by the simultaneous and opposite movement of the aileron on the other wing. The rate of rotation is proportionate to the degree of the aileron displacement and the speed of the aircraft.

c. The longitudinal axis is an imaginary line which runs through the center of gravity from propeller to tail. It is perpendicular to the lateral and vertical axes. Rotation about this axis is called "roll."

3-4.3.2 Elevators

a. The elevators are movable airfoils attached to the trailing edge of the horizontal stabilizers and control the pitch of the aircraft about the lateral axis. They are operated by fore-and-aft pressures on the stick; when pressure is applied to the stick, the aircraft pitches in the direction of applied pressure.

b. The lateral axis is an imaginary line which runs from wing tip to wing tip through the center of gravity and is perpendicular to the longitudinal and vertical axes. Rotation about this axis is called "pitch." When forward pressure is applied to the control stick, the resultant is negative pitch. When back pressure is applied, the resultant is positive pitch.

3-4.3.3 Rudder

a. The rudder, hinged to the vertical fin, is moved from side to side by pressure applied to the rudder pedals in the cockpit. In flight, the
nose of the aircraft will swing, or yaw, about the vertical axis in the same direction that the rudder is deflected by movement of the rudder pedals. The amount of yaw, within limits prescribed by the plane's directional stability, is in proportion to the amount the rudder is moved from the streamlined position. The rudder must be returned to neutral to stop the movement of the nose.

b. The vertical axis is an imaginary line which runs through the center of gravity and is perpendicular to the lateral axis and the longitudinal axis. Rotation about this axis is called "yaw."

When pressure is applied to the right rudder, the resultant is positive yaw. When pressure is applied to the left rudder, the resultant is negative yaw.

3-4.4 AUXILIARY CONTROLS

3-4.4.1 Aileron Trim Tab

a. A trim tab is hinged to the trailing edge of each aileron, but only the left aileron tab is controllable from the cockpit. It enables the pilot to balance the aircraft laterally. Moving the aileron trim-tab wheel to the left has the same effect as left pressure on the stick; moving the aileron trim-tab wheel to the right has the same effect as right pressure on the stick. The right aileron tab is adjustable from the ground only.

b. Both aileron tabs incorporate servo action. As each aileron deflects from the streamline position, its tab moves in the opposite direction, assisting in control deflection and decreasing the aileron stick forces.

3-4.4.2 Elevator Trim Tab

The elevator trim tab enables the pilot to balance the aircraft longitudinally by altering the neutral position of the elevators. This is accomplished through small adjustable auxiliary airfoils hinged to the trailing edge of the elevators and controllable from the cockpit. Moving the elevator trim-tab wheel forward has the same effect as forward pressure on the stick; moving the elevator trim-tab wheel aft has the same effect as back pressure on the stick.

3-4.4.3 Rudder Trim Tab

a. The rudder trim tab is an adjustable auxiliary airfoil hinged to the trailing edge of the rudder. The adjustment of this tab enables the pilot to balance the aircraft, thereby relieving him of the necessity of applying continuous pressure on either rudder pedal to maintain balanced flight. Turning the rudder trim-tab knob to the right, or clock-wise, has the same effect as applying pressure on the right rudder pedal; turning the rudder trim-tab knob to the left has the same effect as applying left rudder pressure.

b. The rudder trim tab is of the anti-servo type. As the rudder is displaced from the streamline position, the tab moves in the same direction, increasing effective rudder area and also the force required to displace it. This provision increases rudder control "feel."

3-4.4.4 Flap Lever

a. The flap lever raises and lowers the electrically operated full trailing-edge flaps. This lever has three (3) positions: UP, OFF, and DOWN. Lifting the lever to the UP position raises the flaps; placing the lever in the DOWN position lowers them. The center (OFF) position stops the flaps at any intermediate setting. However, in primary training, the flaps will be either up or fully extended. The flap lever will not be placed in the center (OFF) position on training flights.

b. The flaps, when fully extended, are displaced 30 degrees. An indicator located on the left side of the instrument panel enables the pilot to ascertain the degree of flap extension. However, this instrument is calibrated in per cent, not degrees. For example, when 15 degrees of flaps are extended, the flap indicator will register 50 per cent flaps down. The flaps will not be lowered at an airspeed in excess of 110 knots.

3-4.4.5 Landing Gear Handle

a. The landing gear handle raises and lowers the electrically operated retractable landing gear. It is located on the left sub-panel and has two (2) positions, UP and DOWN. A three-position indicator for each wheel indicates whether or not the wheels are UP or DOWN, or in an intermediate ("barber pole") unsafe position.

b. There are four (4) checks which the pilot must make each time the aircraft is in a condition of flight where the wheels should be down to assure that they are fully extended.

(1) Landing gear handle in the DOWN position.

(2) Landing gear indicators indicate DOWN.

(3) Landing gear warning light OFF. This red warning light is located in the landing gear
GEAR HANDLE — DOWN
GEAR INDICATES — DOWN
HORN — SILENT
GEAR WARNING LIGHT — OUT

Then...

YOU CAN LAND

handle and illuminates whenever any one of the three wheels is not in the position indicated by the landing gear handle.

(4) Landing gear warning horn OFF. The warning horn will sound each time the throttle is retarded and the landing gear is not fully extended.

c. The landing gear will not be lowered at any airspeed in excess of 110 knots. Each time the landing gear is extended, the following procedure will be used:

(1) Close the throttle.

(2) Permit the airspeed to decrease to 110 knots while maintaining altitude.

(3) Place the landing gear handle in the DOWN position.

(4) Make the four (4) landing gear DOWN checks.

(5) Advance the throttle to the required power setting for the maneuver to be performed.
# 3-5 PRIMARY PRE-SOLO STAGE MANEUVERS AND FLIGHT INFORMATION

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3-5.1 GENERAL

3-5.1.1 Prior to your first flight, there are seven fundamental topics, essentially compatible with the forces acting on an aircraft in motion and safety in flight, which you must be fully acquainted. Those subjects concerning principles of flight you have studied in the classroom. However, they are considered to be of sufficient importance to necessitate re-emphasis.

3-5.1.2 Stability, you learned from your study of the principles of flight, is classified in three major categories: positive, neutral, and negative. Since all military fixed-wing aircraft have positive stability, only this category will be considered.

a. Positive stability is a product of the aerodynamic design of the aircraft, and for this reason, it is called "inherent stability." Inherent stability demands that the aircraft be stable about all three axes: the vertical, horizontal, and longitudinal. An aircraft, such as the T-34B, which is inherently stable, has the tendency to return, without the aid of the pilot, to the condition of steady flight from which it was disturbed. Positive stability is sub-classified into two types--static stability and dynamic stability.

(1) Static stability is an unbalanced force, acting in the proper direction, which tends to return the aircraft to the condition of steady flight from which it was disturbed. For example, if an aircraft trimmed for straight and balanced flight is placed in a dive, it will, of its own accord, tend to return to level flight. However, this reacting force may be so great that the aircraft will pass through the level flight attitude into a steep climb and then a steeper dive, each succeeding oscillation becoming more pronounced, until the aircraft finally stalls.

(2) Dynamic stability is the force which counteracts the overcorrecting tendency of static stability. The oscillations which carry the aircraft past its original attitude, instead of becoming greater, due to the dampening effect of dynamic stability, become less and less until the aircraft is once again at its original attitude in a steady state of flight.

b. Your instructor will demonstrate the inherent stability characteristics of the T-34B by first trimming the aircraft so that it will fly in straight and balanced flight without any assistance from the pilot. This is called "hands off flight." He will then place the aircraft in various attitudes and permit it to return to straight and balanced flight unassisted.

(1) The primary purpose of these maneuvers is to develop your faith and confidence in the aircraft. For this reason, these maneuvers are called confidence maneuvers.

(2) In learning to become a combat naval aviator, you will exclude yourself from unnecessary tension and effort by realizing that your air-
plane is designed to fly and wants to fly. A certain amount of anxiety is normal during the early phase of your training. But with each succeeding day you will find yourself gaining more confidence in your new medium.

3-5.1.3 Torque is defined as a force which causes rotation. As applied to propeller-driven aircraft, it is a collective term encompassing four distinct forces which tend to produce torsion about one or more of the three axes. The four forces are: (a) gyroscopic action, (b) asymmetrical thrust, (c) slipstream effect, and (d) counterrotation reaction. These forces are somewhat unrelated and at least two of them will be occurring at the same time. However, during various flight conditions, one of the forces will be producing a more prominent effect than the other three.

a. Gyroscopic action has two fundamental properties—rigidity in space and precession. Precession is the property which concerns the pilot in maneuvering his aircraft. This property can best be understood if you will imagine that the propeller of the aircraft is a large gyroscope, or top, which is spinning clockwise as viewed from the cockpit with the propeller hub as its center, or axis, of rotation.

(1) Precession is the resultant movement, or tendency to move, which occurs when a force causes the axis of a spinning body to be displaced. This resultant movement acts in the direction of rotation and 90 degrees to the direction of the force which caused the axis to be displaced. For instance, if a top were on a table spinning from left to right and you placed a finger on its axis and pushed lightly straight ahead, the top would move 90 degrees to your left. If you tilted the axis toward you, the top would move 90 degrees to your right. You would also notice that the speed with which the top moved across the table would be in direct proportion to the magnitude of the pressure you had applied to displace the axis of the top.

(2) The spinning propeller of an aircraft acts like a gyroscope; it tends to precess if its axis is moved. During a change in nose attitude, the axis of the propeller is moved, thus causing precession. Disregarding all other factors that act on the aircraft, the nose when lowered will yaw to the left, and when raised, to the right. However, you will see that, even though the nose is raised the aircraft will still have a tendency to yaw to the left. This is due to another force of torque which becomes more pronounced than gyroscopic action under these conditions. So, for all practical purposes, gyroscopic action is prominent only when the nose of the aircraft is being moved away from the pilot.

(3) The amount of precession is directly related to the rate of movement at which the nose is moved away from the pilot. In other words, the effect of gyroscopic action will occur only when the attitude of the aircraft is being altered, and its magnitude will be proportionate to the rate of change.

(4) It would seem that if the aircraft yaws to the left when the nose of the plane is moved away from the pilot, it should yaw to the right when the nose is moved toward the pilot. However, it does not, because as the nose moves toward the pilot, asymmetrical thrust overcomes the effect of gyroscopic action and causes the nose to yaw again to the left.

b. Asymmetrical thrust is an unequal distribution of power transmitted by the propeller about its plane of rotation. The condition of flight which permits asymmetrical thrust to produce an effect on the aircraft is directly dependent on the angle formed between the longitudinal axis of the aircraft and the direction of flow of the relative wind. When an aircraft is in straight and balanced flight, its relative wind is parallel to the longitudinal axis and the angle formed is zero degrees; but when an aircraft is in a climbing attitude, or when the nose movement is toward the pilot, its relative wind will be at an angle to the longitudinal axis. The angle of the relative wind increases as the nose attitude is increased and as the airspeed is decreased.

(1) This unequal distribution of power about the plane of rotation of the propeller occurs because of the direction of its rotation, the pitch of the propeller blades, and the direction of the relative wind. To understand this, imagine a cross section of the propeller blades as they reach a point during their rotation when they are parallel to the lateral axis of the aircraft. Remember that the propeller is rotating in a clockwise direction as viewed from the cockpit.

(2) When an aircraft is in straight and balanced flight, the relative wind is approaching the nose of the aircraft parallel to the longitudinal axis, and the angle of incidence between the chord line of the starboard propeller blade and the relative wind is equal to the angle of incidence between the chord line of the port propeller blade and the relative wind. Thus, the magnitude of the pressure along each propeller is the same on both sides of the axis of rotation. However, if the
nose of the aircraft is moved toward the pilot, the relative wind will form an angle with the longitudinal axis. In this condition, the angle of incidence of the starboard propeller blade and the relative wind is greater than the angle of incidence of the port propeller blade and the relative wind. Therefore, the starboard propeller blade is in a higher pitch and delivering more thrust than the port propeller blade. In other words, the propeller will take a larger bite of the air as it moves down on the starboard side of the aircraft than it will as it moves up on the port side. It will now be apparent that the difference in the magnitude of the thrust delivered by the individual blades varies as they rotate from a position parallel to the vertical axis to a position parallel to the lateral axis, the greatest differential of thrust occurring when the propeller is parallel to the lateral axis.

(3) The differential in thrust causes the aircraft to tend to yaw to the left. With this thought in mind, you can better understand that the effect of asymmetrical thrust becomes more prominent as the nose attitude is increased with respect to the relative wind and/or as the airspeed decreases.

c. Slipstream effect is caused by the high-speed rotation of the propeller which results in a corkscrew rotation of the slipstream. The slipstream spirals backward around the fuselage in a clockwise direction as viewed from the cockpit. When the slipstream reaches the tail assembly, it is spiraling upward on the left side. Part of it strikes the vertical stabilizer at a slight angle and exerts pressure on its left side; an equal part passes freely under the tail of the aircraft, since there is no vertical fin to hinder its flow. It is the difference in the two pressures acting on opposite sides of the vertical stabilizer which causes the nose of the aircraft to yaw to the left.

d. Counter-rotation reaction tends to rotate the aircraft to the left about its longitudinal axis. This force of torque is based on the law of physics, "For every action, there is an equal and opposite reaction."

(1) You can understand this by visualizing a rubber-band-powered aircraft. Wind the rubber band for right-hand propeller rotation, hold the propeller, and release the fuselage. The fuselage will spin around to the left.

(2) This effect is present in any propeller-driven aircraft, except that the propeller, instead of being held still, is resisted by the air. This resistance tends to rotate the aircraft in the opposite direction from the direction of the rotating propeller.

e. Aircraft manufacturers have recognized the reaction of an aircraft to the various forces of torque and have built in corrections which, to a certain extent, tend to counteract these forces.

(1) The vertical stabilizer of the T-34B aircraft is offset one degree to the left to compensate for the effects of torque. However, since
the amount of torque varies as the power and airspeed, it is obvious that built-in corrections cannot be adequate for all flight conditions. The designers, therefore, chose the most common flight condition, namely straight and balanced flight, cruising power, and normal cruise airspeed. The result is that, for power settings and airspeeds other than cruising power and airspeed, the corrections are either too small or too great and the pilot must make his own corrections.

(2) With high power settings and low airspeeds, as in take-offs and climbs, this built-in torque correction is inadequate and the aircraft tends to yaw to the left. To counteract this, the pilot must apply a right rudder correction. With low power settings and high airspeeds, as in dives, the built-in corrections are too great. That is, there is less torque effect than with cruising power, yet the amount of built-in correction has not changed. Therefore, the nose tends to yaw to the right and the pilot will have to apply the necessary left rudder pressure in order to maintain a balanced flight condition.

(3) In almost all flight conditions, other than with cruising power and airspeed, you will notice the effects of torque. As you gain in flight experience and become more proficient in your flying, you will give less and less conscious thought to what to do with the controls in order to counteract torque; you will automatically do what is required to keep the airplane in balanced flight.

3-5.1.4 Balanced flight may be said to exist when the aircraft is neither slipping nor skidding as it progresses along its flight path. With respect to balanced flight, there are two basic principles of control application: (1) any movement which is the result of a force acting upon a control surface will continue to act until that surface has been returned to its neutral position, and (2) there is a definite aerodynamic interrelationship between the application of the rudder and the ailerons in balanced flight.

a. For an aircraft to be in a balanced flight condition, the controls must be adjusted so that the longitudinal axis of the aircraft lies in the plane of forward motion. In straight flight, the wings are normally held level by maintaining the ailerons in the neutral position. The only other control that must be applied is the rudder, using pressure as necessary to hold the aircraft on a straight course. The rudder pressure is then relieved by the proper application of the rudder trim tab.

b. In making a turn, balanced flight is maintained by causing the aircraft to move in a curve at a rate which is in direct proportion to the degree of bank. The angle of bank is established by the coordinated application of ailerons and rudder. The amount of rudder required to establish a turn is dependent upon the rate at which the angle of bank is established. In other words, rolling into a turn rapidly requires more rudder than rolling into the same turn slowly. This interrelation is absolute and should be thoroughly understood.

(1) The utilization of either the rudder or the ailerons, independent of one another, will result in a condition of unbalanced flight. The "turn-and-bank indicator" has a free-rolling ball which indicates an unbalanced condition by moving away from the center position in the direction of the slip or skid. The pilot can also recognize this condition by an awareness of a sensation of side motion. The side motion causes the pilot to tend to lean in the direction of the slip or skid. This unbalanced condition can be corrected by the proper application of the rudder or ailerons, or both.

(2) A skid occurs when the aircraft slides sideways away from the center of a turn. It is caused by too much rudder pressure in relation to the amount of aileron pressure used. In other words, if you try to force the aircraft to turn faster without increasing its degree of bank, the aircraft will skid sideways away from its radius of turn. In a turn, the rudder must follow the flight path of the aircraft. If pressure is maintained on the rudder after the turn is established, a skid will result. A skid may also occur when you are flying in a level flight attitude if the nose of the aircraft is permitted to move sideways along the horizon when the wings are level. This condition would occur when excessive rudder pressures are applied or when the aircraft is improperly trimmed.

(3) A slip occurs when the aircraft slides sideways toward the center of the turn. It is caused by an insufficient amount of rudder in relation to the amount of aileron used. If you roll into a turn without using coordinated rudder and aileron, or if you hold rudder against the turn after it has been established, the aircraft will slip sideways toward its center of turn. A slip may also occur in straight-and-level flight if one wing is allowed to drag; that is, flying with one wing low, and holding the nose of the aircraft straight by the use of rudder pressure. In this case, the aircraft slips downward toward the earth's surface and loses altitude.

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provides a safety factor in the control of the aircraft. It is quite possible to fly the plane without the use of one or more controls. For example, suppose that the elevators failed to operate properly. It is possible to control the position of the nose by the use of power. As the power is increased, the nose will rise; as power is decreased, the nose will drop.

(1) It is also possible to bank the airplane and to turn it without the use of the ailerons. Using only the rudder, the plane can be turned in any desired direction. This use of the rudder will cause the aircraft to yaw or skid in the direction in which the rudder is applied. During the yawing motion, the outside wing moves faster through the air than the inside wing. This increases the lift on the outside wing, causing it to rise, thus producing a bank in the direction in which the rudder is applied. A turn can also be accomplished by using only the ailerons. In this instance, the aircraft will have a tendency to slip before it begins to turn.

(2) The foregoing discussion was given to show the advantage of the overlapping functions of the controls. It must be emphasized, however, that smooth and balanced flight can only be achieved through the proper coordination of all controls. Make it easy on yourself; trim your aircraft.

3-5.1.5 The fallacy of reversed controls is a misconception on the part of the student aviator that the elevators move the nose of the aircraft up or down only with respect to the earth's surface and that the rudder moves the nose right or left only in the plane of the horizon. Actually, as soon as there is any degree of rotation about the longitudinal axis of the aircraft, the elevators begin to control nose movement through the plane of the horizon as well as in the vertical plane, and correspondingly, the rudder begins to control movement in the vertical as well as in the horizontal plane.

a. The tendency to think in terms of "up" and "down," particularly in steep turns and more advanced maneuvers, should be eliminated. Always consider yourself to be the focal point of the three axes of the aircraft about which movement occurs without regard for changes in the relative position of the earth. The following will therefore be true:

(1) The rotation about the various axes is always in the direction of applied pressures.

(2) The rate of movement of the aircraft about its various axes is dependent upon the force of the pressure applied to the controls, and the airspeed.

b. You must have a clear understanding of the foregoing before you will be able to comprehend the effects of the controls on the movement of the aircraft through various flight attitudes. Remember, ALWAYS CONSIDER YOURSELF THE FOCAL POINT ABOUT WHICH THE AIRCRAFT MOVES.

3-5.1.6 Slipstream or "prop-wash" from other aircraft is an invisible but familiar hazard in aviation. It is the turbulence caused by the passage of an aircraft through the air, and is created primarily by the aircraft's propeller. This turbulence trails in the aircraft's wake at a slight downward angle, and acts adversely upon the surfaces of an aircraft flying through it. Slipstream produces a pronounced roughness, and in more serious cases, tends to influence dangerously the pilot's control of the aircraft. Normally, difficulty should not be experienced except at slow airspeeds and low altitudes. Since the volume of traffic around landing fields increases the possibility of encountering slipstream, caution should be exercised when taking off, entering a landing pattern, or making an approach behind another aircraft.

a. If accidentally or unavoidably caught in slipstream while in the landing approach or transition, increase power immediately and maintain nose attitude; do not raise it. This increases the angle of attack and, at low airspeed and in a condition of severe turbulence, the aircraft may stall. Extreme caution should be used at this critical time and a wave-off executed if there is any doubt on the part of the pilot as to the advisability of continuing the approach. If slipstream should be encountered on take-off, maintain nose position, power, and a wings-level attitude until sufficient altitude and airspeed have been gained to permit a shallow turn in order to clear the turbulent area.

b. The most practical method of defeating slipstream is to avoid it. Acquire a healthy respect for slipstream by understanding its source, characteristics, and effect. The following points will help you to recognize conditions which are conducive to the formation of slipstream turbulence and how to avoid its effects:

(1) In a cross-wind condition, slipstream will drift to the down-wind side of the runway.

(2) In a calm-wind condition, slipstream will remain along the runway and take longer to
(3) Maintain a safe interval on take-offs and in landing patterns.

(4) If conditions are such that slipstream dispersion is slow, do not attempt to fly directly behind another aircraft, but rather a little to one side or above the aircraft ahead.

3-5.1.7 **Course rules** are regulations, promulgated by local authority, pertinent to the control of air traffic in and around a specified locale. They came into being for the same reasons as local and state automobile traffic laws: to systematize traffic and provide minimum confusion and maximum safety. Their scope includes specific rules for base field entry and departure, procedures and safety precautions in training areas and at outlying fields, traffic patterns, communications frequencies, etc.

a. During your flight training, you will be flying from several different air stations the course rules of which vary according to the local conditions at each station. These course rules are very important to the control of aircraft because, having been written after months of study of safe air traffic operation in that locale, they provide a safe, expeditious, and efficient method of controlling large numbers of aircraft in the same area. In many instances, local course rules are based on regulations from higher authority.

b. A copy of the local course rules for the primary training areas will be issued to you. It is essential that you learn them thoroughly. Ignorance of course rules, or excuses, will not be tolerated. You will be required to pass a written course rules examination prior to your first solo flight. However, in order to keep them firmly in mind, they must be restudied from time to time.

c. It is each pilot's responsibility to be thoroughly familiar with the course rules; strict adherence is mandatory. Course rules, as do state and municipal driving regulations, have the force of law and any infringement will seriously jeopardize your chances for successful completion of the flight training program. Violation of course rules always endangers someone's life--possibly your own!

3-5.1.8 **Air discipline** is the conduct of a pilot in the air with regard to safety, observance of course rules and flight regulations, and common courtesy. All training units have a large number of aircraft operating in their practice areas and in the vicinity of the base field. It is essential, therefore, that you continually look around. Do not depend upon the other pilot to see you; he may be depending upon you to see him.

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**FOREVER VIGILANT OR ETERNAL REST**

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a. As every contingency cannot be provided for in published course rules, the General Prudential Rule, which says that the pilot's judgment and the dictates of good airmanship must govern special situations, must ever be applied. This may mean that, even though you are maneuvering your aircraft in accordance with prescribed course rules, it will occasionally be necessary to give way to other aircraft in order to avoid the possibility of a collision. Use common sense and courtesy in the air.

b. A most important flying safety requirement, commensurate with air discipline, is a clear and positive understanding at all times as to who has control of the aircraft. Throughout your flying career, you will have experiences in flying with many other pilots, including instructors, check pilots, co-pilots, and others. Therefore, you must have a thorough knowledge of the procedures involved in transferring control of an aircraft. In primary training, the inter-communications system plus hand signals are used.

(1) The procedure for exchanging control is for the instructor to tell you over the interphone, "I have it," or "You have it." When your instructor says, "I have it," you acknowledge by immediately taking your hands and feet off the controls and momentarily raising your hands just above your shoulders where your instructor can see them. When your instructor wants you to take control, he will say, "You have it," whereupon you will take control and acknowledge by shaking the stick with your right hand and patting the top
of your helmet with your left hand. Stay on the controls and keep flying the aircraft until you are told to do otherwise. Never be in doubt as to who is doing the flying. Always fly as if you are flying solo unless you know that the instructor has control.

(2) In the event of ICS failure, you and the instructor must resort entirely to hand signals. The following procedure will be used to exchange control of the aircraft:

(a) The pilot desiring to be relieved, or take control, will shake the stick to attract attention.

(b) The pilot wishing to be relieved pats the top of his helmet and points to the other pilot to take over the controls. This signal means, "You have it."

(c) The pilot taking over the controls pats the top of his helmet and shakes the stick. This means, "I have it."

(d) The pilot being relieved then raises both hands, signifying that he has released control of the aircraft.

c. A wise pilot is constantly aware of the amount of fuel he has aboard his aircraft. To develop this flight safety habit, you will be required to make a gas report to your instructor every fifteen (15) minutes during a flight. You will report, "Gas checked, ___ gal. left and ___ gal. right, sir." These checks will be made in addition to those required at certain reporting points during field entries, etc. Your instructor may require that you report the gas along with the stall or acrobatic check-off list. On your solo flights, make these reports to yourself. Be gas-conscious!

d. In primary training, the front cockpit canopy will always be opened whenever the aircraft descends below 1000 feet of altitude. Also, the front cockpit canopy will not be closed on a climb-out until the aircraft has attained an altitude of 1000 feet or greater. This permits you to devote your full attention to controlling the aircraft close to the ground and is an added safety factor in the event of a power failure at low altitude.

3-5.2 MANEUVER EXPLANATION AND FLIGHT PROCEDURES

3-5.2.1 Taxiing

a. Taxiing is the controlled movement of an aircraft along the deck under its own power. The speed is controlled by the throttle and the direction by the rudder, augmented as necessary by the brakes.

b. Before moving from the checkstands, obtain taxi clearance to the duty runway in the manner prescribed by local course rules. With your feet on the rudder pedals in such a manner that you can operate the brakes with your toes, re-check the seat and rudder pedal adjustment to ensure full rudder throw with complete braking action. Hold the brakes and give the linemen the "thumbs-out" signal to remove the checkstands. You will follow the lineman's signals, but remember that the pilot and not the signalman is responsible for the safety of the aircraft. Keep your left hand on the throttle and your right hand on the stick at all times while taxiing. Every taxi movement is made cautiously. See for yourself that the path ahead is clear. Do
not blindly or implicitly rely on the signals of the lineman to keep you out of trouble.

(1) To start taxiing, check the parking brake—IN, release the brakes, and apply throttle gradually until the aircraft starts to move, then retard the throttle so that you move out of the chocks slowly. As the aircraft moves straight out of the chocks, apply both brakes firmly and evenly to check for adequate braking action. Never permit the taxi speed to build up without first checking the brakes. Once clear of the chocks and on the taxiway, adjust the throttle to sustain movement at a safe and reasonable speed; 800 to 1000 rpm is usually sufficient, depending upon the wind conditions. What constitutes a safe and reasonable speed varies with the circumstances. If other aircraft or obstacles of any kind are in the vicinity, or if the terrain is rough, a safe and reasonable speed is quite slow. In open areas on a smooth surface, a faster speed may be safe. However, while taxiing, you should never exceed the speed at which a man can comfortably trot.

(2) To turn the airplane, use full throw of the rudder before firmly applying the brake. The effectiveness of the control surfaces varies with the speed at which the air flows around them. Inasmuch as they are designed for normal and efficient operation at flying speeds, it is obvious that they are much less effective at taxiing speeds. This means that much greater movement of the controls will be necessary, under most circumstances, for controlling the aircraft on the ground than in the air. The T-34B is very easy to taxi if the throttle, rudder, and moderate brake pressures are correctly coordinated. Turns should be made while the aircraft is in motion. Turns executed from a standstill require more power and shorten tire and brake life. All turns will be made slowly, using a wide radius of turn. Never permit the inside wheel to stop, since locking the wheel may damage the wheel, tire, or strut.

(3) Downwind taxiing will usually require little or no throttle after the initial roll is established. To avoid overheating the engine, keep the use of power to a minimum. Rather than "ride" the brakes, let the speed build up slightly and apply brakes occasionally.

(4) In taxiing cross-wind, the aircraft has a normal tendency to "weather-cock," because of the force of the wind acting against the rudder and vertical stabilizer; however, this tendency is not difficult to overcome. It is advisable to hold the stick into the wind, thereby creating less lift on the windward wing, by spilling the air from under the aileron, to minimize the weather-cocking tendency.

(5) When bringing the aircraft to a normal stop or when slowing down, the throttle should be in the closed position and the brakes applied smoothly, simultaneously, and intermittently. Closing the throttle decreases the thrust and thereby necessitates less brake pressure to overcome inertia. Simultaneous brake application keeps the nose from yawing back and forth, permitting the nose wheel to remain aligned in the direction of travel and reducing the wear and stress on the nose gear assembly. Braking action should be initiated early enough so that only light to moderate brake pressures are necessary to establish the desired rate of deceleration.

(6) When stopping the aircraft to perform an engine run-up, make certain that the nose wheel is aligned with the longitudinal axis of the plane. A run-up with the nose wheel cocked results in excessive stress on the nose gear.

c. Due to the relative ease with which the T-34B can be taxied, the primary student must be cautious not to fall prey to the bad habit of using a slightly high power setting and governing both speed and direction by the use of brakes only. Remember, in taxiing, the speed is controlled by the throttle and the direction by the rudder, augmented as necessary by the brakes.

3-5.2.2 Take-off

a. The take-off is the movement of an aircraft along the runway from its starting position to the point where it leaves the deck with flying speed.

b. Before turning into the runway or entering the take-off area, turn as nearly into the wind as practicable, stop the aircraft with the nose wheel straight, and perform the take-off check-off list: The following items must be checked prior to take-off:

(1) FUEL. Check fuel quantity, fuel control valve "ON," and fuel boost pump switch "ON."

(2) CONTROLS FREE. Check for freedom of movement of all flight controls.

(3) TABS. Check for take-off setting: 6R, 3U, O.

(4) CARB. HEAT. Handle should be in COLD position (IN).
STANDARD AIRCRAFT TAXI SIGNALS

Remove Auxiliary Power Plug
Pole Checks
The Taxi Signalman
Come Ahead
Left Turn
Slow Down
Stop
Emergency Stop
Right Turn
Turnover of Command
Insert Chocks
Cut Engine
Lower Wing Flaps
Raise Wing Flaps
(5) GENERATOR. Check voltmeter and warning light.

(6) INSTRUMENTS. Check engine instruments for normal temperature and pressure.

(7) MIXTURE. Rich (forward).

(8) PROP. Low pitch (forward).

(9) FLAPS. Up.

(10) HARNESS. Locked.

This check shall be completed at a full stop in order that the pilot's attention to the detail of taxiing may not be distracted.

(1) The importance of the take-off check-off list as a safety factor cannot be over-emphasized. You will occasionally hear of pilots who take off with improper trim-tab settings, lean mixture, or other circumstances which contribute to accidents. This is invariably due to carelessness and haste in completing the check-off list. In primary training, you will already have completed your take-off check-off list prior to leaving the check, since every item on the take-off check-off list is contained in your pre-flight check-off list, but just before you taxi onto the runway for take-off, go over the take-off check list.

(2) Scan the runway and approach area for landing aircraft, check the tower for any light signals, and check the time. If all is clear, taxi into the take-off position and align the nose wheel straight along the runway. If on a dual flight, report to the instructor, "Check list complete; tower checked; time is____; ready for take-off, Str." When the instructor has acknowledged this report, and the nose wheel of the aircraft taking off ahead of you has been raised off the deck, commence the take-off roll. The actual time spent in the take-off position should be a matter of only a few seconds. Unnecessary delay is poor pilot technique and a traffic hazard. This may cause congestion of other aircraft who cannot enter the take-off position and, in some circumstances, other aircraft may be prevented from landing. Do not hurry but be ready to commence the take-off as soon as you are in the take-off position.

c. To take off, release the brakes, put your heels on the deck, position the stick in neutral, and smoothly advance the throttle to full open. Directional control during the take-off run is maintained with the rudder alone. It is important to detect any small changes in heading and to make corrections immediately. Remember that torque will tend to pull the nose of the aircraft to the left. Thus, as take-off power becomes effective, right rudder pressure will be necessary to maintain a straight heading along the runway. To help detect slight changes in heading, select a reference point directly ahead of you at the end of the runway (runway dividing lines, or obstacles such as buildings, fences, trees, etc.) and keep the nose of the aircraft pointed directly at this reference point. As the speed increases and the controls become more responsive, the effect of torque will become less noticeable. When you feel a good response to the elevator control, approximately 50-55 knots, apply back pressure to the stick and position the nose slightly above the taxi altitude so that the nose wheel is off the deck. Hold this attitude and fly the aircraft smoothly off the deck at between 60 and 65 knots of airspeed. When positively airborne and when a safe landing cannot be made on the runway should an emergency develop, retract the wheels. Maintain the take-off attitude, full throttle, and full increase rpm until the airspeed has accelerated to 100 knots; then make the transition to the 100-knot climbing attitude and retrim the aircraft if necessary to relieve control pressures. Conform to the local course rules on field departure.

3-5.2.3 Fundamental Flight Attitudes and Transitions

a. There are four fundamental flight attitudes, all of which are used at least once during every normal flight. These conditions of flight are:
(1) straight and level flight, (2) the climb, (3) the glide, and (4) the turn. These four basic attitudes and their various combinations are recognized and maintained by using three of the five physical senses: Sight, sound, and feel.

(1) Through your sense of sight, note the position of the nose of the aircraft in relation to the horizon; how far it is above or below, the angle formed between the top of the cowling and the horizon, and the rate at which the nose moves across the horizon. Observe the angle formed by the wing tips and the horizon, the amount of space between the wing tips and the horizon, or the point at which the horizon intersects the high wing. Remember that a correct and constant seat position in the cockpit is very important. If you sit high in the cockpit one time and low the next, your points of reference will be meaningless. This holds particularly true during the early phases of your flight training.

(2) Fix in your mind the sound of the
engine under the various conditions of flight. In a climb or a glide, the relative pitch of the engine noise is much the same as that of an automobile going up or down a steep hill.

(3) Learn to recognize the relative speed of the aircraft through the feel of the pressures acting on the control surfaces and the rapidity with which the aircraft responds to control movement. At high airspeeds, the controls will be firm and the aircraft will respond immediately to their slightest movement. At low airspeeds, the controls will feel "sloppy" or "mushy" and the aircraft will react sluggishly to their movement.

b. Straight and level flight is a condition in which the aircraft is flown in balanced flight holding a constant heading, and maintaining a constant altitude. This condition is attained by holding the aircraft in balanced flight in a wing-level attitude so that the lift is acting vertically to the earth's surface, and by combining the nose attitude and power so that the lift of the wings is equal to the earth's gravitational pull on the aircraft. The T-34B can be flown in straight and level flight at varying airspeeds; however, the most common condition, known as normal cruise, is 120 knots of airspeed, 2000 rpm, with sufficient manifold pressure to maintain altitude, approximately 21 to 23 inches.

(1) Your instructor will introduce straight and level flight at normal cruise. As you gain in experience, you will be able to sense the straight and level attitude of the aircraft. At first, however, keeping the aircraft in the straight and level flight attitude will be a matter of conscious control adjustment.

(2) For straight and level flight, it is necessary that a certain heading and altitude be maintained with a power setting which fulfills the purpose of that particular phase of the flight. The trim-tab controls will be used to trim the aircraft so that a minimum of pressure is necessary to hold the controls in a neutral position at this power setting. The throttle primarily controls the altitude. Reducing power will cause the aircraft to lose altitude; increasing power will cause the aircraft to gain altitude. The nose attitude controls the airspeed. While maintaining a constant throttle setting, lowering the nose will cause the airspeed to increase; raising the nose will cause the airspeed to decrease.

(3) It is most important in maintaining straight and level flight to develop the proper scan pattern. Both wing tips should be the same distance below the horizon and the nose should maintain its same relative position below the horizon without any lateral motion.

(4) Do not be alarmed by moderately rough or gusty air. Remember that your aircraft is inherently stable and, if properly trimmed, will tend to return to the straight and level flight attitude. Straight and level flight requires almost no pressure on the controls, provided the aircraft is properly trimmed and the air is smooth. However, when the air is rough and you are flying through thermals of varying intensities, the flight attitude may change with each bump. Don't try to fight the controls to prevent these bumps from occurring. Just make smooth adjustments in the flight attitudes as needed. Like driving over a very bumpy road, you can't keep the car from bouncing but you can keep it in your lane.

(5) Common errors of the student in maintaining straight and level flight are: (a) Over-controlling; making the control movements too great for the amount of correction required. Remember to relax. (b) Holding one wing low. Keep checking both wing tips. (c) Fighting the controls; attempting to correct immediately for all minor changes in attitude caused by rough or gusty air---give the aircraft a little time to make its own corrections. (d) Over-concentration. Focusing your attention too long on one reference point; remember, you must refer constantly to all check points in order to maintain the proper attitude. (e) Failing to use trim tabs to relieve unnecessary control pressures. Proper utilization of the trim tabs will make you a smoother and more precise pilot. Always, TRIM--TRIM--TRIM!

c. The climb is a maneuver to gain altitude and is accomplished by combining the nose attitude and power so that more lift is created on the wings than is necessary to sustain the aircraft in level flight. The normal climb is that attitude and airspeed at which an aircraft climbs most efficiently at climbing power. The most efficient climbing airspeed for the T-34B is 100 knots with a nose attitude in relation to the horizon which will sustain this airspeed at climbing power. When the climb is introduced by your instructor, take particular notice of the position of the nose in relation to the horizon as it appears to you from the cockpit. Placing the nose in the same relative position with the horizon each time a normal climb is effected will assure you of the proper climbing airspeed, requiring only occasional cross-checks of the airspeed indicator and permitting you to maintain a proper scan pattern. Remember, the same attitude and power settings will always produce the same airspeed.
(1) To make the transition to a climb from normal cruise, first make certain that the area ahead of and above you is clear of other aircraft. Then bring the nose up smoothly to the climbing attitude and advance the propeller control to the full increase (2500) rpm position as the airspeed decreases. Just as the airspeed decelerates to 100 knots, smoothly apply full throttle. Retrim the aircraft for normal climb. Make gentle "S" turns during the climb in order to clear adequately the area in front of the nose.

(2) As the airspeed decreases and the power increases, the effects of torque will be more noticeable. The nose of the aircraft will develop a tendency to yaw to the left. To maintain heading and balanced flight, it will be necessary to increase right rudder pressure smoothly as the airspeed decreases and to relieve this increasing rudder pressure by constantly retching the aircraft with right rudder tab.

(3) To return to straight and level flight upon reaching the desired altitude, lower the nose to the normal cruise attitude with smooth forward pressure on the stick. As the airspeed increases, apply forward stick proportionately to prevent the aircraft from climbing and left rudder to prevent yaw. Constantly rettrim to relieve the increasing control pressures. When the airspeed has increased to 120 knots, retard the throttle to 18-19 inches of manifold pressure and then adjust the propeller control for 2000 rpm. As the rpm is decreased, there will be a proportionate rise in the manifold pressure, so that as 2000 rpm is attained, the manifold pressure will have increased to the desired normal cruise power setting (21-23 inches). However, a slight re-adjustment of the throttle may be necessary when the propeller has stabilized at 2000 rpm. When normal cruise has been established, make a final trim adjustment.

(4) The following climbing airspeeds will be used:
- Wheels up and flaps up...100 knots
- Wheels up and flaps down...70 knots
- Wheels down and flaps up...80 knots
- Wheels down and flaps down...70 knots

(5) Common errors of the student are: (a) Pulling the nose up violently. (b) Holding the nose too high above the horizon, permitting the airspeed to decrease below the normal climb airspeed. (c) Allowing the nose to yaw to the left before applying corrective rudder and trim tab. (d) Erratic nose position. Establish the climb attitude. Make only slight adjustments to correct airspeed. Maintain the proper scan pattern and TRIM--TRIM--TRIM.

d. A descent or glide is a maneuver to lose altitude. It is accomplished by combining the nose attitude and power so that the lift on the wings is insufficient to maintain the aircraft in level flight. An aircraft can descend or glide at various airspeeds and power settings, however, a pilot should normally use the most efficient gliding airspeed, that is, an airspeed which will produce the greatest lateral distance for a given loss of altitude. The two most efficient normal glides in the T-34B are performed power off at 90 knots and power on at 120 knots. When your instructor introduces these glides notice the position of the nose in relation to the horizon. You are learning to fly by attitude and will be able to maintain a steadier airspeed and, thus, a more constant rate of descent; do not rely primarily on the airspeed indicator. Note how the sound of the engine changes as power and airspeed change. The firmness of the controls will also vary as the airspeed varies.

(1) To transition to a 90-knot power-off glide from normal cruise, smoothly close the throttle. As the airspeed decreases, maintain altitude by gradually increasing back pressure on the stick to increase the angle of attack (raise the nose); maintain heading with rudder. As the airspeed approaches 90 knots, lower the nose smoothly to the gliding attitude and maintain 90 knots of airspeed by small adjustments in nose attitude. Retrim the aircraft. Make gentle "S" turns to clear adequately the area ahead of you. Clear the engine every 500 feet of descent by momentarily advancing the throttle to ensure that the engine operating temperatures are maintained.

(2) To return to normal cruise from a power-off glide, smoothly advance the throttle to normal cruise power (21-23 inches of manifold pressure) when 250 feet above the desired altitude. Maintain the power-off glide attitude until 50 feet above the desired altitude to permit the airspeed to build up, and then gradually raise the nose to the normal cruise attitude. Level off at the desired altitude with 120 knots of airspeed. As power is applied, the nose will tend to rise rapidly; apply proportionate forward pressure on the stick in order to maintain the power-off gliding attitude and to prevent the nose from rising. As the power and airspeed are increased, adjust the trim tabs as necessary to maintain balanced flight.

(3) The transition to a 120-knot power-on glide from normal cruise is accomplished by retarding the throttle to 13 inches of manifold pressure, simultaneously lowering the nose to maintain 120 knots of airspeed, and rettriming the aircraft for the power-on glide attitude. Gentle "S"
turns are made during the descent to clear the area ahead. The return to normal cruise is accomplished by smoothly advancing the throttle to normal cruise power 50 feet above the desired altitude and gradually raising the nose to the normal cruise attitude. Retrim for the normal cruise attitude.

(4) In the 90-knot power-off glide, there will be no torque, and in the 120-knot power-on glide, the effects of torque will be greatly reduced. However, because of the built-in torque correction, the aircraft will automatically tend to counteract the effects of torque. This causes the nose to yaw to the right as power is decreased. To offset this tendency and maintain balanced flight, it is necessary for the pilot to increase left rudder pressure steadily and constantly rettrim until power and airspeed are stabilized.

(5) If a descent is entered from a climbing attitude, deliberate forward pressure on the stick must be applied to lower the nose to the gliding attitude as the throttle is retarded. This is to ensure that a safe flying speed will be maintained while the aircraft is changing to the new attitude.

(6) In approaches to landings, the glide must be normal with a constant rate of descent for satisfactory results. For example, if the nose is too low, the airspeed becomes too great and the aircraft will "float" a considerable distance over the ground when the transition to the landing attitude is made before the excessive airspeed can be dissipated and a landing effected. If the nose is too high, the airspeed decreases below the normal gliding airspeed. The aircraft will then settle rapidly toward the deck, shortening the normal gliding distance. It is impossible to stretch or prolong a glide by raising the nose above the normal gliding attitude.

(7) The following gliding airspeeds will be used for the conditions prescribed:

**POWER OFF**

- Wheels up—flaps up. ............... 90 knots
- Wheels down—flaps up. ............... 85 knots
- Wheels down—flaps down ............... 75 knots

**POWER ON**

- Wheels up—flaps up. ............... 120 knots
- 13 inches MP
- Wheels down—flaps up. ............... 80 knots
- 16 inches MP
- Wheels down—flaps down. ............... 70 knots
- 16 inches MP

(8) Common errors of the student in performing glides are: (a) Failure to maintain a constant attitude. This is usually the result of "chasing" the airspeed indicator in an effort to maintain the proper airspeed. (b) Failure to clear the engine during power-off glides. (c) Forgetting to execute "S" turns to clear the airspace ahead. (d) Failure to maintain balanced flight. This is the result of inadequate utilization of the trim tabs.

(9) A turn is a basic maneuver used to change the heading of the aircraft. It is probably the most complicated of all the fundamental flight attitudes and involves the close coordination of all the controls—ailerons, rudder, and elevators. Since turns are Incorporated into almost all other maneuvers, it is important that you be able to perform them well.

(1) To execute a turn, use side pressure on the stick in the direction you wish to turn. At the same time, use enough rudder in the same direction to prevent yaw. Hold these pressures until the aircraft assumes the amount of bank necessary for the rate of turn desired. Then relax the pressures on the ailerons and rudder, maintaining only enough opposite aileron pressure to prevent overbanking (since the outside wing will be moving through the air faster than the inside wing, it will have more lift and will, therefore, tend to rise). During the turn, the nose of the aircraft will tend to drop, inasmuch as the lift is acting horizontally as well as vertically. It is necessary, therefore, to increase the amount of lift to maintain altitude. This extra lift is obtained by increasing the angle of attack. As your wings start to bank into the turn, you must coordinate back pressure on the stick and maintain this back pressure throughout the turn.

(2) To recover from the turn, apply stick and rudder pressures opposite to the direction of the turn. As the wings approach the level position, relax these pressures and neutralize the controls. At the same time, gradually decrease the back stick pressure which you have been holding so that the nose of the aircraft will be in the proper attitude for straight and balanced flight as the wings are rolled to the level position.

(3) Before practicing turns, it is necessary that the student thoroughly understand the salient forces which affect the aircraft in a turn. Turns are made in an aircraft by increasing the angle of bank in the desired direction. Banking causes the direction of the lift of the wings to move from the vertical to one side. Therefore, the effect of lift is to pull the aircraft in the direction of the bank as well as to continue to overcome gravity. This is accomplished by coordinating the control pressures to roll the aircraft in the desired direction.
(4) When an aircraft is flying in straight and level flight, the lift component is acting perpendicularly to the wings and the deck. As the aircraft is rolled into a turn, the lift divides into two components. One, the vertical component, acts perpendicularly to the deck; the other, the horizontal component, acts in a direction parallel to the deck. These two lift components act at right angles to each other, causing a resultant lifting force to act perpendicularly to the wings of the aircraft. It is this resultant force that turns the aircraft.

(5) As the angle of bank increases, the vertical lift component decreases and the horizontal component increases; this causes the resultant lifting force to act more and more in the direction of the horizontal component. Since the resultant lifting force acts more horizontally, the effect of lift acting vertically is decreased. This loss of vertical lift causes the nose of the aircraft to become lower in relation to the horizon, and thus the aircraft loses altitude. When your aircraft is in a turn, you will find that a greater angle of attack is necessary to keep the nose from dropping and to prevent a loss of altitude. Increasing back stick pressure will keep the nose up. The steeper the angle of bank, the more back pressure is necessary to keep the nose in the correct attitude. With an increase in bank and a greater angle of attack, the resultant lifting force will be increased and the rate of turn will be faster.

(6) In using ailerons to effect a bank, the movement of the aileron surfaces out of their streamlined position creates an increase in drag. This drag is not distributed equally on each aileron; the aileron of the high wing, since it has been lowered to increase the lift of that wing, receives the greatest amount of drag effect. Thus, when the aileron control is used, there is a tendency for the nose of the aircraft to yaw in the direction of the high wing (opposite to the direction of bank). The degree of aileron drag effect is dependent on the speed of the aircraft. At low or near stalling airspeeds it is very prominent, whereas at high airspeeds it may not be noticeable. This is true because the movement of the aileron surfaces must be greater to produce the same amount of lift at power airspeeds.

(7) The effects of aileron drag must be overcome with rudder. As you apply aileron pressure, simultaneously apply rudder pressure in the same direction so that the aircraft responds proportionately to the amount of aileron pressure applied. Use rudder pressure as long as banking action is taking place. The correct amount of rudder pressure depends on the airspeed and the amount of aileron used.

(8) Always remember to use rudder and aileron pressures simultaneously, although the individual amount of pressure may differ, depending on the effect of the drag. Also, remember that aileron drag is just as effective during a recovery from a turn at the end of an entry, since aileron drag is also present during a roll-out. If insufficient rudder is used on entering the turn, the nose will yaw to the outside of the turn and the aircraft will "slip." You will experience a tendency to slide to the inside of the turn. If too much rudder is used, the aircraft will "skid." You will feel a tendency to slide to the outside of the turn. It is imperative that you maintain good posture in the cockpit at all times. Do not lean against or with the direction of turn; otherwise, you will not feel the need for the various coordinated control pressures necessary to maintain balanced flight.

(9) When pressures are applied to the controls, corresponding surfaces are moved into the air flow. This causes the aircraft to alter its attitude in proportion to the amount of pressure applied and to the duration of its application. Consequently, the response of the aircraft depends on your ability to judge how much pressure to apply to the controls. If you desire a slow rate of roll, you should apply light, smooth pressures to the controls. If you desire a rapid rate of roll, greater control pressures will be necessary. Pressure control, your ability to feel the pressures on the controls, should be in proportion to the degree of rapidity of the change desired.

(10) Points to remember: (a) Turns are extensively combined with the climb and the glide. Therefore, due consideration must be given to the increased effects of torque. (b) It will be necessary to anticipate or "lead" the recovery from a turn so that the desired heading is attained as the roll-out is completed, since the aircraft will continue to turn during the roll-out. (c) In a turn, drag increases as the angle of bank increases, and proportionately, the airspeed will decrease. (d) Do not turn into uncleared areas—maintain balanced flight—scan.

3-5.2.4 Division of Attention

a. Division of attention, or scanning, is the "awareness" that a pilot must possess in order to fly his aircraft effectively. It is quite obvious that you must look outside the airplane to see where you are going; look at the aircraft with respect to the horizon to check and maintain a desired attitude; and look inside at the instrument panel to check for proper power settings, flight
instrument readings, and for any signs of engine malfunction. Coupled with the diversified attention involved in the fundamental control of the aircraft is the concern that must be devoted to flight safety—avoiding other aircraft. The proper division-of-attention techniques which you learn in training is the foundation for the mandatory alertness of a combat military pilot.

(1) Within the period of your first or second flight, you will discover that a pilot must be constantly aware of the many things that are happening about him. It may seem that the task of being aware of these numerous events and circumstances at the same time is impossible. However, the ability to do so is an integral part of your flight training and is developed more or less naturally. Of course, as in any endeavor, its development is expedited by a conscientious effort to learn.

(2) In order to divide your attention, the development of a scan pattern will offer the most efficient means by which you can readily ascertain required information and not dwell on any one item with a subsequent failure to notice other equally important details.

b. A scan pattern is a means, or procedure, by which you can observe everything you need to see by starting at one point, moving visually about the aircraft, checking all applicable items systematically and thoroughly, and completing the pattern at
the starting point. A scan pattern may be started anywhere, but it must be completed and continu-
ous. The following scan pattern is a workable ex-
ample, and for convenience, is started in the
cockpit.

(1) Look at the engine and flight instru-
ments, make necessary corrections, and quickly
move your eyes to--

(2) The left wing area behind the wing, up
and below, looking for other aircraft, then--

(3) The left wing tip to determine the proper
position in relation to the horizon, making any
corrections necessary.

(4) Ahead of, up and below the left wing,
over to the nose, looking for other aircraft;
determine the nose attitude, making any required
corrections. Check heading and area.

(5) Next, ahead of, up and below the right
wing area for other aircraft, to--

(6) The right wing tip to determine the
proper position in relation to the horizon, making
any corrections necessary.

(7) Behind the right wing, up and below,
for any other aircraft. Then--

(8) Back into the cockpit and repeat the
pattern.

c. The entire pattern should take very little
time and no one item will have fixed your attention
to the exclusion of another. Meanwhile, cor-
rections have been initiated for any errors de-
tected and the next scan over the pattern will en-
able you further to correct or perfect your condition
of flight.

d. Remember, while you are staring at the in-
struments, the nose attitude and wing position may
become erratic, and while you stare at the nose
position and correct it, the instrument readings
may vary. You cannot afford to gaze at any one
item for any length of time or the pattern will be
broken; but instead, scan each position, initiate
corrections, and then check those corrections
when you return to that position in the scan pat-
ttern. Be alert! Look around! Remember that
under you is a blind spot. Never assume that
others see you.

3-5.2.5 Steep Turns

a. The steep-turn maneuver is a turn of 45 de-
grees angle of bank. This maneuver supplies a
method of accomplishing rapid changes of direc-
tion, clearing turns for high work, and is in-
corporated into various high-performance maneu-
vers. Your instructor will introduce steep turns
and the pattern which you will use to practice
them. The steep turn is executed at a constant
altitude, through a pattern 360 degrees in one di-
rection and then 360 degrees in the opposite di-
rection, rolling smoothly from one turn into the
other, and recovering on the original heading. As
you practice steep turns, your orientation and
ability to coordinate control pressures will im-
prove.

b. Establish the aircraft in normal cruise
aligned with a reference point on the horizon or
section line on the ground. Before you enter a
steep turn, as in any other turn, look in the di-
rection of the turn to ascertain that the area is
clear of other aircraft or clouds that may inter-
fere with flight safety. If clear, commence a turn
in either direction.

(1) The pressures applied to the controls to
begin a steep turn are the same as the pressures
used in all other turns. You merely apply them
for a longer period of time, until the aircraft has
assumed the desired angle of bank. However, as
the bank steepens, more back pressure on the
stick must be applied to increase the angle of at-
tack in order to compensate for the loss of verti-
cal lift and to overcome the effect of centrifugal
force. When 45 degrees of bank are established,
the aileron and rudder pressures are relaxed
smoothly at the same rate at which they were
established. The backstick pressure is not re-
leased but is held constant.

(2) Throughout the turn, the degree of bank
should be held constant with the ailerons. This
may necessitate holding side pressure on the
stick in the direction of the high wing to counter-
act the over-banking tendency of the aircraft.
However, the over-banking tendency is not so
pronounced in a steep turn as in a shallow- or
medium-banked turn, due to the fact that, in a
steeply banked turn, the arcs through which the
wings are traveling are more nearly equal than in
a shallow- or medium-banked turn.

(3) Complete a turn for a 360-degree
change of direction. Since the aircraft will con-
tinue to turn as long as there is any bank, start
the roll-out before reaching your original heading.
As the wings are approaching the level position,
relax the control pressures smoothly until they
are neutralized and the aircraft is again in straight
and balanced flight. Without hesitation, roll into
a steep turn in the opposite direction for 360 degrees of turn and recover on the original heading in normal cruise.

c. In a steep turn, back pressure is not as effective in raising the nose as it is in level flight. In an excessively steep bank (60 degrees or more), back pressure pulls the nose around the horizon without appreciably increasing the nose attitude. For this reason, if you allow the bank to get past 45 degrees and the nose to drop, you should shallow the bank before applying back pressure to raise the nose.

(1) As the airspeed decreases in a steep turn as a result of an increased angle of attack, torque effect will cause the nose of the aircraft to yaw to the left, regardless of the direction of the turn. Therefore, right rudder pressure will have to be used to overcome it. In a steep turn to the left, torque will pull the nose down, while in a steep turn to the right, it will tend to pull it up. Do not try to anticipate the effect of torque in a steep turn. Use whatever rudder pressure is necessary to maintain balanced flight.

d. Common Errors

(1) Missapplication of control pressures during the entry into the steep turn; that is, applying the control pressures too rapidly and abruptly, using too much back-stick pressure before it is actually needed. Remember, the aircraft is flown through a medium-banked turn before it reaches a steep turn.

(2) Incorrect posture in the cockpit; leaning into or away from the turn.

(3) Staring at the nose and consequently applying control corrections too late. Divide your attention. Look around! Scan! A steep turn provides a rapid change of heading; therefore, if you are going to stay "ahead of the aircraft," you must think ahead of it.

(4) Poor planning; failure to anticipate the roll-out of a steep turn in order to effect recovery on the desired heading.

3-5.2.6 Slow Flight

a. Slow flight is a condition in which the aircraft is flown in balanced flight, with an airspeed which is reduced to a point near the minimum at which controlled flight can be maintained. Slow flight is practiced to develop your coordination and "sense of feel" of the controls at low airspeeds. Since it is executed with a relatively high power setting, torque will be prominent. To the primary student, therefore, it is an excellent torque and trim exercise. Slow flight will acquaint you with the flight characteristics of the aircraft during the early part of a wave-off and during some of your practice stalls.

(1) During the entry and recovery from slow flight, you will be required to maintain altitude and heading. Therefore, to practice this maneuver, line up on a section line or adjust heading toward a reference point, and level off at an altitude that will provide easy altimeter readability (any thousand- or thousand-plus-five-hundred-foot altitude). Because the aircraft is near a stalled condition during slow flight, you will practice this maneuver at a safe altitude.

(2) The combat naval aviator is often called upon to control his aircraft at relatively low airspeeds and high angles of attack. Landing a combat aircraft on a carrier deck demands extreme precision of control, in that the nose-high approach is executed in a near-stalled condition at minimum airspeed. The naval aviator is proud of his mastery of slow flight and now is the time for you, the primary student, to lay the groundwork if you are to avoid difficulty during the slow-flight requirements of your advanced and operational flying.

b. While in normal cruise, close the throttle, advance the propeller control to full increase (2500) rpm, and maintain altitude and heading as the airspeed decreases. At 110 knots of airspeed, lower the wheels. When the horn stops blowing, the landing gear indicators indicate down, and the landing gear handle warning light is out, advance the throttle to 15 inches of manifold pressure and lower the flaps. When the aircraft has decelerated to 70 knots of airspeed, advance the throttle to 19 to 21 inches of manifold pressure to maintain altitude and 70 knots of airspeed.

(1) Trim the aircraft as frequently as possible throughout the changing flight conditions. Maintain altitude and heading! As the throttle is closed and the airspeed decreases, it will be necessary to prevent yaw with rudder control and maintain altitude by smoothly increasing the nose attitude. When the throttle is advanced at 70 knots, considerable right rudder pressure and trim will be necessary to overcome the effects of torque. Back elevator trim must also be used to relieve stick pressure and assist in maintaining the nose-high attitude.

(2) Once the transition to slow flight has been completed, practice flying the aircraft in
straight and level flight. Note the "sloppiness" of the controls, caused by the decrease in the flow of air around the wings. It is one positive indication that the aircraft is very near to a stalled condition. Practice straight and level slow flight until you are satisfied with your ability to maintain a constant altitude and airspeed. You will find that throttle-elevator coordination will vary. That is, when you make a change in nose attitude, you will have to make a proportionate adjustment in the throttle setting, or vice versa, in order to maintain a constant altitude and airspeed.

(3) Practice gaining and losing altitude by coordinating throttle and nose attitude. During the introduction of slow flight, your instructor will demonstrate that power plus attitude equals performance.

(4) After you have developed your proficiency in straight and level slow flight, try turns. Start out by practicing a coordination exercise using gentle turns, smoothly rolling from one shallow banked turn to another through a central reference point. Then make turns to change heading 90 or 180 degrees. Notice how you will have to add throttle in order to maintain a constant altitude to compensate for the loss of vertical lift in a turn. You are already at a near-minimum airspeed and raising the nose any appreciable amount is obviously impractical. The rate at which the aircraft turns is caused by the degree of the bank and the airspeed. This rate of turn is directly proportional to the degree of bank, but inversely proportional to the airspeed; consequently, the slower the aircraft is flying through the air, the greater the rate of turn for any given angle of bank. Therefore, when practicing turns during slow flight, notice the fairly rapid rate of turn that is produced by a shallow bank. This is mentioned to point out that steep turns are not necessary to execute rapid changes in direction at low airspeeds, for example, when executing a wave-off. Steep turns during a wave-off are dangerous, and a shallow bank will give you an adequate turning response.

(5) Due to the nose-high attitude of slow flight, your forward visibility is restricted. Make sure that the area ahead of you is clear of other aircraft before you start. Prolonged periods of slow flight on one heading should be avoided.

(6) To return to normal cruise from slow flight, apply full throttle and raise the wheels. When the wheels indicate up, raise the flaps. Maintain altitude and heading while the airspeed increases to 120 knots, keeping alert for the effects of torque and the need for a proportionate change in nose attitude (lower) as the flight conditions change. It is imperative that, during the transition from slow flight to normal cruise, the trim tabs be used to relieve corresponding control pressures. Upon accelerating to 120 knots, reduce the power, to the normal cruise power setting and make the final trim adjustments as necessary.

c. To demonstrate that attitude plus power equals performance, your instructor will increase the throttle to full and maintain the slow-flight attitude; the airspeed will increase and there will be a slight increase in altitude. He will then return to the level-flight power setting and 70 knots. Next, your instructor will apply full throttle and adjust the nose attitude to maintain 70 knots; notice the constant gain in altitude. Right rudder pressure will be necessary to maintain balanced flight. He will then return to the level-flight power setting and 70 knots. Next, your instructor will lower the nose attitude and increase the airspeed to 80 knots; notice the loss of altitude. To stop the loss of altitude, power will have to be added. He will return to level-flight power setting and 70 knots. He will then raise the nose slightly and slow the airspeed to 60 to 65 knots. Notice the slight gain in altitude and that then the altimeter will stabilize. This is near the area of "reverse command" or the backside of the power curve. A further increase in nose attitude will establish a sink rate and there will be a loss of altitude. This is called "over-rotating". Any further increase in attitude will aggravate this condition and a stall will likely result. The instructor will recover from the over-rotated condition by increasing power and decreasing the nose attitude.

3-5.2.7 Introduction to Stalls

A. A stall is a condition of flight in which the lift acting on an aircraft is overcome by drag and/or the force of gravity. This condition occurs when the angle of attack has become too great and the smooth flow of air over the wings is disrupted sufficiently to cause a "burbling" effect which reduces the effective lift to the extent that lift is no longer sufficient to sustain the weight of the aircraft. When an aircraft stalls completely, it is no longer flying but becomes a free-falling body.

(1) First of all, abandon the idea that there is a fixed stalling speed. An aircraft will stall any time its critical angle of attack, or stall angle, is exceeded; its stalling airspeed will vary as the stall characteristics of the aircraft vary. It is important, therefore, that you understand the conditions which induce an excessive angle of attack. This requires that you make the proper
mental approach to this problem; that you consider the factors, not the airspeed, which affect the stall characteristics of your aircraft. These factors are: balance (weight and its distribution), bank (wing loading), nose attitude (critical stall angle), coordination (abrupt control movement), drag (use of flaps), and power. Remember, a stall can occur at any airspeed, in any attitude, or at any power setting, depending on the number of factors affecting the aircraft.

(2) Stalls are not dangerous unless they occur so close to the deck that there is insufficient altitude to effect recovery. They will not, in themselves, damage or impair the performance of the aircraft unless the conditions of flight immediately prior to the stall entry are such that the structural limitations of the aircraft are exceeded. With sufficient altitude, the performance of stall maneuvers is perfectly safe.

b. In order to become a proficient pilot, you must be able to recognize the flight conditions that are conducive to stalls and know how to apply the necessary corrective action quickly. In primary flight training, stalls are taught to develop your ability to recognize an approaching stall and avoid it, and to recognize a complete stall and be able to recover, correctly, quickly, and automatically with the least loss of altitude or before the stall develops into a spin. Since you are not provided with an instrument to tell you when your aircraft is approaching a stalled condition, you must be able to recognize the "stall warning" through either one or a combination of three senses—sight, sound, and feel.

(1) Sight: You can see the abnormally nose-high attitude or the rapid nose movement in excessive back-pressure turns.

(2) Sound: You can hear the engine as it begins to labor from excessive propeller loading. Under certain conditions, you can also distinguish the diminishing sound of the slipstream as it blows past the canopy.

(3) Feel: You can feel the control pressures become light and "less effective" (sloppy) at low airspeeds. During rapid turns, or at high airspeeds, you can feel the excessive pressure that forces you into the seat as well as the excessive pressures you are applying to the controls.

(4) It would be extremely difficult, if not impossible, to place the T-34B in an attitude or condition of flight where at least one of the three senses would not warn you of an impending stall. You should readily understand the necessity of developing the techniques of sight, sound, and feel, rather than depending solely upon a mechanical medium, such as the airspeed indicator, to warn you of an approaching stall.

c. The T-34B aircraft has proved itself to be very stable, and though the aerodynamic warning preceding a stall is not as prevalent as in high-performance aircraft, it is adequate for safe operation by student pilots. However, it is important that you understand the techniques involved in recognizing an approaching stall condition. This knowledge will prove invaluable in performing stall maneuvers and ultimately enable you to become a better, more proficient, and safer combat pilot.

(1) The following list of stall indications will assist you in developing your stall—warning recognition technique. These indications of an approaching stall will not occur individually but in various combinations. Study them and recognize them as they occur in actual flight.

(a) High nose attitude (low airspeed).
(b) Excessive rate of nose movement.
(c) Control sloppiness (low airspeed).
(d) Excessive seat pressure (high airspeed).
(e) Control stiffness (high airspeed).
(f) Laboring engine (low airspeed).
(g) Slight buffeting.

(2) The stall characteristics of the T-34B, as in all types of aircraft, will differ slightly in the power-on and power-off conditions of flight. With power off, the stall will occur at a slightly higher airspeed and the aircraft will have less tendency to roll, should the aircraft be in a slightly unbalanced flight condition, than with power on. Recognizing an approaching stall in the power-on condition requires more concentration, because there is a lack of noticeable aircraft "buffeting" (trembling, shaking, or vibrating sensation), with the exception of the steep-turn stall. The actual stall itself is characterized by an abrupt "pitch-down" of the nose.

d. In order to effect an efficient stall recovery, there are certain related procedures which are peculiar to the particular type of stall experienced. However, the following general comments are applicable to all types of stalls.

(1) There is a definite order of progression in which the control surface lose their effectiveness: ailerons, elevators, and rudder. The order in which they regain their effectiveness is reversed; rudder, elevators, and ailerons.
(2) Since a stall is the result of an excessive angle of attack, this angle must be reduced by relaxing back-stick pressure at high airspeeds, or by a positive forward motion of the stick at low airspeeds.

(3) During a stall, there is a possibility of a wing dropping; however, do not use the ailerons to raise the low wing until flying speed has been regained. Assume for example, that the right wing dropped during a stall. If left aileron pressure were applied to raise the wing, the downward-moving aileron on the right wing would impose an even greater angle of attack, and consequently, greater drag on that wing. Thus the aileron would cause the wing to become stalled to an even greater degree, because of the increased angle of attack. This drag, if of sufficient magnitude, may cause the nose to yaw to the right, in the direction of the low wing.

(4) The primary use of the rudder in stall recoveries is to maintain directional control. A spin cannot develop if a constant heading is maintained. It is, therefore, extremely important that rudder be properly used to keep the aircraft traveling straight ahead during the recovery from a stall. Consider that, in a stalled condition, the position of the rudder in the slipstream is such that it will remain, for the most part, effective unless, of course, all forward motion is lost. As the aircraft falls forward, the rudder slices, or cuts, through the slipstream like a knife through butter. Its critical angle of attack is not affected like the horizontal stabilizer and elevator surfaces. The rudder, therefore, can be used, even though all other controls are completely stalled, to maintain heading and stop the rotation of the wings.

e. Before performing any stall maneuvers, there are certain safety precautions that must be observed. First, complete the following stall check-off list, and, if on a dual flight, report to your instructor, " Stall check-off list complete, Sir." Then ascertain that the airspace above, below, and in the general proximity of the aircraft is clear of other planes or clouds prior to commencing any maneuver which will result in a large gain and/or loss of altitude, by performing clearing turns.

(1) Check-off list:

(a) Canopy closed and locked.
(b) Safety belt tight and locked.
(c) Shoulder harness tight and locked.
(d) Propeller control full increase rpm.
(e) Gyro compass caged (if installed).
(f) Bilges clear of loose objects.

(2) To execute a clearing turn, roll into a steep turn (minimum of 45 degrees angle of bank) and turn 90 degrees while looking above, below, and all around you. Then smoothly roll into a steep turn in the opposite direction and repeat the procedure; however, if circumstances dictate, the second 90 degrees of turn may be made in the same direction. Roll out of the last 90 degrees of clearing turn on a section or cardinal heading, in a wings-level attitude, with the proper power setting, airspeed, and nose attitude for commencing the stall maneuver. As you adjust the nose attitude of the aircraft to complete the clearing turn at the proper airspeed, simultaneously adjust the aircraft trim so that when the stall-entry attitude is established, very little time will be utilized in making the final trim adjustment.

(3) Minimum altitude for recovery from any stall maneuver is 3000 feet.

3-5.2.8 Power-off Stall

a. This stall might occur while you are descending in an actual or simulated emergency. Recovery is made with power off so that you will become proficient in recovering from a stall without power in the event of an actual engine failure.

b. Execute the stall check-off list. Complete the last 90 degrees of clearing turn in a normal 90-knot power-off descent and trim the aircraft. Then smoothly raise the nose to a position 15 degrees above the normal cruise attitude. Maintain this attitude with the wings level and the aircraft in balanced flight until the stall occurs. As the airspeed diminishes, it will be necessary to increase the back-stick pressure gradually in order to maintain a constant nose attitude. Maintain heading with rudder. Immediately prior to the stall, the stick will be all the way back.

(1) When the stall occurs, decrease the angle of attack with a positive forward motion of the stick to position the nose slightly below the 90-knot gliding attitude. Stop any rolling tendency with rudder pressure applied opposite to the direction of roll and, as soon as aileron effectiveness has been regained, smoothly level the wings with coordinated rudder and ailerons. Hold the recovery attitude in balanced flight to permit the airspeed to build up and, as 90 knots of airspeed are reached, assume the normal 90-knot power-
off glide attitude. The stall maneuver thus completed, smoothly advance the throttle and return to straight and level flight.

c. Enter this stall maneuver smoothly and without rushing to avoid overcontrolling. The entry glide simulates an actual flight condition and also provides a "measure" for the student pilot to use in establishing the proper recovery attitude. Since the recovery is effected without power, you cannot rely on thrust to "pull" you out of the stalled condition, but must "get the nose over" and utilize the force of gravity to enable the aircraft to regain flying speed.

3-5.2.9 Power-off Spiral

a. A power-off spiral is a prolonged gliding turn at a constant airspeed without power (the throttle in the idle position). This maneuver enables a pilot to lose altitude while remaining in the general vicinity of a desired area. For example, suppose your engine failed at high altitude and you wanted to land on a field directly below you. A spiral would permit you to dissipate enough altitude to start your landing approach without ever getting out of gliding distance of the field. It is a maneuver which provides safe conditions of flight during descents in inclement weather. For the primary student, practicing power-off spirals is one of the most excellent methods of improving basic airmanship. As a proficiency and procedural maneuver, the power-off spiral involves a transition from normal cruise to a straight power-off glide, two 360-degree power-off gliding turns in opposite directions, return to a straight power-off glide, and transition to normal cruise.

b. To perform a spiral, establish normal cruise along a section line or toward a reference point and make a normal transition to a straight, 90-knot, power-off glide. Trim the aircraft. Smoothly roll into a turn in either direction and maintain a constant angle of bank of approximately 30° and 90 knots of airspeed. Continue the turn for 360 degrees. Just prior to returning to the original heading, start rolling out of the turn. The original heading and a wings-level attitude should be reached simultaneously. Continue your roll until a turn in the opposite direction with the same angle of bank as before is established. The roll-out and roll-in are executed smoothly and at as constant a rate as possible. After completing the second 360-degree turn in a wings-level glide, make a transition to normal cruise at the next 500' level. Notice that when the angle of bank is held at 30 degrees, approximately 1000 feet of altitude are lost in each 360-degree turn. If a steeper bank is used, less altitude loss will occur in each turn. A shallower bank will result in more loss of altitude.

c. In a spiral, the principles of control involved in a medium through a steeply banked turn and a glide are combined. Maintain heading and altitude as the airspeed decreases during the transition to the power-off glide, and as the airspeed reaches 90 knots, lower the nose to the normal gliding attitude. This is checked by noting the position of the nose below the horizon. The airspeed indicator may be utilized as a cross-check to help determine the proper gliding attitude.

1) Adjust the nose attitude with back-stick pressure to maintain airspeed as the angle of bank is established. To keep the rate of turn and airspeed constant, keep the bank and the nose attitude constant. Remember, for a given airspeed, the nose attitude is lower in a banked turn than it is when the wings are level. Therefore, to maintain 90 knots during the reversal of direction in the spiral, it will be necessary to adjust the nose attitude in accordance with the decreasing and subsequently increasing angle of bank. That is, as you roll out of the turn to the wings-level attitude, the nose will have to be raised slightly, and as the angle of bank steepens during the roll into the turn in the opposite direction, the nose will have to be lowered again. Be smooth and coordinate the control pressures.

2) One noticeable effect in establishing gliding turns which is not present in level, power-on turns is that slightly more left rudder pressure will be necessary during entries and recoveries to the left to overcome the "rigging" of the aircraft, which is constantly tending to correct to the right for torque that is not present. For the same reason, a smaller amount of right rudder pressure will be necessary in turns and recoveries to the right.

3) During the spiral, the engine should be cleared at least once for each 500-foot loss of altitude, or as often as necessary to keep the cylinder-head temperature above its minimum operating limits. To accomplish this, smoothly and momentarily apply a small amount of throttle. Keep in mind the need for adequate clearing of the airspace ahead and constantly check the airspace into which you are turning.

3-5.2.10 Standard Field Entry and Departure Procedures

a. The standard field entry and standard field departure are a series of uniform procedures by
Complete landing check-off list except for canopy, gear, flaps, and prop.

Enter 1,000' traffic circle 120 knots wings level, tangent to the circle

On downwind leg, report "gear down, brakes firm, parking brake in, temperature and pressures normal" 500' 90 knots wingtip distance

With traffic in pattern--parallel traffic at 500' 90 kts until clear to join traffic.

With no traffic--cross over at 500' 90 knots.

Level off at 500' 90 knots, approximately 21-23" M.P.

Let down 90 kts. 13" - 15" M.P.

1,000' traffic circle wing tip distance from intended point of landing

Throttle back (horn blows),

Gear down at 110 knots.

STANDARD FIELD ENTRY PROCEDURES

OPEN Canopy, set Prop 2200 rpm, adjust throttle to maintain 120 knots and altitude.

#1 position report "Gas checked. Canopy open. Landing check list complete except for gear prop, and flaps!"
which all aircraft in the primary phase of Basic Training enter and depart the landing pattern of outlying fields. These procedures are used because of the number of aircraft which may be operating from the same field. It is absolutely necessary that each conform to some systematically established pattern and procedure. If properly executed, these procedures will combine a maximum of safety with a minimum of confusion. All necessary procedural checks will be given prior to the landing, thereby providing less possibility for a mid-air collision with other aircraft because of confusion over the right-of-way.

b. There are 3 items of major importance which must be considered in order to make a standard field entry.

(1) Intended point of landing: This is the point on the runway where you intend to "touch down," or land, the aircraft. It should be the middle of the first third of the runway or in the "box" if practicing precision landings.

(2) Landing line: This is an imaginary line extending through the intended point of landing and parallel to the course over which the aircraft will actually pass in the final straightaway and landing.

(3) Wind line: This is an imaginary line extending through the intended point of landing which parallels the direction of the wind. It may or may not coincide with the landing time.

(4) Landing pattern: The landing pattern is a geometrical race-track course flown at 500 feet of altitude, so that a landing approach may be executed in a systematic sequence. The landing line and upwind leg and the parallel downwind leg from the sides of the race-track pattern. These lines are joined together by the upwind turn and by the approach turn at the downwind end of the pattern.

(5) Traffic circle: This is a circular course about the intended point of landing, flown at 1000 feet of altitude and at a wing-tip distance measured from a wings-level altitude. Prior to entering the traffic circle, complete landing check-off list except for canopy, gear, flaps, and propeller.

c. Enter the 1000-foot traffic circle wings level, in normal cruise at any point, but on a tangent to the circle in the direction of the traffic. After entry into the traffic circle, continue until you pass through the "number 1" and "number 2" positions. The "number 1" position is the point in the traffic circle which is 45 degrees from the landing line prior to reaching the approach end of the field, a wing-tip distance from the intended point of landing. The "number 2" position is the point in the traffic circle where it intersects the landing line a wing-tip distance from the intended point of landing on the approach end of the field.

(1) Prior to the "number 1" position, open canopy, set prop at 2200 rpm, and adjust throttle to maintain 120 knots. At the "number 1" position report: "Front canopy locked open. Gas reads (amount) left and (amount) right. The landing check-off list is now complete except for the prop, gear, and flaps, Sir." At the "number 2" position, close throttle, and start a level turn toward the point of intended landing to establish a course of half-wing-tip distance to the right and parallel to the landing line. When the airspeed has decreased to 110 knots, lower the landing gear. When the gear is down and locked, advance the throttle to 13-15 inches of manifold pressure to complete the transition to a 90-knot power-on descent. Descend to level off at 500 feet of altitude with 90 knots of airspeed and 21-23" inches of manifold pressure.

(2) One of the following methods, depending upon the circumstances, will be used for actual entry onto the downwind leg after passing the upwind end of the runway: (a) if there are no other aircraft ahead on the upwind leg, you may start a left turn to join the downwind leg, planning the turn from a point so that a normal interval will be maintained behind any aircraft already established on the downwind leg; or, (b) in the event that traffic conditions will not permit an entry into the pattern on the downwind leg in the manner just described, continue ahead, parallel to the traffic outbound from the field, but keeping a safe distance to the right. When you are "number 1" in the pattern, join the traffic on the upwind turn, taking a proper interval on the aircraft ahead, and maintaining 500 feet of altitude and 90 knots of airspeed. You become "number 1" on the upwind leg of a landing pattern when the aircraft ahead either commences its turn to the downwind leg, raises its wheels to depart the field normally, or executes a low-altitude emergency. The proper interval on the aircraft ahead is established by starting your upwind turn when the aircraft turning ahead is on the opposite course just ahead of the port wing tip. This interval will not vary appreciably if both aircraft are at the same airspeed and flying the same basic pattern.

(3) The regulation of the angle of bank in the upwind turn is important in establishing the proper lateral distance from the runway on the downwind leg. The proper lateral distance is attained by superimposing the outboard edge of the red, white, and blue bar of the wing insignia on the center of the runway. This is referred to as a "wing-tip distance" and must be measured from
a wings-level attitude.

(4) You should have ample time to trim the aircraft on the downwind leg and to correct for wind drift. Make sure that the wing tips are equidistant below the horizon.

(5) The standard field entry is completed when the aircraft is abreast the upwind end of the runway headed downwind at 500 feet of altitude, a wing-tip distance from the landing line, and at 90 knots of airspeed.

d. The traffic patterns of outlying fields may be departed by one of the following methods:

(1) If you are in the 1000-foot traffic circle and wish to depart the field, level the wings at any time and fly clear of the traffic circle in normal cruise. Be alert for other aircraft at all times!

(2) If there are no other aircraft ahead in the landing pattern following take-off, retract the wheels when a safe wheels-down landing can no longer be effected on the runway should an emergency develop. At 200 feet of actual altitude, raise the flaps and transition to a 100-knot climb. At 250 feet of altitude and 100 knots, continue climbing, turn right, left, or continue straight ahead. Remain clear of the traffic circle during departure.

(3) When you become "number 1" on the upwind leg, this may occur while you are climbing out or after you have leveled off at 500 feet of altitude, retract the wheels and transition to a 100-knot climb. This will indicate to the pilot in the aircraft behind that you are departing the pattern. Continue climbing, turn right, left, or continue straight ahead. Remain clear of the traffic circle during departure.

(4) A simulated low-altitude emergency may be given by the instructor following take-off at a minimum of 500 feet of indicated altitude. Extreme caution must be used to avoid planes entering the landing pattern or traffic circle during the subsequent climb-out. Should the low-altitude emergency be executed to the left, caution must be exercised following the recovery to remain below the 500-foot landing pattern until clear of the aircraft on the downwind leg. Solo students will not execute a simulated low-altitude emergency as a means of departing a landing pattern.

3-5.2.11 Introduction to Landings

a. A normal landing is the process by which an aircraft ceases to be airborne and comes to rest safely on the runway. Landings may be classified in two major categories: (a) into-the-wind, (b) crosswind. Regardless of which category of landing is made, the aerodynamic factors that limit the conditions under which controlled flight can be maintained remain the same. For this reason, the pilot technique must vary as the direction and velocity of the wind vary in order that full control of the aircraft may be maintained and a touch-down effected on or near a predetermined point on the ground while moving in a predetermined direction.

(1) The first consideration in making a good landing is to make a good approach—the result of careful planning while you are approaching the landing area.

(2) Although the various parts of the landing should eventually become a smooth, continuous process, there are four separate, successive phases: (a) the approach, (b) the flare-out, (c) the touch-down, and (d) the landing roll-out. The proper accomplishment of each succeeding step in the landing process depends, to a great extent, upon how successfully each preceding phase is performed. Remember, a good landing always begins with "a good approach!"

b. A normal into-the-wind landing is accomplished with power, at sufficient airspeed to maintain full control of the aircraft. In the primary phase of training, you will be taught to fly the T-34B aircraft in two "landing configurations" through the four phases of the normal into-the-wind landing: (1) flaps up, wheels down, and (2) flaps fully down, wheels down. The flaps can be set at any intermediate position; however, for training purposes, only the full-up or full-down positions will be used.

(1) Approach: The approach is started from a position a wing tip abreast the intended point of landing at 500 feet of altitude and follows a prescribed, descending, race-track pattern over the ground to a point, 5-10 feet above the ground, where a "flare-out," or landing transition, is started. A constant nose attitude will be maintained throughout the approach and the rate of descent will be controlled by reducing power as necessary. A proper abreast position is vital to a good approach. A close distance (less than a wingtip) is particularly dangerous, as it results in a steep turn in the approach which increased the stalling speed and makes rudder coordination more difficult.

(a) The approach turn must be planned
so that the final straightaway is entered 600-800 feet from the point of intended landing, wings level, with 100-125 feet of altitude. During the approach turn, you should concentrate mainly on flying the aircraft around the pattern to the point where the approach pattern intercepts the final straightaway, or landing line, rather than the intended point of landing. Then, as this point is approached, redirect your attention to the intended point of landing. However, this does not mean that the intended point of landing, the runway, or the landing line are to be completely disregarded. Quite the contrary! Hold your head still, but keep your eyes moving. The problem is one of placing the proper degree of emphasis on each at the right time in the approach.

(b) Balanced flight must be maintained throughout the approach. An unbalanced flight condition increases the stalling speed, gives an erroneous impression of the flight path of the plane, and may cause difficulty during the subsequent flare-out, touch-down, and/or landing roll-out. Fly the aircraft smoothly; avoid sudden or erratic control movements. Remember, good basic air work is mandatory.

(2) Flare-out: the transition to the landing attitude is normally called the flare-out. When you appear to be 5-10 feet above the ground, smoothly apply back pressure to the stick as the aircraft continues to descend. This will cause the nose of the aircraft to rise, thus gradually "breaking" the straightaway-approach glide and initiating the flare-out.

(a) When the nose of the aircraft is raised in a flare-out, the lift is momentarily increased; consequently, the rate of descent is decreased. (The ground does not appear to be coming up as fast.) However, since power is not used to increase the thrust during a landing, the airspeed will be constantly decreasing. This, in turn, will cause the lift to decrease and the angle of the relative wind to increase. In effect, when you execute a landing transition, you are decreasing the airspeed to touch-down speed and at the same time increasing the lift to let the aircraft down gently onto the runway. The flare-out should be executed so that a landing attitude and airspeed are attained just above the runway surface. From this height, the aircraft will gently settle onto the runway.

(b) The rate of upward movement of the nose depends on the conditions of flight, the height of the aircraft above the ground, and the rate of descent at the moment the flare-out is initiated. A high flare-out must be executed more slowly than one from a lower height so that the altitude may be dissipated. Apply back-stick pressure proportionately to the apparent upward movement of the ground. When the ground appears to be coming up rapidly, raise the nose of the aircraft rapidly. When the ground appears to be coming up very slowly, raise the nose slowly.

(c) If you misjudge the apparent upward movement of the ground and think it is coming up faster than it actually is, you may raise the nose too rapidly and cause the aircraft not only to stop descending but actually to start climbing. This sudden climb during the flare-out is known as "ballooning." Ballooning presents a dangerous situation, because your height above the ground is being increased and your aircraft may be approaching a stalled condition. Any time that you balloon excessively, apply full throttle smoothly and execute a wave-off.

(d) When the ground stops coming up toward you, the rate at which you have raised the nose has been too rapid, and you will be too high above the runway. To compensate for this, stop the nose movement and maintain a constant nose attitude until the aircraft again starts descending, and then continue with the flare-out. However, this technique should be used only when you have adequate flying speed. If, however, you have reached the landing attitude and are still well above the ground, do not wait for the aircraft to start descending again. Execute a wave-off and plan another flare-out after a new approach. Remember that when a landing attitude is attained, the aircraft is rapidly approaching a stall, because the airspeed is decreasing and the critical angle of attack is being approached, even though you are no longer raising the nose.

(e) When the nose of an aircraft is lowered, the lift is also decreased momentarily as the nose attitude is changed. This is also true during a flare-out. If you lower the nose of the aircraft when fairly close to the runway to increase the rate of descent, the momentary decrease in positive lift may be so great that the aircraft will land hard on the nose wheel, which may collapse. You should execute a wave-off any time that it is necessary to lower the nose excessively during the flare-out. When it is necessary to lower the nose, this is an indication that you may be too high above the ground and approaching an immediate stall.

(3) Touch-down: The touch-down is the setting of the aircraft gently onto the runway from a landing attitude. As the aircraft settles, the landing attitude must be maintained with back-
PLAN AHEAD
FOR A GOOD LANDING
stick pressure as necessary. If the landing attitude is not maintained, the nose wheel will contact the ground with or before the main gear and the aircraft will probably bounce back into the air. If the aircraft is flown onto the ground with excessive speed in a flat attitude, the same thing will occur. These situations call for immediate pilot action. A very hard or high bounce has only one remedy: application of full power to execute a wave-off. A moderate skip or bounce can usually be corrected by raising the nose to the landing attitude and re-landing the aircraft. Failure to take any corrective action or the use of improper technique such as chasing the nose will result in a "porpoise." A "porpoise" is a condition where the aircraft oscillates in successive bounces, which usually results in an eventual severe nose-wheel-first landing with probable damage to the nose gear.

The rigging will affect the aircraft during the flare-out and landing, just as it does in other conditions of flight. The vertical stabilizer, being fixed at an angle of one degree to the left of the longitudinal axis of the aircraft, will cause the aircraft to tend to yaw to the right when there is no torque unless a slight amount of left rudder pressure is used to keep the nose straight. Although this rigging effect is also present during cross-wind landings, it may not be apparent, because rudder pressure is already being used to compensate for other more prominent factors.

(4) Landing roll-out: The landing roll-out is a very important phase of the landing, because directional control must be maintained throughout the roll. The roll-out is not completed until normal taxi speed is reached or until the aircraft is brought to a stop.

(a) To execute properly this phase of a landing, you must understand what factors may influence the maneuverability of the aircraft after the landing has been made so that you may exercise sound judgment in applying corrections. Some of these factors are a high center of gravity, strong cross-winds and/or gusty winds, swerves, and a low oleo strut. Special precautions will have to be taken any time the wind is a cross-wind and/or gusty, which will be explained later.

(b) Any time there is a change in direction, centrifugal force will cause the center of gravity of the aircraft to be moved outward and away from the direction of the turn. If the turn is severe, centrifugal force may move the center of gravity far enough to cause the outside wing to strike the ground. For this reason, swerves should be avoided whenever possible.

(c) While considering the dominant factors which affect the landing roll-out, it is important to analyze what controls are available to counteract them and what effect they have on the aircraft. There are three control measures, all regulated from the cockpit, which can be used to control the aircraft on the ground. They are rudders, brakes, and ailerons. The throttle is not used to aid the pilot in directional control. Adding power after a swerve has developed may aggravate the condition, because of the effects of torque, thereby increasing the severity of any resulting ground loop. Also, later you will find that the use of power to control swerve in jet aircraft will be of no avail, since jet engines accelerate relatively slowly and with no immediate increase in slipstream. The use of power to recover from a swerve requires the attention of a skilled pilot. Normally, use of the elevators in the landing roll consists in holding the nose off the deck until the speed has decreased sufficiently to permit lowering the nose wheel to the deck; however, it may be considered as a fourth means of controlling the aircraft, since it influences the use of the other three.

(d) The rudder serves the same purpose on the ground as it does in the air: it yaws the aircraft. On the ground, however, this yaw is transformed into directional control; that is, the rudder may be used to initiate a turn or to stop a turn. The effectiveness of the rudder depends on the speed of the aircraft. Immediately after touch-down, when the speed is high, rudder usage is very effective, because the relative wind exerts pressure on the exposed side of the rudder surface and causes an immediate reaction.

(e) The brakes of an aircraft serve the same purpose as the brakes of an automobile, that is, to reduce the speed of the aircraft on the ground. They may also be used as an aid in taxiing, when a sharper turn is required than could be obtained with rudder alone.

(f) During any ground roll, you can change the direction of the aircraft by applying pressure on a single brake or uneven pressures on both brakes. Because of excessive wear on the brake shoes and drums and the high degree of pilot proficiency required, brakes should not be used as a normal means of directional control; brakes should be used to correct for turns or swerves when rudders are inadequate. Caution must be exercised when applying corrective brake action, because it is very easy to over-control. If it becomes necessary to use brakes to slow the aircraft while it is traveling a straight course, apply firm, even pressure to both brakes.
simultaneously, thus preventing unnecessary stress on the nose gear assembly.

(g) The ailerons have a special function in cross-wind landings. However, in normal into-the-wind landings, ailerons should remain in the neutral position. As the aircraft is rolling down the runway, the wings will not be providing sufficient lift to overcome the weight of the aircraft.

(h) Remember this! Almost all difficulties on a landing roll-out can be prevented if you keep the nose of the aircraft moving straight ahead!

c. Cross-wind landings: It is improbable that you will encounter very many ideal landing conditions where the wind is calm or blowing straight down the runway. Many of your landings will be executed in cross winds of various degrees and velocities. For this reason, it is necessary that you have a thorough understanding of the techniques employed in the execution of cross-wind approaches and landings. For the purpose of explanation, the cross-wind landing will be broken into the integral phases of all landings—approach, flare-out, touch-down, and landing roll-out—and explained separately; however, they must be thought of as one continuous landing maneuver.

1) Cross-wind landings: There are several ways of executing a cross-wind landing; however, only one is utilized in the primary flight training program—the wing-low method. It was selected after considerable research as the safest for all pilots, regardless of the type of aircraft being flown. The merits of the wing-low method cannot be overemphasized. It will compensate for wind from any direction; permit you to keep the longitudinal axis aligned with the runway throughout the final straightaway, landing flare-out, touch-down, and roll-out; allow you to utilize the same visual references for the flare-out, since it is very similar to the normal flare-out; and provide an automatic cross-wind correction during the flare-out, touch-down, and landing roll.

(a) After turning onto the final straightaway, establish the proper drift correction by lowering the upwind wing with aileron. The degree that the wing is lowered is governed by the amount of drift that is present. If there is a strong cross wind, the wing will have to be lowered farther than if a light cross wind is encountered. Apply whatever rudder pressure is necessary to keep the longitudinal axis of the aircraft properly aligned with the landing line.

(b) When a turn is entered with aileron alone, the aircraft will begin to slip in the direction of the turn or toward the low wing. After the slip has been established, the nose will begin to turn in that direction, unless rudder is used to keep it from turning. This is exactly what happens when a wing is lowered for drift correction on a cross-wind approach.

(c) In order to remain on the desired approach path, the aircraft must slip back into the wind at the same rate that the wind is trying to move it away from the landing line. This is accomplished by lowering a wing into the wind, and this wing-low attitude must be maintained as long as the cross wind is apparent. If the effect of the cross wind is reduced, this cross-wind correction must also be reduced or the aircraft will begin slipping away from its flight path and into the wind.

(d) On the final approach and throughout the remainder of the landing, keep the longitudinal axis aligned with the landing line, regardless of the amount of cross-wind correction necessary. Use whatever rudder is necessary to keep the nose traveling straight down the landing line. The idea behind the wing-low drift-correction technique is to counteract wind drift and keep the longitudinal axis aligned with the landing line.

(e) The wing-low drift-correction technique differs only slightly from a normal approach. The nose attitude, airspeed, and flare-out are the same as if a cross wind were not encountered. The wing-down condition is maintained throughout the flare-out and landing, thus providing an automatic correction to overcome the tendency of the upwind wing to be lifted and the tendency of the aircraft to weathervane.

2) Cross-wind flare-out: When the point of flare-out is reached, begin breaking the glide smoothly, just as if no wind were encountered. Continue to maintain the cross-wind correction—upwind wing down and rudder to keep the longitudinal axis aligned along the landing line. The nose should be raised smoothly to a landing attitude at a rate proportional to the apparent upward movement of the ground.

(a) Since the airspeed is dissipating slowly as the flare-out progresses, the effectiveness of both the ailerons and rudder is reduced. These are the controls that are being used to correct for the cross wind. Since these controls
are losing some of their effectiveness, it is necessary to increase the movement of these controls and expose more of their surface to the relative wind in order to maintain the same wind-drift correction. In short, as the flare-out is executed, progressively more upwind aileron and opposite rudder must be used to prevent the aircraft from drifting. Not only must the control pressures be increased, but the wind must actually be lowered farther as the airspeed decreases. The lower the airspeed, the more relative effect the cross wind has in causing the aircraft to drift in relation to the ground.

(b) Do not level the wings during the flare-out or touch-down as long as the cross wind is affecting the aircraft. If you level the wings, the aircraft will begin drifting and will touch down in a crab and/or drift. This will cause the center of gravity to be thrown in the same direction of the drift, thus giving the aircraft a tipping or rolling effect in that direction.

(3) Cross-wind touch-down: As the aircraft settles onto the runway in a landing attitude, the actual touch-down will be made on only one of the main wheels. As the forward momentum decreases, the weight of the aircraft will cause the other main wheel to settle onto the runway. The aileron will continue to be held into the wind, and if any difficulty is encountered in maintaining directional control, the nose will be lowered to the deck.

During gusty or high-wind conditions, extreme caution should be used to make certain that the aircraft is not drifting and/or crabbing as the landing is executed. Wave off if necessary, but do not land while drifting or crabbing. A "crab" or drift is a condition that occurs when a touch-down is executed while the longitudinal axis of the aircraft is not aligned with the landing track. Since the aircraft is actually traveling sideways in relation to the ground, it will be given a tipping moment in the direction that the aircraft is traveling. Touching down in a crab or a drift will also cause the aircraft to turn away from the intended landing path. This turn is called a swerve. Any time a swerve develops, centrifugal force will be created commensurate to the speed of the swerve. It is dangerous to land in a crab or drift, because control of the aircraft may be lost momentarily, thus exposing you to other adverse landing factors.

(4) Cross-wind roll-out: It is necessary first to understand the effect wind has on the aircraft during the roll-out before explaining the techniques employed to maintain directional control and to overcome the effect of a cross wind on the landing roll.

(a) When an aircraft is airborne and free from the ground, it is moving through a mass of air, and at the same time moving in the same direction and at the same velocity that the mass is moving. This is true, regardless of the heading and velocity of the aircraft. Therefore, the only wind that is acting on the aircraft is the wind that is created by the aircraft’s movement through the air. This is called the relative wind. It always strikes the aircraft from straight ahead during coordinated flight. Although the wing-low method of correcting for drift during a landing results in a slight slip, for all practical purposes the relative wind may be considered as striking the aircraft from straight ahead.

(b) When an aircraft is on the ground, however, it is unable to move with the air mass. Therefore, the relative wind, as well as the cross wind, is acting on the aircraft. The relative wind is striking it from straight ahead, and the cross wind is striking from one side; somewhere between these two component winds, there evolves a resultant wind. The angle of this resultant wind to the aircraft depends on the velocities and the directions of both the relative wind and the cross wind. As the aircraft slows down during the after-landing roll, the resultant wind moves more broadly (toward the cross wind), because the relative wind from ahead is gradually diminishing, while the cross wind remains the same.

(c) The construction of the T-34B aircraft is such that there is more side area behind the main landing gear than in front. Considering the main landing gear as the fulcrum point and the difference in side area forward and aft of this point, the aircraft will act as a weather vane and try to nose into the wind. This tendency of the aircraft to turn into the wind is called “weather-vaning” or “weather-cocking.”

(d) It is easy to understand that this weather-cocking tendency becomes more prominent as the forward speed of the aircraft dissipates. You should consequently understand the importance of using rudder and/or brake (as necessary) to maintain directional control during the roll-out.

(e) If the increasing angle of the resultant wind is considered, you should realize the importance of moving the aileron farther into the wind as the aircraft rolls down the runway and the forward speed diminishes. It is equally important, however, that the aileron not be used to the extent that the desired flight attitude is chang
ed. In short, use enough aileron to prevent the cross wind from lifting that wing, but not so much that the wing will start coming down.

(f) Another reason for using aileron into the wind on the roll-out in a cross-wind condition is that the aileron control surface that is moved down is on the downwind wing and, acting as a torque arm, helps to counteract the weathercocking tendencies of the aircraft. Since the lowered aileron creates drag, and since its location near the tip of the wing gives it quite a turning force, it assists the down-wind rudder in compensating for the weather-vane effect.

(g) During the roll-out, use the same technique to maintain directional control and to keep the wings level that was outlined for a normal into-the-wind roll-out. Use the rudder and the brakes (if necessary) to keep the aircraft rolling straight along the landing line. In addition, maintain aileron (stick) into the cross wind.

3-5.2 12 Full-flap Landings

a. A full-flap landing involves a 180-degree power approach started from a position abeam the intended point of landing. This type of approach develops the student's judgment and ability to control his rate of descent with power over a given distance, following a prescribed pattern over the ground under varying wind conditions. It develops consistency in landing the aircraft on or near the intended point of landing.

b. Following the standard field entry, enter the landing pattern by joining the traffic on the down-wind leg, with the proper interval between aircraft, at 500 feet of altitude, 50 knots of airspeed, and the flight path of the aircraft parallel to the landing line at a wing-tip distance. When approaching the upwind end of the runway, check wheels, brakes, and parking brake, and, if on a dual flight, report to your instructor when abeam the upwind end of the runway, "Wheels indicate down, brakes firm, parking brake on, temperatures and pressures normal (if temperatures and pressures are within limits), air." Just prior to reaching a position abeam the point of intended landing, retard the throttle to 16 inches of manifold pressure, place the propeller control in the full increase position, lower full flaps, and make the transition to an 80-knot gliding attitude. When abeam the point of intended landing, start a gradual turn toward the landing line and trim for an 80-knot approach.

(1) Control the rate of descent with gradual throttle reductions and vary the angle of bank as necessary to intercept the landing line with 100-125 feet of altitude, 600-800 feet of straightaway, and 70 knots of airspeed. Continue the approach with the longitudinal axis aligned along the landing line, and when at an altitude of 5-10 feet, if any power remains, smoothly close the throttle while effecting the landing transition (flare-out).

(2) Gradually increase the nose attitude until it is slightly above the taxi, or level-flight, attitude while dissipating the remaining attitude. Maintain this landing attitude until the main wheels contact the ground. As soon as the main wheels are firmly on the runway and the aircraft is rolling straight ahead, hold the nose wheel off the runway in the landing attitude with smooth application of the necessary back-stick pressure. Keep looking out both sides of the cockpit so that you may recognize immediately any tendency of the aircraft to swerve. Maintain directional control with the rudder, using brakes only if the rudder movement is not sufficient to control heading. As the speed decreases, but while rudder control is still available, permit the nose wheel to lower gently onto the runway by slowly relaxing the backstick pressure. The landing roll-out is completed when the aircraft reaches taxi speed.

(3) When practicing touch-and-go landings, take-off power is applied before the nose wheel lowers to the runway during the landing roll-out. In this case, the landing attitude becomes the take-off attitude as the throttle is advanced.

(4) After becoming airborne during the take-off, maintain the take-off attitude until the airspeed has accelerated to 70 knots, then smoothly raise the nose to, and maintain, a 70-knot climbing attitude. Upon reaching 200 feet, actual altitude, raise the flaps and establish an 80-knot climb. The wheels are left in the down position during touch-and-go landing practice. The upwind turn may be started as traffic permits, but not before ascending to an actual altitude of 250 feet. Level off at 500 feet of altitude and make the transition to 90 knots. As soon as 90 knots are attained, reduce throttle to 21-23 MP and rpm to 2200.

(5) Under ideal conditions, the throttle should be reduced gradually throughout the approach. Then, as the nose of the aircraft is raised to the landing attitude, the remainder of the power should be removed; that is, close the throttle at the same rate at which the nose is raised so that the landing attitude and a power-off condition are reached simultaneously. However, it is not always possible to arrive at the point of flare-out with power, since gusty wind conditions and/or thermals in the approach may have neces-
Retard throttle as necessary throughout approach

Straightaway
100' - 125' alt.
600' - 800' to landing

Transition point
5' - 10' alt.

Touch-down

Abeam
Start approach turn
80 knots

Just prior to abeam position
1. Reduce power to 16" M.P.
2. Place prop. full increase rpm
3. Lower flaps

Downwind leg
Altitude: 500
Airspeed: 90 knots
Power: 21" - 23" M. P.

FULL-FLAP LANDING
stated a throttle reduction which was more rapid than normal. In the event that the throttle was reduced too rapidly during the approach with a correspondingly greater loss of altitude than normal, so that you are low turning into the straightaway, do not raise the nose to stop the loss of altitude. First add power, then raise the nose slightly to maintain the desired airspeed, and slow or stop the rate of descent, depending on the amount of power added. It is always permissible to add power to maintain safe flight.

(6) The velocity and direction of the wind in relation to the landing line affect three factors which are controllable by the pilot: (a) rate of roll into the approach turn, (b) the angle of bank finally established in the turn, and (c) the rate of throttle reduction. The key word in establishing the proper angle of bank from the 180-degree position is "start." If the wind is strong, then the rate of roll into the approach turn will be rapid to prevent the wind from drifting the aircraft too far downwind or too "deep." This condition may not become apparent to the unpracticed eye until after approximately 90 degrees of turn. If the wind is light, the rate of roll into the turn will be relatively slow. If the rate of roll into the turn is too rapid or the angle of bank too steep, you will be flying a track inside the approach pattern and will have to level the wings and fly toward the landing line on a more or less straight course and at an angle; this is a common error and is called an "angling approach." On the other hand, if the rate of roll into the turn is too slow or the angle of bank too shallow, the aircraft will follow a path outside the approach pattern, resulting in a deep approach and a long straightaway. In both cases, if corrections are not initiated early enough in the approach turn, a steep turn onto the landing line will be necessary with danger of crossing, or overshooting, the landing line. In this event, do not "S" turn back to the landing line—execute a waveoff.

(7) In any normal landing, the touch-down is made in the first third of the runway. As the aircraft touches down on the runway, make sure that it is going straight ahead; that is, make sure that the longitudinal axis of the aircraft is aligned with the landing line. If the aircraft is allowed to touch down while moving sideways (drifting or crabbing), not only will excessive stress be imposed on the landing gear, but a swerve may develop. Maintain directional control with the rudder, augmented, as necessary, with the brakes.

(8) During the take-off, be alert for torque and trim accordingly. Since the trim-tab settings for a rolling take-off will not have been preset, as in a take-off from a standing start, considerable retrimming, especially of the rudder, will be necessary in order to relieve the excessive control pressures and maintain balanced flight.

(9) As the flaps are retracted during the climb-out, acceleration will be sufficient to offset the tendency for the aircraft to sink as the result of the decrease in lift, provided, of course, that the aircraft is in a 70-knot climb, the engine is developing full power, and a constant nose attitude is maintained.

(10) When you level off at 500 feet, ease the nose over to permit the airspeed to increase to 90 knots and then retard the throttle to 21-23" inches of manifold pressure to prevent the airspeed from increasing or the aircraft from gaining altitude. A common student error is to retard the throttle immediately upon reaching the pattern altitude, thereby delaying the transition to 90 knots. This practice not only interferes with proper interval maintenance between aircraft, but is poor basic air work and poor headwork.

3-5.2.13 Simulated High-altitude Emergency Procedure

a. A high-altitude emergency is an emergency which occurs above 1500 feet of altitude. For instructional purposes, your instructor will normally initiate the simulated high-altitude emergency at or above an altitude of 2500 feet.

b. The pilot of an aircraft must be prepared at all times to cope with the emergencies which may arise should he experience a partial or complete engine failure. To develop this "preparedness" in your pre-solo flight training and supply a basic technique by which a safe landing may be effected, according to the prevailing conditions, your instructor will introduce the simulated high-altitude emergency. Following the introduction, you will be given a simulated "high-altitude emergency" on every dual flight during your primary flight training to prepare you to act promptly and efficiently in the event of an actual emergency. Practicing simulated high-altitude emergencies develops accuracy, judgment, planning technique, and confidence. Normally, you will never know in advance when a simulated "forced landing" will be given, so be alert at all times to the possibility of your instructor's giving you one. Probably at no other time in your training will your ability to use calm judgment be more severely tested.

(1) The simulated high-altitude emergency procedure will simulate, insofar as possible, the
actual characteristics of the aircraft with a "dead" engine. The simulated forced-landing condition will establish a glide ratio and rate of descent similar to that encountered in an actual emergency and forced landing. The simulated approach will allow you to descend low enough to determine approximately where the aircraft would land under actual conditions.

(2) An alert pilot is constantly on the lookout for suitable forced-landing fields, one of which he would have to select in the event of an actual emergency. Naturally, the perfect forced-landing field is an established airfield. The next best substitute is a hard-packed, long, smooth field with no high obstructions on the approach end, but, since these are not readily found in many places, you must be able to select the best available field. Cultivated fields are usually good. Plowed fields are good if you land with the furrows. Avoid selecting fields which contain boulders, ditches, or large trees.

(3) There are many factors to consider in determining how long a field is needed on which to land an aircraft. When you are landing into a strong wind on a level field, the distance needed for landing may be only a small fraction of the distance which would be required if you were landing downwind. If you are landing upslope, the aircraft will decelerate rapidly. Try to select a field that is wide enough to permit you to correct for errors in altitude and distance by varying the final approach turn.

(4) If it is impossible to land into the wind because of low altitude or because a suitable field is not available, then land crosswind or downwind. A large field that is cross-wind, or even downwind, may be better than a smaller field which is directly into the wind.

(5) Always be aware of the direction from which the wind is blowing. Wind direction can be determined in several different ways. Other than the wind indicators at an established field, the best indication of wind direction is blowing smoke. If the smoke rises for a short distance and then abruptly flares out close to the earth in a straight line parallel to the ground, the wind velocity on the surface will be fairly high. Grass and grain fields will ripple in the direction of the wind. Blowing dust is another excellent wind indicator. If you are unable to determine wind direction by any of these means, use the direction of the wind at the time of your last take-off.

c. The instructor will initiate the simulated high-altitude emergency in only one way—by closing the throttle. The student pilot will then execute the following procedures immediately and in sequence:

(1) Commence a transition to a 90-knot gliding attitude.
(2) Check the wheels and flaps up.
(3) Select the most desirable landing area.
(4) Place the propeller control in full
increase rpm; check the mixture full-rich.
(5) Trim the aircraft for the 90-knot gliding attitude.
(6) Fuel boost pump switch ON.
(7) Open the canopy.
(8) Make a systematic cockpit check to determine the cause of the emergency.
(9) Make an ICS voice report to the instructor stating:

(a) Identification (This is 2S_.__).
(b) Position and altitude (Over____ at____ 000 feet).
(c) Type of emergency and cause
(simulated engine failure caused by______).
(d) Intentions (Will bail out or attempt a landing at______).
(e) Wind direction (Wind from the______).
(f) Landing direction if applicable
(Will land to the______).
(g) This is a simulated emergency.

d. If your airspeed is above 90 knots when your instructor closes the throttle, you should accomplish the above cockpit procedures while maintaining altitude and waiting (transitioning) for the airspeed to decrease to 90 knots. If, however, the airspeed is at 90 knots or lower, the nose of the aircraft must be lowered immediately to maintain a safe flying speed and the cockpit procedures accomplished during the glide.

(1) Glide the aircraft toward the desired landing field, clearing the engine with a momentary throttle advance during each 500 foot loss of altitude. Adjust the glide path to fly over the intended point of landing at 1500 feet actual altitude headed in the direction of landing. If the arrival over the intended point of landing is made above 1500 feet, use 360-degrees or spirals, right or left, to dissipate the excess altitude, varying the angle of bank as necessary to arrive again over the intended point of landing at any 1000-plus-500-foot altitude; and finally, to arrive at the high key.

(2) Upon reaching the high key, lower the landing gear, transition to an 85-knot glide, and execute a right or left gliding turn which will place the aircraft at a position abreast the point
of intended landing at a wing-tip distance, on a heading 180 degrees to the direction of landing and with approximately 1000 feet of altitude. This portion will be referred to as the low key. Complete the landing checklist prior to 90-degree position and report, "Wheels indicate down, landing check-off list complete, sir." Continue the gliding approach, making an 'S' turn if necessary in order to enter the final straightaway with a minimum of 200 feet of altitude and 800 feet from the point of intended landing. Lower the flaps when it is apparent that a safe landing can be effected in the first third of the field. With the flaps extended transition to and maintain 75 knots of airspeed while descending to the point where the landing transition is started.

(3) The minimum (and mandatory) wave-off altitudes at which simulated high-altitude emergencies are to be completed are as follows:

(a) Farmer's fields .... 350' indicated or 200 feet actual, whichever occurs first.
(b) Navy fields (other than ELP and T-2 field) .... 1500 ft.
(c) Emergency landing practice (ELP) and T-28 field .... 2000 feet.

(4) Your instructor is responsible for initiating the wave-off at the completion of a simulated emergency. This will be done by the instructor's taking physical control of the aircraft and executing the wave-off at the time the minimum altitude is reached.

When the simulated emergency is taken to a farmer's field, the wave-off will be executed at a minimum altitude of 200 feet actual or from 350' indicated, and from whatever position is reached in the approach pattern. The instructor will make the transition to a normal climb and proceed straight ahead across the field along the landing line. Departure will be made in the direction which affords the best field in which another emergency landing could be made in case of engine failure. In the event that there are no other suitable fields near, climb out around the field just utilized and "break away" when reaching 1000 feet of altitude. The instructor will normally transfer control of the aircraft to the student after attaining the 100-knot climb.

e. Things to remember: The following should be kept in mind at all times:

(1) If a field is within a wing tip's distance, it is usually within the gliding range of your aircraft.

(2) Clear the engine during each 500-foot loss of altitude during power-off descents.

(3) Keep your aircraft over the selected landing field. Do not permit the wind to drift you away from the field.

(4) If your gliding airspeed is too fast, you may overshoot the field; if it is too slow, you may undershoot and even stall on the final approach.

(5) Do not change your mind at the last minute about your selected landing field. You will be rushed, and may be forced to make turns at a dangerously low altitude.

(6) It is mandatory to hit the high key; however, the other check points are to help you plan your approach.

(7) If your approach has been properly planned, you should never need to use more than a medium angle (20-30 degrees) of bank.

(8) Strict adherence to the minimum wave-off altitudes is mandatory.

(9) Trim the aircraft as necessary and maintain balanced flight.

(10) All emergency landings require good judgement in selecting a field, maintaining a constant glide, and planning the letdown and approach turn. Your instructor will probably initiate simulated high-altitude emergencies over areas in which only one field is suitable for landing, thereby making it imperative that you use the utmost skill and judgment in maneuvering the aircraft to a position from which a safe landing can be effected.

3-5.2.14 Simulated Low-altitude Emergency Procedure

a. A low-altitude emergency is one which occurs below 1500 feet of altitude. It is normally associated with a loss of power immediately following take-off, or following a wave-off from a simulated high-altitude emergency.

b. Practicing low-altitude emergencies develops the judgment, accuracy, coolness, and planning technique required to accomplish promptly and properly a successful landing, wheels down, in any available area, should an actual emergency occur. This maneuver will be initiated by the instructor's closing the throttle, and will not be given below 500 feet of indicated altitude. The aircraft will not be permitted to descend below.
Engine Failure on Take-off

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200 feet of actual altitude or 350 feet indicated above the terrain on any simulated low-altitude emergency. Wave-off procedures are the same as from a high-altitude emergency.

c. When your instructor closes the throttle at low altitude, execute the following procedure:

(1) **Immediately make the transition to a safe gliding attitude.**
Remember, you will probably be in a climbing attitude when the low-altitude emergency occurs; hence, you must immediately lower the nose of the aircraft to establish a safe gliding attitude. Any delay in lowering the nose will result in a dangerously rapid rate of deceleration; consequently, the aircraft will very rapidly approach its critical angle of attack.

(2) **Select a landing field.** Your selection of the best available field will depend upon your altitude, geographic location, and knowledge of the surrounding terrain. Your decision must be expeditious and final. In any event, if an actual emergency should occur immediately following take-off, DO NOT attempt to turn back into the field you just left. If sufficient altitude is available, make coordinated, shallow-banked turns to line up into the wind, if possible, and/or fly to a selected landing area.

(3) **Place the propeller in full increase rpm.**

(4) **Check canopy open.**

(5) **Blow open if actual.** Gear will be lowered prior to touchdown or prior to the wave-off in the event of a simulated emergency.

(6) **Lower the flaps.** The flaps are important for two basic reasons: (1) They increase the glide angle, thus increasing the rate of descent without increasing the airspeed. (2) They permit the aircraft to land at as slow an airspeed as possible, thereby reducing the force of impact on landing. However, flaps should not be lowered until it is apparent that the selected landing area will be made.

(7) **Lower gear prior to touchdown or whenever field is made.** Land gear up in water or swampy terrain.

d. The smart pilot always plans ahead. You will be flying from comparatively few fields during your primary training and it will behoove you to become familiar with the terrain features and suitable landing areas in the immediate vicinity of the home and outlying fields.

3-5.2.15 **Precision Spin**

a. A spin is an aggravated stall that results in autorotation. The aircraft describes a corkscrew path in a downward direction. One wing has more lift than the other, and the aircraft is forced downward by gravity, pitching, rolling, and yawing as it descends in a spiral path. In all normal spins, you have control of the lift and drag of both the rudder and the elevator. Manipulation of these controls will permit you to cause, maintain, or remove the conditions of a spin. A spin is very easy to perform, and recovery can be just as easily effected. This maneuver places no excessive loads or stresses on the aircraft when properly executed.

A precision spin is one in which recovery is initiated after two (2) turns, on the same heading as that on which the maneuver was entered.

b. You will be taught to perform spins so that you will be able to recognize an entry, and be able to recover promptly and automatically from intentional and unintentional spins. Being able to perform spins will actually increase your confidence in yourself and the aircraft and improve your orientation in unusual attitudes. In this respect, spins are an excellent introduction to aerobatics. Practice them both to the left and right.

c. To perform a spin, complete the stall check-off list and establish the aircraft in straight and balanced flight lined up with a road or section line. Start the spin at an altitude which will ensure that the aircraft can be returned to normal flight, fully under control, no lower than 3000 feet above the terrain. Minimum altitude to start the spin is 4500 feet.

(1) Since considerable altitude will be lost in the spin, be sure that the area below is clear of other aircraft or clouds by making clearing turns. The last 90° of clearing turn must be made in the direction of spin. At the start of the last 90 degrees of clearing turn, close the throttle. Complete the clearing turn at 75 knots of airspeed, the nose 15 degrees above the normal cruise attitude, wings level, and in balanced flight. Maintain this attitude, and immediately prior to the stall, apply (lead in) rudder smoothly in the desired direction of spin. The nose will begin moving in that direction, and when you feel the aircraft stall, apply full rudder and smoothly bring the stick straight and fully back. Hold full back stick and full rudder with the spin. Do not use aileron in the entry, during the spin, or before the rotation stops on
recovery.

(2) To remain oriented during the spin, use ground references such as roads, section lines, landmarks, etc. You began the spin while lined up with one of these references, so watch for this point of reference as the aircraft rotates. Each time the reference point passes the nose, you have made one turn. Count the number of turns so that you may perform a precision maneuver. Do not stare directly over the nose, but look out toward the horizon at an angle. Also look in the direction of the spin for the approaching reference point or line. Follow it briefly as it moves past the nose.

(3) In a two-turn precision spin, you will be required to initiate the recovery at completion of the second turn.

d. To recover from a spin, first apply positive opposite rudder to the neutral position. Follow immediately with stick to the neutral position with a positive straight-forward motion. Do not "pump" the stick, and do not use alleron at this point. Maintain the recovery controls until the rotation stops, making certain that the aircraft is not in a diving attitude without skidding. Recover from the dive by smoothly applying back-stick pressure and raise the nose to the horizon. Apply throttle to conserve altitude as the nose reaches the horizon.

(1) Be careful not to apply excessive back-stick pressure immediately after the rotation stops. Sometimes a student does this because he is too anxious to raise the nose to the horizon. To do so may cause a secondary stall, resulting in another spin more violent than the first one. Recover with a minimum loss of altitude, but smoothly. In a good recovery, the airspeed will not exceed 140 knots.

(2) Do not use alleron pressure during the entry, the spin, or the recovery. After the rotation is stopped, however, the wings may not be level with relation to the horizon. Use alleron pressure to level the wings as the nose is raised to the horizon. The aircraft has now regained full flying speed and this is simply good coordination. But remember that this is not done until after the rotation has been stopped.

3-5.2.16 Wave-off Technique

a. Frequently, during your landing practice, you will have to discontinue an approach for reasons of safety and execute a wave-off, which is climbing to a safe altitude, and which may or may not include a field departure, depending upon the circumstances. Specific wave-off and field departure patterns are applicable to certain fields, depending upon the field's utilization. For example, although basically the same in procedure and purpose, the wave-off pattern used at a runway field will differ slightly from the one used at a special turf field and/or an ELP field. The correct wave-off patterns are outlined in the local course rules and it is your responsibility to know these procedures and to follow them explicitly any time you must take a wave-off.

Regardless of the wave-off pattern prescribed, there are certain factors common to all wave-offs. This section will be directed to the pilot technique and the sequence in which these factors are accomplished.

b. Although a landing approach may be aborted at any point in the pattern, a wave-off will usually be executed during the approach turn, in the straightaway, or during the landing flare-out. Of course, the sooner a poor landing condition is recognized and the wave-off executed, the safer it will be. If at any time your approach does not feel comfortable or you are too close to the aircraft in front of you, "take it around again." You should not wait until the last second to make a decision. Occasionally, however, poor judgment or technique during the landing touch-down may require a wave-off. For instance, a bounce, a high level-off, or some other unforeseen exigency would preclude an earlier wave-off. But regardless of the height above the ground, a safe wave-off may be executed if properly flown.

c. The correct procedure for executing a wave-off is as follows: (1) Advance the throttle smoothly and firmly to the full open position. (2) Simultaneously level the wings, maintaining directional control and balanced flight, and maintaining the nose in a safe climbing attitude. (3) Trim to relieve excessive control pressures. (4) Clear the landing area. (5) Raise the landing gear and flaps at home field and ELP fields. Leave gear down at touch-and-go fields.

d. Since the flight conditions at the point of the wave-off govern the proper pilot technique, each step in the procedure will be explained separately.

(1) Throttle usage: The throttle is always advanced to the full open position on a wave-off. Make this a habit! It will pay off during your advanced and operational flying in heavier aircraft. Advance the throttle smoothly and firmly. Abrupt use of the throttle may cause the engine to "sputter" or fail completely.

(2) Directional control and balanced flight:
Since the aircraft will usually be trimmed for a gliding attitude, the nose will rise sharply and veer to the left unless firm control pressures are maintained. As the throttle is advanced, forward-stick pressure must be held to keep the nose in a safe climbing attitude; right rudder must be simultaneously increased to keep the nose straight -- to overcome both left-rudder trim and the prominent effects of torque. The importance of maintaining directional control and balanced flight during a wave-off cannot be overemphasized. Turning, skidding, or slipping all tend to diminish the effectiveness of lift. This becomes especially significant at low airspeed when both the landing gear and the flaps are down.

(3) **Trim:** After the throttle has been advanced, you should roughly trim the aircraft to remove most of the excessive control pressures. Do this quickly. Remember, this is only a rough trim and you will probably have to continue holding some control pressures. Hold the aircraft in the proper climbing attitude, regardless of the amount of pressures that must be used.

(4) **Clearing the landing area:** The landing area is cleared in accordance with the prescribed wave-off pattern for that particular field. The wave-off pattern must be strictly adhered to! It may involve a climb straight ahead, or a turn in either direction to parallel the runway, and a level-off at 3000' altitude, until the field boundary is reached and/or until you are clear of the pattern traffic.

Should the wave-off pattern require that you clear the runway, smoothly roll into a very shallow bank and turn approximately 20 degrees. When you are well clear of the runway, execute another shallow-banked turn to align the aircraft parallel to the runway. If the aircraft is not aligned with the runway (or landing line) at the time that the wave-off is initiated, do not attempt to realign it immediately, but concentrate primarily on maintaining a safe climbing attitude and keeping the aircraft flying straight. After sufficient altitude and airspeed have been gained, you may then realign it, if necessary.

(5) **Raising the landing gear and flaps:** At ELP fields, the landing gear will be retracted following a wave-off when a safe wheels-down landing can no longer be made on the remaining runway or landing area should an emergency develop, or as local course rules direct. At home field, raise gear as waveoff is initiated. After flying clear of the runway, or climbing straight ahead, depending upon the pattern procedures prescribed for that field, raise the flaps at an actual altitude of 200 feet.

3-5.2.17 **Wind Effect and Drift Correction.**

a. Inasmuch as the aircraft flies in an air mass, any movement of this air mass affects the course of the aircraft. In other words, the path of the aircraft over the ground will be determined not only by the direction in which it is headed, but also by the direction and velocity of the air mass movement. In perfectly still air, for example, the nose of the aircraft points exactly in the same direction as its path over the ground. Or to put it another way, the path of the aircraft through the air and its path over the ground coincide. However, you will notice that the aircraft does not always follow a course over the ground in same direction the nose is pointed.

You have probably, at one time or another, been flying parallel to a road or section line. The longitudinal axis of the aircraft was aligned perfectly with this road or section line and you were flying a straight and level course. Suddenly, you realized that the aircraft was getting closer to the road or had actually crossed it, without any turn having been made. This would indicate to you that the air in which you were flying was moving in a direction which caused the aircraft to cross the road at some angle. Since the aircraft is buoyed by the air mass in which you were moving, it tends to move with the air mass in the same direction and at the same velocity.

b. Suppose you were flying along straight and level and the wind were blowing 30 knots from your left and at 90 degrees to the direction your aircraft was pointed. At the end of one hour, the body of air in which you were flying would have moved 30 miles to your right. Since the aircraft was in this body of air, and moving with it, you and the aircraft would also have drifted 30 miles to your right in one hour. Of course, in relation to the air mass itself, you would have moved forward only; but, in relation to the ground, you would have moved forward and 30 miles sideways. This effect of the movement of the air on the track of the aircraft is known as drift. The difference between the actual heading of the aircraft and its track over the ground is called the angle of drift. Drift must be compensated for in order to cause the aircraft to maintain a desired course over the ground.

c. The proper way to correct for drift, when you are flying in straight and balanced flight and wish to follow a desired ground track, is to make a shallow balanced turn into the wind. When you seem to have the drifting effect neutralized, or stopped, return to straight and balanced flight. The aircraft is now pointed into the wind slightly. This causes the aircraft to fly into the wind at the
same rate that the wind is trying to move it sideways. Since the effect of drift has now been neutralized, the aircraft will fly a straight and selected ground track. The nose of the aircraft, however, is not pointed in the direction of the ground track, but is pointed slightly into the wind and away from the ground track. This is known as drift correction, and is usually referred to as crabbing, because the aircraft is moving sideways in relation to the ground.

d. There will be times when you will want to correct for drift while in a turn, for example, when in a landing approach. As you know, the wind in relation to the ground will be acting on the aircraft from constantly changing directions when the aircraft is turning. The length of time you remain in any particular part of a turn, in order to make a certain ground track, or pattern, is governed by the direction and the velocity of the wind. At times, the wind will be blowing opposite to the direction of turn, and at other times, it will be blowing in the same direction.

(1) To be able to fly correct ground patterns, and to make safe landings under all types of wind conditions, you must be able to recognize and analyze correctly drift at all times and to make any corrections necessary to maintain a desired path over the ground.

(2) In order to illustrate drift and assist you in understanding its effect on an aircraft in flight, your instructor will fly the aircraft around a rectangular course over the ground, or he may execute "S" turns along a road or section line or figure 8's over a road to demonstrate the varying angles of bank necessary to compensate for drift in a turn.

3-5.2.18 No-flap Landing

a. A no-flap landing involves a 180-degree power approach started from a position abeam the intended point of landing, without the use of flaps. This type of approach develops the judgment and ability of the student to control his rate of descent over a given distance following a prescribed pattern over the ground. It familiarizes the primary student with the feel of the aircraft in the no-flap configuration. A no-flap approach would be necessary in the event of electrical failure where flaps would not be available, or under certain conditions, such as high or gusty winds, that might require that an approach and landing be made without flaps.

b. Following the standard field entry, enter the landing pattern by joining the traffic on the downwind leg, with the proper interval, 500 feet of altitude, 50 knots of airspeed, and at a wing-tip distance from the landing line. When abeam the upwind end of the runway, check and report, "Wheels indicate down, brakes firm, parking brake in, temperatures and pressures-normal, Sir." Just prior to the abeam position, retard the throttle to 16 inches of manifold pressure and place the propeller control in the full increase rpm position and make the transition to an 85-knot gliding attitude. When abeam the intended point of landing, start a gradual turn toward the landing line and trim the aircraft for an 85-knot power approach. Control the rate of descent with gradual throttle reductions and vary the angle of bank as necessary to intercept the landing line, wings level, with 100-125 feet of altitude and 500-800 feet from the intended point of landing.

(1) Continue the approach at 80 knots, straight along the landing line, and when at an altitude of 5-10 feet, if any power remains, smoothly close the throttle and start the landing transition. Gradually increase the nose attitude until it is slightly above the taxi (nose wheel just off the dock), or level flight, attitude, while dissipating the remaining altitude. Maintain this landing attitude as the aircraft settles onto the runway on the main wheels. With the aircraft rolling straight ahead, hold the nose wheel just above the runway in the landing attitude with smooth application of the necessary back-stick pressure. Be alert for a swerve, maintaining directional control with the rudder, using brakes only if the rudder control is not sufficient to maintain heading. As the speed of the aircraft decreases, but while rudder control is still available, permit the nose wheel to descend slowly and gently onto the runway. The landing roll-out is completed when the aircraft has slowed to taxi speed.

(2) In planning the approach, take into consideration the shallow glide angle and the increased gliding ratio due to the absence of drag from extended flaps. Throttle reduction will be faster in this type of approach, as compared with the full-flap approach, because of the tendency of the aircraft to glide farther in the no-flap configuration.

c. When practicing touch-and-go no-flap landings, take-off power is applied before the nose wheel lowers onto the runway during the landing roll-out. In this case, the landing attitude becomes the take-off attitude as the throttle is advanced. Do not attempt a take-off unless the landing roll-out is under control.

(1) After becoming airborne, maintain the
Retard throttle as necessary throughout approach

80 knots

Straightaway
100' - 125' alt.
600' - 800' to landing

Transition point
5' - 10' alt.

Touch-down

Abeam Start approach turn.
85 knots.

Just prior to abeam position
1. Reduce power to 16'' M.P.
2. Place propeller full increase rpm.

Downwind leg

Altitude: 500'
Airspeed 90 knots
Power: 21'' - 23'' M.P.

NO-FLAP LANDING
take-off attitude until the airspeed has accelerated to 80 knots, then smoothly raise the nose to the 80-knot climbing attitude. Be alert for the effects of torque as power is applied and during the take-off and trim the aircraft accordingly. The wheels are left in the down position during touch-and-go landing practice.

(2) The upwind turn may be started as traffic permits, but not before reaching an altitude of 250 feet and the end of the runway in use. Level off at 500 feet and make the transition to 90 knots, retarding the throttle to 21-23” inches of manifold pressure as 90 knots of airspeed are attained. Reset prop to 2200 rpm.

3-5.2.19 Cross-wind Landings

a. A landing which is not directly into the wind is called a cross-wind or out-of-the-wind landing. It is necessary that the student aviator be able to cope with such a situation, since frequently circumstances such as obstructions, shape of the landing field, and shifting winds make cross-wind landings necessary. In fact, it is improbable that you will encounter many landing conditions where the wind is calm or blowing straight down the runway or landing line. Many of your landings will be executed in cross winds of various degrees and velocities. When flying solo, you will not be allowed to practice landings at outlying fields if there is a cross wind which exceeds certain limits. These limits are defined in your local course rules. Know them! Normally, the wind condition in which you will be flying will require relatively small cross-wind correction and should give no cause for apprehension.

(1) However, you must have a thorough understanding of the techniques employed in effecting cross-wind approaches and landings, and you must be proficient in their execution. You will develop this proficiency through practice with your instructor at outlying fields which are assigned expressly for this purpose. The traffic pattern at cross-wind fields is identical to the pattern used at into-the-wind fields, except that the landing line is placed at an angle to the wind line. The permissible degree of divergence of the wind line from the landing line is dependent upon the velocity of the wind.

(2) 3-5.2.11 (Introduction to Landings) contains a detailed explanation of cross-wind landing techniques. An intelligent review, on your part, of the material presented in that paragraph is necessary at this point.

b. Following the standard field entry, enter the landing pattern by joining the traffic on the downwind leg, with the proper interval between aircraft, at 500 feet of altitude, 90 knots of airspeed, and with the flight path (not the longitudinal axis) of the aircraft parallel to the landing line at a wing-tip distance. In order to make the track on the downwind leg parallel to the landing line, it is necessary to establish a "crab" to counteract drift. You will recall that this is accomplished by making a balanced turn into the wind to set up a heading in straight and balanced flight which will correct for the drift. When abreast of the runway end, check wheels, brakes, and parking brake, and report to your instructor, "Wheels indicate down, brakes firm, parking brake in, temperatures and pressures normal, sir." Maintain 500 feet of altitude and a track parallel to the landing line at a wing-tip distance as you continue in a normal pattern to the abreast position. Full or no flaps will be used, depending upon the degree of divergence and velocity of the cross wind.

(1) In either the full- or no-flap approach, start a turn toward the landing line when abreast the intended point of landing. Trim the aircraft for the proper power/approach airspeed. Control the rate of descent by gradually retarding throttle; vary the angle of bank as necessary to intercept the landing line with 100-125 feet of altitude and 600-800 feet of straightaway from the intended point of landing. Remember, fly the same prescribed pattern over the ground that you would during into-the-wind landings.

(2) When retarding throttle, take into consideration the fact that wind direction and velocity combine to produce an effective force which acts on the aircraft. During the approach turn, if the wind is drifting the plane toward the landing line, as in a left cross-wind condition, it is necessary to make a more rapid reduction in power than normal in order to achieve the proper rate of descent relative to the rate of closure toward the landing line. To fly the correct pattern and to avoid being drifted past the landing line (overshooting) in the final phase of the approach, make a shallow turn from the 180-degree position and then steepen the angle of bank as you approach the 90-degrees position. Hold this steeper bank to the straightaway to avoid overshooting. If the wind tends to hold the aircraft away from the runway (right cross-wind), it is necessary to make a slower reduction of power to achieve the proper rate of descent, since the relative rate of closure toward the landing line is less. Under this condition, the angle of bank must be decreased in the last 90 degrees of the approach turn in order to maintain the desired track to the landing line and prevent an "undershoot."
c. Upon rolling out into the straightaway, level the wings and hold the aircraft in balanced flight with its longitudinal axis aligned with the landing lines. Quickly observe the magnitude of the drift and immediately establish the proper drift correction by lowering the upwind wing with aileron—just enough to counteract the drift. At the same time, coordinate opposite (top) rudder pressure as necessary to keep the nose of the aircraft going straight down the runway. The degree to which the upwind wing is lowered and the amount of opposite (top) rudder pressure applied are governed by the amount of drift present. If there is a strong cross wind, the wing must be lowered farther than if a light cross wind is encountered.

(1) In order to remain on the desired approach path, the aircraft must be slipped back into the wind at the same rate that the wind is attempting to move the plane away from the landing line. If the effect of the cross wind is reduced, as between gusts or by trees or other low-altitude obstructions, the cross-wind correction must also be reduced or the aircraft will begin moving upwind away from the landing line.

(2) In the straightaway, and throughout the landing, keep the longitudinal axis aligned with the landing line, regardless of the amount of cross-wind correction being used. Sit straight in the cockpit. Do not lean away from or towards the low wing! Remember, the fundamental concept behind the wing-low drift-correction method is to counteract the drift and keep the longitudinal axis aligned with the landing line.

d. Make a normal transition to a landing but continue to hold the cross-wind correction. The touch-down will be made low wheel first. As the forward momentum decreases, the other main wheel will settle onto the runway. Maintain the cross-wind correction to minimize the weather-cocking tendencies of the aircraft and lower the nose wheel gently onto the runway, if necessary to maintain directional control. Brakes are used only if the rudder is not sufficient to control heading.

e. The take-off in a cross wind is the same as a normal take-off, except that aileron is held into the cross wind during the take-off roll. Hold aileron into the wind during the first part of the take-off roll; this reduces the lift on the upwind wing and assists in directional control. As the aircraft approaches flying speed, the upwind aileron pressure must be reduced proportionately to keep the wings level as the aircraft leaves the runway.

(1) If the upwind wing is allowed to rise, a "skipping" effect may result. This is a series of very small bounces, caused by the aircraft's attempting to fly and then settling back onto the runway. As this occurs, the cross wind will cause the aircraft to move sideways. This skipping imposes side stresses on the landing gear which could result in material failure. Just as the aircraft leaves the ground, take out the cross-wind correction and establish balanced flight.

(2) As the wheels leave the runway, the aircraft will start to drift with the wind away from the center line. Smoothly apply sufficient control pressures to execute a small coordinated turn into the wind, taking care to make a very shallow bank. When you have turned sufficiently to counteract drift and climb straight out from the runway, roll the wings level to straight and balanced flight and continue to climb straight ahead, maintaining the into-the-wind crab. Normal pattern procedure for touch-and-go landings will be followed, once airborne.

3-5.2.20 Skidded Turn Stall

a. The skidded turn stall may occur in either a right or left, power-on or power-off, landing approach. However, it will most likely occur in a right turn while "S" turning into the landings straightaway during a power-off simulated or actual emergency approach, where the wheels are down and the flaps are up. Under these conditions, the student is conscious of the near proximity of the ground and is reluctant to lower the right wing to maintain balanced flight. The normal tendency, then, is to use excessive rudder to turn the aircraft into the landing line and raise the nose slightly to attempt to stretch the glide while trying to keep the wings level. This may very easily result in a stall at low altitude from which a safe recovery is impossible. This maneuver demonstrates the increased airspeed at which the aircraft will stall when in an unbalanced flight condition.

b. This stall will not be performed by the student, but is demonstrated by the instructor to emphasize the importance of maintaining balanced flight. Your instructor will complete the last clearing turn with the landing gear down, throttle closed, in an 85-knot power-off descent. He will then roll smoothly into a right turn of 30 degrees of bank. When the bank is established, excessive right rudder pressure is applied while left aileron is used as necessary to maintain the 30 degrees of bank. Simultaneously, back-stick pressure is applied to raise the nose slightly to simulate a
nose-high gliding turn. The control pressures are increased as the airspeed is reduced. At the instant the plane stalls, recovery is made by simultaneously adding full throttle and neutralizing the controls to return the aircraft to balanced flight. The wings are leveled and the nose is raised to stop the loss of altitude as soon as flying speed is regained. The skidded turn stall involves a power-off entry with a power-on recovery.

(1) A stall that occurs in unbalanced flight is inevitably accompanied by a roll, and the accuracy and timing with which recovery controls are applied will determine the extent to which the roll will continue. This demonstration of a skidded turn stall will illustrate how quickly an inverted attitude may result, quite unexpectedly. This inverted attitude, coupled with the fact that the stall usually occurs near the ground, should certainly impress the primary student with its extreme danger. It must be remembered that recovery from inadvertent inverted flight is best accomplished by the roll-out method, and in this case particularly, pulling through would prove to be fatal.

(2) Do not try to turn the aircraft by skidding the nose around with rudder. Maintain balanced flight!

3-5.2.21 Steep Turn Stall

a. The steep turn stall will occur in a steep turn if excessive back pressure is applied to the stick. This stall is a good illustration of what would occur where a pilot is concentrating on an object on the ground and inadvertently applies back pressure on the stick to keep the object in sight. It is an excellent example of an aircraft stalling at high airspeed with excessive stall pressure as the indication of the approaching stall.

b. Complete the last clearing turn with 20 inches of manifold pressure, 120 knots of airspeed, in straight and level flight. Trim for this attitude. Roll smoothly into a steep turn, in either direction, using 45 degrees angle of bank. Hold this angle of bank momentarily and check the nose position to assure level flight. Increase the angle of bank to 60 degrees and, at the same time, rapidly, but smoothly, apply back pressure on the stick until the aircraft stalls. At the instant the stall occurs, recover by relaxing the back pressure on the stick to reduce the angle of attack and use rudder and aileron as necessary to roll the aircraft to straight and level flight with a minimum loss of altitude. The entry and recovery are the same in both the left and right steep turn stalls.

(1) The approaching stall is characterized by excessive seat pressure due to the increased "G" forces imposed and buffeting during the stall.

(2) It is important that this stall be entered in balanced flight. A tendency to roll in either direction as the stall occurs depends upon the degree of rudder coordination. If the nose is allowed to drop in the turn, a tight diving spiral instead of stall will result.

3-5.2.22 Climbing Turn Stall (Left Turns)

a. This stall might occur in any climbing turn, for example when climbing out of a field following a take-off.

b. Complete the last 90 degrees of clearing turn in a 100-knot climbing attitude with full throttle. Trim for this attitude. Smoothly roll into a 15-degree angle of bank to the left and raise the nose to an attitude 30 degrees above the normal cruise attitude. Hold the nose in this attitude, maintaining balanced flight and a constant 15-degree angle of bank. When the aircraft stalls, recover with positive forward stick to position the nose in an attitude slightly below the level-flight attitude. Return to straight and balanced flight and stop the loss of altitude as soon as flying speed has been regained.

c. It is important that balanced flight be maintained throughout the climb up to the point where the aircraft stalls. As the aircraft decelerates, the trim counteracting the Torque becomes less effective and right rudder must be added proportionately to maintain balanced flight and prevent yaw. A yaw present at the initial break of the stall will cause the aircraft to roll in the direction of the excessive rudder. In addition, as the aircraft decelerates, it tends to increase its angle of bank in the direction of the turn. This overbanking tendency must be corrected by the application of "right" aileron as the stall approaches in order to maintain a constant 15-degree angle of bank. After the stall breaks and the nose drops through the horizon, rudder and aileron are both effective in returning the aircraft to a wings-level attitude.

3-5.2.23 Progressive Spin

a. A progressive spin is the result of improper recovery technique from a previous spin. Like all spins, a progressive spin is not dangerous when sufficient altitude is available to permit a
safe recovery. When recovering from a spin at low altitude, a pilot naturally attempts to hurry the recovery as much as possible, but rushing it too much may result in a progressive spin.

b. A progressive spin may be caused by: (1) failure to release back pressure on the stick in the recovery, thus maintaining too great an angle of attack; (2) using too much opposite rudder in recovery, which causes the aircraft to recover in a violent skid, causing another stall and, consequently, another spin; and (3) attempting to pull out of the dive too quickly when recovering from the original spin, thereby rapidly increasing the angle of attack, causing an accelerated stall and a possible spin. Any one, or any combination, of these errors may result in a progressive spin. The direction of rotation in the progressive spin may be in the same direction as the original spin or in the opposite direction. This depends on the errors made in the original recovery.

c. To demonstrate what may occur if improper recovery technique is employed while recovering from a normal spin, your instructor will enter a normal one-turn spin and follow it with a progressive spin in the opposite direction.

(1) After one turn of a normal spin in either direction, your instructor will recover with full rudder opposite to the direction of rotation, but will continue to hold full back stick. In this condition of flight, the spin stops, the plane stalls again and spins in the opposite direction. He will recover immediately from the second spin as from a normal spin. When the rotation has stopped, the controls are neutralized and then smooth back pressure on the stick is used to bring the nose up to the horizon. As the airspeed decreases, the throttle will be advanced to conserve altitude.

(2) The second spin will not be started if the airspeed exceeds 95 knots. This is a demonstration maneuver only, and the primary student is not allowed to practice progressive spins on solo flights.

3-5.2.24 Approach Turn Stall

a. This stall may occur in any approach to a landing.

b. Lower landing gear and full flaps prior to entering clearing turns. Complete the last 90 degrees of clearing turn in a 70-knot glide with 10 inches of manifold pressure and trim for this attitude. Smoothly roll into a left turn, establishing a 30-degree angle of bank. Raise the nose slowly while retarding the throttle to the fully closed position. Continue to raise the nose until the air-

craft stalls, making certain that a constant 30-degree angle of bank is maintained. When the aircraft stalls, recover with positive forward motion of the stick, placing the nose slightly below the level-flight attitude and simultaneously applying full throttle. When flying speed has been regained, return to straight and balanced flight, stopping the loss of altitude.

c. Consider that in learning to perform this stall properly, the major concern is stopping the loss of altitude as soon as possible, since this maneuver simulates a stall close to the deck. The approaching stall is accompanied by a very noticeable reduction of slipstream noise, while the actual stall is typically characterized by the immediate pitch-down of the nose. This nose movement, and its accompanying increase in the rate of descent, necessitates a rapid recovery involving expert coordination of controls and power. As full throttle is applied, the effect of torque must be proportionately overcome with right rudder. Accurate rudder coordination must be used to control any tendency the aircraft may have to roll. Because of the increased drag caused by the extended wheels and flaps, acceleration is relatively slow, and caution must be exercised so that the nose recovery-attitude is maintained until definite flying speed has been regained and thus the aircraft is prevented from inadvertently entering a progressive stall. This is, of course, especially applicable to a stall which occurs in an actual approach to a landing.

3-5.2.25 Special Turf Field Entry and Traffic Procedure

a. During this stage of your primary flight training, you will practice landings with your instructor at a special turf field located in one of the training areas of your primary base. This is the field where you will make the first solo flight of your military flying career, so know the traffic procedures thoroughly.

The special turf field is approximately one mile square and is divided into halves along each landing course by a white line which is referred to as the runway centerline. As seen in a landing approach, the right half of the field is used for touch-and-go into-the-wind landings, and the left half is used for full-flap into-the-wind landings to a complete stop. (The left half is also used for take-offs initiated from a designated position on the field following the full-stop landings.) A threshold line (a 1000-foot white line) is located at each end of and perpendicular to the runway centerline. All aircraft will land upwind of the threshold line located at the approach end of the field. A crash truck is positioned on the
Standard Field Entry
Traffic circle at 1,000 feet at 120 knots. Wing-tip distance.

Touch-and-go Pattern
Normal landing interval on downwind leg. Solo touch-and-go landings will be made just to right side of runway centerline. Dual touch-and-go landings may be made to the extreme right side of runway centerline. Wave-off on landing line; stay below 300 feet until over field boundary.

Full-flap Full-stop Pattern
Land in corridor that lies between right side of crash truck and left side of runway centerline at 8A and Pace Fields, but to the right of the aircraft landing ahead. After landing roll-out, make left turn to field boundary and taxi along field boundary to take-off corridor. Use 0 degrees of flap fo take-off. Wave-off on full flap side; stay below 300 feet until clear of downwind traffic before making a climbing left turn.

- Marks intended point of landing.
- Start turns on all courses parallel to crash truck located at left end of threshold line.
- Marks crash truck.
b. Enter the landing pattern by making a standard field entry. The number 1 and number 2 positions are determined by reference to the intersection formed by the runway centerline and the threshold line at the approach end of the field. Start the letdown from the number 2 position, which is located directly downwind from this intersection. Adjust the turn from the number 2 position so that you let down to 500 feet at approximately 1/2 wing-tip distance from the center of the touch-and-go landing area. After passing the upwind end of the landing area, turn downwind as traffic permits, taking a normal interval on other aircraft in the pattern.

(1) The downwind leg of the touch-and-go landing pattern is flown at a wingtip distance from the landing line at 500 feet indicated altitude and 90 knots of airspeed. Upon passing the upwind end of the field, headed downwind, report "Wheels indicate down, brakes firm, parking brake in. Temperatures and pressures - NORMAL, Sir."

(2) Normal abeam and landing procedures will be used. All touch-and-go landings are to be made to the right of the runway centerline. Wave-offs will be executed along the landing line straight down the field, staying below 300 feet of actual altitude until the upwind edge of the field is reached. Following the take-off from a touch-and-go landing, the upwind turn will be started at 250 feet of actual altitude, traffic permitting, but not before reaching the upwind edge of the field.

c. To enter the full-stop landing pattern, either during the initial field entry or when changing from the touch-and-go landing pattern to the full-stop pattern, a wide upwind turn will be made, as traffic permits, to fly the downwind leg at a wingtip distance from the full-stop landing line. Check that wheels indicate down, brakes firm, and parking brake in upon passing abeam the upwind end of the field on the downwind leg. A normal full-stop approach will be made to land in the corridor between the crash truck and the runway centerline on the full-stop side of the field but to the right of any aircraft landing ahead. Wave-offs from a full-stop approach will be made straight down the field, staying below 300 feet of actual altitude until the upwind end of the field is reached and clear of any aircraft on the downwind leg of the touch-and-go landing pattern.

(1) The full-stop approach will be made without endangering any aircraft ahead or any that might be taxiing back toward the take-off position. When the aircraft has slowed to taxi speed during the landing roll-out, raise the flaps, make a left turn, and taxi toward the field boundary to clear the landing area. Particular caution must be exercised while taxiing on a turf field to avoid "Chuck holes," obstruction markers, fences, etc.

(2) The take-off after a full-stop landing will be made from the left side of the "take-off and full-stop landing corridor," directly adjacent to and to the right of the crash truck. After clearing the approach area for landing aircraft, taxi into the take-off position and align the aircraft parallel to the runway centerline with the nose wheel straight. Complete the take-off check-off list and receive a "thumbs up" from the crash truck crew for take-off clearance. The take-off will be made with flaps up. After take-off, the downwind leg of either landing pattern may be joined as traffic permits. The sole portion of the pre-solo check flight will conform to the procedures outlined above.

(3) Normal procedure for departing out-lying fields will be used to leave the landing pattern of a special turf field.

d. Since a special turf field can, and usually does, accommodate a large amount of traffic, strict compliance with course rules and flight regulations, especially wave-off procedures, must be observed. All pilots must display the highest degree of air discipline.

3-6 EMERGENCY PROCEDURES

3-6.1 GENERAL

3-6.1.1 As the name implies, an emergency is a situation resulting from some compulsion of circumstances that requires immediate action. In aviation, an emergency is generally regarded as a flight situation which results in a forced landing or bail-out, and is usually associated with partial or complete engine failure, a fire, damage to the aircraft while airborne, or with the pilot's having become lost.

3-6.1.2 A pilot must follow a definite plan of action in order to be able to cope with the particular type of emergency he has encountered. This plan of action is referred to as an emergency pro-
cEDURE. Emergency procedures may be broad in scope. That is, they may pertain to flight operating techniques in general, as well as being applicable to the operation of a specific type of aircraft, in your case the T-34B. Every emergency that can reasonably be expected to occur in the T-34B is discussed in (a) Emergency Procedures section of the Pilot's Handbook of Flight Operating Instructions and (b) the Emergency Procedures Pamphlet, CNABT P247. You have been issued both of these publications for reference and study, and you will be required to become thoroughly familiar with their contents. The Emergency Procedures Pamphlet is to be considered as part of your flight equipment and will be carried in your flight suit on all flights, but remember:

**THE BEST TIME TO KNOW PROCEDURES AND THE WORST TIME TO STUDY THEM IS IN AN EMERGENCY!**

3-6.1.3 As you may have inferred by this time, all the practice and instruction that you receive in simulated emergencies is given to you for one purpose: to prepare you to make a successful forced landing if you experience an actual engine failure. The procedures and techniques which you learn should become second nature to you and readily adaptable to actual forced landings.

- a. Your chances of making a successful forced landing will be greatly improved if you remain calm. If a cleared area is available, the landing can usually be accomplished with minimum damage to the aircraft and no injury to the pilot. As the emergency becomes evident, accomplish your cockpit procedures and broadcast your MAYDAY report. Select your field as you did in your routine simulated forced landings. After you have selected your landing site, do not change your mind and attempt to make your approach to another field. This will only tend to confuse you and greatly endanger the successful completion of a forced landing. If time and altitude permit, attempt an air start.

- b. Proceed with your approach and when you have the field definitely made, lower full flaps, if possible. A full-flap landing is desired so that you may land at the slowest possible speed. On the final approach, be sure to cut all switches, place the mixture in idle cut-off, and turn the fuel control valve handle off. Remember, always land gear-down except in water or swampy terrain.

- c. Be particularly careful not to stall in the final phase of the approach by attempting to stretch the glide to prevent under-shooting. Execute the landing just as you would a normal landing. Be careful that you do not level off high during the landing transition, since you will most likely strike the ground very hard in a nose-low or wing-down attitude and quite possibly cartwheel. If you have to make an emergency landing into trees, plan to hit them at ground level if possible. Do not attempt to land in the tree tops if this can be avoided. You may be injured by branches coming up through the unprotected panels of the aircraft. Remember, you and your plane can withstand more deceleration shock when traveling straight ahead then when traveling in any other direction. When the aircraft stops completely, abandon it and stay clear until you are absolutely certain that it will not catch fire or explode.

3-6.1.4 After the landing is completed, your next step is to telephone (Government collect) the Operations Department at your home station and report the following information:

- a. Your name and the side number of your aircraft.

- b. The exact location and type of field.

- c. Cause of the forced landing.

- d. The extent of the damage to the aircraft and injury to personnel.

- e. Directions for contacting you by telephone.

3-6.1.5 Do not leave the aircraft unattended until you receive instructions or unless authorized by competent authority to do so. Enlist help to send your message and to guard the aircraft if you are injured.

3-6.2 LOST-PLANE PROCEDURE

3-6.2.1 One type of emergency is created when a pilot becomes lost. Students sometimes become lost as a result of becoming too interested in the maneuvers they are practicing. They do not take the time, at the completion of each maneuver, to check their position in the training area. Perhaps they were using a cloud, or a clear space between cloudy areas, as a landmark and had failed to realize that their reference point was moving with the wind. And upon completion of their high work, they were astonished to find that the terrain under them was quite unfamiliar.

Always practice within sight of some familiar and prominent landmark. At the end of each maneuver, check this landmark. If you
IF YOU HAD TO MAKE A FORCED LANDING RIGHT NOW — WOULD YOU KNOW WHERE TO GO?
notice that you are drifting away, plan the next clearing turns and the maneuver so that it will take you back into your practice area.

3-6.2.2 If you actually become lost, follow the lost-plane procedures set forth in your Emergency Procedures Pamphlet. Of course, it will also be necessary for you to use your own initiative and good judgment. Since every situation will be different, it is impossible to establish a criterion which will apply to every set of circumstances. There are several things you can do, however, to brighten the situation of being lost.

a. Check your fuel supply at once. Never fly around until your fuel is exhausted. Stay within the area where you first realized you were lost until you have planned what you are going to do. Use your compass to orient yourself definitely with respect to direction. Do not fly over an overcast or allow one to form beneath you. Maintain visual contact with the ground at all times; never fly into the clouds.

b. Determine the wind direction. This is very important, because the chances are you have drifted downwind from your practice area. Remember the clues that enable you to determine the wind: smoke, dust, ripples on the surface of water, movement of cloud shadows on the ground, etc.

c. If the ceiling and visibility permit, climb for altitude to improve radio performance and visibility.

d. Do not attempt to estimate the time; it passes very slowly when you are lost. Use your watch.

e. Many times, some prominent landmark such as a river, coastline, railroad, or principal highway will be located near your own station or in your practice area. If such is the case, it may be possible to fly to these landmarks and follow them back to your home base. Such possibilities will usually be mentioned by your instructor and safety lecturers. If you are over land in the Basic Training Command area, fly south to the coastline, where you may be able to recognize a familiar landmark.

f. Call for a VHF-UHF/DF steer according to the procedure described in your Emergency Procedures Pamphlet. If it appears that you will fly into clouds while following a steer, discontinue the steer, orbit in a clear area, and advise the tower of your situation.

3-6.2.3 The important thing to remember is this: Do not fly aimlessly about the area. Be calm and follow whatever plan your good judgment and established procedures dictate. If, after trying to identify your position by every known means, you still do not know where you are, plan to make a forced landing before your fuel is exhausted or before darkness falls.

3-6.2.4 It is desirable, of course, to land at some established landing field. If you find one, you should circle it at a safe altitude and locate all obstacles and hazards. Before landing at a strange field, you should be concerned with the length and width of the runways, wind direction, type of runway surface, and the elevation of the field. If there is a tower at the field, try to contact it for landing instructions. After you have become familiar with the field, make a normal traffic pattern and landing. Remember, however,
that the elevation of this field will probably be different from that of your home station. For this reason, your traffic pattern altitude will vary accordingly. After landing, it is your responsibility to ensure that your home base is notified of your landing location.

a. If you are unable to find an established airport on which to land, select a good field where you can land as nearly as possible into the wind. It is well to keep in mind that you will have to telephone your home station. Therefore, land within a convenient distance of a town or farmhouse if possible. You will have to "drag" the field to determine whether it will be suitable for landing. Circle the landing area at a safe altitude, about 500 feet above the terrain, and look for high-tension wires, telephone lines, or other obstructions which may interfere with your approach. After you are certain that your intended approach path is clear, "drag" the field by flying into the wind and slightly to one side of the landing area at an altitude from which you can inspect the intended landing path. Look for rocks, ditches, stumps, low fences, livestock, etc., which might interfere with your landing. Do not become so involved in looking at the intended landing path that you allow your airspeed to drop dangerously low or fail to notice obstructions ahead and on the other side of the aircraft. Observe drift conditions if they are present. From this flight over the field, you should have also determined whether the field is long enough for a landing, and, if the approach is made and difficulty is encountered, whether there would be enough room for a wave-off.

b. If the field is suitable, fly a normal traffic pattern and make a wheels-down/flaps-down forced landing in the first third of the field. On the final approach, cut all switches, place the mixture in idle cut-off, and turn the fuel control valve handle off. Be sure your shoulder straps are locked tight. Notify your home station of your location, etc., as explained previously, as soon as possible.

3-6.3 EMERGENCY HAND SIGNALS

Sometimes, because of radio failure or lack of identical radio channelization, communications between aircraft are inhibited. However, like the Indians of pioneer days, pilots have developed their own sign language. This sign language in primary training is utilized in the event of an emergency when a chase pilot or escort plane is necessary and radio communications cannot be established. Learn the following hand signals. Later on, when you have progressed to the tactical phase of training, these signals will be used as standard communications procedure within flights.

3-6.3.1 Gain altitude: hand clenched, thumb extended and moved upward.

3-6.3.2 Lose altitude: hand clenched, thumb extended and moved downward.

3-6.3.3 Level off (fly straight and level): hand flat, palm down, moved from side to side in the horizontal plane.

3-6.3.4 Turn: hand clenched, thumb extended and moved horizontally in the direction of the desired turn.

3-6.3.5 Straight ahead: hand flat, extended vertically and moved fore and aft.

3-6.3.6 Land: hand flat, palm down, moved down and forward.

3-6.3.7 Lower or raise wheels: hand clenched and rotated in a fore-and-aft vertical plane.

3-6.3.8 Report fuel state: hand clenched, thumb extended and brought to lips is a drinking motion.

3-6.3.9 My fuel state is: give above signal followed by one extended finger for each ten gallons of fuel remaining.

"FIRST SOLO"
"TODAY I AM A MAN"
CHAPTER IV

A PRECISION APPROACH MAKES A PRECISION LANDING
CHAPTER IV

PRIMARY PRECISION AND ACROBATIC STAGE

4-1 INTRODUCTION

4-1.1 GENERAL

4-1.1.1 This stage of primary training is devoted to the instruction and practice of precision and acrobatic maneuvers. Development of basic air work, headwork, and orientation shall be of prime consideration. The instructor will be alert for any evidence of mechanical flying that the student may allow to develop and will take the necessary action to correct this undesirable habit.

4-1.1.2 Acrobatic maneuvers in this stage to which the student will be introduced are the wingover, loop, barrel roll, Cuban eight, Immelmann and accidental spin recovery technique. The stalls practiced in this stage will further the student's basic knowledge of practical aerodynamic principles and assist in the development of safe flying habits. Emergency landing practice and full-flap precision landing procedures will be introduced to improve the student's judgment and technique. In addition, the instructor will demonstrate the split "S" and inverted stall. Of course, proficiency in the performance of all maneuvers previously introduced will be expected to improve.

4-1.1.3 It is in this stage of flight training that increasing emphasis will be placed on the development of precise flying techniques and, as the student progresses, performance requirements will become more rigorous. This increasing demand on the development of his ability and skill will assist in preparing him to progress successfully toward the high standards necessary to become a naval aviator.

4-1.1.4 The term "acrobatics," in its broadest sense, includes all maneuvers which exceed 90 degrees of pitch or 90 degrees of roll, and which are not necessary to normal flight. Maneuvers inherent to air navigation and normal tactical flying (dive bombing, gunnery, combat, etc.) are not considered to be acrobatic maneuvers.

4-1.1.5 The purpose is to teach the student standard acrobatic maneuvers and to develop further his precision techniques while improving his basic air work and fundamental knowledge. A portion of each dual flight in this stage will be devoted to a review and practice of previously introduced maneuvers.

4-1.1.6 The split "S" and the inverted stall are maneuvers which are demonstrated to the student by his instructor and are not to be practiced by the primary student.

4-1.1.7 Acrobatic flying improves the pilot's coordination, timing, and orientation as the aircraft is flown through predetermined unusual attitudes, and further develops the student's "sense of feel" of the airplane. Flying by "sense of feel" is a nebulous term synonymous to the archaic expression, flying "by the seat of the pants." It implies positive control of an aircraft through physical sensation and a subconscious comprehension of these sensations which produces involuntary muscular reactions to maintain a desired flight condition. "Sense of feel" is not inherent; it is a conditioned response which is developed through experience. The degree of development varies with the individual.

4-1.1.8 Acrobatic training familiarizes the pilot with the unusual attitudes possible in the airplane and the proper methods of recovery to normal flight, leads to confidence in himself and the plane, and helps to overcome any aversion he may have to inverted flight. A better understanding of practical aerodynamics is gained as the student learns to fly the aircraft through the various acrobatic patterns while applying varying control pressures in order to compensate for the effects of gravity and constantly changing attitudes and airspeeds. Acrobatic training is essential to the development of a good military pilot.
4-1.2 RULES AND SAFETY PRECAUTIONS FOR AEROBATIC FLIGHT

4-1.2.1 Prior to the performance of any acrobatic maneuver, it will be necessary to observe certain rules and safety precautions. Local regulations will prescribe restrictions governing the altitudes and the areas over which acrobatic maneuvers are to be flown. A thorough knowledge of and strict compliance with these regulations are mandatory.

4-1.2.2 Before performing any acrobatic maneuvers, execute the acrobatic check-off list. This procedure is the same as the stall check-off list; except for the prop: (1) canopy closed, (2) gyro compass caged, (3) shoulder harness and seat belt locked and tight, and (4) bilge clear of any loose objects.

4-1.2.3 Make a level-flight transition to acrobatic cruise—straight and balanced flight, 130 knots of airspeed, 2400 rpm, manifold pressure as necessary to maintain this airspeed, and trim the aircraft for these conditions. Once the aircraft is trimmed for the acrobatic cruise altitude, trim tabs are not to be used further in the performance of any of the acrobatic maneuvers. Since one of the objectives in teaching acrobatics is to develop the student's "sense of feel," further use of the trim tabs during the performance of acrobatic maneuvers would inhibit the development of this sense by altering the feel of the controls each time the trim-tab settings were changed.

4-1.2.4 Clearing turns, with a total change of direction of 180 degrees, will be executed immediately prior to the performance of each acrobatic maneuver. The pilot will thoroughly check the area throughout the clearing turn for the proximity of other aircraft. Acrobatic maneuvers will not be performed until the pilot is sure that his immediate area is free of other aircraft and that there is no danger of a mid-air collision.

4-1.2.5 Know your procedures. Understand what you are trying to do and the manner in which it is done.

4-1.2.6 Acrobatic maneuvers will be started from an altitude which will permit complete recovery to straight and level flight at 3000 feet of altitude or above.

4-1.2.7 Know the airplane and its structural limitations. Be smart! Do not intentionally exceed them. If you should inadvertently overstress the aircraft, return to home field immediately and "down" the plane so that the airframe can be inspected prior to its next flight.

4-1.2.8 Do not remain in the inverted position for more than 15 seconds. The engine may be damaged by oil starvation. If, at any time, while in the inverted position, the engine cuts out, close the throttle to protect the engine from the detrimental effects of a sudden surge of power when the engine starts running again.

4-2 PRIMARY PRECISION AND AEROBATIC STAGE MANEUVERS

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4-2.1 PRECISION LANDINGS

4-2.1.1 The term "precision landing" is applied to the advanced degree of proficiency with which the primary student will be required to execute the full-flap landing, landing on or near the intended point of landing with consistency. It is in this stage of flight training that the primary student begins to develop the exacting landing techniques which, as his diligence and perseverance are augmented with experience, result in his acquiring the intense pride taken by Navy pilots in their precision approaches and landings.

4-2.1.2 There is no difference between the full-flap landing procedures used in the pre-solo stage and the precision landing procedures executed henceforth, except of course, the consistency with which you will be required to land in a designated area on the runway.

4-2.1.3 The situation involves the pilot's ability to maneuver his aircraft from a position abeam to a landing in the desired area. Of prime essence in making precision landings is the consistency with which the student pilot sets himself up at the proper altitude and with the prescribed wing-tip distance at the abeam starting position, the consistency with which the proper approach pattern is flown, regardless of wind, the consistency with which the airspeed is controlled, and the accuracy with which the rate of descent is regulated over a given distance by proper throttle reduction.

a. In a sense, it may be surmised that a student's ability to become proficient in his flying is a result of his conscientious effort to learn and the normal absorption of certain knowledge due to being repeatedly exposed to the sensations of flight. As the student pilot gains experience, his division of attention becomes more comprehensive. Peripheral vision has had a chance to develop; therefore, scanning becomes easier. In other words, he is able to "keep up with the airplane." He is more aware of what is happening around him and can, consequently, maneuver the aircraft with increased proficiency.

b. For a precision landing, the aircraft must arrive in the straightaway at the proper altitude, airspeed and distance from the intended point of landing neither angling nor over-shooting. The only variable should be the wind. It is the effect of the wind that determines the distance the aircraft will travel, and subsequently touch down, after the throttle is closed. The approach pattern must be flown with the accurate consistency noted above so that a proper analysis of wind effect can be made and power regulated as necessary to accomplish the touch-down in the desired area.

4-2.1.4 A normal touch-down on the main gear with the aircraft in the same attitude must be made on each landing. Otherwise, there would be no basis on which to make corrections during the next approach, particularly if the factors involved in maneuvering the aircraft into the proper straightaway are also allowed to vary appreciably. Diving for the deck when high and holding off when low are not the correct methods of compensating for errors which occur earlier in the approach.

a. If a touch-down is long (beyond the intended point of landing) and the approach pattern is correct with respect to altitude and airspeed, it could very logically be deduced that the force of the wind was overestimated and that the throttle was closed too late, causing the aircraft to "float" up the runway. Also, landing short, after a proper approach pattern, would be caused by closing the throttle too soon.

b. It must be understood that once the throttle is closed, the pilot has committed himself to a particular point of touch-down, provided of course, he does not dive or hold off. Therefore, it is the judgment with which he determines when the throttle should be closed that enables him to land his aircraft on or near his intended point of landing. (See 3-5.2.12 --Full Flap Landings).

4-2.2 ACCIDENTAL SPIN

4-2.2.1 An aircraft cannot spin unless it has first been stalled. All accidental spins, therefore, result from unintentional stalls. Recovery is effected in the same manner as in normal spins, regardless of whether the spin has been entered intentionally or not.

a. Accidental spins are demonstrated so that you can learn to recognize the signs of an approaching spin and effect recovery before the spin actually develops.

b. Accidental spins at low altitude are dangerous because there is usually insufficient altitude for safe recovery. Inasmuch as the spin is not anticipated, the pilot is not prepared for an immediate recovery. Hence, it takes him longer to react to the situation and start applying recovery controls properly.

4-2.2.2 An accidental spin may develop from any attitude, airspeed, and/or power setting. The
following situations are examples of conditions from which accidental spins might occur.

a. If the nose of the aircraft is held too high in a climbing turn—because of carelessness or for some other reason—the maximum allowable angle of attack will have been exceeded and the aircraft will stall. A spin will result if proper corrective action is not immediately initiated. This resulting spin may very well occur "over the top." Instead of falling off and spinning in the direction of the low wing, as you would expect, the high wing stalls first, and the aircraft whips over into a spin in that direction. This may be due to the fact that, just before the stall, the plane was slipping toward the low wing, causing a partial blanketing of the airflow about the high wing. Likewise, it can be, and usually is, the direct result of incorrect rudder coordination in the climb just prior to the stall.

b. Excessive skidding in turns produces a loss of airspeed and the nose of the aircraft tends to drop. The normal reaction of the inexperienced pilot is to try to keep the nose up by increasing the back pressure on the stick, thus causing an excessive increase in the angle of attack. This condition, of course, causes the aircraft to stall. If the proper recovery techniques are not immediately applied, the stall combined with the excessive rudder pressure (which caused the skidding in the first place) will result in an accidental spin.

c. If you hold the nose too high in a glide, the airspeed decreases and the nose tends to drop. The new student experiences a natural tendency to try to raise the nose again by pulling back on the stick. This greatly increases the angle of attack and the aircraft stalls in complete readiness for an accidental spin. A similar, but aggravated, situation exists in gliding turns, in which the aircraft stalls at a higher airspeed than in a straight glide.

4-2.3 EMERGENCY LANDING PRACTICE (ELP)

4-2.3.1 Emergency landing practice comprises a series of prescribed procedures for getting into an emergency landing field from a position directly over the point of intended landing. These procedures were adopted in the Basic Training Command because of their similarity to the flame-out procedure used by jet type aircraft. ELP teaches you how to maneuver the aircraft to a safe landing, should an actual or simulated emergency occur. Through practice, it develops coolness, planning, judgment, and technique. Basically, it is a continuation of the high-altitude emergency as the descent is made from the high key.

4-2.3.2 Enter the ELP pattern at 1500 feet altitude, normal cruise, with two miles of straightaway along the landing line prior to reaching high key. Lower visor, check and report the gas, open the canopy, and complete check list except for wheels, flaps, and prop, while in this straightaway. Report: "Gas reads (amount) left and (amount) right. The landing check-off list is now complete except for prop, gear, and flaps, Sir." Carefully check the area to your right as you approach the high key position to ascertain if there is danger of collision. Planes already in the pattern have the right-of-way. If traffic will not permit an entry, a wave-off will be
EMERGENCY LANDING PROCEDURE

normal departure
Start turn
250' 100 knots.
100 knots.
Flaps up
200' Normal departure if desired
70 knots
Gear up.

Gear down at 110 kts.
Level flight trans. to 85 kts.
Low key
Approx. W. T. D. 1000'.
85 kts.
Advance prop. Close throttle
High key.

Flaps down as necessary 75 kts.
Level off, 1500' normal cruise.

Check entry channel for traffic.

ENTRY
WAVE
-OFF 1500'
1 mile

Report:
Gas checked: --- right, --- left.
Landing checklist complete except for gear, prop, and flaps.
Canopy open.

1500', 120 knots.
initiated by making a 180-degree level turn to the left. Reenter the channel as traffic permits.

a. Upon reaching the high key, close the throttle to simulate an engine failure. Advance the propeller control to full increase rpm and start a left turn. At 110 knots, extend the landing gear and make a level transition to an 85-knot glide.

EMERGENCY LANDING PATTERN

Trim for the glide and vary the turn so as to arrive at low key at approximately a wing-tip distance and at least 1000 feet. Clear the engine at low key and report "wheels indicate down and locked, braces firm, parking brake in" and "landing check-off list complete except for flaps" prior to reaching the 90-degree position. Continue the approach turn, using an "S" turn if necessary to arrive on final with 800 feet of straightaway and 200 feet of actual altitude. Lower full flaps as necessary to make a safe landing in the first third of the field. Transition to a 75-knot glide with the flaps down and make a normal landing. Hold the nose wheel off after touchdown and make a normal take-off. Raise the gear when a safe landing can no longer be made should an emergency occur. Raise the flaps at 200 feet actual, transition to a 100-knot climb and, at 250 feet actual, start a climbing right turn, rolling out of the turn so as to maintain a wing-tip distance from the landing line. When abeam the high key, commence a right turn for another shot and transition to 120 knots at 1550 feet. After 90 degrees of turn, check the entry channel for any aircraft which may be entering the pattern, leveling the wings momentarily if necessary. Even though you have the right-of-way over entering aircraft, a good pilot will always know the position of other aircraft in his immediate area which might prove to be a hazard to safety of flight. Wave-offs in the ELF pattern will normally be made to the left side of the landing course.

4-2.3.3 Departure from the emergency landing practice field may be accomplished by using one of three acceptable procedures: (1) make a 45-degree left turn, minimum of 250 feet of altitude, flaps up, and 100 knots, when you are the last plane upwind following take-off and continue climbing away from the field (2) following a low-altitude emergency given by the instructor, or (3) continue in the pattern and break away 45 degrees to the left after heading downwind but before reaching the abeam position.

4-2.3.4 Emergency landing practice teaches you to maneuver an aircraft into a field for safe landing without the use of power. Since power is not available, the aircraft has, in effect, become a glider, making it necessary for the pilot to analyze accurately the direction and velocity of the wind and its subsequent effect upon the distance over the ground that the aircraft will glide. The velocity of the wind directly influences the ground speed. Therefore, the aircraft will travel less distance over the ground, for a given loss of altitude, headed into the wind than it will headed downwind. Consequently, it is possible, by underestimating or overestimating the wind, to arrive in the straightaway with insufficient altitude to reach the field or so high that the field will be overshot entirely.

a. Approach planning begins before reaching the high key. The proper pattern over the ground, from the high key down through the 1000-foot abeam position and approaching the 90-degree position, is circular and always the same, regardless of wind. However, the direction and velocity of the wind must be considered in order to fly this pattern. The stronger the wind, the shallower the initial turn from the high key; and conversely, under slight- or no-wind conditions, the steeper the angle of bank will be in the initial turn. Since the pattern over the ground follows a circular path, it will be necessary to vary the angle of bank constantly in order to compensate for the effects of the wind, the degree of variance depending upon the wind velocity.

b. After passing through the abeam position and while turning towards the 90-degree position, the wind velocity and its effect on the aircraft may be more accurately determined by the use of cross-wind gliding technique. For example, under strong wind conditions, it will become apparent that a continual increase in the angle of bank will be necessary to maintain the circular flight path over the ground as the aircraft approaches the 90-degree position and the flight path becomes perpendicular to the direction of the wind. If a slight- or no-wind condition exists, the turn will be correspondingly shallow, with only a slight increase necessary in the angle of bank. Upon approaching the 90-degree position, it will be apparent that a strong wind will tend to hold the aircraft away from the field, slowing the ground speed and thus the relative motion, while a light- or no-wind condition will permit the aircraft to continue to approach the field without any noticeable change in the relative motion. This knowledge allows the pilot to coordinate his rate of closure toward the point where he intercepts the straightaway at the proper altitude with his rate of descent. From the 90-degree position, the pilot may start a turn toward the straightaway
if the wind is strong or continue the cross-wind glide if the wind is light thereby losing more altitude by decreasing the rate of closure. Should the pilot misjudge the rate of descent versus the rate of closure so that he is high as he approaches the landing line, he may, if necessary, dissipate this excess altitude with a shallow to moderate "S" turn. The size of the "S" turn depends upon the altitude to be lost and the strength of the wind. However, this error in judgment should never be so pronounced that the size of the "S" turn necessitates more than 30 degrees of bank. Remember, the steeper the angle of bank, the less lift on the wings and the greater the corresponding loss of altitude. In executing the "S" turn, the landing line may be crossed only once.

4-2.3.5 The student will initiate his own "cut" so that he will gain experience in the use of lateral reference points to assist him in determining when he is directly over a point geographically located on the ground. Through practice, he will improve his judgment and technique so that it will not be necessary for him to rely on the use of flaps in the straightaway to lose excess altitude. Flaps are used primarily to slow the landing speed of the aircraft; in an actual emergency, flaps might not be available because of mechanical or electrical failure. He will develop his ability to analyze the wind and determine the effect it will have on his flight path. He will learn that scanning and good basic air work are requisite to successful ELP landings.

4-2.4 WINGOVER

4-2.4.1 The wingover is a 180-degree reversal in the direction of flight, accomplished by combining a smooth climbing turn of 90 degrees with a smooth diving turn of 90 degrees, recovering at the same airspeed and approximate altitude at which the maneuver was started, but on the opposite heading. The wingover develops the student's ability to control the aircraft smoothly in balanced flight through constantly changing attitudes and airspeeds. It is a slow, smooth maneuver, and when properly executed, no abrupt control movements are necessary. It may be performed in either direction, right or left, and is always done in a series of two so that the series is completed on the heading at which the first wingover was started. This is the only maneuver in the acrobatic phase that does not require clearing turns, but a constant watch for other aircraft is necessary during the performance of the wingover and all other acrobatic maneuvers.

4-2.4.2 When the wingover is introduced, it is of primary importance that the student acquire a mental picture of the path through which the aircraft is to fly. Notice the appearance of the airplane in relation to the ground and the horizon as you see it from the cockpit. Once you are able to visualize this, the wingover is merely a matter of flying the aircraft in balanced flight through this pattern.

4-2.4.3 Complete the acrobatic check-off list prior to beginning this maneuver. With the aircraft trimmed for straight and level balanced flight, 130 knots, 2400 rpm, and 21-23 inches of manifold pressure, select a reference point on the horizon 90 degrees to the heading of the aircraft, either right or left, and start a smooth climbing turn towards the reference point. Control the climb and the bank so that the nose of the aircraft appears to reach its highest point after having turned approximately 45 degrees from the original heading. At this point, the nose will be approximately 45 degrees above the horizon and the angle of bank will be approximately 45 degrees. The nose then starts smoothly downward in a circular path towards the horizon as the angle of bank steadily increases. The constantly increasing angle of bank and the smoothly descending nose are controlled so that, as the aircraft is flown through the 90-degree reference point, the nose is on the horizon and the plane is in a 90-degree angle of bank. As the nose passes down through the horizon at the 90-degree reference point, airspeed approximately 70 knots, start rolling out into a diving turn. After 135 degrees of turn, the nose will be 45 degrees below the horizon and the angle of bank will have decreased to 45 degrees. Increase the back pressure as necessary to control the increasing airspeed and continue rolling out at a constant rate so that the aircraft returns to straight and level flight at 130 knots of airspeed, 180 degrees from the original heading. Immediately start a wing-over in the opposite direction. Flying the maneuver in series will enable you to develop the "feel" of the control pressures and the rhythm of the maneuver. The series is complete when the aircraft has returned to its original heading in straight and balanced
flight at 130 knots of airspeed.

4-2.4.4 General Comments

a. The wind has no aerodynamic effect on the performance of the wingover maneuver. However, the direction and velocity of the wind do affect the relative motion of the aircraft with respect to the ground. For this reason, it is advisable to start the series of wingovers on a cross-wind heading if possible, making the turns into the wind to counteract drift.

b. It will be helpful to use a long road or section line to help orient yourself in the 180-degree change of direction and, of course, to help you keep from getting lost.

c. Since you are learning to fly the airplane in a predetermined pattern, keep your eyes out of the cockpit. Plan the attitude of the aircraft and its flight path throughout the wingover pattern relative to the reference points and the horizon. Maintain the proper scan pattern and use the instruments for only as occasional reference to check your sensory impressions.

d. The nose should always move at a constant rate (in relation to the horizon) as it describes similar arcs, first above, and then below the horizon. Remember, in turns to the right, torque and slipstream effect must be offset with more rudder than in turns to the left.

e. The nose and wing movement in the wingover is relatively slow. This is a rhythmic maneuver demanding maximum coordination of control pressures to maintain balanced flight. Apply pressures smoothly and avoid slipping or skidding. Maintain constant power settings throughout the maneuver.

f. You may justly claim the reward of profound satisfaction when you have mastered the wingover.

4-2.5 SPLIT "S"

4-2.5.1 The split "S" consists of a half-roll to the inverted position, followed by the last half of a loop. The aircraft changes direction 180 degrees and recovers in straight and level flight with a loss of altitude.

4-2.5.2 The correct procedure for recovery from inverted flight is the half-roll. The split "S" is demonstrated to you by your instructor to emphasize improper recovery procedure from inverted flight. It clearly illustrates the hazards of attempting recovery from the inverted position, particularly at low altitudes, by "pulling through." High-speed conditions, combined with excessive "G's," which can black out the pilot, over-stress the aircraft, or cause a high-speed stall, will be encountered and valuable altitude lost.

4-2.5.3 Your instructor will complete the last 90 degrees of clearing turn with 100 knots and the nose 30 degrees above the normal cruise attitude. He will then roll to the inverted position, check that the area is clear below, close the throttle, and when the airspeed is 90 knots or less, pull through as in the last half of a loop. Back pressure is varied to complete the maneuver at approximately 140 knots. The nose is raised slightly and throttle is added after checking the oil pressure. Note that in this demonstration a considerable amount of altitude is lost with relatively high "G" factor, even though the maneuver is started at a low airspeed with the throttle closed. It should be apparent that much more altitude loss, higher airspeed, and greater "G" force will occur if this maneuver is used to recover from inverted flight at higher airspeeds with power on.

4-2.6 INVERTED STALL

4-2.6.1 The inverted stall is similar to the normal stall in that it is caused by an excessive angle of attack. The demonstration of this maneuver will illustrate the proper recovery technique which affords the least loss of altitude.
This technique of recovering from inverted flight is called the "roll-out method." The inverted stall is recognized, in its approach and actual stall stages, by sight, sound, and feel. The aircraft is inverted and the nose is well above the horizon. The pitch of the sound of the airstream over the aircraft's surface drops as the stalled condition is approached. Control movement will produce less and less response as the airspeed decreases. When the aircraft stalls, the elevators will no longer hold the plane in an inverted nose-high attitude. The nose will drop toward the horizon and the aircraft may fall off on one wing.

4-2.6.2 Your instructor will demonstrate the inverted stall by entering a normal 150-knot loop. As the nose approaches a position 45 degrees above the opposite horizon, forward stick is applied to stop the nose movement. The throttle is then closed and forward stick pressure is applied as necessary to maintain this nose-high inverted attitude until the aircraft stalls. When the stall occurs, recovery is made by releasing the forward stick pressure and placing the stick in the neutral position. Recovery from inverted flight is then made by rolling out in the shortest direction.

a. If, when the aircraft stalls, one wing drops, the roll-out is started in the direction that will result in the shortest roll-out distance. In other words, aileron is always applied in the direction of the wing that is above the horizon. This wing will appear to be falling away from you. After the return to straight and level flight, the throttle is smoothly advanced after checking the oil pressure.

b. Remember, you are not allowed to practice intentional inverted stalls on solo flights.

4-2.7 BARREL ROLL

4-2.7.1 The barrel roll is a maneuver in which the aircraft is rolled 360 degrees about an imaginary point on the horizon which bears 45 degrees from the original heading of the aircraft.

4-2.7.2 It is taught to develop further the student's confidence, coordination, and "sense of feel" while flying the aircraft through varying attitudes and airspeeds. The barrel roll is excellent for developing orientation while flying the aircraft, in balanced flight, through the inverted position.

4-2.7.3 Here is how it is done. Complete the last 90 degrees of clearing turn in straight and balanced flight, acrobatic cruise, along a road or section line. Establish a reference point on the horizon 90 degrees from your heading in the direction you intend to roll. Then raise the nose and smoothly start a coordinated, balanced flight roll, up and around in a circular path in the direction of the selected check point. After 45 degrees of turn, the angle of bank will be 90 degrees and the nose will be at its highest point. Continue rolling the aircraft at a constant rate until you are in a wings-level, inverted flight attitude, headed directly at the 30-degree reference point on the horizon. The nose should be slightly above the horizon and the airspeed between 60 and 70 knots. Fly the aircraft through the inverted position and continue rolling at a constant rate, completing the maneuver on your original heading in straight and balanced flight and acrobatic cruise.

a. The nose should appear to make a perfect circle about the imaginary point on the horizon 45 degrees from your original heading. The last half of the circle will, therefore, be the same distance below the horizon that the first half is above the horizon. Remember that, as the airspeed decreases on top of the maneuver, it will be necessary to increase the movement of the ailerons, rudder and elevator to maintain a constant rate of roll and nose movement. Notice that this roll is started as a climbing turn, which then becomes a continuous roll at a constant rate.

b. Keep your eyes well ahead of the nose so that you do not get "behind the aircraft." Maintain a constant rate of roll and give yourself plenty of room in which to get on your back, wings level, headed toward your 90-degree reference point.
Inscribing a small arc above the horizon in the first half of the maneuver and a larger arc below the horizon in the last half will result in too great an airspeed at the completion of the maneuver. During the roll-out to the original heading, regulating the back pressure on the stick will enable you to recover at 130 knots.

4-2.7.4 Common Errors

a. Failure to raise the nose high enough during the first 45 degrees of turn. Generally, this will result in too high an airspeed at the 90-degree reference point, a correspondingly nose-low attitude below the horizon, and a proportionately high airspeed when recovery is completed.

b. Improperly coordinating the rate of roll with the rate of turn. This normally results in the aircraft's passing through the 90-degree reference point prior to its becoming inverted and failing to recover on heading.

c. Failure to maintain balanced flight throughout the maneuver.

4-2.8 LOOP

4-2.8.1 The loop is a 360-degree turn in the vertical plane, during which the aircraft is rotated at a constant rate about its lateral axis. Since it is executed in a single plane, the elevator is the major control surface utilized. Ailerons and rudder are employed to maintain directional control and balanced flight.

4-2.8.2 The loop teaches coordination, orientation, confidence, and develops the student's "sense of feel." It is started from straight and balanced flight and passes successively through a climb, inverted flight, a dive, and return to straight and balanced flight. The loop is probably the oldest and one of the simplest known acrobatic maneuvers, yet one which is difficult to do well. Follow the procedures carefully and you will find the loop one of the most enjoyable maneuvers to perform.

4-2.8.3 To perform the loop, select a road, section line, or other prominent landmark that extends ahead and also behind. Enter a shallow dive in the last 90 degrees of clearing turn and roll out on the desired reference line in straight and balanced flight at 150 knots of airspeed. Start a smooth straight climb. Check to see that the wings are level as the nose comes up through the horizon. Continue straight back on the stick to keep the nose moving at a constant rate. After passing the vertical position, tilt your head back so that you can see the opposite horizon as soon as possible. Keep the wings parallel to the horizon and maintain the proper heading by gradually increasing right rudder pressure as the airspeed decreases, thereby counteracting the effect of torque and maintaining balanced flight. At the top of the loop, in the inverted position, the airspeed will be greatly reduced. Relax back pressure slightly as the nose passes through the opposite horizon to prevent the aircraft from stalling, but keep the nose moving at a constant rate. When the aircraft becomes inverted on the opposite horizon, pick up your ground reference line immediately and fly the nose of the aircraft along that line back to straight and balanced flight at 150 knots. Gradually relax right rudder pressure as the airspeed increases in the dive and apply back stick pressure as necessary to maintain a constant rate of nose movement.

4-2.8.4 Common Errors

a. Poor directional control. This is the result of a failure to use the rudder correctly to maintain balanced flight, although the wings are held parallel to the horizon, and b) failure to keep the wings parallel to the horizon at all times.

b. Initial pull-up too fast. This results in an excessively rapid deceleration, because the aircraft is, in effect, "mushing" during the initial part of the climb, thus approaching the inverted position in a stalled or near stalled condition. A pull-up that is too fast can easily be detected by excessive seat pressure.

c. Initial pull-up too slow. This allows the aircraft to decelerate more rapidly than the rate at which it is rotating about its lateral axis, causing it to stall prior to reaching the inverted position, because of insufficient airspeed.

d. Excessive back pressure in the inverted position. This is caused by a feeling that the nose is not approaching the opposite horizon fast enough and increasing backstick pressure correspondingly to speed up nose movement, thereby increasing the angle of attack too rapidly, resulting in a possible stall. Remember that in the performance of a normal loop the wings are still providing positive lift, even in the inverted position.

e. Not tilting your head back soon enough to check the opposite horizon, thereby enhancing the possibility of becoming disoriented.
4-2.9 Immelman

4-2.9.1 The Immelmann is the combination of the first half of a loop followed by a half-roll to the wings-level attitude. It achieves a 180-degree change of direction with a gain in altitude.

4-2.9.2 The Immelmann develops orientation while flying the aircraft to the inverted position and rolling to a wings-level attitude while maintaining the longitudinal line-up with a reference line.

4-2.9.3 To perform the Immelmann, select a road, section line, or other prominent landmark which extends ahead of and behind the aircraft. Enter a shallow dive in the last 90 degrees of clearing turn and roll out on the desired reference line in straight and level flight at 170 knots of airspeed. Start a smooth, straight climb. Check to see that the wings are level as the nose comes up through the horizon. Continue to apply back pressure on the stick as in the loop. When you pass the vertical position, tilt your head back so that you can see the opposite horizon. Keep the nose moving at a constant rate, and when the nose is 20 degrees above the horizon, commence a roll, using aileron primarily and slight forward stick pressure to complete the maneuver on your reference line with the wings level in the level-flight attitude. As you approach 90 degrees of roll, apply rudder pressure in the direction of roll as necessary to maintain longitudinal line-up with your reference line. It will be necessary to use sufficient rudder in the direction of roll to maintain heading and to assist in the roll. Recover in level flight on your reference line. This maneuver is done in a single vertical plane and the final roll is not balanced.

4-2.9.4 Common Errors

a. During the first half of the maneuver, the errors occurring will be corrected the same as for the loop, bearing in mind that the starting airspeed is 20 knots faster than in the loop.

b. Excessive negative "G/". This is normally caused by applying too much forward stick pressure in the roll or by starting the roll before the nose is 20 degrees above the horizon.

c. Recovering off heading. Caused by not using enough forward stick in roll or by becoming disoriented while inverted and using back stick pressure to pull aircraft around to heading (usually 90 degrees off). Use as much control pressure as necessary to maintain heading.

d. Stalling or mashing in roll. Probably caused by not using enough back stick pressure in the first half of the maneuver (1/2 loop) and by being slow at the top. Could also be caused by rolling too slowly.

4-2.10 ONE-HALF CUBAN EIGHT

4-2.10.1 One-half Cuban Eight combines the first two-thirds of a loop to a position where the nose is 20 degrees below the horizon inverted, followed by a half-roll to a wings-level attitude in a 45-degree dive. It constitutes a 180-degree change of direction.

4-2.10.2 The one-half Cuban eight is taught to help the student develop orientation.

4-2.10.3 To perform the one-half Cuban eight, select a road, section line, or other prominent landmark that extends ahead and also behind. Enter a shallow dive in the last 90 degrees of clearing turn and roll out on the desired reference line in straight and balanced flights at 150 knots of airspeed. Start a smooth straight climb. Check to see that the wings are level as the nose comes up through the horizon. Continue straight back on the stick to keep the nose moving at a constant rate. After passing the vertical position, tilt your head back so that you can see the opposite horizon as soon as possible. Keep the wings parallel to the horizon and maintain the proper heading by gradually increasing right rudder as the airspeed decreases, thereby countering the effect of torque and maintaining balanced flight. Relax back pressure slightly as the nose passes through the opposite horizon to prevent the aircraft from stalling, but keep the nose moving at a constant rate. As the nose approaches a point 20 degrees below the opposite horizon, commence a roll in either direction, using aileron primarily in the desired direction of roll. During the roll, it will take forward stick to hold the heading and to continue the nose straight down to a position 45 degrees below the horizon. Regulate the back pressure to pull out of the dive easily and level off at 150 knots. This is done in a single vertical plane and the final roll is not balanced.

4-2.10.4 Common Errors

a. Poor directional control in the pull-up. This is a result of failure to use the rudder correctly to counteract torque and failure to keep the wings parallel to the horizon at all times.

b. Initial pull-up too fast. This results in a stalled or near stalled condition over the top of
the loop.

c. Excessive back pressure—over the top. This results in too great angle of attack, a possible stall, and roll-out off heading. Remember, if you also start the roll before the 20 degree nose-low inverted attitude, the roll will be more difficult and you will most likely come out off heading and in too shallow a dive.

d. Failure to use sufficient aileron and forward stick during the roll will result in a very shallow dive and recovery off heading.

e. Initial pull-up too slow. This results in a stalled or near stalled condition over the top of the loop.

4-2.11 UNUSUAL ATTITUDES

4-2.11.1 Unusual attitudes are attitudes not necessary for normal flying and are entered unintentionally.

4-2.11.2 These are taught to acquaint the student with unusual attitudes and to teach the student a prompt automatic recovery using the proper methods.

4-2.11.3 To enter unusual attitudes, the instructor will normally put the aircraft into an attitude not used during the regular syllabus. He will then inform you that you have control of the aircraft. If the attitude is nose-high, you will lower the nose to level-flight attitude; then level the wings, using coordinated aileron and rudder. If you find yourself in a nose-low condition, immediately close the throttle, level the wings in a dive, and smoothly raise the nose to the horizon. If inverted, roll out to the wings-level attitude in the shortest direction, using co-ordinated aileron and rudder.

4-2.11.4 Common Errors

a. Failure to close the throttle in nose-low unusual attitudes.

b. Not leveling the wings in the nose-low attitude before raising the nose to the horizon. This results in unsymmetrical stress on the aircraft.

c. Not lowering the nose to the horizon before leveling the wings. If you level the wings first in a nose-high unusual attitude, the airspeed continues to drop and a stall will probably result before you can lower the nose. This also results in the uncomfortable negative "G."
Well
That's about it fellows