Memphis Soaring Society

Basic

FLIGHT TRAINING MANUAL

May 4, 2001

TABLE OF CONTENTS

Page

CHAPTER 5

TAKEOFF

CHAPTER 6

AEROTOW AND RELEASE

CHAPTER 7

SAILPLANE AREA ORIENTATION

CHAPTER 8

BASIC FLIGHT MANEUVERS

CHAPTER 9

PATTERN AND LANDING

CHAPTER 10

EMERGENCY PROCEDURES

CHAPTER 11

CONSIDERATIONS FOR SOLO

APPENDIX I

APPENDIX II

CHAPTER 1

INTRODUCTION

1-1. SAFETY.

Safety considerations and practices are central to the Soaring Program. Safety is critical in all flying operations. All of the procedures described in this manual are designed with safety as the first and paramount consideration. Your instructor will always emphasize safety. Safety in flying is not a "spectator sport." For our operations to remain safe, we need your help and participation. The procedures you will learn are not arbitrary. If you have questions, let someone know. If everyone involved in soaring (including you) comes to the flight line with attentiveness and the desire to follow the established procedures, then we will continue to have a safe operation.

1-2. WHAT TO EXPECT.

a. From the beginning you will receive ground training which will cover much of the content of this manual. It is difficult sometimes for your instructor to schedule both ground and flight instruction. Much of the book work must be done by you in advance and is absolutely necessary to make you a safe pilot. A familiarity with this manual will help your training flow smoothly and efficiently. You'll have a better time if you arrive at the flight line with an understanding of the concepts introduced by this publication.

b. This manual is written with an emphasis on the things you need to know to safely accomplish your flight training. The focus here is on glider flying. If you read this manual and understand basic concepts such as transfer of aircraft control, checklist usage, clearing, basic flight maneuvers, patterns, and landings before you fly, then you will have the preparation you need to make the most of your flight training.

c. This manual uses the terms "glider" and "sailplane" interchangeably. Depending on your past flying experience (if any) and other factors, you can expect to fly five to twenty flights with an instructor pilot before you fly solo in a sailplane. If you have power aircraft experience you can expect to move rapidly, however there are many differences and you should study this Manual.

1-3. ATTENDANCE POLICY.

a. Our club publishes a handout titled "Standard Operating Procedures for Student Pilots." Insure that you have a copy and obey the requirements. This is a volunteer group and you can be assured that your instructor is here because he loves flying and the teaching of this sport. However, there are many **courtesies** and **responsibilities expected** of you to make it work.

b. One cannot learn to fly safely on a hit or miss schedule. Learning to fly demands that you fly at least 4 to 6 times a month.

1-4. ABOUT THE TEXT.

a. This manual is organized in a logical sequence. It begins with basic flight concepts, introduces the aircraft you will fly, describes ground operations, then moves through takeoff, basic flight maneuvers, and so on. It is vital that you read and understand the material before you fly. This saves everyone time and effort and ensures that you receive the best possible training.

b. In the beginning of each chapter, objectives are listed. These objectives describe the main ideas you should absorb from the reading. Any additional study you perform will only help make you a better pilot.

c. As you progress toward your solo flight, read the final chapter, titled "Considerations for Solo."

d. If you have any suggestions for this manual, please contact one of the Club's instructors.

1-5. A FINAL NOTE.

a. We sincerely hope you find this text useful. This may well be the most exciting and rewarding experience of your lifetime. It may continue to expand **flight** training you have already received. Or it may represent the beginning of a long flying career. Whichever it is for you, we are here to help you get the most out of the program, but we need your interest and participation. Reading this text is a good place to start.

b. Remember that your instructor is the primary source of guidance and information. He/she will do everything possible to help you. ***Have fun, and fly safe!***

David W. Cahoon, Chief Instructor

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CHAPTER 2

BASIC FLIGHT TERMS AND CONCEPTS

2-1. <u>OBJECTIVES</u>.

Understand the following:

a. Lift

b. Relative Wind

c. Angle of Attack

d. Stall

e. Drag

f. Best L/D Speed

g. Minimum Sink Speed

h. Adverse Yaw

i. Center of Gravity

j. Three Axes

k. Primary Flight Controls

l. Spoilers

2-2. <u>LIFT</u>.

Lift is produced by the pressure difference between the top and the bottom of an airplane's wing. Bernoulli's Principle basically states that when a fluid or gas is in motion, the pressure it exerts decreases as the speed increases. When air molecules pass *over* or *under* a wing, they make this passage in the same amount of time. (Two adjacent molecules hit the wing, one goes over, one goes under, they arrive at the trailing edge of the wing simultaneously.) However, because the top surface of an airplane's wing is more curved that the bottom surface, air passing on top effectively moves faster than air on the bottom. This difference in speed results in a difference in pressure in accordance with Bernoulli's Principle. The greater pressure on the bottom surface pushes the wing up, producing LIFT (Fig. 2-1). The *amount* of this lift depends on the wing's speed through the air and it's angle of attack. We'll talk about "angle of attack" shortly.

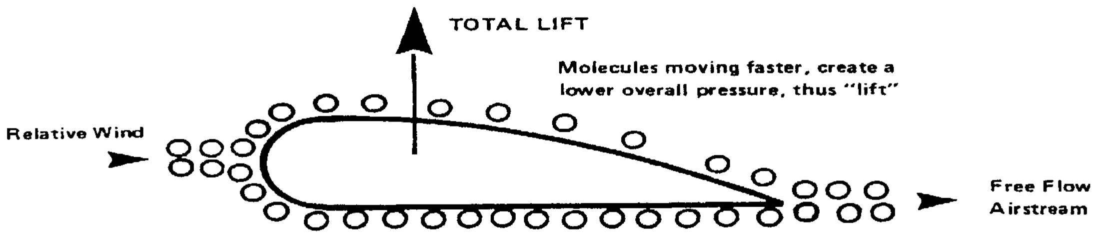


FIGURE 2-1

2-3. RELATIVE WIND.

The "wind of flight" always comes at the airplane from the direction toward which the aircraft is moving. If the plane flies level (glider A), the relative wind blows back level. In a glide when the airplane moves downward along a sloping flight path (glider B), the relative wind comes blowing up that slope (Fig. 2-2).

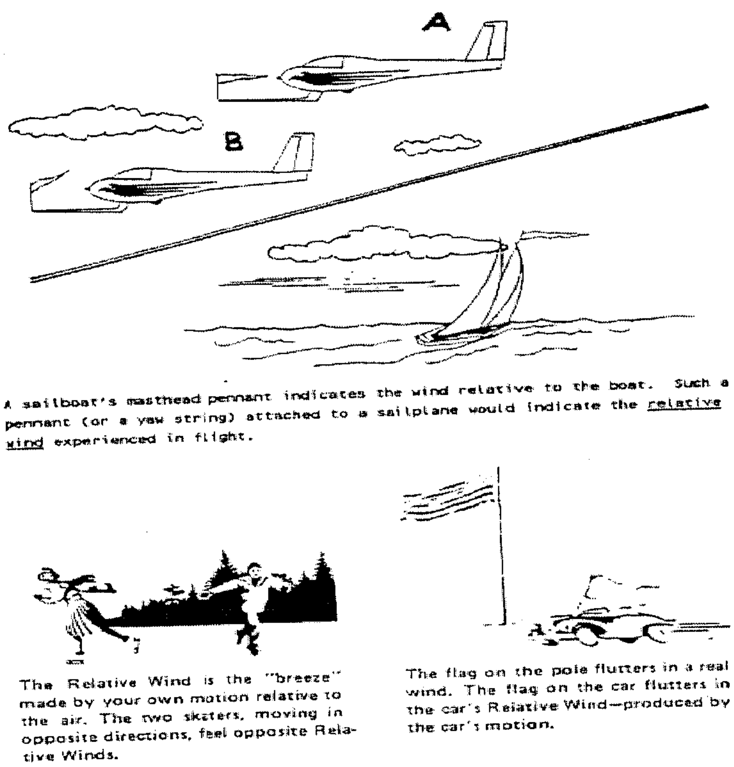
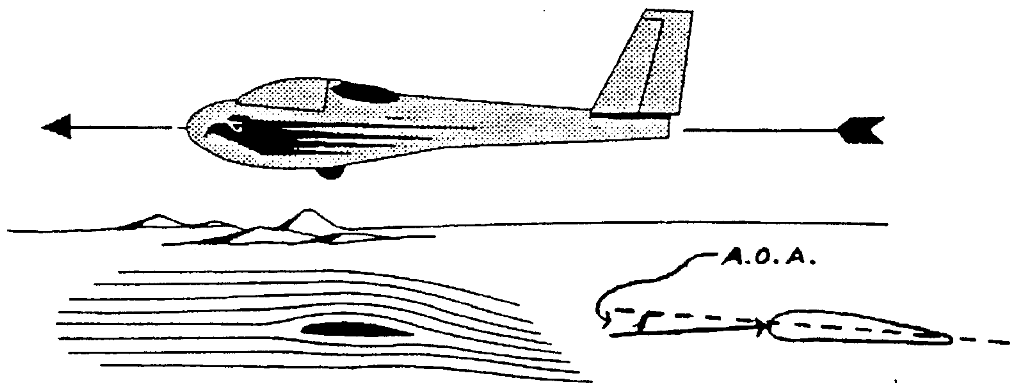


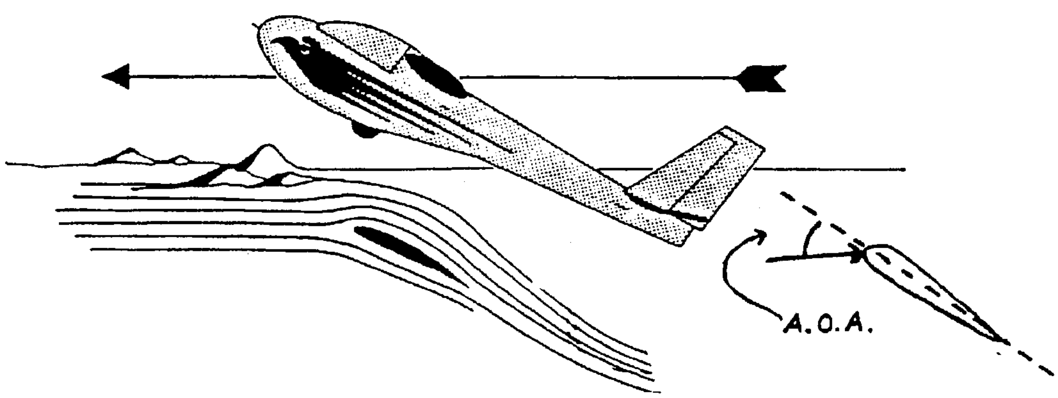
FIGURE 2-2

2-4. ANGLE OF ATTACK.

This is the angle at which the wing meets the relative wind (Fig. 2-3). Generally, when the angle of attack increases, lift also increases. Please note that the angle of attack is different from the aircraft's *pitch angle*, which is the angle of the longitudinal axis (axis drawn from an aircraft's nose to tail) relative to the horizon. In normal flight, changes in angle of attack roughly corresponds to changes in pitch angle. When you raise the nose of the sailplane in normal flight (increase the pitch angle), you will also increase the angle of attack, causing increased lift, causing the sailplane to climb -- at least for a short while. When you lower the nose of the sailplane (decrease the pitch angle and angle of attack), the reverse happens, and the aircraft descends.



Fast flight. Angle of Attack is almost invisibly small, downwash slight. Elevator neutral. This is normal cruising condition.

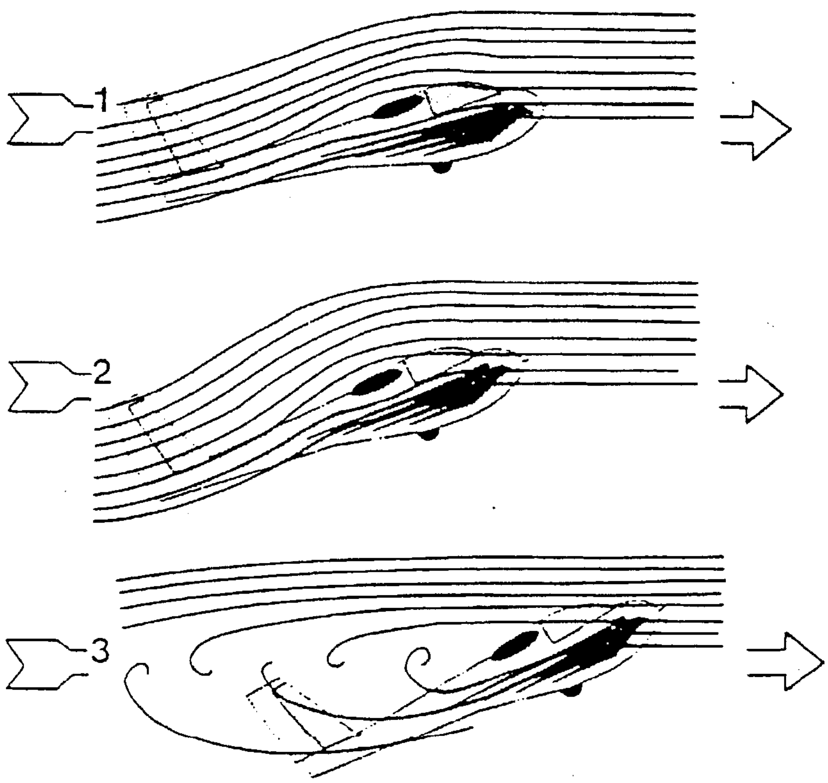


Slow flight. Arrow shows direction of flight. The Angle of Attack is large and the downwash is sharp. Upward-deflected elevator (pilot holds stick back) keep ship at large Angle of Attack.

FIGURE 2-3

2-5. <u>STALLS</u>.

Although lift increases with the angle of attack, it only does so up to a certain point. That point is called a stall. The direct and immediate cause of any stall is one thing: EXCESSIVE ANGLE OF ATTACK. Whenever a wing meets the relative wind at too sharp an angle, air passing over the wing ceases to flow smoothly and breaks up into turbulence (Fig. 2-4). When this happens, the wing loses lift, causing the airplane to descend (possibly very rapidly, depending on the severity of the stall). A similar phenomenon happens when you stick your hand out from a fast moving car. With palm flat and slightly angled into the wind, your hand acts as a wing, and you can feel lift. But if you angle your hand sharply into the wind, the lifting force disappears, and you instead feel a force pushing your hand in the same direction as the wind is moving. This force is a form of *drag*, which is the next topic of discussion. For now, you must understand the basic concept of a stall. (Your Instructor will thoroughly explain this concept, and you will practice several different stall maneuvers in flight.) This understanding is a pre-requisite to the safe operation of *any* aircraft.



An ordinary stall occurs simply because the pilot forces the airplane as a whole to an excessive Angle of Attack. The pilot is trying to lift his airplane by pulling the stick back. He overdoes it, and thus it stalls.

FIGURE 2-4

2-6. DRAG.

When any object moves through a fluid or gas, it experiences a retarding force parallel to the relative wind. This retarding force is called drag. An airplane in flight experiences **parasite drag**, basically caused by the bulk of the airframe moving through the air. As you can imagine, the amount of parasite drag increases with speed. Additionally, airplanes also experience **induced drag**. Induced drag is caused or induced by the production of lift. During flight, a component of the lifting force is parallel to the relative wind and retards the motion of the airplane. Unlike parasite drag, induced drag varies inversely with speed -- induced drag increases as airspeed *decreases*. (Of course, if the airspeed is zero, there is no relative wind, and there is no drag of any kind.) Induced and parasite drag add up to the **total drag** acting on an airplane (Fig. 2-5). Note that total drag is at a minimum at a certain speed. This is true for any airplane, but especially important for sailplanes, because it's where the sailplane glides most efficiently.

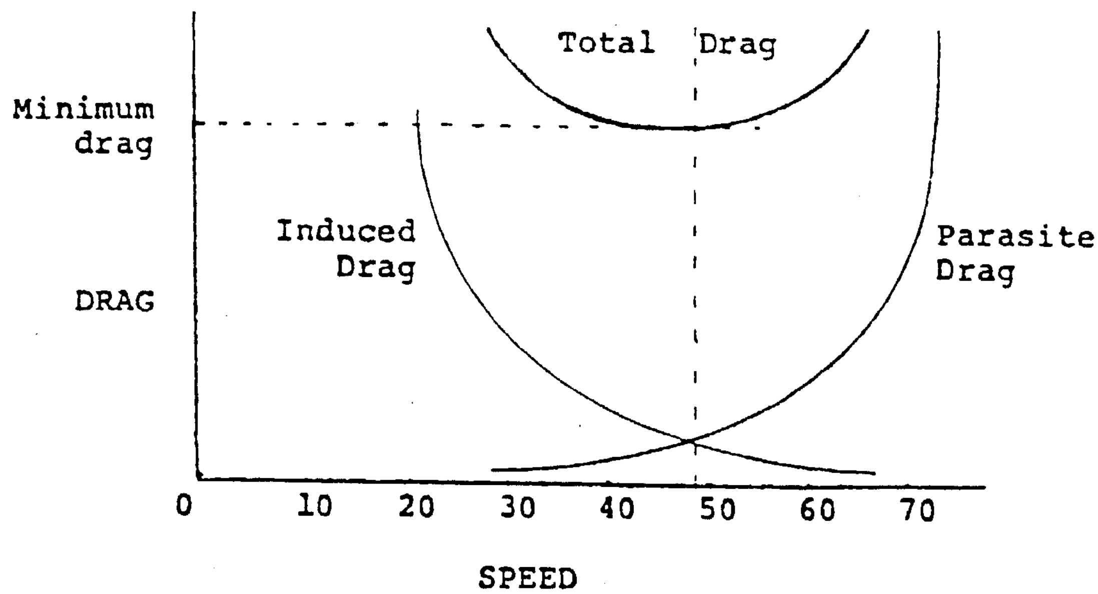


FIGURE 2-5

2-7. BEST L/D SPEED. (Pronounced "Best L over D")

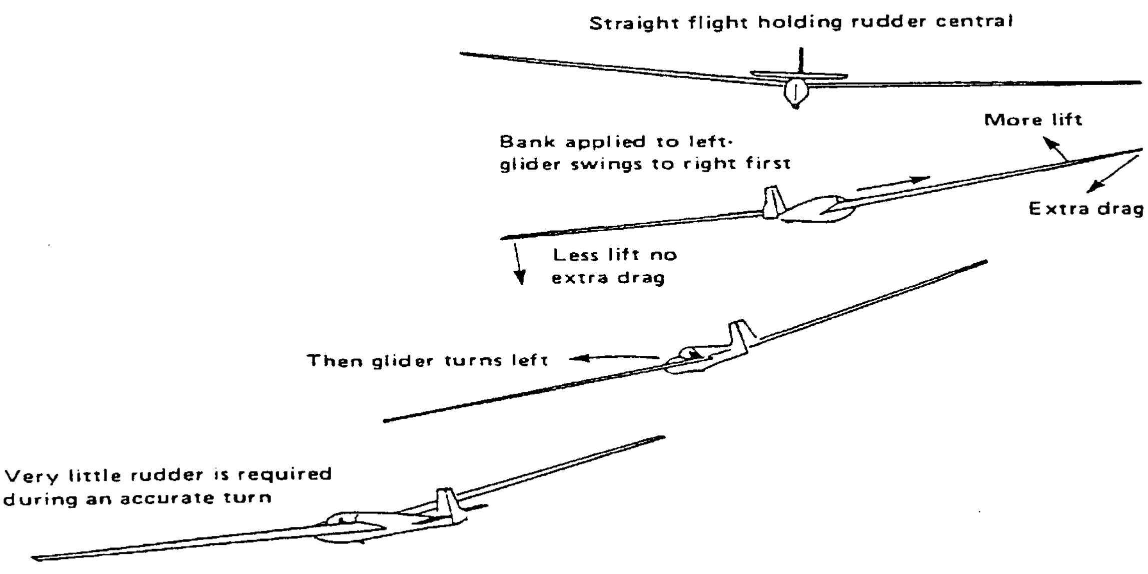
This speed is where an aircraft's total drag is at the minimum, resulting in the greatest or "best" Lift to Drag ratio, which is one measure of flying performance. At this speed, our sailplane can glide the greatest distance with the minimum altitude loss. Best L/D *speed* varies with gross aircraft weight. For example, the best L/D (or "best glide") speed for an SGS 2-33 sailplane with two people on board (dual) is 50 mph. With one person on board (solo), it's 45 mph. At these speeds, the 2-33's L/D *ratio* is 23:1. This means that the sailplane travels forward 23 feet for every one foot of altitude it loses. Speeds greater or less than best L/D results in reduced glide performance. (Appendix I lists all the speeds for the SGS 2-33 that you should know.)

2-8. MINIMUM SINK SPEED.

The speed at which a glider loses the least amount of altitude in a given time period. Equivalently, it's the speed that allows you to remain airborne the longest, given a certain altitude. Minimum sink speed varies with gross aircraft weight. For the 2-33, the minimum sink speed is 42 mph (dual) and 38 mph (solo).

2-9. ADVERSE YAW.

As an aircraft begins to bank (roll about the aircraft's longitudinal axis), the aircraft's nose will tend to yaw away from the direction of the rolling input. As the ailerons are moved to bank the aircraft, the lowered aileron of the rising wing will increase the wing's angle of attack and camber (curvature), increasing the lift on that wing. But as lift increases, induced drag increases, causing that wing to lag behind the lowered wing, which is producing less lift. This is adverse yaw. Proper rudder application in the direction of the turn *during aileron inputs* counteracts the adverse yaw and makes for a more "coordinated" turn (Fig. 2-6).



The effect of aileron drag when the glider is banked at the start of a turn causes a momentary swing in the opposite direction. For an accurate turn the stick and rudder must be applied together to prevent this swing.

FIGURE 2-6

2-10. CENTER OF GRAVITY OR "CG".

A point on the aircraft at which all the aircraft's mass may be considered to be concentrated. Practically speaking, this is the point where the aircraft balances, and it varies with aircraft loading. For all aircraft, the CG for each flight must fall within a safe range. Otherwise, the aircraft will be unstable or unresponsive. Especially in sailplanes, consideration of the aircraft's center of gravity is important on every flight, because the relatively light sailplane's CG is drastically affected by the weight of the crew. Therefore, every time you fly, you and your Instructor will ensure that the aircraft is properly loaded for safe flight.

2-11. THREE AXES.

All movement on an aircraft is made about three axes of rotation. These three axes intersect at the aircraft's center of gravity and are perpendicular to each other (Fig. 2-7).

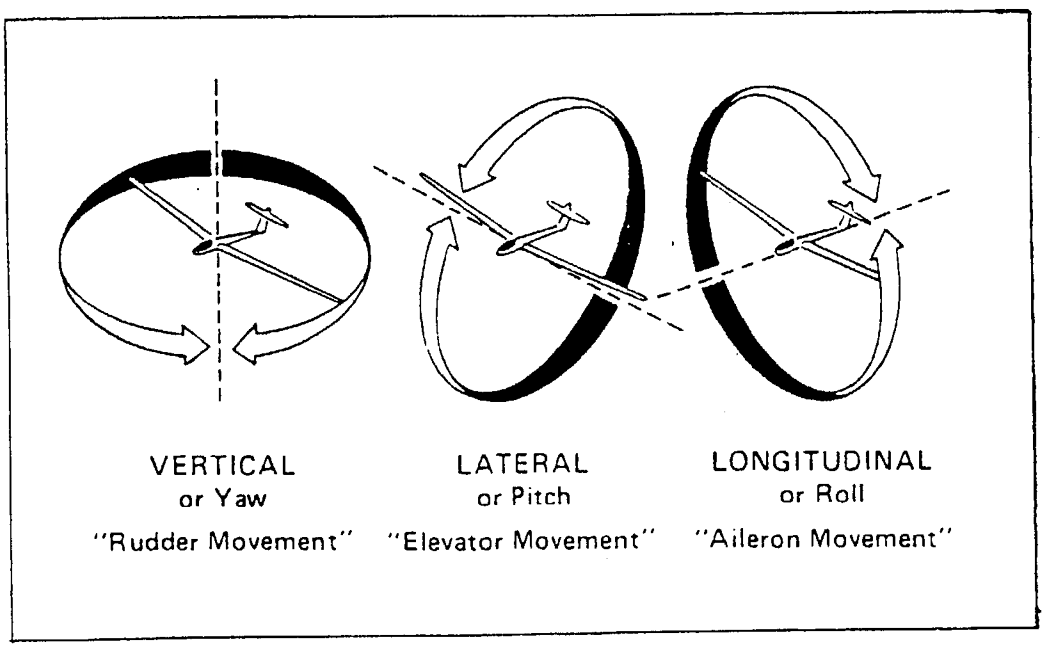


FIGURE 2-7

2-12. PRIMARY FLIGHT CONTROLS.

Three primary flight control surfaces direct aircraft movements about the three axes of rotation. The **ailerons**, connected to the wings near the wing tips, are moved by left and right movement of the control stick. They bank or roll the aircraft. The **elevator** is hinged on the rear of the horizontal stabilizer and is controlled by backward and forward movement of the stick. It changes the aircraft's pitch angle. The **rudder** is connected to the vertical stabilizer and is controlled by depressing the left or right pedal. It yaws the aircraft's nose left and right. With the ailerons, elevator, and rudder, you can rotate an aircraft respectively about the longitudinal, lateral, and vertical axes. Your flight training will teach you to coordinate the use of the flight controls to steer your aircraft through the three dimensions of the sky.

2-13. SPOILERS (AIRBRAKES, DIVE BRAKES).

Hinged panels on the top and bottom of each wing open up into the wind stream to spoil lift and create extra drag. The resultant effect is an increase in the sailplane's descent rate, thus controlling the glide path/angle. These spoilers are activated by a lever on the left side of the cockpit. In the SGS 2-33 sailplane, the spoiler handle slides aft to open the spoilers. (In the 2-33, the last inch or so of spoiler handle travel also activates the wheel brake. **You must be careful not to lock up the wheel on a landing touchdown.**) Regardless of mechanical variances between different aircraft, spoilers provide you increased control over the aircraft's descent. Controlling the descent is particularly important during the pattern and landing phase of flight, so that you can touchdown and stop at the desired points on the airfield.

CHAPTER 3

AIRCRAFT DESCRIPTION

3-1. OBJECTIVES.

State the general aircraft description, features, and instruments for Schweizer SGS 2-33 Sailplane.

3-2. SCHWEIZER SGS 2-33 SAILPLANE.

a. The SGS 2-33 is a conventional two place, tandem, basic training sailplane. It is all metal with fabric cover on the fuselage and tail surfaces. The "2" stands for two place and "33" is the model number. Here's a look at the SGS 2-33:

(1) Aside from the lack of an engine and propeller, the SGS 2-33 has all the major parts and features of a powered airplane.

(2) The supporting members connecting the underside of the wings to the wheel area are the wing struts. On the ground, you push or pull on a "strut" to move the sailplane. In the air, the wing strut is a useful visual reference tool in the traffic pattern.

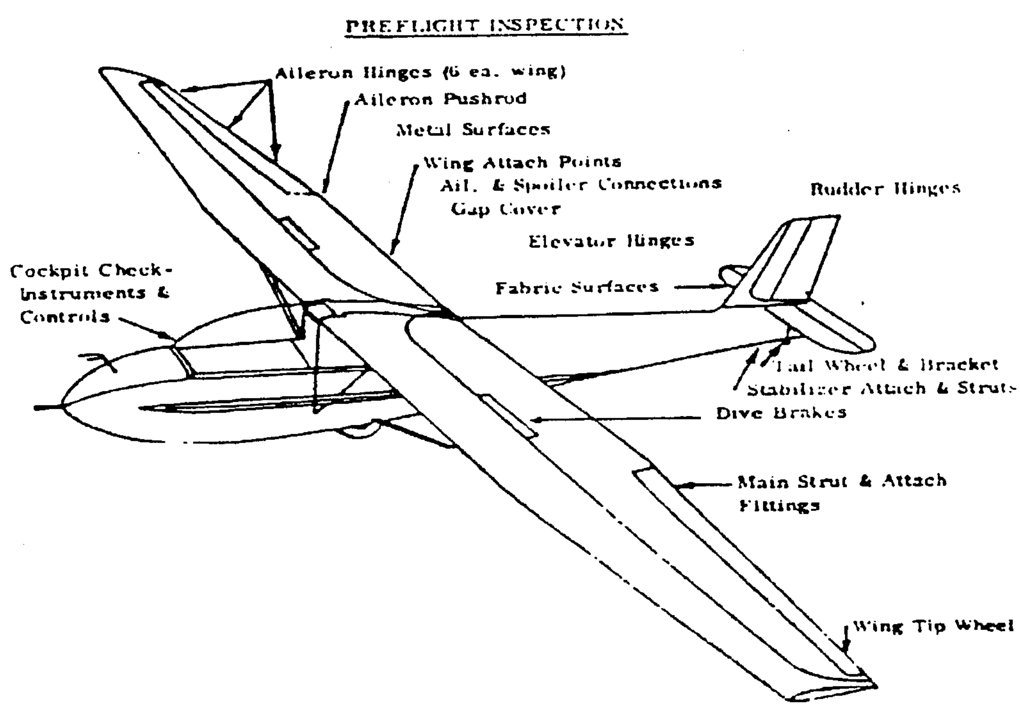


FIGURE 3-1

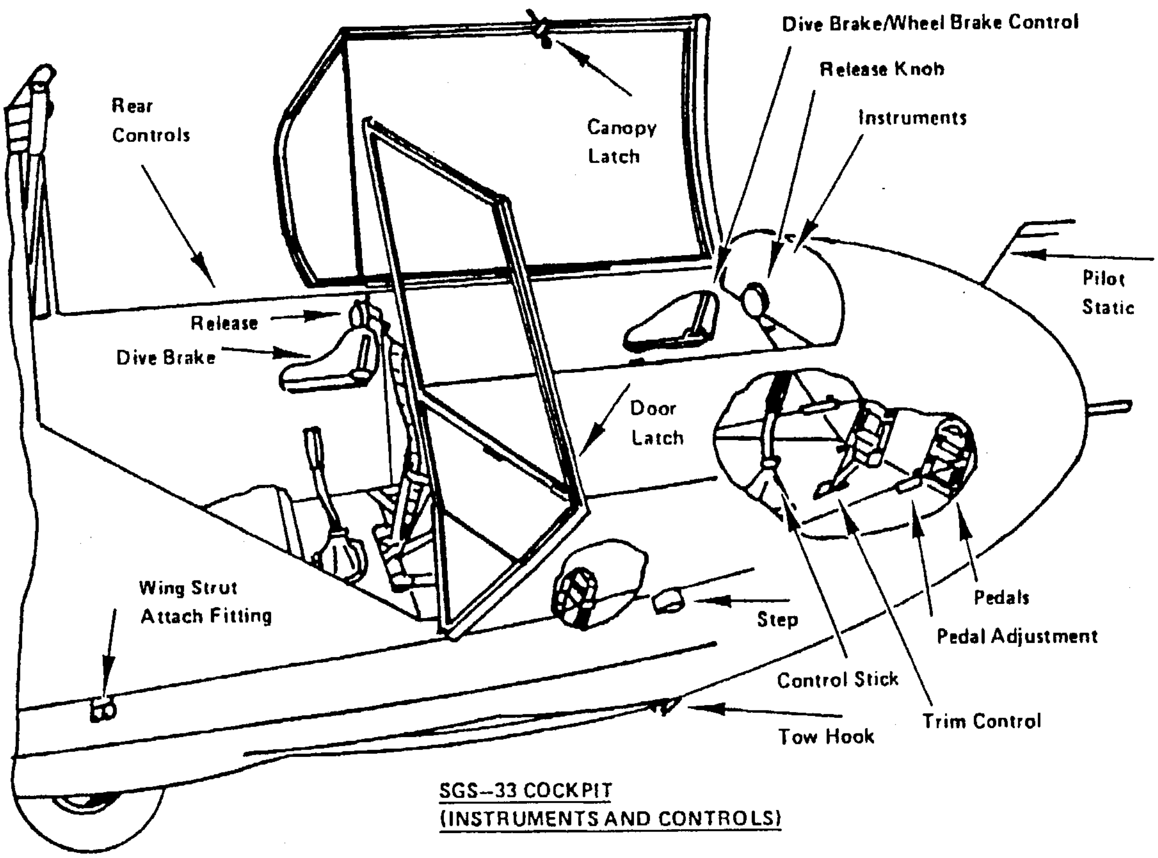


FIGURE 3-2

b. Above (Fig. 3-2) is a picture of the SGS 2-33 exterior cockpit area:

(1) You fly in the front seat.

(2) Don't apply excessive force to the canopy frame or plexiglass. Always keep the canopy closed and locked when not in use.

(3) The tow hook below the front cockpit is where the tow rope is attached.

(4) Between the tow hook and the main wheel is a metal strap called a skid. With a person in the front seat, the sailplane rests on the skid and main wheel. On the takeoff roll, when there is sufficient airspeed, the skid rises off the runway if you hold in some back stick pressure. On the final part of the landing roll out, the skid slides on the grass or ground and (along with wheel braking, if used) helps slow you down.

(5) The pitot static tube near the aircraft's nose senses static air pressure and also dynamic air pressure when the aircraft is moving into the wind. Static pressure alone operates the altimeter and variometer. Static and dynamic pressure operate the airspeed indicator, which compares the two pressures to give you an airspeed indication.

(6) The appendage directly on the nose is a handhold to aid in ground handling the sailplane. Push down on handhold to move tail around. Lower tail gently.

c. Inside the SGS 2-33 cockpit (refer to Fig. 3-2):

(1) The instruments and radio in the front cockpit are the only ones in the sailplane. Your Instructor sees them over your shoulder. He/she may ask you to adjust them during flight.

(2) There are no headsets in the 2-33. You and your Instructor will converse normally, although you may need to speak loudly to be heard by the Instructor in the back. The radio is heard via a speaker in the rear cockpit. You control the volume with the knob on the radio. Make radio calls with the hand-held microphone held close to your lips.

(3) Operate the spoilers with the spoiler handle on the left side of the cockpit. Close the spoilers by sliding the handle forward and lock them in the closed position by rotating the handle up, as pictured. Open spoilers by reversing the process. The last inch or so of the spoiler handle travel activates the wheel brake. Be sure not to have the wheel brake on during the landing touch down.

(4) The release knob sits in the lower center of the instrument panel. Pulling out the knob a few inches opens the tow hook. Touch this knob only when you hook up to a tow rope and when you want to release from tow. Inadvertent activation on the release knob in flight could put you and your Instructor in a precarious situation.

(5) In the rear cockpit, your Instructor has a control stick, rudder pedals, a spoiler handle, and a release knob that all work exactly the same as yours.

CHAPTER 4

GROUND OPERATIONS

CHAPTER 5

TAKEOFF

5-1. OPERATIONS.

Describe the following:

a. The Before Takeoff checklist

b. Hookup procedure

c. Obtaining takeoff clearance

d. Normal takeoff

e. Crosswind takeoff

5-2. BEFORE TAKEOFF CHECKLIST.

a. Checklists are important in the operation of any aircraft. They summarize the things you must perform to accomplish tasks safely and efficiently. The "Before Takeoff" is the first of two important checklists you have to know to fly the SGS 2-33. You must know what each item entails, and it's best to do them in the order listed:

C - CONTROLS: Ensure the elevator, ailerons, and rudder work freely, fully, and in the correct sense. If the control surfaces cannot be seen from the cockpit, a helper must be used to check proper movement.

* **B - BALLAST**: Ensure aircraft is within proper weight and balance limitations. (Reference placard posted in the sailplane.)

* **S - STRAPS**: Ensure that seat belts and shoulder harness straps are fastened securely tight (front and rear). If solo, rear cushions and straps must be clear and secure.

I - INSTRUMENTS: Set the altimeter to the field elevation, turn on the radio, check the proper frequency, adjust the volume, and ensure other instruments are indicating normally (airspeed indicator and variometer should read "0").

T - TRIM: Check/set the trim lever full forward.

* **C - CANOPY**: Close and lock the canopy. Ensure that it does not yield to upward pressure. Check the canopy retention cable clear of the rear stick.

A - AIRBRAKES: Ensure that airbrakes (spoilers) work freely and together, and that they are closed and locked.

L- LOOKOUT: Check wind conditions (speed and direction) and calculate pattern airspeed. Check for traffic on the takeoff leg. Make sure there is no one in front of any part of the sailplane.

b. We use the acronym **CB SIT CAL** (pronounced "C B SIT CALL") as a memory aid for doing this checklist.

c. Each item marked with an asterisk (*) is referred to as a "challenge and response" checklist item. This means that whoever is running the checklist performs the prescribed actions and then verbally challenges the other crew member to perform the same. (In the case of "Ballast," you need to ask the other person for his/her weight in order to use the weight and ballast placard in each airplane.) A "challenge and response" item is not complete until the other person responds positively.

d. Only when all steps of the CBSITCAL checklist have been accomplished may you hook up to the tow plane.

5-3. HOOKUP.

As you're doing the Before Takeoff checklist, the rope runner has marshalled a tow plane in front of you. As the tow plane taxis into position, the rope runner picks up the rope and inspects it for breaks and knots. (He/she informs you if the rope looks deficient in any way.) The rope runner then holds the sailplane end of the rope in front of the cockpit and asks the crew, "Seat belts, shoulder harness, canopy secure, checklist complete, ready for hookup?" At the same time, he/she visually checks these items and confirms that the spoilers are closed. If you acknowledge affirmatively and the spoilers are closed, the runner kneels down, puts the release hook through the rope ring and commands, "Open, close, check, close." With his free hand the rope runner simultaneously signals with an open hand as he says "open" and "check" and with a fist for "closed" (see Fig. 5-1). You must alternately (gently) pull and release the release knob at these commands to allow the rope runner to hook up the rope and to confirm that the release mechanism is working properly. After the hookup, the rope runner firmly tugs on the rope to physically check the release and then walks clear of the sailplane (behind the wings).

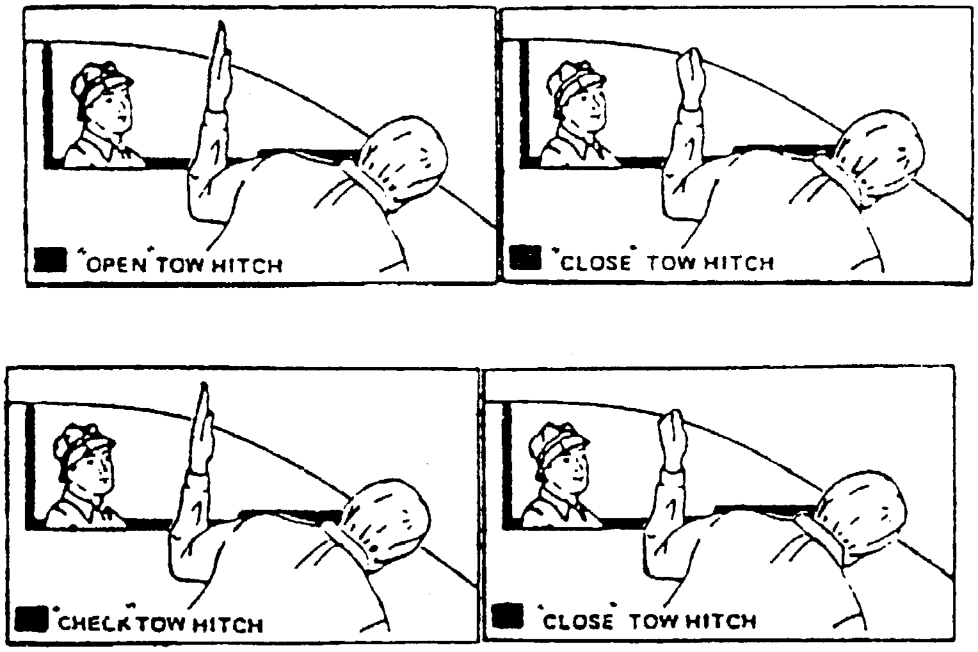


FIGURE 5-1

5-4. BEFORE TAKEOFF.

You cannot takeoff without checking ground safety and air traffic. Look around the sailplane again to make sure no one except the wing runner is near the aircraft. Then give the wing runner a "thumbs up" sign to tell him to raise the wing. This signals the tow pilot to take up the slack on the rope. When the rope is straight, wag your rudder prominently to tell the tow pilot that you're ready. (Do not bang the rudder on its stops.) The tow pilot acknowledges by wagging his rudder as he applies power.

5-5. NORMAL TAKEOFF.

a. Phase I. Position and hold the control stick neutral or aft of neutral, depending on the combined weight of the crew. During the first few seconds of the takeoff, the sailplane's metal skid slides on the ground and the wing runner continues to hold the wings level. As airspeed increases, the amount of elevator you're holding should progressively raise the sailplane's nose and skid off the ground, and ***you*** must keep the wings level with the ailerons. As the nose rises, adjust the stick pressure forward in order to keep the fuselage horizontal. Keep the wings level with aileron inputs. Steer directly behind the tow plane with rudder inputs. You will soon learn the value of anticipation, smoothness, and coordination.

b. Phase II. As you accelerate, the controls become more effective, and smaller corrections are needed. At about 40 mph, the tow plane's tail wheel comes off the ground. This is about the same time the sailplane becomes airborne. Allow it to fly off the ground. Don't pull it off. During Phase II, you're airborne, the tow plane isn't. It's very important during this phase to **stay low**, within a few feet of the ground, to avoid pulling the tow plane's tail higher than normal (Fig. 5-2).

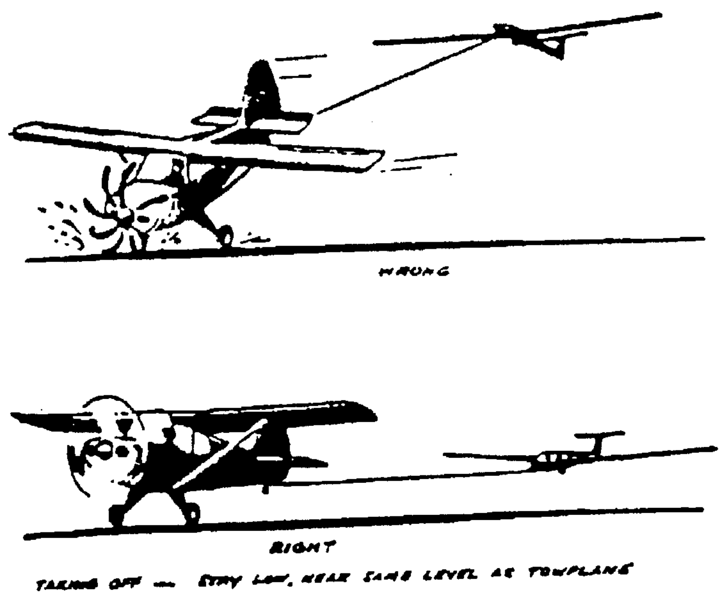


FIGURE 5-2

c. Phase III. In a short while, the tow plane also become airborne. During Phase III, you're aerotowing at a very low altitude.

5-6. CROSSWIND TAKEOFF.

A crosswind during takeoff requires you to apply crosswind controls to avoid being blown off the runway.

a. Phase I. Just as in a normal takeoff, hold the stick aft of neutral to raise the skid and then adjust accordingly as the speed increases. A crosswind doesn't really change how you use the elevator. The ailerons, however, must be used to keep the upwind wing lower than normal during Phase I of takeoff. Initially, the wing runner should hold the upwind wing lowered into the wind. For example, in a left cross wind, the wing runner should hold the left wing tip lower than usual. You want to maintain this wing-low attitude by deflecting the ailerons into the wind (left stick). You may have to start with nearly full deflection until the increasing airspeed makes the ailerons more effective. As this happens, reduce the deflection to keep a constant bank angle. Also, since the sailplane is still rolling on the ground, you must do one more thing -- apply appropriate rudder inputs to keep the sailplane directly behind the tow plane (right rudder in this case). Take care not to over control. This combination of "cross controls" (left ailerons and right rudder) during a crosswind takeoff is one of very few times when flying the sailplane in an uncoordinated manner is useful.

b. Phase II. As the sailplane becomes airborne, you should establish a crab into the wind using rudder.(Fig. 5-3). Keep wing level. Stay directly behind the tow plane on the runway and, again, **stay low** without descending back to the runway.

c. Phase III. As the tow plane flies off the ground, it also crabs into the wind. Stay behind and level with the tow plane as it climbs out. Do not allow the sailplane to drift into fences or trees.

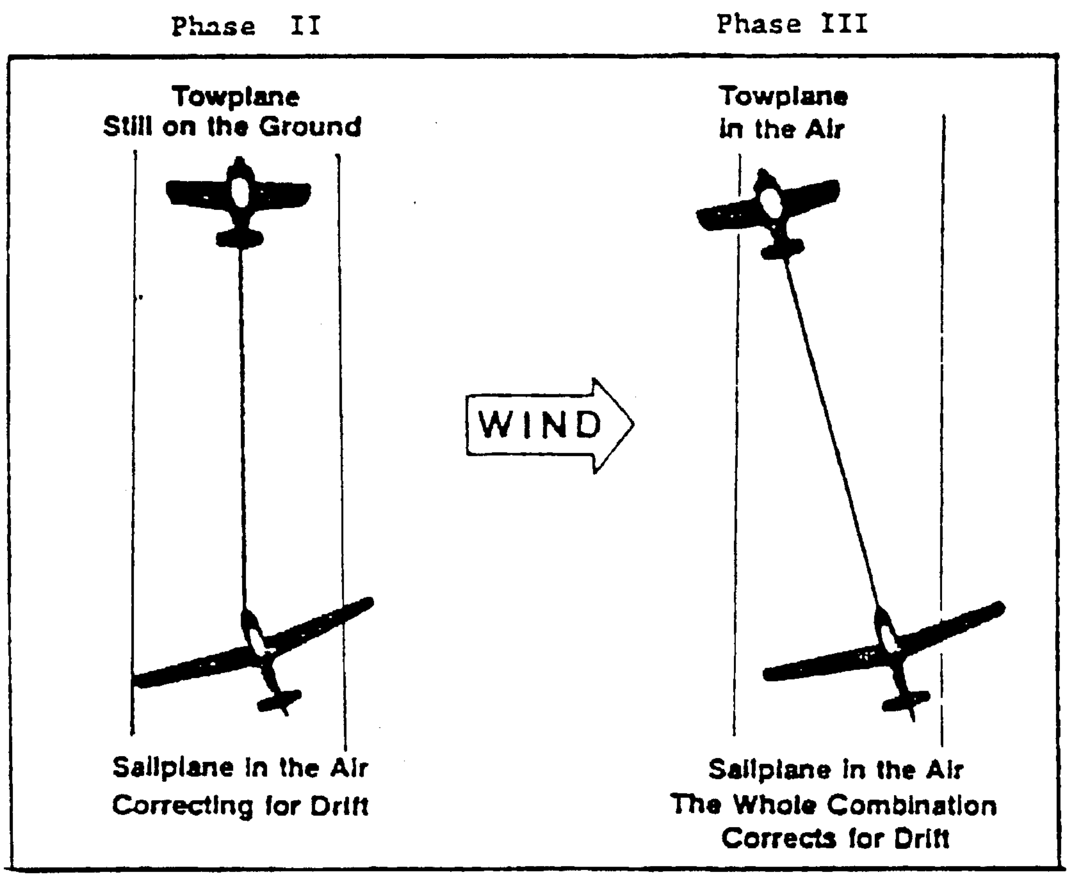


Figure 5-3

CHAPTER 6

AEROTOW AND RELEASE

6-1. OBJECTIVES.

Describe the following:

a. Wings level aerotow

b. Aerotow turns

c. Boxing the wash

d. Slack line recovery

e. Release

6-2. WINGS LEVEL AEROTOW.

Aerotow requires you to fly in formation behind the tow plane. Approximately 200 feet of tow rope separates you from the tow plane. You use ailerons, elevator, and rudder to stay in proper position.

a. Figure 6-1 shows the proper wings level aerotow position. The sailplane is at the tow plane's six o'clock, matching the tow's altitude and bank angle (0°). From your perspective in the sailplane, the tow plane's wings are on the horizon, and you're sighting directly down the vertical stabilizer. If the picture looks different, you're out of position.

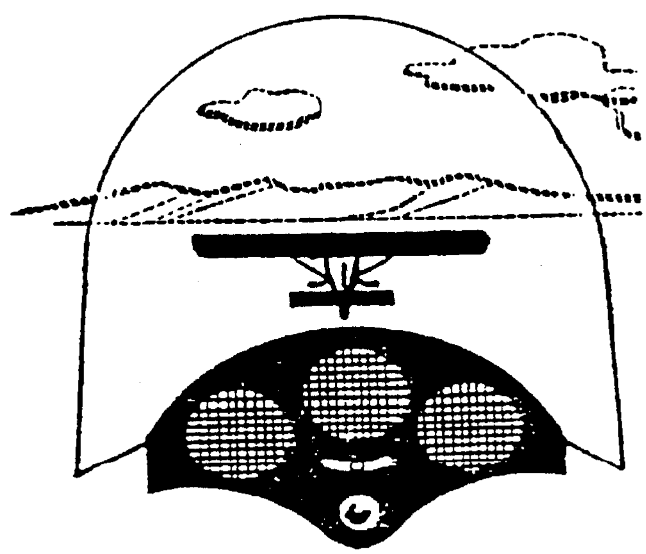


FIGURE 6-1

b. Factors including turbulence and pilot inattention may cause you to deviate from a proper position. When a deviation occurs, correct it. Remember, when you're flying, **you** are controlling the aircraft. Don't allow the reverse to happen to you! For minor deviations, use stick and rudder simultaneously in the same direction to keep the wings level and to steer back to the proper aerotow position. But, if you're getting significantly out of position, the following "WAR" acronym simplifies the process of getting back into position:

(1) **Wings Level.** (Stabilize) Prevent a worse situation by recognizing the deviation, remaining calm, and taking control. A very good technique is to use your aileron to match your bank angle with the tow's bank angle. This is a lot better than making haphazard inputs, and helps to avoid deviations in the other two axes.

(2) **Altitude.** (Correct vertically) If you're higher than the tow plane, *ease* the stick forward; if you're low, *ease* it back. As you make this correction to descend or climb back to the tow plane's altitude, you will see the tow's wings return to the horizon. As the wings *approach* the horizon, relax your corrective input to prevent an overshot.

(3) **Rudder.** (Correct horizontally) Now that you're at the correct altitude, apply rudder pressure on the same side that you want the sailplane to move **while keeping the wings level**. As you approach the tow plane's six o'clock position, relax rudder pressure to prevent an overshot.

c. As you gain more experience, you will be able to coordinate control inputs to correct smoothly back to position. For now, the above steps not only simplify the process but also show you the individual effect on each control surface. In any case, you will find that in all corrective actions, you must reduce, neutralize, even reverse slightly whatever control inputs you were holding as you approach the desired position. Otherwise, you will overshoot and have to correct the other way. Lastly, the best way to be in position is not to deviate much from the proper position to begin with. Anticipation, smoothness, and confident control inputs make for good aerotow.

6-3. AEROTOW TURNS.

An aerotow turn involves following the tow plane around an arc, much like following a car on a curved road. Therefore, you must start your turn at the same "point in space" as the tow plane.

a. Without any visible reference for this arc, the best technique is to wait two seconds after the tow plane has banked into the turn before banking your sailplane. Rolling into the turn requires use of ailerons and rudder in the same direction to keep the yaw string centered (pointing at you). As you approach the tow plane's bank angle, relax some aileron and rudder inputs so you don't over-bank. When your bank matches the tow's bank, he will stay stationary on your canopy. Ask your Instructor for additional references. Figure 6-2 shows how an aerotow turn should look.

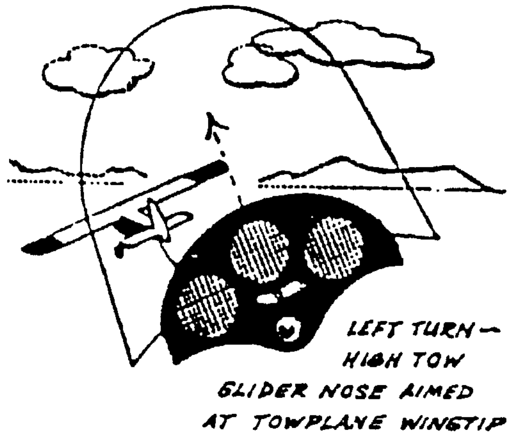


FIGURE 6-2

b. The tow plane's outside wing is seen above the horizon; the other wing is below the horizon. (The area above the tow pilot's seat is called the "canopy." It should be just above the horizon for both wings level and turning aerotow.) Your sailplane's nose should point at the tow's outside wing tip.

c. If you get out of position during the turn, use the same corrective procedure: wings, altitude, rudder (WAR). In a turn, correcting horizontally requires use of the rudder *and* ailerons. If you're inside of the turn, lessen your bank angle and apply a little bit of "top rudder" (using the rudder pedal on the outside of the turn). If you're outside of the turn, do the reverse. Remember to keep the *canopy* just above on the horizon as you do this.

d. Rolling out of a turn involves reversing the steps of getting into a turn. When the tow plane begins to roll out, wait two seconds before applying coordinated ailerons and rudder. Relax these inputs as you approach wings level flight. You're back to wings level aerotow.

e. Any time you're on aerotow, but especially when you're turning, clearing remains a primary concern for you and your Instructor. **Don't focus solely on the tow plane.** In fact, if you actively clear on aerotow, you not only see other traffic better, you may find aerotow easier and more relaxing because the horizon supplements the tow plane as your attitude reference.

6-4. SLACK LINE.

A slack in the tow rope exists any time the distance between the tow plane and sailplane is less than the length of the rope. Left uncorrected, this "slack line" may worsen and become hazardous. A slack line can result from turbulence, slowing of the tow plane, poor aerotow corrections, anything that closes the distance between the two airplanes. Whatever the cause, correct a slack line using the following steps:

a. Stabilize. Stop the slack line from worsening by reducing the sailplane's speed relative to the tow plane. Freezing the controls is a good start. Then, raising the nose slightly usually stops the slack from getting larger because the sailplane slows as it climbs. Using the rudder to yaw away from the slack works in some situations. Your Instructor will show you some different techniques.

b. Fly Formation. Flying perfect formation will another aircraft, by definition, means that there is no relative speed between them. This step not only prevents the slack from worsening, it actually takes the slack out as the powered tow plane begins to speed away from the sailplane. So, after you've stabilized the slack line, strive to match the tow plane's attitude exactly. This means the same bank and pitch angle (not climbing or descending relative to the tow plane). You should see the slack decrease in size as the tow plane pulls away. (Opening the spoilers is an obvious way to lose speed. Doing so, however, is usually unnecessary, and even IP's rarely use this technique.)

c. Accelerate. You want to match the tow plane's speed as the slack disappears. As the slack lessens, descend and/or yaw toward the tow plane to accelerate. Too little acceleration results in a jerk or possibly a broken rope when the rope straightens. Too much causes another slack line. Your Instructor will show you techniques that will enable you to *finesse* a slack line recovery.

6-5. BOXING THE WASH.

During normal aerotow, you fly above the propeller wash, a region of turbulence behind and below the tow plane emanating from the tow's propeller and wingtips. When you "box the wash," you fly a rectangular pattern around the "prop wash and wake created by the wingtips." Figure 6-3 shows the maneuver. Your Instructor will demonstrate a box the wash and may ask you to try it, though you don't have to achieve any level of proficiency. It's a challenging maneuver that requires you to use each of the control surfaces as you move around the prop wash. It's also a fun maneuver, showing the individual effect of each control surface and allowing you to build confidence on aerotow.

a. Start the maneuver from the normal aerotow position shown in the top middle frame of Figure 6-3. (This position is sometimes referred to as the "high aerotow" position.) You may proceed clockwise or counterclockwise, but assume that we're boxing the wash clockwise.

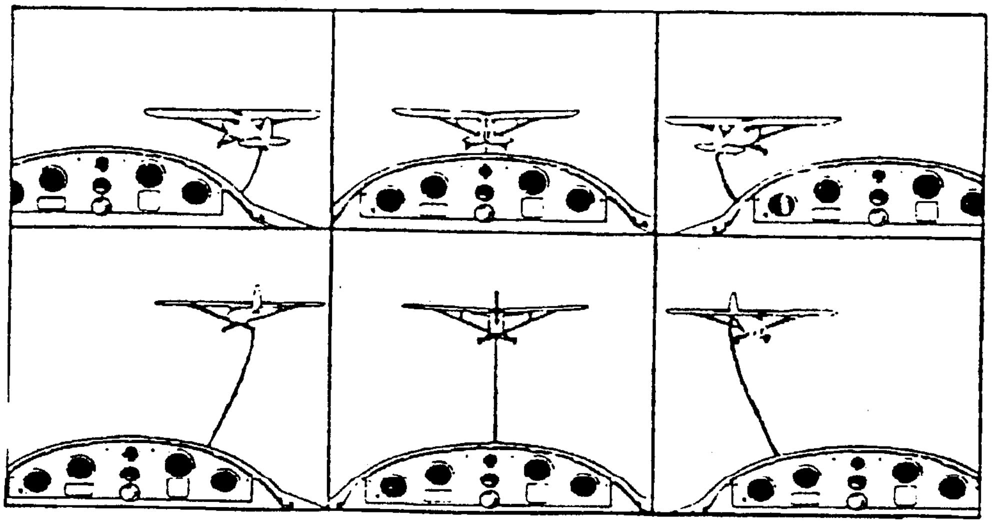


FIGURE 6-3

b. Keep the altitude constant and the wings level as you use rudder to slide to the right. Pause momentarily in this first "corner." You should see the tow plane's tail wheel superimposed on its left main wheel. You may have to hold in some right rudder to maintain position against the pull of the rope, and to keep your fuselage aligned (parallel) with the towplane's.

c. Descend to the bottom right corner by easing forward on the stick while maintaining lateral position. Pause momentarily in this corner. You should see the tow plane's horizontal stabilizer superimposed on its wings, and the tail wheel should be in line vertically with the left main wheel.

d. Slide left to the bottom left corner with some left rudder. Remember to keep the wings level. As you do this, you pass a few feet below the prop wash, transiting through the "low aerotow" position shown in the bottom middle frame of Figure 6-3. Pause slightly at the bottom left corner to see the tow's tail on its wings and the tail wheel directly above the right main wheel.

e. Climb to the top left corner. Hold in some left rudder to maintain lateral position as you ease back on the stick. Pause here to see the tail wheel superimposed on the right main wheel.

f. Finish boxing the wash by returning to the high aerotow position.

g. Boxing the wash may be performed in a turn but requires more skill because turning forces are involved and because the tow plane becomes your primary attitude reference (instead of the horizon).

6-6. RELEASE.

After five to ten minutes on aerotow (depending on lift/sink conditions and tow plane performance), you should be at 3,000 feet AGL (above ground level) or 3,249 feet MSL (mean sea level) as indicated by the altimeter, if in Forrest City. It's time to release from tow. The basic procedure is to clear well, pull the release knob, and start a shallow climbing turn to the right. The tow plane will dive to the left. Always ask your Instructor if he/she is ready for release! He/she may want a higher tow.

a. Throughout this program, you will be reminded to clear "left and right" before releasing from tow. It's paramount to clear extremely well *before* and *after* releasing, as tow plane and sailplane will be making significant heading and altitude changes after release. First, inspect the left quadrant (nine to 12 o'clock) from the horizon to the ground. Your tow pilot will turn and descend in this region. Then inspect the entire right side (12 o'clock and aft), especially on and above the horizon. If all is clear, pull the release knob fully. Fly straight momentarily to confirm that the tow rope is falling away. Begin a turn to the right, climbing in a shallow angle to trade aerotow speed for some more altitude.

b. Your Instructor will teach you some other common practices concerning the release. For example, being in good aerotow position, being upwind of the entry point (more on this later), and *not* being in the sinking air are good things to check for prior to pulling the release knob. You may release in a turn, although it might not be wise to do so in a right turn, where the tow plane is banking in the same direction that you'll be turning.

c. After the release, continue to clear as you make your first turn to the right. You can make a 180° turn before rolling wings level. Or, you can roll out after 90° and do another 90° turn. Either way, you must do at least one "clearing turn" immediately after release in order to clear the work area.

CHAPTER 7

SAILPLANE AREA ORIENTATION

7-1. OBJECTIVES.

Describe the following:

a. Sailplane area and pattern overview

b. Areas to avoid

c. Basic area planning

CHAPTER 8

BASIC FLIGHT MANEUVERS

8-1. <u>OBJECTIVES</u>.

Describe the following:

a. Composite flight concept

b. Straight glide

c. Normal and steep turns

d. Slow flight

e. Stalls

f. Spiral

g. Transfer of aircraft control

h. Clearing

i. Radio use

8-2. <u>COMPOSITE FLIGHT</u>.

Airplanes are flown using outside references backed up by occasional glances at the instruments. Especially in sailplanes, the horizon, its perceived position on the wind shield, the yaw string, even the wind noise, give you the most reliable data for controlling the aircraft. Instruments only quantify certain data. Referencing them allows you to fine tune your control inputs. But instruments can malfunction, and their indications usually lag. At best, sailplane instruments merely back up the information given by outside references. So, while flying, keep your eyes focused outside and refer to the instruments only occasionally. This is the concept of composite flight.

a. By far the most useful and reliable tool in any sort of flying is the horizon. The horizon's position (i.e., amount of ground in your canopy) as seen relative to the wind shield gives direct and immediate information about the aircraft's *attitude*, the combination of pitch and bank. Aircraft attitude determines aircraft performance. Nose high (less ground) -- airspeed decreases, nose low (more ground) -- airspeed increases, right bank -- right turn, etc. The term "picture" is used to describe the horizon's position on the wind screen and is an unerring reading of aircraft attitude. So, changing this "picture" changes the aircraft performance. The key to good flying is to **establish and maintain an appropriate "picture."** Once a picture is established, reference the instruments to check for desired performance (airspeed, climb/descent rate, whatever readings are applicable). Then adjust the picture as required. (Note: The horizon is where the sky meets flat terrain.)

b. Instruments lag behind the phenomenon they measure, whether it's airspeed, altitude, or climb/descent rate. Also, turbulence makes them erratic. **Don't "chase" instrument readings.** If you want to fly at a constant airspeed, set a picture (specifically, *pitch* picture), check the airspeed, then adjust the picture as needed. If the reading is erratic, don't chase it. Maintain a constant picture and accept the average reading. Remember, instruments only back up your most reliable tool -- the horizon.

c. Looking outside most of the time has other benefits. You can clear better. You maintain better position awareness. And, the scenery is fantastic!

8-3. STRAIGHT GLIDE.

Among the first things you do in the sailplane is to glide straight ahead at a constant airspeed. The aircraft's wings have to be horizontal, and the nose has to point below the horizon. You should see the horizon cut straight across and approximately half way up the wind screen. Your sitting position determines the exact picture that you see. Glance left and right. Your wings are level if the distance from wing tip to the horizon is the same on both sides. Check the airspeed indicator. It should be reading close to 50 mph. If the reading is more than desired, raise the nose a bit. You should now see more sky than ground than before. Re-check the speed. Adjust the pitch picture again if you need to.

8-4. NORMAL TURN.

a. Normal turns involve bank angles up to 30°. To turn, first clear in the direction of the turn. Then move the stick in that direction. As you deflect the ailerons, add rudder in the direction of the turn to counteract adverse yaw. Apply enough rudder to keep the yaw string centered on the wind shield. Apply rudder on the same side that you want the yaw string to move to be centered. Doing so makes for a **coordinated** turn. Remember this: **Whenever you apply ailerons, apply rudder in the same direction to keep the yaw string centered.** This rule applies whether you're rolling into or out of a turn. As you approach the desired bank angle, you must relax or even reverse the aileron and rudder inputs to avoid over-banking. In a bank, the total lift produced by the wings is a vector with vertical and horizontal components. It's the horizontal component of lift that turns the airplane (Fig. 8-1). Note: Once you are established in a stabilized turn, you do not need any rudder (i.e., neutralize the rudder pedals). You only need rudder when changing the bank angle.

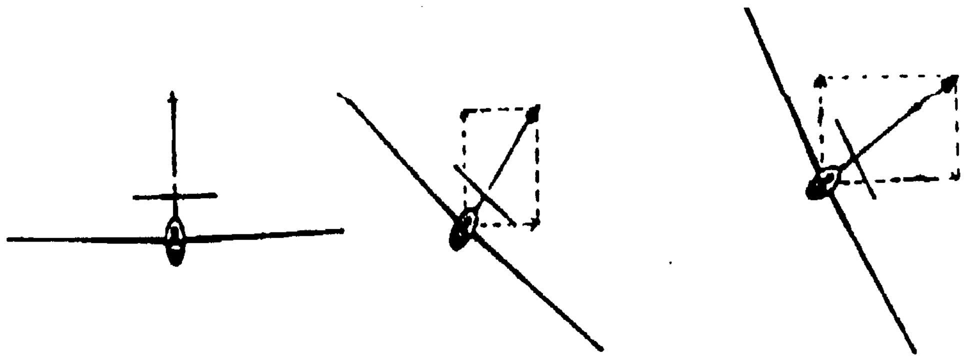


FIGURE 8-1

b. As you increase bank, the <u>vertical</u> component of lift decreases. Since weight remains the same, the nose will fall. To recapture this vertical lift, back pressure must be applied *and held* to increase the angle of attack/total lift. The greater the bank angle, the more back pressure you need. Once established in a turn, make small inputs as required to hold the bank and pitch constant. In other words, you should fly a picture. In a turn, you should see the horizon cutting across the wind shield at a constant angle and there should be more ground than sky. Continue to clear in the direction of the turn. Rolling out of a turn requires smooth application of aileron and rudder. As vertical lift is regained, smoothly release back pressure as required to keep the pitch attitude constant.

c. Roll out of the turn using the same procedure for getting into a turn. Be sure to clear first. Then use coordinated ailerons and rudder, keeping the yaw string centered. To roll out precisely on a desired point, you must "lead" the roll out. This lead angle is approximately a third of the bank angle. For example, in a 30° banked turn, begin rolling out about 10° before the aircraft's nose reaches the roll out position.

8-5. <u>STEEP TURN</u>.

A turn using 45° to 60° of bank is considered a steep turn. A steep turn lets you make a heading change quickly. But it requires more coordination and puts the aircraft closer to a stall. When you practice a steep turn, you should find that it takes more ailerons and rudder to bank, more elevator to keep the nose from dropping, and more airspeed to avoid getting into a stall. A good airspeed for entering and performing steep turns is **60 mph**.

8-6. <u>SLOW FLIGHT</u>.

Slow flight is done at altitude to simulate the landing phase when the aircraft is close to the ground and slowing. Slow flight speed is slightly above stall speed. From a straight glide, slow the aircraft by raising and holding the nose at a landing attitude (nose about on the horizon). As the airspeed approaches stalling speed, turbulent air flow from the wings hits the airplane's fuselage and tail to create a vibration called "buffet," or "buffeting." You can feel the buffet through the entire airframe and especially the control stick. When you first recognize the buffet, note the airspeed. Then lower the nose slightly to fly 3 to 5 mph faster than the airspeed where the buffet began. This is slow flight airspeed, which may vary with each individual sailplane. Continue the slow flight practice by holding a stable straight glide for a few seconds. Next, roll into a coordinated left or right turn using shallow bank (about 10° to 15°) and turn slightly from heading. Then reverse the direction of the turn and return to the original heading using shallow bank. You should find that it takes a good amount of rudder to stay coordinated and that all control surfaces seem sluggish in slow flight. Here too, establishing a proper aircraft attitude is the key to flying good slow flight. Remember, the airspeed indicator is only a backup for the good pitch picture. Also note the reduced noise during slow flight. Later you will learn to thermal, slow flight is one key to success in finding and staying in thermal lift.

8-7. STALLS.

Practicing stalls teaches you to recognize the indications of a stall and the procedure for recovering from a stalled condition. This knowledge will hopefully prevent you from getting into a real stall, especially close to the ground. We practice three different stalls: turning stall, landing attitude stall, nose high stall. Prior to practicing a stall, you must clear well for other traffic, especially below your aircraft. Make some "clearing turns" before doing each stall or a series of stalls.

a. As we said in Chapter 2, a stall occurs when the critical angle of attack is exceeded. A full stall is almost always preceded by several warning indications. The following are common indications of an impending stall:

(1) Nose high attitude (most of the time)

(2) Decreasing airspeed

(3) Decreasing wind noise

(4) Sluggish controls

(5) Buffeting

Loss of control accompanies a full stall.

b. Recover from an impending or full stall using the following procedure:

(1) **Release back stick pressure** (ensure spoilers closed). This reduces the angle of attack below the critical value. Releasing back stick pressure does not mean "dumping" the nose. Doing so on a real stall recovery may mean hitting the ground.

(2) **Level the wings** using rudder first and then ailerons a second later. With the wings level, the lift vector points vertically, away from the ground.

(3) **Recover to normal flying attitude**. Take care not to apply up elevator too soon or too abruptly as this will cause "secondary stall."

c. Turning stall. This is the first of two "traffic pattern stalls." It demonstrates what could happen in a turn in the traffic pattern or in any turn where you allow the airplane to approach the critical angle of attack. From a straight glide, enter a shallow turn. Then raise and hold the nose on the horizon. Again, do whatever it takes to hold a constant attitude. Observe the signs of the impending stall. When you feel the buffet, recover using the three-step procedure. The practice turning stall is not a full stall, since you recover as soon as buffeting sets in.

d. Landing attitude stall. This is the other "traffic pattern stall." It simulates a stall in the landing phase of the flight. In a straight glide, open the spoilers to at least half. Then raise the nose to a landing or flare attitude (nose about on the horizon). Hold this attitude and observe the signs of the impending stall. When you feel the buffet, recover. Remember to close the spoilers as you release the back stick pressure. It's particularly important during this recovery not to dump the nose. Just lower it enough to break the stall without losing more altitude than necessary. You're simulating a stall very close to the ground. Like the turning stall, the practice landing attitude stall is not a full stall.

e. Nose high stall. You experience a full stall in the nose high stall. From a straight glide, smoothly raise the nose 20° to 30° above the horizon (picture your feet on the horizon). Hold this attitude with increasing back stick pressure as the airspeed decreases. Keep the wings level with aileron inputs. The airplane is fully stalled when you can no longer maintain the desired attitude (loss of control). Recover when this happens.

8-8. SLIP.

A slip allows you to lose altitude rapidly and is normally used in the traffic pattern as needed. The aircraft is purposely cross-controlled with ailerons and rudder to expose more of the fuselage to the air stream, creating more drag.

a. Make sure the spoilers are fully opened.

b. Analyze the wind. If there is any crosswind component, the upwind wing should be lowered. For example, if there is a crosswind from the left, you will lower the left wing. In calm winds or a direct headwind, it doesn't matter which wing is lowered.

c. Slowly step on the downwind rudder pedal. In a left crosswind, step on the right pedal. Use full rudder to maximize the effect of the slip.

d. As you apply rudder, simultaneously apply some opposite aileron. The airplane is now flying somewhat sideways into the wind, descending rapidly. You don't need full aileron -- just enough to continue steering straight down the landing area. The rudder stays fully deflected. During a slip, the yaw string is really askew, but this is fine so long as you maintain sufficient airspeed. Keep the nose below the horizon. The airspeed indicator will not be accurate during a slip.

e. When you have lost enough altitude, recover from the slip. You must get out of a slip no lower than 100 feet AGL. Simultaneously and smoothly neutralize the rudder and ailerons. Adjust the spoilers as needed to continue the descent.

8-9. TRANSFER OF AIRCRAFT CONTROL.

Almost all your flying will be done with an instructor sitting behind you. It is critical to know who is flying the airplane at all times. Without proper transfer of aircraft control, a situation could develop in which no one is flying the airplane or you are fighting each other, both trying to fly. The universally approved procedure is for the person assuming aircraft control to say, "I have the aircraft (plane, glider, etc.)," while shaking the stick slightly. The other pilot acknowledges by saying, "You have the aircraft" as he/she relinquishes all controls, including the rudder pedals and spoiler handle. **When in doubt as to who has control, ask immediately!**

8-10. CLEARING FOR TRAFFIC.

Having progressed this far in the manual, you should already realize that clearing is a continual, essential part of flying. The soaring area is tiny relative to the traffic in it. You have to clear for anything that poses a mid-air hazard: airplanes, parachutists, birds. Clearing is an active activity involving sight and sound (i.e., radio calls).

a. Be "heads up" in the cockpit, literally. You must look outside the majority of the time to actively look for traffic. Don't just casually scan the sky. Pick a segment of the horizon, focus on a distant object for a couple of seconds and look for any traffic movement. Then shift your focus above and below the horizon and do the same. Pick another section of the horizon and repeat the process systematically so that you can clear all around the aircraft. Intersperse your focused scanning with quick glances inside to check the instruments.

b. Listening to the radio allows you to focus *attention* on possible traffic. For example, if you hear, "One Four Bravo, two minutes to downwind," you know that a sailplane is two minutes from being on the downwind leg of the pattern, which means that it's still in the area, probably preparing to fly over the entry point. Knowing its approximate location, you can now get a better visual fix on this sailplane.

8-11. RADIO USE.

You need to make several radio calls on a typical sailplane flight. There can be only one transmission made at any one time. Simultaneous transmissions interfere with each other. So, before making your call, know what you want to say and make sure no one else is talking or waiting for an answer. Then place the microphone directly in front of your lips, push the transmit button, make the call, and release the button. On most flights, you're required to make the following calls:

a. Takeoff. When the CBSITCAL checklist is finished, make this call: "Glider (your tail number) ready for tow." Often the tow pilot will also announce the tow for other aircraft traffic.

b. Two Minutes to Downwind. This is an advisory call "in the blind." It is not addressed to anyone in particular: "Forrest City traffic, (tail number), two minutes to downwind." The call helps other pilots to clear for you and to sequence their pattern entry ahead or behind you.

c. Downwind. On downwind make this call: "Forrest City traffic, (tail number), downwind.

d. General. A radio call generally consists of three parts: (1) Who you are addressing, (2) Who you are, and (3) Your message or request. Call signs are normally the last three characters of the aircraft registration. For example, N2045T is "four-five-tango." Only the last two characters may be numbers or letters, so 0SS is pronounced "zero sierra sierra," not oscar sierra sierra." Finally, pronounce the number nine as "niner" to reduce confusion between "nine" and "five" which can sound similar on the radio.

CHAPTER 9

PATTERN AND LANDING

9-1. OBJECTIVES.

Describe the following:

a. Before Landing checklist

b. The landing pattern

c. Final approach and landing

d. Crosswind landing

Your ability to fly a good, safe pattern and landing is a primary consideration in your instructor's decision to send you up solo. Read this chapter thoroughly and ask questions about *anything* that is not clear.

9-2. BEFORE LANDING CHECKLIST.

a. You must complete the Before Landing Checklist before landing. Your Instructor will challenge you to complete this checklist even before you enter the pattern. It's a good idea to run the checklist immediately after the "two minutes to downwind" call. Two minutes should give you enough time to accomplish the following steps:

* **S - STRAPS**: Ensure that seat belts and should harness straps are fastened securely tight for each crew member.

C - CLEAR: Look and listen for other traffic and check the landing area. Be especially vigilant for tows approaching the entry point.

W - WINDS: Determine the speed and direction of the surface wind.

A - AIRSPEED: Compute the speed to fly in the pattern based on the wind conditions. Then fly at that speed and adjust the trim.

A - AIMPOINT: Select an appropriate aimpoint based on wind conditions.

A - AIRBRAKES (Spoilers): Check that they work freely and together.

b. Use the acronym **SCWAAA** to remember this checklist. Remember that an item marked with an asterisk is a challenge and response item.

c. Clear well near the entry point (See Fig. 9-1). There could be other sailplanes or powered aircraft entering the pattern. Do whatever it takes to safely sequence your aircraft into the pattern, including using spoilers to increase your descent. Use the radio to advise the other pilots of your position or intention in order to avoid a conflict. Clear well and take positive action to prevent an unsafe situation. Remember, with no engine, you have the right of way, but only one chance to do it right.

INSERT FIGURE 9-1

d. Flying a proper airspeed in the traffic pattern is a must! The fourth step in the SCWAAA checklist requires you to determine the pattern airspeed to fly. **PATTERN SPEED IS NO LESS THAN 55 MPH AND NO GREATER THAN 65 MPH USING THE FOLLOWING GUIDELINES:**

DUAL (two people in the airplane): 50 mph + maximum wind speed
SOLO (one person in the airplane): 45 mph + maximum wind speed

By maximum wind speed, we mean the maximum gust, if any. For example, if you determine through looking at the wind socks or listening to Ground that the surface wind is 10 mph and gusting to 15 mph, then the maximum wind speed is 15 mph. So, the correct pattern speed would be 50 + 15 = 65 mph (dual) or 45 + 15 = 60 mph (solo).

In another example, if the wind speed is four knots, what is the proper pattern speed? For dual, it's 55 mph, because 50 + 4 = 54 is less than 55. For a solo sortie, it's also 55 mph, because 45 + 4 = 49 is less than 55. **THE MINIMUM PATTERN SPEED IS ALWAYS 55 MPH!** Hint: For winds less than 10 knots, you should always be flying at 55 mph.

You must fly at least the pattern speed. A little faster is OK. A little slower is not! Also, the direction of the wind is irrelevant to pattern speed calculation.

e. We'll talk about what an "aimpoint" is later on in this chapter.

9-3. THE SAILPLANE PATTERN.

a. Entry Point. The entry point is a prominent landmark that you must fly over in order to enter the rectangular traffic patter (See Fig. 9-1).

b. Pattern Entry. Fly over the entry point **no lower the 1,000 AGL** and at about a 45° angle toward the runway. This heading places you on a 45° intercept to the downwind leg. As we said earlier, clear extremely well for traffic converging to the entry point. If you fly over the entry point at less than 1,000 AGL, you will be flying a "low pattern," which will be addressed in Chapter 10. Clearing, coordination, and particularly flying the right pattern speed are essential until you touch down.

c. Downwind Leg. From the entry point, you need to turn downwind to fly parallel to the runway and landing area. (You will land west of the paved runway.) Compensate for any crosswind at altitude by angling or "crabbing" into the wind so that your ground track parallels the landing area. Your Instructor will show you techniques for keeping the proper spacing to the landing area so that your pattern will neither be too large or too small. As a rule of thumb, the runway should be half way up your wing strut. This also equates to a 45° angle down. On downwind, make your radio call to Ground to get the landing sequence and wind reading.

d. Base Leg. Turn from downwind to base leg when you pass 30° to 45° beyond the aimpoint. In the cockpit, if you can see the aimpoint between 30° to 45° behind your shoulder, it's time to turn to base leg. Use a normal turn and keep the airspeed up. On base, crab into the wind if necessary to keep your ground track perpendicular to the runway/landing area. Check the wind sock near the landing area. Determine if you're higher or lower than optimum and use the spoilers accordingly. Half way on base leg, you should be near 700' AGL.

e. Final Leg. Turn from base to final leg so that you roll out wings level on final at least 300' AGL. Time this turn so that you line up directly on your landing area. We'll discuss the final approach and landing next.

9-4. FINAL APPROACH AND LANDING.

a. A good landing starts with a good final approach, which begins as you roll out on final leg with at least 300' AGL. On final approach, the sailplane is guided to an "aimpoint" and then "flared" to arrest the descent rate and reduce the speed to make for a soft touchdown. On the landing roll out, the airplane is brought to a stop by rolling friction or the wheel brake. Figure 9-2 shows the relationship of the aimpoint, touchdown point, and stopping point. Normally, the stopping point if fixed. You must select an aimpoint appropriate for the prevailing wind condition so that you can stop at the desired place. A strong head wind, for example, would help you slow the airplane on landing roll out. So, you'd want to select an aimpoint closer to the stopping point. Select an aimpoint on downwind so that you know when to turn base. (Reference paragraph 9-3d.) As a guide, move the aimpoint into the wind one "hash mark" off the runway centerline stripe (approximately 100') for each five knots of headwind. For a tailwind, move it back.

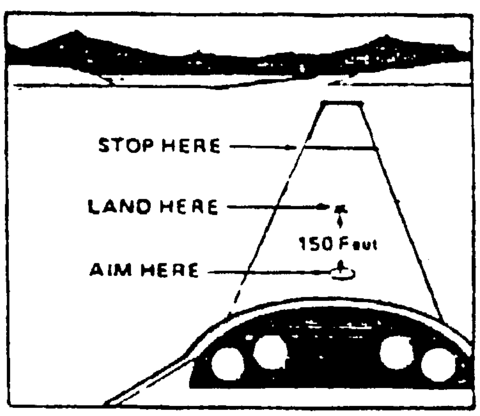


FIGURE 9-2

b. The two most important considerations during the final approach are airspeed and aimpoint. The ideal final approach is one in which your aircraft flies a perfectly straight, constant speed path to within a few feet of the aimpoint before the flare. In fact, you would crash directly into the aimpoint if you didn't flare. From the cockpit, the aimpoint stays fixed on one spot on the windscreen. If it appears to be shifting up or down, you are deviating from a straight glide path.

c. As always, control airspeed with the elevator. Holding a good "pitch picture" helps you maintain a constant speed. Remember, the calculated pattern speed is the minimum speed! This speed should not change until you start to flare.

d. Control the glide path with spoilers. It will take some experience for you to recognize whether you're above, on, or below the optimum glide path. For now, Figure 9-3 shows the differences of a high, normal, or low approach. **If you're high** (aimpoint moving down windshield), **increase spoilers. If you're low** (aimpoint moving up windshield), **reduce spoilers.** Ideally, you should be able to fly the pattern so that you roll out on final, open spoilers to half deflection, and fly to the aimpoint with very small corrections. Starting out with half spoilers allows you to correct either way. If you're very high, a slip helps. Recover from the slip no lower than 100' AGL and accept a long landing if you must. **Do not slip below 100' AGL.** If you're very low, leave the spoilers closed and accept a short (but on-speed) approach and landing. **Do not attempt to "stretch out" the glide on a low approach by rasing the nose.**

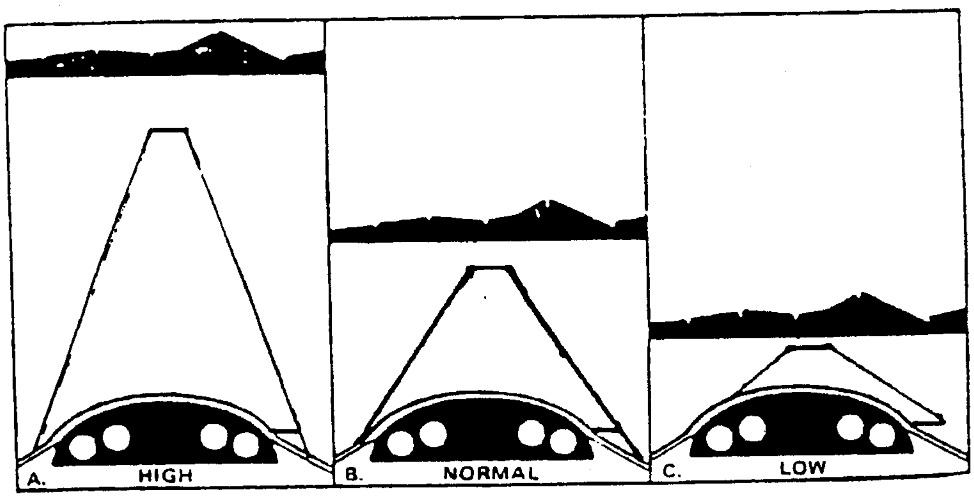


FIGURE 9-3

e. As you approach the aimpoint, about five to ten feet off the ground, smoothly start applying back pressure to decrease (not stop) your rate of descent, and reduce your airspeed. At one to two feet, continue to apply back stick pressure to hold the airplane just above the ground. Strive for a "fully held off" landing with the airplane touching down softly just above the stall speed in a slightly nose high attitude. After touching down, continue flying the airplane because the controls are effective with as little as 8 mph of indicated airspeed! Use ailerons to hold the wings level and the elevator to hold the skid off the ground, steering straight ahead with the rudder. As you approach the stopping area, ease the spoiler handle back to engage the wheel brake and bring the sailplane to a full stop. (The last one or two inches of travel activates the wheel brake.) As best you can, fly a wing tip gently to the ground before releasing the controls.

9-5. CROSSWIND LANDING.

A crosswind affects all segments of the pattern, but it's especially important to apply appropriate crosswind controls on the final approach and landing.

a. On downwind and base, crab into the wind so that your ground track, the path that your airplane makes relative to the ground, is parallel and perpendicular, respectively, to the runway. Check the wind sock periodically.

b. On final, everything we've said with respect to airspeed and aimpoint holds. If you slip, be sure to slip with the upwind wing low. **Do not touch down in a crab.** The main wheel is not really stressed for the side forces involved in a crabbed touchdown. Use the rudder to align the fuselage with the landing direction and hold the upwind wing lowered into the crosswind. Maintain this wing low attitude starting on short final (approximately within 100' of the ground), flare, touch down, and roll out. This is the same cross-control procedure used in Phase I of a crosswind takeoff.

CHAPTER 10

EMERGENCY PROCEDURES

10-1. OBJECTIVES.

a. Describe the procedures for the following situations:

(1) Rope Break

(2) Spin Recovery

(3) Spiral Dive

(4) Severe Sink

(5) Low Pattern

(6) High Pattern

(7) Downwind Landing

(8) Emergency Release

(9) Radio Failure

b. Sailplanes are very safe and controllable in most situations. Anything that could be considered an "emergency" is generally an abnormal situation that the pilot allows to deteriorate into a potentially hazardous problem. For any in-flight problem, follow these steps:

(1) MAINTAIN AIRCRAFT CONTROL.

(2) ANALYZE THE SITUATION AND TAKE THE PROPER ACTION.

(3) LAND AS SOON AS CONDITIONS PERMIT (on the airfield, if possible).

The procedures in this chapter are designed to take care of the most common sailplane emergencies. However, in any emergency, nothing should replace good judgement and common sense. Always FLY THE AIRPLANE.

10-2. ROPE BREAK.

a. Tow ropes occasionally break during aerotow. At lower altitudes, your response to a rope break may be a critical factor in effecting a safe landing. As such, always be prepared for a rope break, at any altitude. If it does happen, perform the following "critical action" or "boldface" procedure:

(1) ESTABLISH GLIDE.

(2) RELEASE - PULL TWICE.

b. Establishing a proper glide picture and speed is especially important at low altitudes. If the rope break occurs within 1,000' AGL, establishing pattern airspeed would be appropriate.

c. Pulling twice on the release knob should release whatever section of rope that might be dangling from your sailplane to prevent it from being entangled with any part of the sailplane.

d. If the rope breaks below 200' on takeoff, land straight ahead or make only small turns to clear obstacles.

e. Above 200', you may turn back to the field and make a downwind landing. Turn into the wind, this will reduce the radius of your turn. Keep clear of other airport traffic. If you are high enough on a rope break, a modified pattern can be flown so that you can land into the wind.

f. Above pattern altitude, attempt to fly a normal pattern by entering the pattern at the entry point or on downwind. Clear aggressively.

g. In all cases, fly the airplane! Proper airspeed and coordination cannot be overemphasized. Use the radio only if you have the time and altitude.

10-3. SPIN RECOVERY.

a. It is extremely unlikely that you will ever enter a spin in a 2-33. Your instructor will demonstrate an aggravated stall which is similar to a spin entry. Since a spin is a stall aggravated by a yaw (rudder) input, it is impossible to enter a spin with the yaw string centered. However, if you stall and yaw the aircraft close to the ground, you may enter a spin and not have time or altitude to recover. Basically, a spin is characterized by stall conditions (loss of control, low airspeed, low wind noise) coupled with autorotation (the aircraft rotates under the influence of spin forces). Recover from a spin using the following procedure:

(1) **RUDDER - FULL OPPOSITE DIRECTION OF SPIN.**

(2) **STICK - FORWARD.**

(3) **CONTROLS - NEUTRAL AFTER SPINNING STOPS AND RECOVER FROM DIVE.**

b. The first step counteracts the rotation. The second step breaks the stall. Neutralizing the controls just before pulling out from the dive reduces the chance of getting into a secondary stall or another spin during the recovery.

10-4. SPIRAL DIVE.

Basically, a spiral dive is an over-banked steep turn in which additional back stick pressure fails to raise the nose and only aggravates the spiraling condition. A spiral dive is often mistaken for a spin but there are several differences. First, in a spiral dive, the airspeed is high and possibly increasing. Second, because the airspeed is high, the wind noise is very loud. Lastly, a spiral dive has increasing "G" forces, whereas a spin has few "G" forces To recover from a spiral dive:

a. RELEASE BACK STICK PRESSURE.

b. ROLL THE WINGS AT LEAST TO 45° OF THE HORIZON (TOWARDS WINGS LEVEL).

c. PULL STICK BACK TO RAISE THE NOSE AND REGAIN NORMAL AIRSPEED.

Be cautious. You can easily overstress the aircraft if you don't first relax the back pressure.

10-5. SEVERE SINK.

You may find yourself landing in a bean field if you don't deal with severe sink correctly. The normal descent rate of the SGS 2-33 flying the best L/D speed is about 250' to 300' per minute. Severe sink is any sink approaching or exceeding 1,000' per minute down, as indicated by the variometer. Remember that increasing your airspeed and turning toward the airfield are two things to do in significant sink. If, at best glide, you are descending at a rate of 600' per minute, fly out at about 60 mph. Fly about 70 mph for 1,000 fpm sink. Be aware that as you speed up, your descent rate will increase, adding to your overall descending trend. As soon as you think you've exited the sink, slow back to Best L/D to recheck your instruments.

10-6. LOW PATTERN.

a. If you find yourself entering the pattern somewhat below the required 1,000' AGL altitude over the entry point, fly directly at the closest end of the runway at best L/D speed (45 mph solo, 50 mph dual). To correct a low entry, you must fly a tighter pattern, closer in on downwind, with an early base turn. Don't try to salvage a poor pattern by "stretching" out the glide and making low turns. Adjust the pattern so you can still roll out on final with 300' AGL. A 200' final is acceptable for a very low pattern. Where you come to a stop is a minor concern, as long as it's a safe landing somewhere in the landing area. If needed, the ground crew will send out people or a tractor to help you drag the sailplane back.

b. But let's say this is not your day. You are extremely low and cannot perform a pattern. In this case, clear extremely well and plan to land safely anywhere on the airfield. If feasible, call Ground to advise of your location and intentions. If you land far from the airport, leave the radio on as you wait for help.

10-7. HIGH PATTERN.

Now let's say you are conservative and cross the entry point at 1,200'. Then you notice as you are on downwind that your altitude is increasing because you are now in lift. Your first option is to use spoilers. You could also fly a longer downwind or displace your pattern to the west. The last two options may not be the best options due to a possible change in the lift/sink situation, which may result in an eventual low pattern. But let's say you turn final and you're still at 700'. It's time to slip. Make sure you have spoilers fully out and then slip with full rudder. Don't slip lower than 100' AGL. If you are going to land long, use enough brake after touchdown to stop as soon as possible.

10-8. DOWNWIND LANDING.

Because of a low altitude rope break or severe sink, you may have to land downwind, opposite other aircraft. There are two concerns in doing an "opposite direction" landing: avoiding other aircraft, and landing with a high ground speed. If time permits, advise Ground that you will be landing downwind. Clear extremely well. Once established on final, slow to 55 mph to minimize your groundspeed. After touchdown, open the spoilers fully and smoothly apply the wheel brake. Your ground speed will be higher than normal. A phenomenon called "control reversal" may happen when landing in a strong tail wind. As you slow down, the tail wind will make all control surfaces do the opposite of what they normally do. So, as you come to a stop on a downwind landing, control reversal, if it happens at all, will briefly make controlling the aircraft very challenging.

10-9. EMERGENCY RELEASE.

Several things can happen to make you want to release from tow early. Tow plane loss of power, a dangerous aerotow situation resulting from inattention, strong turbulence, improper slack line recovery, or a deliberate rocking of the tow plane's wings (a visual signal that the tow pilot wants you to release from tow). Treat an emergency or any unplanned release similar to a rope break. Establish a proper glide and take actions to land safely. The tow pilot has the ability to release the rope at his end and may do so in very rare instances. If this happens treat it as if it were a rope break.

10-10. RADIO FAILURE.

a. Before concluding that your radio has failed, check the following:

(1) On/off switch -- ON

(2) Volume -- UP

(3) Squelch -- ON (try OFF)

(4) Connections -- Check (Check the microphone connection)

(5) Battery- -Check connection

The loss of radio is really not an emergency. Don't let it throw you. Fly the airplane

b. On the ground, if you think the radio or battery is dead (i.e. no one is answering you), tell the ground crew so the problem can be resolved.

c. In the air, if you have made several calls with no response, and/or you have not heard anyone on the radios, make sure you accomplish all the steps above. If your radio still does not work:

(1) Continue to make radio calls "in the blind." You may not hear others, but they may hear you.

(2) CLEAR!

CHAPTER 11

CONSIDERATIONS FOR SOLO

a. Our Soaring Program is designed to give you the training necessary to fly a sailplane solo. If the weather cooperates, and your own desires and abilities are sufficient, there is an excellent chance that you one day will find yourself strapping into the cockpit of a sailplane all by your lonesome. That moment when it dawns on you that you are about to fly an airplane ALONE can be one of pleasant excitement and anticipation. You know that you are prepared, you are up to the challenge, and you are on edge just enough to do your very best. Or, that moment can be filled with fear, anxiety, and uncertainty. Naturally, you (and we) would prefer the former. This section will offer some advise and encouragement to help you become prepared to fly solo with confidence and expertise.

b. Really, the best preparation you can perform for solo is to take the flight training seriously. Read and study this manual. Consider studying some supplemental material. Pay attention on the flight line at all times. When you are on the ground, watch takeoffs and landings analytically. Be prepared when you come to fly. Get enough rest. Drink plenty of water. Study the material that is likely to apply to the flying you will do that day. Listen to your instructor. Ask questions about things which are not clear to you.

c. For most of you this will be your first opportunity to fly an aircraft solo. Your first solo is an important milestone. If you continue in a flying career there will be more solos, but the first solo is one you'll remember. The program can be a lot of work, but it can yield significant personal rewards and satisfactions as well.

d. Obviously, the bottom line is a safe return to the field. It is very important to understand the pattern and landing phases. Make sure you know how to correct for winds. Know also that the aircraft will fly a little bit differently with only one person in it verses two. The nose will come up much quicker on the takeoff, and you may have to apply more forward pressure to stay in position on the aerotow.

e. You're going to be excited on this first solo. The adrenaline will be pumping. Breathe normally, stay calm, and listen to the radio. Often, your instructor will have something to tell you while you're flying. He/she may advise you of changing conditions, gusting winds, an impending runway change, and so forth. Enjoy the ride. Your instructor would not have let you go solo unless he/she is absolutely confident about your flying abilities. You've come a long way in a few lessons, and the solo flight is a deserved reward. After the flight, your training will be capped off with an informal cutting of your shirttail.

APPENDIX I

SGS 2-33 SAILPLANE SPEEDS

The following numbers are important to know in the operation of the SGS 2-33. Your instructor will often ask you to recite them. All speeds are in miles per hour.

DUAL

Stall speed, wings level	33
Stall speed, 30° bank	36
Minimum sink speed	42
Best glide (best L/D) speed[@]	50
Maneuvering speed	65
Never exceed speed	98
Pattern speed	50 + wind speed, 55 mph minimum 65 mph maximum

SOLO

Stall speed, wings level	31
Stall speed, 30° bank	34
Minimum sink speed	38
Best glide (best L/D) speed[@]	45
Maneuvering speed	65
Never exceed speed	98
Pattern speed	45 + wind speed, 55 mph minimum 65 mph maximum

[@] Note: Best glide speed in a head wind is the calm wind best glide speed plus half the amount of headwind. In a tail wind, subtract half the tail wind from the calm wind best glide, but not slower than the minimum sink speed.

Examples: best glide speed in 20 knots of head wind is 50 + 10 = 60 mph (dual) or 45 + 10 = 55 mph (solo); best glide in a 20 knot tail wind is 42 mph (dual) or 38 mph (solo), because subtracting 10 from 50 or 45 would put you at a slow speed than minimum sink.

APPENDIX II

SAILPLANE VISUAL SIGNALS