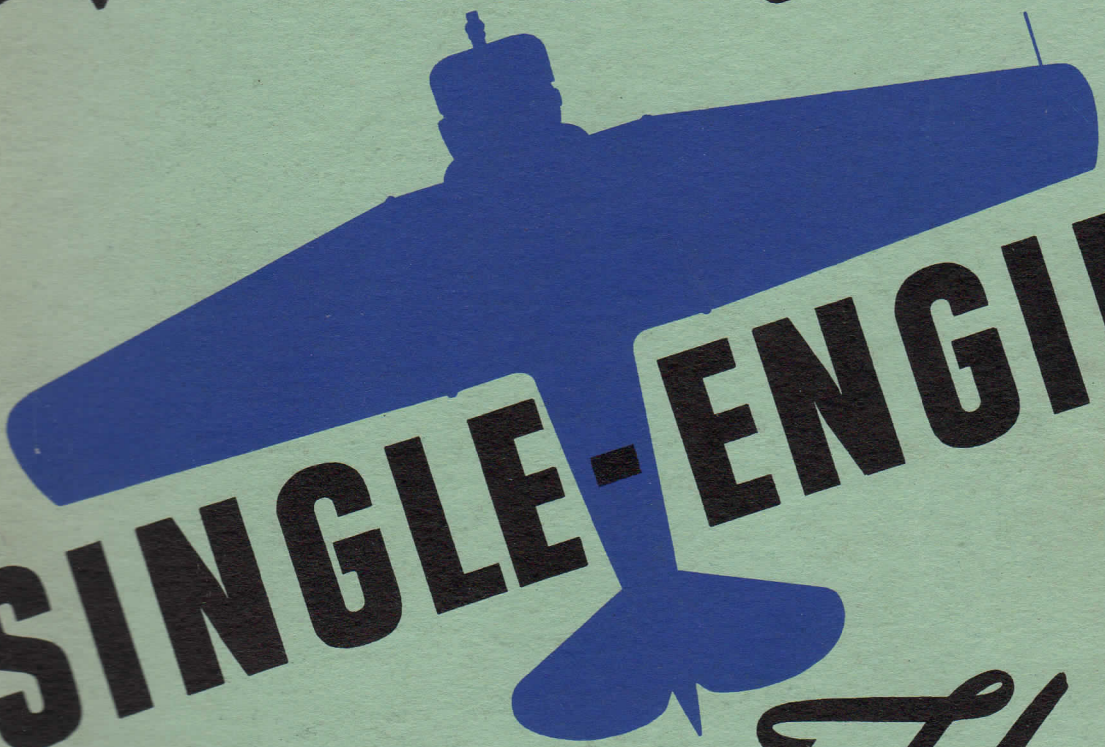
INSTRUCTORS' MANUAL

Advanced SINGLE-ENGINE Flying



ARMY AIR FORCES TRAINING COMMAND

INSTRUCTORS' MANUAL

ADVANCED SINGLE-ENGINE *Flying*

Prepared by the

ARMY AIR FORCES TRAINING COMMAND

Visual Training Unit, in collaboration with the

CENTRAL INSTRUCTORS SCHOOL

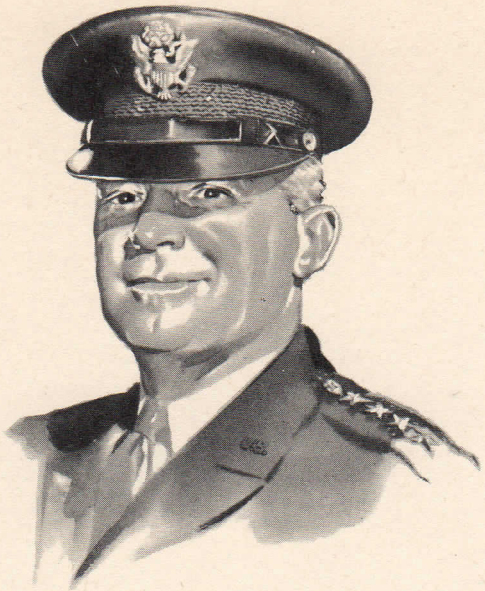
Randolph Field, Texas and

HEADQUARTERS, AAF, OFFICE OF FLYING SAFETY

Safety Education Division

TO BE USED IN CONJUNCTION WITH THE CURRENT
AAF TRAINING COMMAND MEMORANDUM COVERING
ADVANCED SINGLE-ENGINE FLYING TRAINING

ARMY AIR FORCES TRAINING COMMAND



INSTRUCTION

TODAY IS NOT A JOB

IT'S A RESPONSIBILITY

WE'RE AT WAR

H. H. Arnold

GENERAL, U. S. ARMY,
COMMANDING GENERAL,
ARMY AIR FORCES

Foreword

This is a Manual for flying instructors; tested, compiled, and recorded over the period of more than a quarter of a century that the Army pilot training program has been developing. It represents the accumulated experience of thousands of instructors with hundreds of thousands of student pilots and millions of hours of flying instruction. Combat has given the final acid test to the program, and the reports from that test have moulded the course into its present shape.

Published in this new form, it is the official pilot instructor's guide of the Army Air Forces Training Command. Though its format and manner of presentation are new, it offers no radical change from the course of training outlined in the series of Training Command Memoranda issued from time to time by this Headquarters.

The standards of proficiency and performance presented in this Manual are not only desirable, they are mandatory! The Training Command has assured the Army Air Forces that every one of our graduating pilots will have achieved these standards without fail. Success in combat operations depends upon the fulfillment of that promise. Neglect of any step in the Training Program on the part of any instructor or student may lead directly to the failure of an important combat mission.

In a very real sense of the word, the basis of combat efficiency of the Air Forces is laid by our instructors. This manual is for you, to make your job easier, to make your work more efficient, to insure that your efforts will be most highly productive. If you do a complete, thorough and conscientious job, there can be no doubt of the final result.

Lieutenant General, U.S.A.
Commanding

Introduction

This Instructor's Manual is essentially an ILLUSTRATED CHECK LIST FOR FLYING INSTRUCTORS. It is designed to furnish a graphic resume of the fundamentals that each student **must be taught,** and bases the teaching of each of those fundamentals on the explanation of three primary points:

WHAT the maneuver or fundamental is,

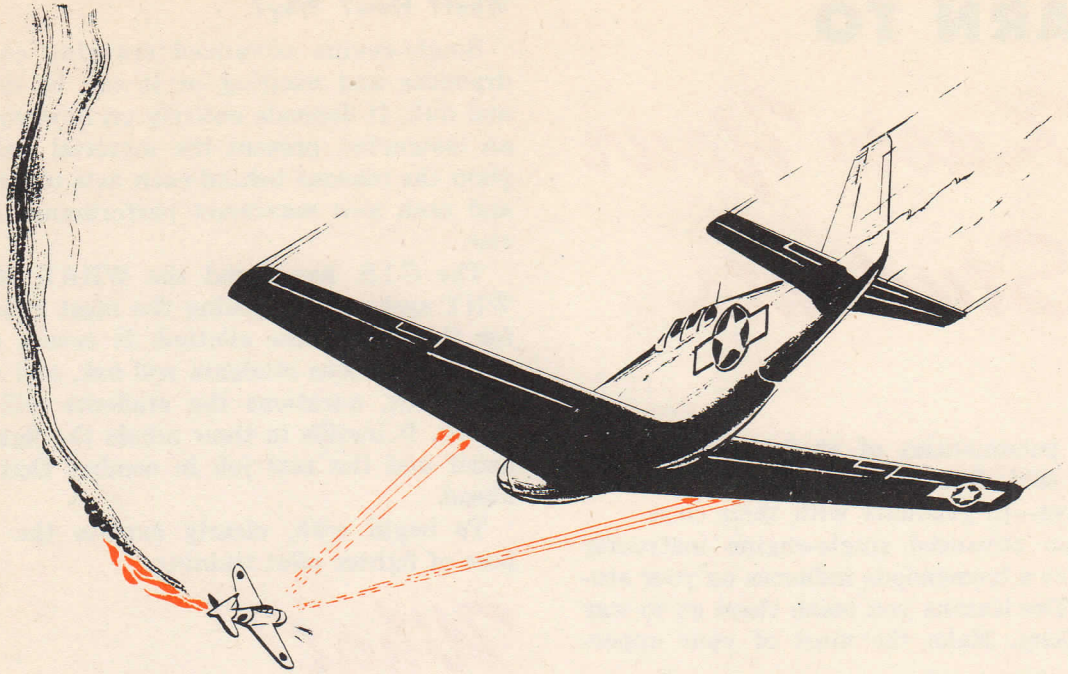
WHY it is included in the curriculum, and

HOW it is to be performed.

Follow this WHAT, WHY, HOW formula in your teaching. Strive for precision performance within practical limits, BUT DON'T CONCENTRATE ON PERFECTION IN FLYING EXHIBITIONS to the neglect of any of the principal points about the maneuver concerned. Ten fundamentals about a maneuver, **and their reasons,** are far more important to a student pilot than his ability to perform any one of those ten points so precisely that a French curve, a T square, or an Einstein can find no flaws.

On many flying lines, the Chandelle, for instance, has provoked hours upon hours of wasted time in discussions of the split-hair accuracy of performing the maneuver. These hours could well be spent teaching the more important fundamentals of flying. The Chandelle, like all maneuvers, should be approached simply as a training exercise designed to promote general mastery over the airplane. Split-hair accuracy should be secondary to good, solid, basic flying technique. Don't make a student fit your pattern just because IT IS YOUR PATTERN. Emphasize smooth flying rather than the mechanical performance of any maneuver according to a step-by-step procedure. Pilot training should be standardized, not mechanized. Pilots should be "maximum-performance" pilots, not "maneuver-perfection" pilots.

Use this Instructor's Manual as a "check list" to make sure that you cover all the points outlined. Know the fundamentals — then use your own initiative in working with your students to the mastering of those fundamentals. Above all, make sure that they learn how to fly an airplane, with confidence and consistent proficiency.



YOUR JOB

YOUR OPPORTUNITY

As an advanced single-engine instructor, your job is to teach maximum performance. To do that job you must first reach maximum performance as an instructor.

You must never forget that the things you teach your students make them the best fighter pilots in the world—the things you fail to teach them thoroughly may result in the failure of a mission.

Your students, already trained in basic flying, come to you eager to learn. They are potential fighter pilots. It is your job to polish up their rough edges, teach them maximum performance, and graduate them as top notch, fighter pilot material, or calmly and fairly, to recognize inherent flaws in some and reject them for that reason. That is a big responsibility.

This manual is dedicated to the proposition of helping you shoulder that responsibility.

LEARN TO

Know Your Students

The personalities of students vary from hot to cold. But they all have one common objective—to graduate with their class.

As an advanced single-engine instructor you have a tremendous influence on your students. The lessons you teach them go to war with them. Make the most of your opportunity.

Don't forget that the difference between the terms "common sense" and "teaching psychology" is very little. It's plain common sense to make each of your students feel you are personally interested in him.

Don't Be a Villain

The practice of humiliating students by tongue lashing went out with rotary motors and bloomers. Don't try to revive it. Many a potential fighter pilot has been washed out because he wasn't the type who could take the verbal lash.

Be Calm, Be Friendly, Be Firm

Your students may brag among themselves about what hot pilots they are, but you alone, as their instructor, represent perfection to them. Don't make that perfection seem tough to attain. When they feel that you're a regular guy, they'll work that much harder to please you, so be friendly. Let them in on the little secret that you were a student not too long ago yourself and that you understand their problems.

But also, be firm. Monkeyshine relations between students and their instructor have no place in the Air Forces. Being too much of a good fellow, with its accompanying breakdown in respect, is just as bad as being a Simon Legree.

What? How? Why?

Single-engine advanced training can be dramatic and exciting or it can be dreary and dull. It depends entirely on how you, as an instructor, present the material and explain the reasons behind each new maneuver and each new maximum performance exercise.

The C.I.S. has found the WHAT, HOW, WHY system of teaching the most effective for the short time allotted. It covers most of the questions students will ask, and more important, questions the students will fail to ask. It instills in their minds the fighting spirit and the real job in combat that lies ahead.

To begin with, clearly explain the purpose of fighter pilot training.

What?

The purpose of single-engine advanced training is to achieve **maximum performance** of the airplane and the pilot together. It means just that and only that. It doesn't mean almost maximum performance.

How?

Maximum performance can be taught only by demonstration and by brushing away "boogy-man" notions from the student's mind. Dual and solo practice at smooth coordination is essential. Stress this fact now: **maximum performance flying means getting the most out of the airplane under all conditions.**

Why?

Explain WHY you put this great emphasis on maximum performance. You are training your students to do one specialized job—to be masters of a flying gun platform. Hammer home the fact that this is not training for training's sake. Let them know that you are preparing them for their immediate future, when maximum performance will mean the difference between shooting down the enemy or being shot down.

SAFETY

Students often misinterpret the meaning of maximum performance. The term to some of them is an excuse for dangerous hot pilot flying. See that all your students understand on the first day that show-off flying is kid stuff and doesn't belong in Advanced Single-Engine Training.

Maximum performance has absolutely nothing to do with recklessness. **Maximum performance means getting the most out of the airplane under all conditions.** Instructors must always do their utmost to prevent accidents.

Be sure your students observe the basic safety rules.

1. Let them know that you will tolerate no wise guy flying. Hot pilots belong in the movies, not in fighter squadrons.

2. Be sure students understand the local traffic pattern and the reasons for observing it to the letter.

3. Insist that all training aerobatic maneuvers are at altitudes high enough to permit recovery no lower than 5,000 feet above the ground. Explain the need for clearing the area before doing acrobatics.

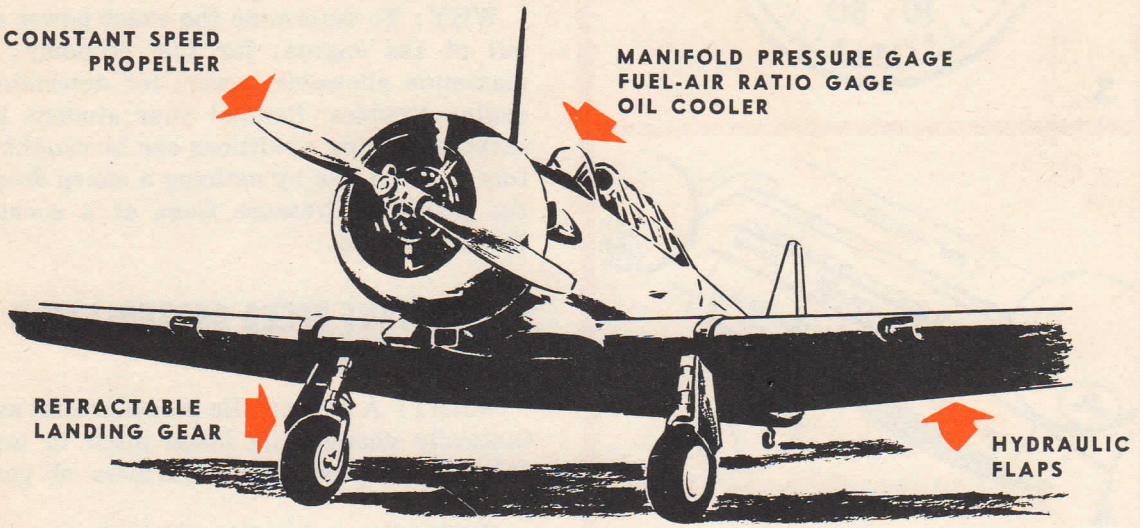
4. Explain the WHAT, HOW, AND WHY of all the safety rules. Point out that the need for "S"-ing while taxiing is carried right into the air and into the combat areas where "S"-ing is a part of air alertness, which is the greatest life insurance for a fighter pilot.

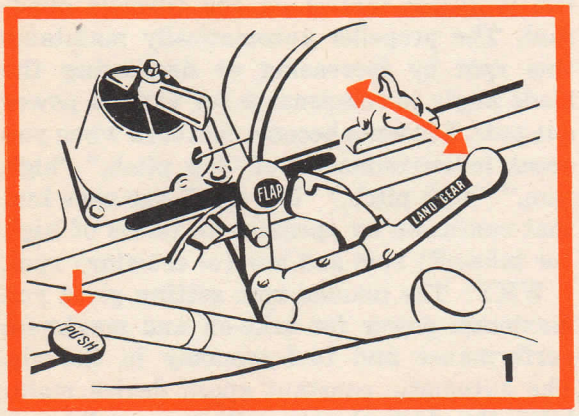
TRANSITION TO THE AT-6 AIRPLANE

What's New

GROUND INSTRUCTION

Be sure your students learn the NEW THINGS about this NEW AIRPLANE. Explain point by point the difference between the Basic Trainer and the AT-6. Follow the C.I.S. WHAT—HOW—WHY method of teaching:





1. RETRACTABLE LANDING GEAR

WHAT: Landing gear that retracts and folds into the wing or fuselage.

HOW: Hydraulically retracted by operating the cockpit controls.

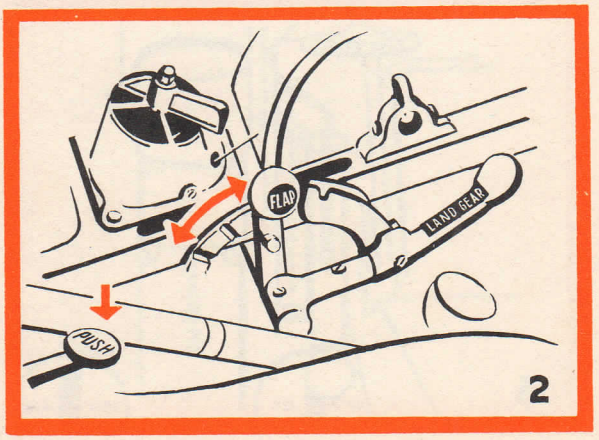
WHY: Reduces drag to give the airplane higher top speeds and greater maneuverability.

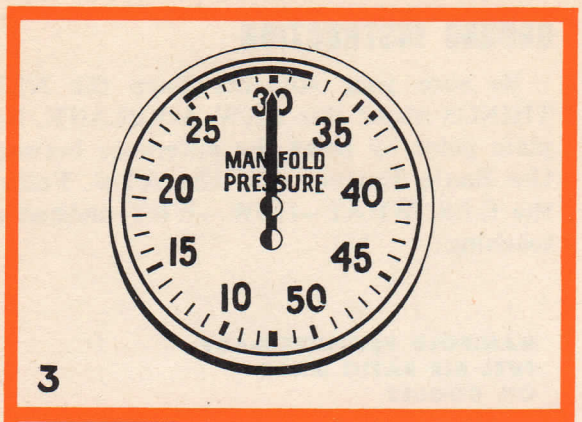
2. HYDRAULICALLY OPERATED FLAPS

WHAT: Split Flaps that operate hydraulically.

HOW: Hydraulically operated from the cockpit controls.

WHY: To decrease landing speeds. To give a steeper angle of glide for maximum landing visibility. To make more accurate landings by using different degrees of flaps during the approach.





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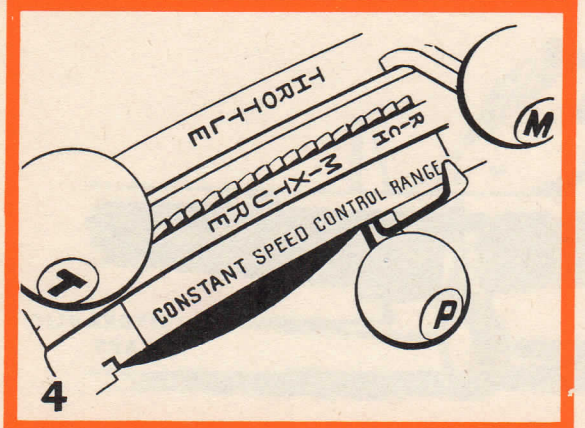

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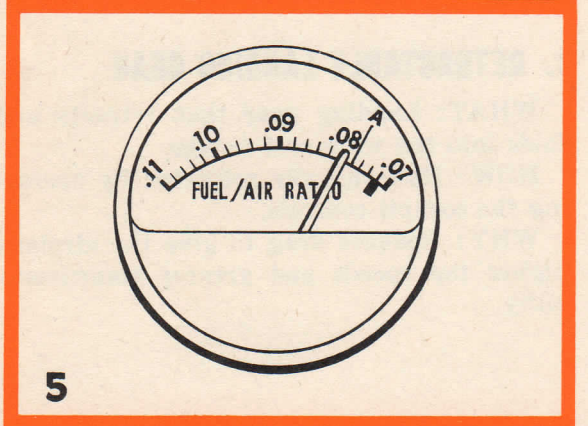

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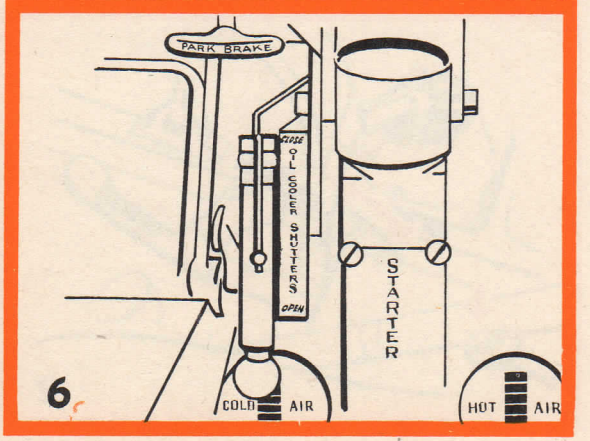

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3. MANIFOLD PRESSURE GAGE

WHAT: A gage that accurately determines the power output of the engine.

HOW: Since the AT-6 has a constant speed propeller, rough or faulty engine operation cannot be determined on the tachometer because the constant speed propeller compensates in rpm for the power loss.

WHY: To determine the exact power output of the engine; for fuel economy; for maximum allowable power; for determining engine troubles. Remind your student that carburetor icing conditions can be caught before it is too late by noticing a sharp drop in the Manifold Pressure Gage at a constant throttle setting.

4. CONSTANT SPEED CONTROLLABLE PITCH PROPELLER

WHAT: A hydromatic propeller that automatically changes its blade pitch to maintain any desired rpm, regardless of power output.

HOW: You select the desired rpm with the propeller control on the throttle quadrant. The propeller automatically maintains this rpm by increasing or decreasing the blade angle to compensate for various power out-puts. Students become confused when you speak indiscriminately of "low pitch," "high rpm," "high pitch," "low rpm"—so save him that confusion by speaking in terms of high (or take-off) rpm and low (or cruising) rpm.

WHY: The manual rpm setting gives you maximum power for take-off and maximum performance and fuel economy in the air. The automatic constant speed device maintains the desired rpm setting regardless of power output which results in top power plant efficiency.

5. FUEL-AIR RATIO ANALYZER

WHAT: A gage that determines the ratio of fuel and air the engine is burning.

HOW: A sensitive electrical device that measures the exact fuel-air ratio.

WHY: To achieve maximum engine performance at various altitudes by maintaining a fuel-air ratio of .079 on the indicator. This gage is more accurate than, and should

be used in connection with, the head temperature gage to determine fuel ratio. Carburetor ice is also indicated by a rapid drop on the fuel-air ratio gage from proper setting to full rich.

6. OIL COOLER SHUTTERS

WHAT: A shutter controlled from the cockpit decreasing or increasing the airflow over the oil radiator.

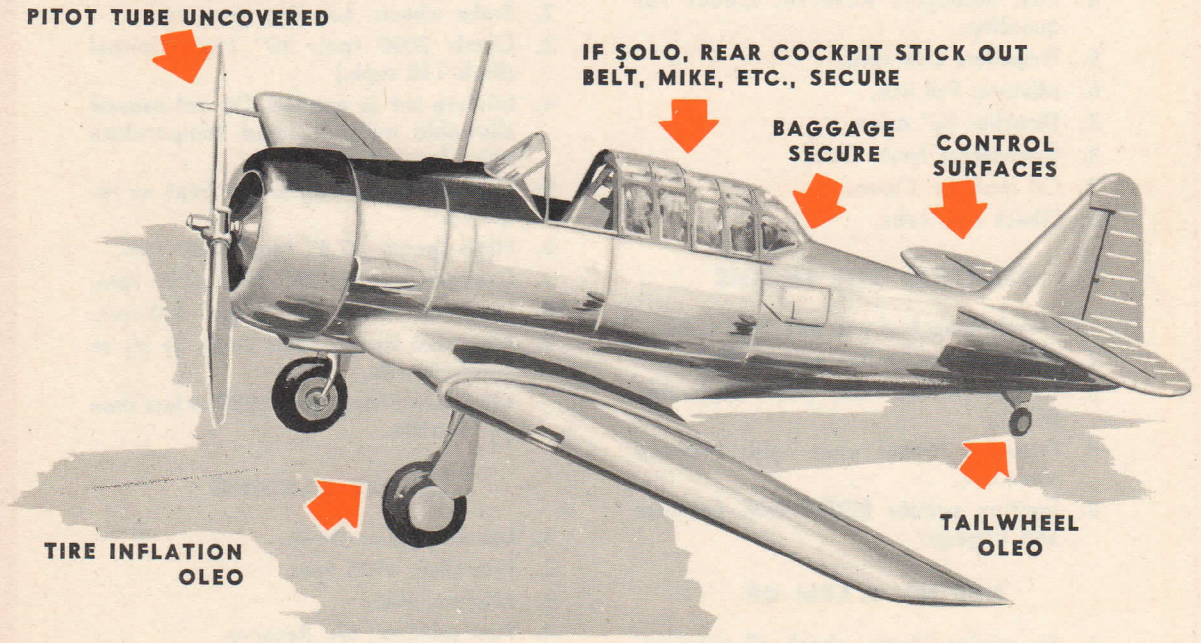
HOW: Controlled manually from the cockpit to maintain proper oil temperatures.

WHY: To maintain desired oil temperatures at various altitudes and air temperatures encountered.

Explain

these new points about the AT-6—**and explain them again.** Remember that this is a new airplane to your students. Don't forget it was once confusing to you, too. Point out that it is just MORE airplane. But don't make the mistake of scaring students into believing the AT-6 is tricky or hard to fly.

PRE-FLIGHT *Check*



On the Ground

Your students must develop the habit of a regular pre-flight check before entering the cockpit prior to take-off.

1. They must examine all control surfaces for dents or tears.
2. See that material located in the baggage compartment is properly fastened down.
3. Examine landing gear to see that oleos are properly extended and that there is no fluid leakage.
4. Visually check tires for proper inflation.
5. For solo flight check from front cockpit, students must see that control column in rear cockpit is fastened in stow socket, safety belt is fastened over seat, microphone and head set are secure, and that all loose objects are fastened.
6. Pitot tube cover must be removed.

PILOT'S CHECK LIST

BC-1, BC-1A, AT-6, AT-6A, AT-6B, AT-6C, SNJ-3 and 4

R 1340-AN-1 Engine

BEFORE ENTERING COCKPIT

1. Check pitot tube for cover, check oleo struts, check tires, check rear cockpit. (If solo remove rear stick, fasten rear safety belt. Cage rear gyros if acrobatic mission.)

BEFORE STARTING ENGINES

1. Check Form 1A. Fill out Form 1.
2. Set parking brakes.
3. Unlock surface controls and check operation.
4. Fuel selector: Reserve. Check for quantity.
5. Propeller: Low rpm.
6. Mixture: Full rich.
7. Throttle: 1/2" open.
8. Carburetor heat: Cold.
9. Oil shutters: Open.
10. Check trim tabs.

STARTING THE ENGINE

1. Hand pump fuel pressure to 3-4 lbs.
2. Generator main line switch: On.
3. Battery switch: On. (Not applicable BC-1).
4. Prime: 4 strokes when cold; 1 stroke when hot.
5. Ignition switch: BOTH ON. Energize and Engage.

DURING WARM UP

1. As engine starts, check oil pressure. If no pressure shows after 30 seconds, shut down and investigate.
2. When oil pressure reaches 70-90, shift propeller to full "Increase rpm."
3. Check left and right magnetos at 1500 rpm. Maximum drop 100.
4. Check all tank positions of Fuel Selector for proper functioning.
5. Check operation of: Flap, Propeller Controls, Hand Hydraulic Pump, Fuel signal and other switches.

BEFORE TAKE OFF

1. Propeller: "Increase rpm."
2. Mixture: Rich.
3. Carburetor heat: Cold.
4. Oil temperature: 40° C. minimum, 95° C. maximum.
5. Cylinder head temperature: 100° C. minimum, 260° C. maximum; oil pressure 70-90.

DURING FLIGHT

1. Take off: 36" Hg.; 2250 rpm.
2. Brake wheels. Landing gear up.
3. Climb 2000 rpm; 30" Hg. (Normal climb 110 mph.)
4. Mixture set as needed. Do not exceed allowable cylinder head temperature when leaning out.
5. Oil cooler and carburetor heat as required.
6. High speed: 32.5" Hg.; 2000 rpm.
7. Desired cruising: 25" Hg.; 1850 rpm.
8. Maximum range: 22.5 Hg.; 1350 rpm.
9. Maximum diving rpm: 2640, at 1/3 or more throttle.

   Maximum diving rpm: 2200 at less than 1/3 throttle.

BEFORE LANDING

1. Landing gear: Down.
2. Propeller: 1925 rpm.
3. Mixture: Rich.
4. Fuel selector: On Reserve.
5. Flaps as required. (Below 126 mph.) Normally full flaps will be used.

AFTER LANDING

1. Flaps: Up.
2. Propeller: Low rpm.
3. Oil dilutions: As necessary.
4. Mixture: Idle Cut Off.
5. Set brakes and lock controls.
6. All electrical switches: Off.

TELL YOUR STUDENTS — AGAIN — THERE IS NO SINGLE "MUST" MORE IMPORTANT THAN ALWAYS USING THE CHECKLIST.

Your student should become so familiar with the Checklist and Cockpit procedure that he can go through it confidently, even under the blindfold test.

Explain the WHY of the Checklist. Your student can fly any airplane safely and efficiently ONLY IF HE MAKES THE CHECKLIST HIS "FLYING BIBLE."

There are two times when the student must make a cockpit check. Once before he takes off. Again, before he lands.

Before Take-Off

C—Controls.
I—Instruments.
G—Gasoline.
F—Flaps.
T—Trim.
P—Propeller.
R—Run Up.

Before Landing

G—Gasoline.
U—Undercarriage.
M—Mixture
P—Propeller.

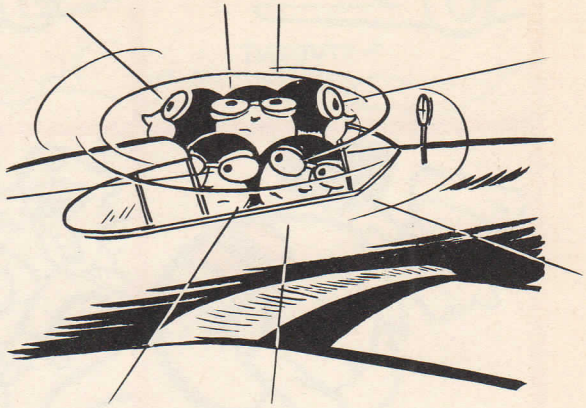
Don't dish out facts faster than your student can take them. Remember that the things that you know so well are new to the student. That's why you must repeat and repeat them carefully to your student.

Give the student a quiz briefly covering your ground lecture. **You haven't done your job as an instructor until the student knows and understands the WHAT, HOW, and WHY of each thing you've told him.**

Dual Flight Instruction

1. While starting the engine explain over the interphone exactly **what** you will do.

2. As you "S" while taxiing explain **why** you are doing it. Remember that this is a **demonstration flight and lecture combined.** Your painstaking care in this first ride will save you many a headache in the days to come.



THERE IS NO PLACE IN THE AIR FORCES FOR A STIFF NECK

Keep Looking Around

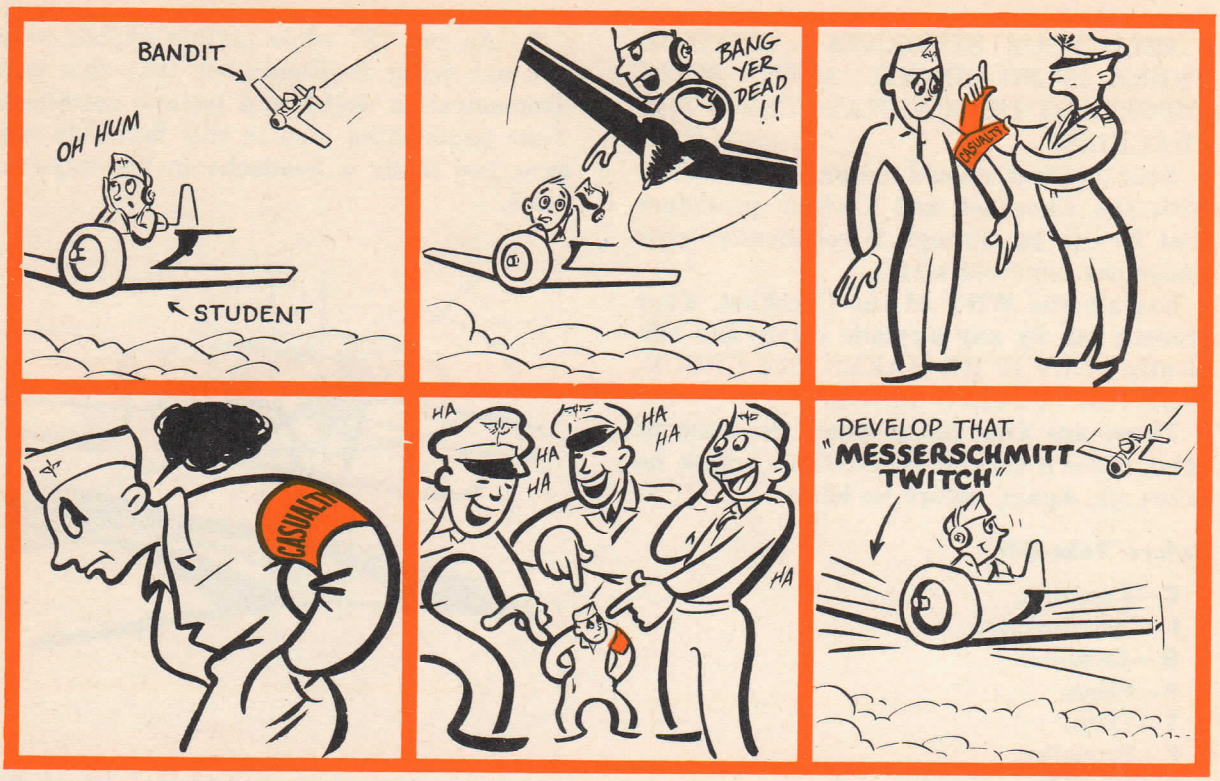
You can't exaggerate the importance of alertness in the air. If the student notices that your head is on a **swivel** he will pick up that habit from you on his first ride. There is no room in the Air Forces for a stiff-neck pilot.

During this first dual ride, which is actually an aerial lecture, carefully EXPLAIN THE WHY of air alertness.

1. Air alertness is necessary to absolute safety in the over-crowded flying areas during training.

2. Air alertness, in combat, is a matter of life or death. Many a good pilot has been shot down by "doping off" for just an instant.

You Can't Stress the Importance of Air Alertness Too Much



THE CASUALTY SYSTEM

C.I.S. has found the Casualty System for maintaining air alertness phenomenal in its successful reactions on the students.

Here's how—

WHAT: In the Casualty System, the single engine Group Commander, members of the Advisory Board, the Squadron Commanders, the Operation Officers, and the Fighter Unit Commanders are all encouraged to approach any student airplane during day time with simulated attack.

HOW: Authorized pilots are encouraged to sneak up on the student from any and all points of deflection to within effective gun range, which is considered 250 yards. If the student does not immediately rock his wings in recognition, he is considered a dead duck, a "casualty," and made to wear an embarrassing decoration consisting of a yellow armband with the stigma "Casualty" lettered thereon. This band, thereafter, must be worn on the student's left arm, and may not be removed until 1900 each day unless the student leaves the post.

The authorized bandit who makes the successful attack, reports the plane number and time of attack to the squadron commander, who then confers the humiliating decoration.

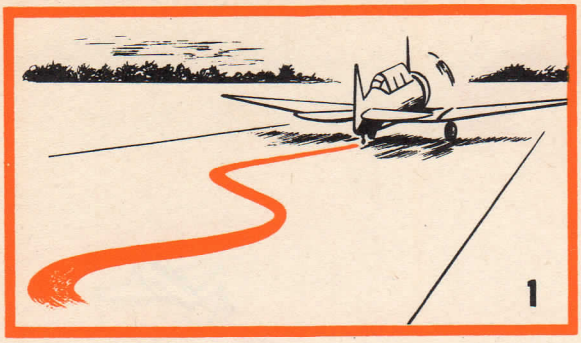
Remember these exceptions:

Simulated attacks on instrument training flights are discouraged.

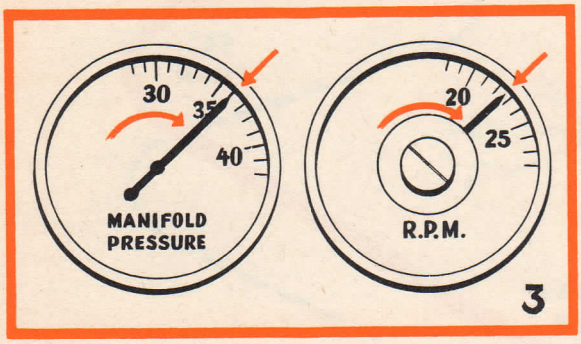
Simulated attacks on formations are subject to local regulations.

WHY: To maintain a high proficiency among students in air alertness. The Casualty System provides many a good-natured laugh among students and instructors, but more important, it makes students highly competitive in air alertness. As the boys swivel their heads in training to keep from becoming "casualties," they are learning a fighter pilot's most vital lesson — TO BE ALERT AT ALL TIMES.

AND ALSO: Remind students with "funnel vision" that most American pilots overseas are happily afflicted with the "Messerschmitt twitch"—a protective habit of turning one's head forth, back, and around like a mechanical doll. This habit has nothing to do with physical culture. It has to do with spotting the enemy, before he can crowd in with a deadening burst.

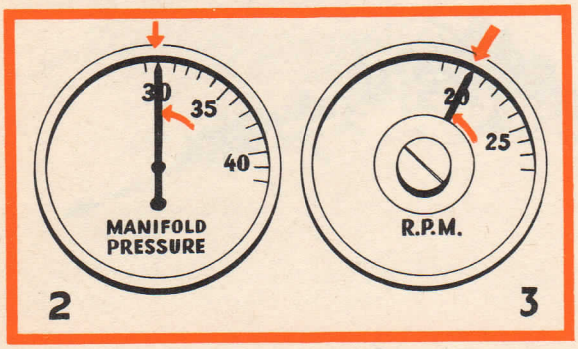


2. Observe traffic. Run the magneto check as quickly as possible with propeller set in high rpm. The motor should be run up to 1500 rpm to check both magnetos. Tell your student that a good pilot returns a rough motor to the flying line instead of guessing it'll do.



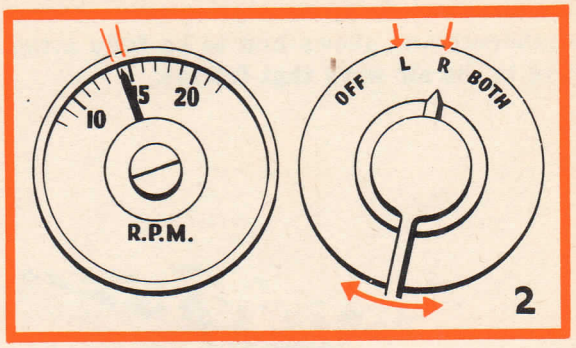
AFTER TAKE-OFF

1. Brake and retract wheels as soon as the airplane is safely air borne.

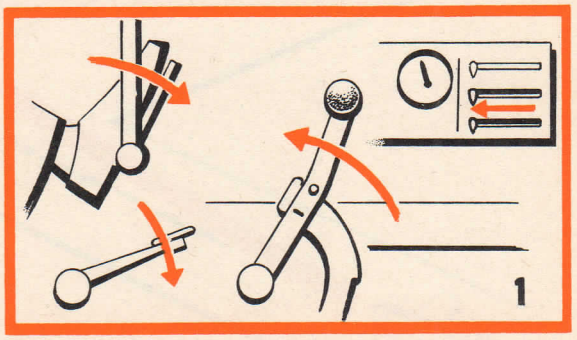


TAKE-OFF

1. "S" while taxiing to the take-off position.



3. Take-off is started with the throttle opened smoothly but quickly until the manifold pressure is 36" and the tachometer is 2250 rpm.



2. Reduce manifold pressure to 30" Hg.

3. Reduce prop pitch to 2000 rpm.

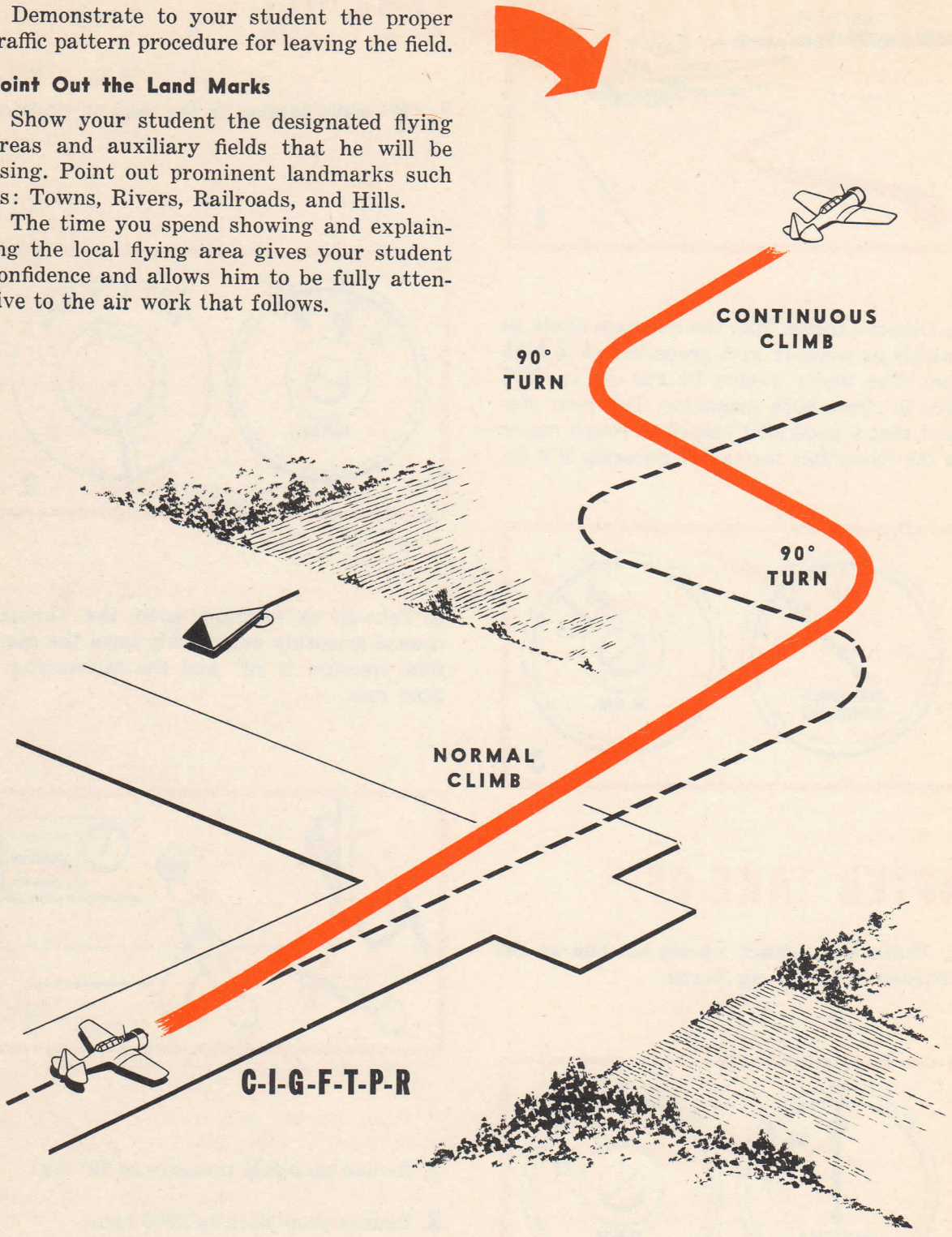
Traffic Pattern

Demonstrate to your student the proper traffic pattern procedure for leaving the field.

Point Out the Land Marks

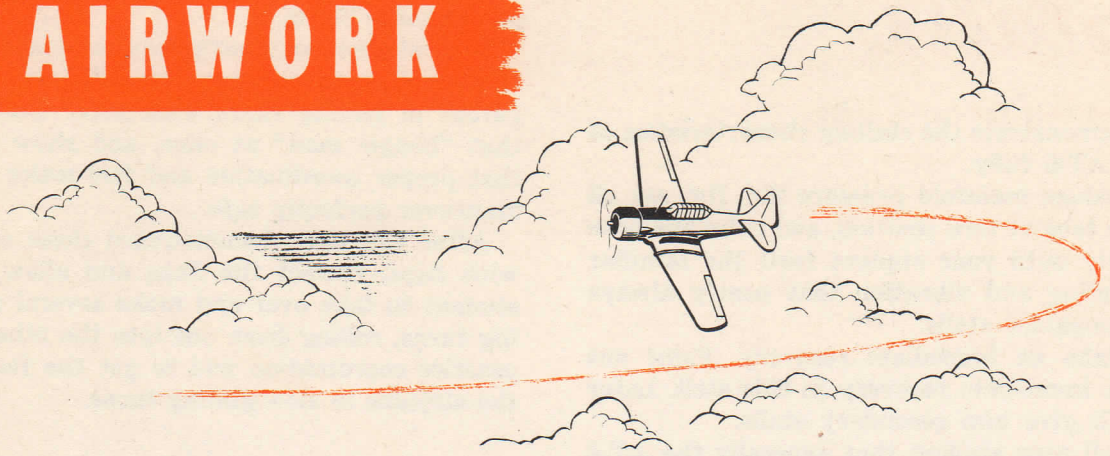
Show your student the designated flying areas and auxiliary fields that he will be using. Point out prominent landmarks such as: Towns, Rivers, Railroads, and Hills.

The time you spend showing and explaining the local flying area gives your student confidence and allows him to be fully attentive to the air work that follows.

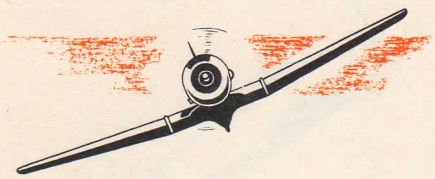


FIRST 90° TURN AT 300-500 FT.

AIRWORK

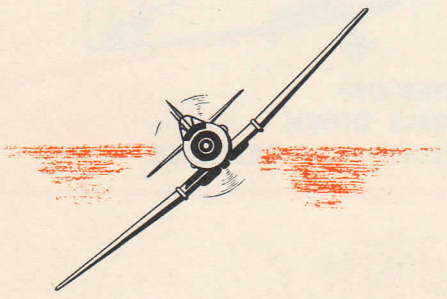


Climbing Turns



Demonstrate normal climbing turns in both directions at 110 mph, 30" Hg, and 2000 rpm.

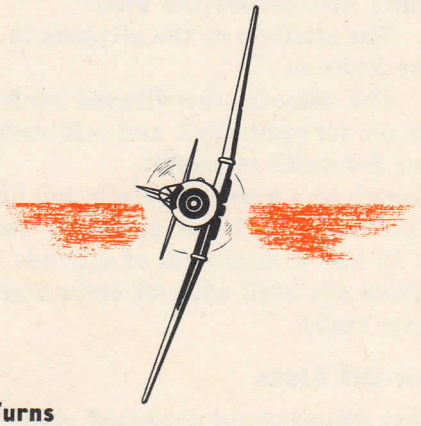
Be sure your student is following through on everything you do. Explain the need for continual use of rudder and elevator trim tabs on the AT-6. Point out that he must trim the airplane for all attitudes and power settings of flight.



Medium and Steep Turns

Place the airplane in level flight. Reduce your manifold pressure to 25 Hg. and rpm to 1850. Demonstrate how to trim the airplane with normal cruising power and give your student a chance to get the feel of the airplane in straight and level flight. Have the student take over and try several medium and steep turns to the right and left.

Don't be too critical here if he loses or gains altitude. Remember he is still flying a strange airplane. Make your first corrections quietly and simply. It will promote the proper instructor-student relations for the entire course. Let him know that most students are a little sloppy at first and that's why you're there as an instructor. This will build his confidence and make him that much more receptive.



Steep Turns

Allow the student to try steep turns. Explain that the airplane is a little harder to fly from the rear seat and that he will soon be up front where the visibility and feel is much better. Caution him against reefing back on the stick. It may result in high speed stalls in turns.

No doubt he will lose or gain a little altitude on steep turns, but tell him you expect him, after a few minutes practice, to correct his own mistakes.

Stalls

Demonstrate the stalling characteristics of the AT-6 fully.

Reduce manifold pressure 20" Hg, set all trim tabs at zero position, and raise the nose slowly until your student feels the familiar buffeting and vibration that nearly always accompanies stalls.

Make an immediate recovery. Point out your immediate recovery in this stall. Later you'll give him secondary stalls.

Tell your student that generally the AT-6 ducks its right wing on a stall and an unintentional spin will occur, unless you give it immediate forward pressure on the stick and left rudder to get quick recovery. He should remember from Primary and Basic flying that ailerons are almost ineffective at stalling speeds, but jog his memory. Make sure that he knows it.

After demonstrating, let the student take over and try these stalls himself. Caution him to watch:

A. The air speed indicated and feel of the airplane just before the stall.

B. The attitude of the airplane in relation to the horizon.

C. The smooth, coordinated control pressures on forward stick and left rudder necessary for quick recovery.

Though he's heard it before, tell him again the reason behind the power-on stall exercise: to lose a minimum of altitude recovering from the stall without encountering secondary stalls.

Power-Off Stalls

Next demonstrate power-off stalls straight ahead with the wheels down using varying degrees of flaps. Tell the student to bear in mind the different attitudes of the airplane in a stall with flaps, and to watch the indicated air speed.

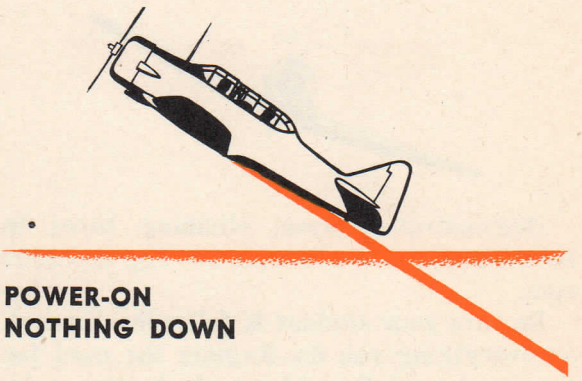
Stalls in Gliding Turns

Build the student's confidence in the airplane by allowing him to make gliding turns with wheels and flaps down. Demonstrate stalls to him from gliding turns both to the right and left to fix in his mind the **maximum performance** limits.

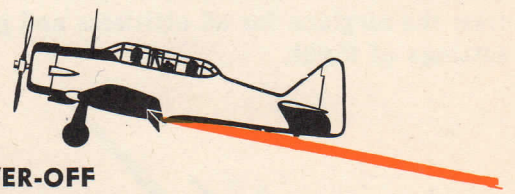
Your student may have heard and believed Hanger Gab rumor that the AT-6 is dangerous in gliding turns with flaps. Destroy that "boogie man" at once, and show him that proper coordination and feel make this maneuver perfectly safe.

After you have demonstrated these stalls with flaps, retract the flaps and allow the student to take over and make several gliding turns, rolling from one into the other to practice coordination and to get the feel of the airplane in slow gliding turns.

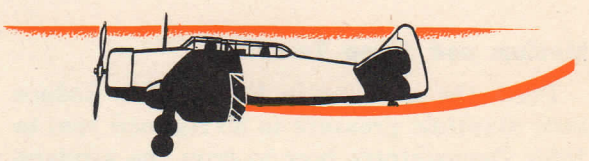
DEMONSTRATE FULLY:



POWER-ON
NOTHING DOWN

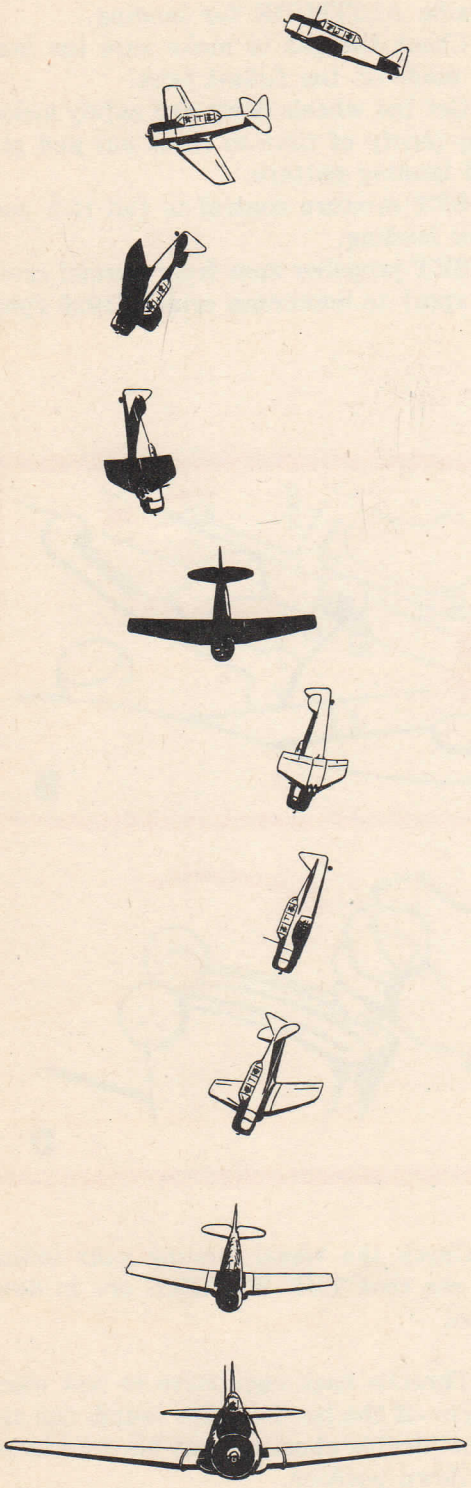


POWER-OFF
WHEELS DOWN
VARIOUS FLAP SETTINGS



POWER-OFF
IN GLIDING TURNS
WHEELS, FLAPS DOWN

Spins



Let the student take over and climb the airplane to a safe altitude for spinning (about 7000 ft. above the ground). See that he clears the area beneath him properly. Demonstrate spins according to the following procedure:

A. Set trim tabs in neutral (zero) position.

B. Maintain sufficient power to prevent the landing gear warning horn sounding—from 12 to 16 inches Hg. The reason for this is to remove a possible fire hazard sometimes encountered when spinning the AT-6 with power completely off.

C. Make spin entry smooth and well coordinated. Hold the nose approximately 45° above the horizon. Increase back pressure on the stick until a complete stall is felt and apply full rudder pressure in the direction of the desired spin. Impress upon the student the need to hold full rudder pressure and stick straight back for a smooth spin entry.

Begin spin recovery after two to three turns. The airplane, depending upon the ability of the pilot, will recover between one-half and one full turn after recovery has been started.

NORMAL RECOVERY PROCEDURE

- Apply **full** opposite rudder briskly against the spin. Immediately return the stick to neutral position and slightly against the spin.
- When the spin stops, neutralize rudder, gradually increase power and assume a normal climb back to the altitude in which the maneuver was started.

Students must be cautioned against too rapid recovery attempts from spins. It often causes another spin in the opposite direction.

Tell your student to be **altitude conscious.** Ask him over the interphone how many feet he lost in the spin.

Never let him forget that in maximum performance flying the minimums are constantly narrowing and that smooth coordination and technique are his only keys to achieve maximum performance from the airplane.

LANDING *Procedure*

GUMP

Proper landing procedure cannot be stressed too much. It is extremely important that the student understand the WHAT, HOW, and WHY of each thing you demonstrate.

A. OBSERVE TRAFFIC BEFORE entering traffic ALTITUDE for landing.

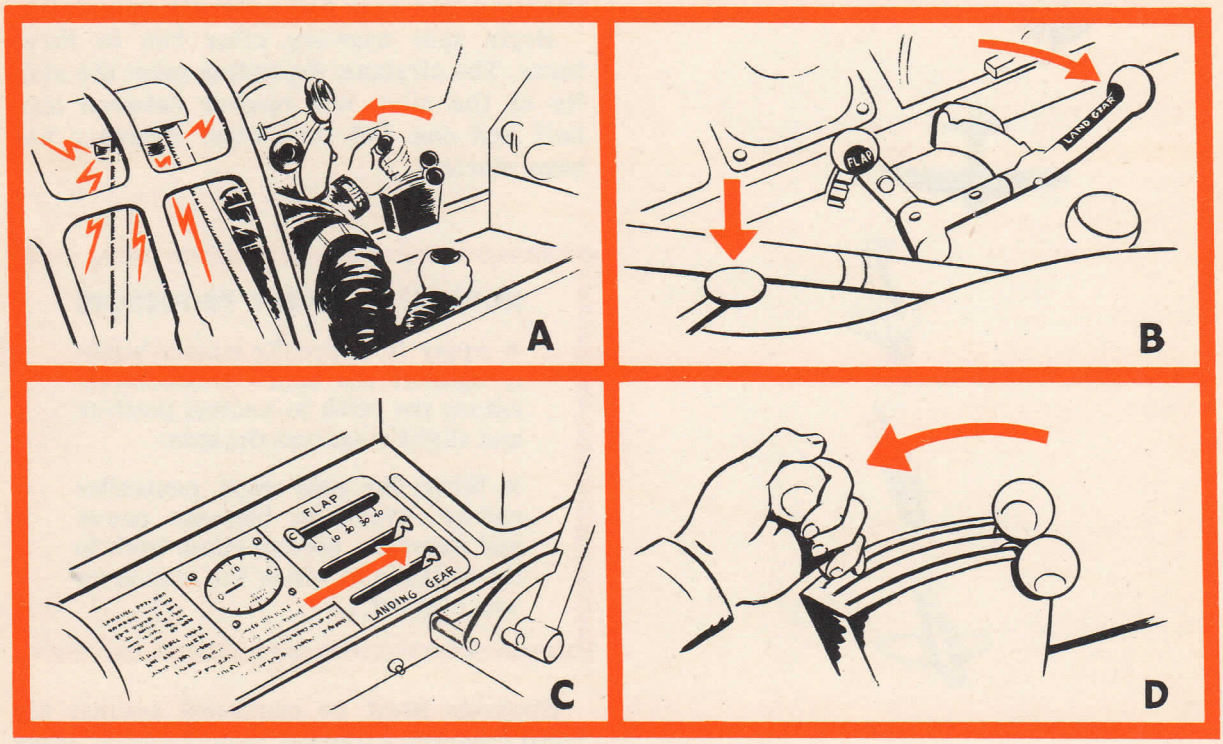
B. Check the gas to make sure the landing is made on the fullest tank.

C. Get the wheels down and safely locked, leaving plenty of time to think out and plan a good landing pattern.

D. SET mixture control to full rich position for landing.

E. SET propeller rpm from normal cruise (1850 rpm) to maximum cruise (1925 rpm).

LANDING GEAR PROCEDURE



Stress the need of going through the following landing gear procedure before entering traffic altitudes.

A. Throttle back to test warning horn. This is the only way the student can be sure the warning horn is working.

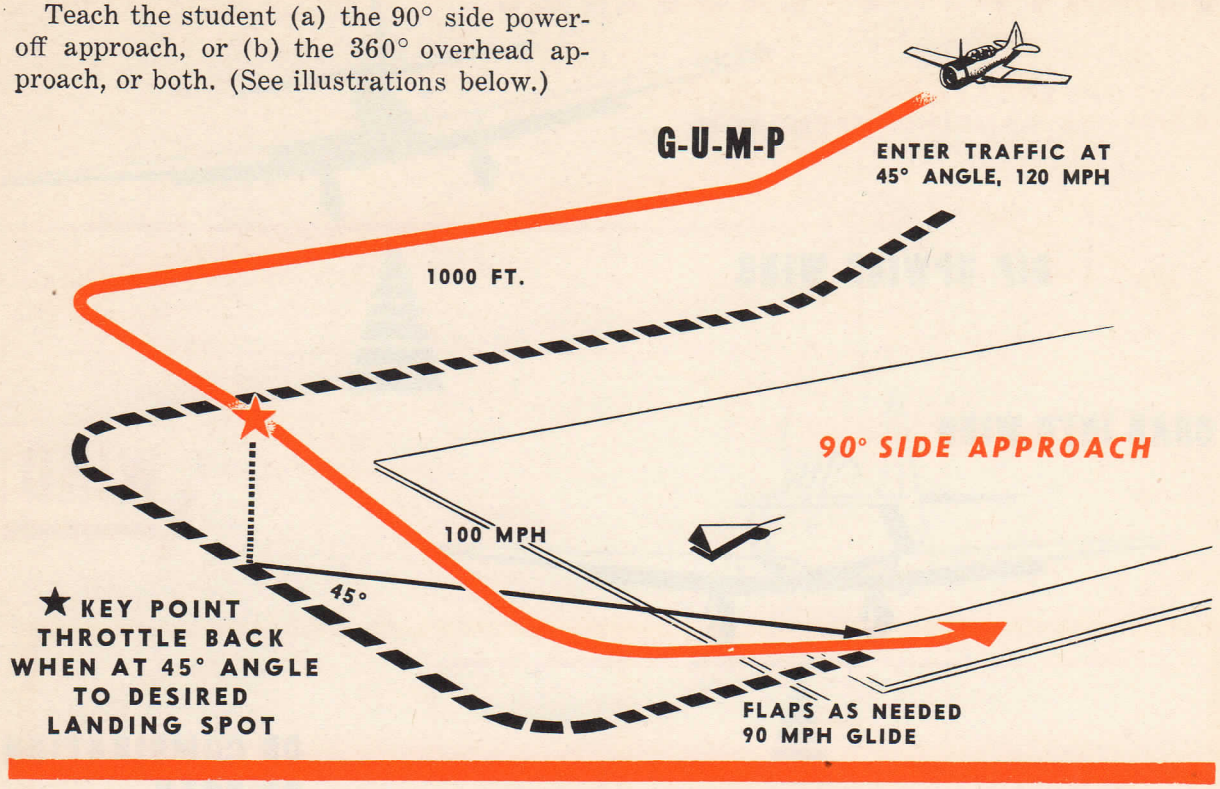
B. Press hydraulic power button and move landing gear lever to down position.

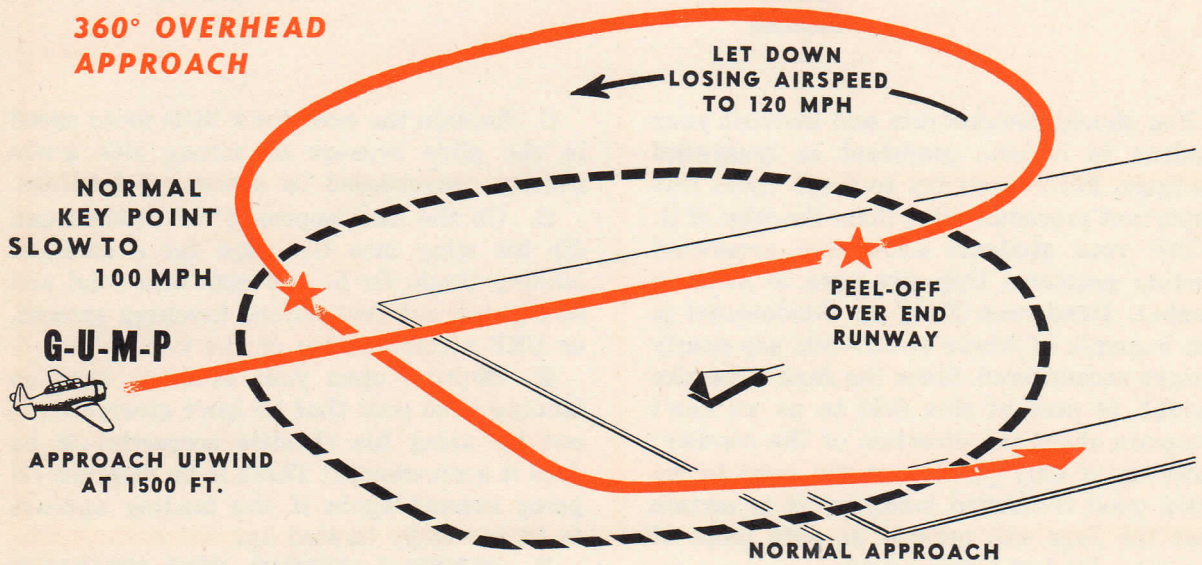
C. Check the visual landing gear indicator to see that THE WHEELS are in down position.

D. Throttle back once more to test warning horn—if the horn doesn't sound, the student has double checked that his wheels are in the down position.

LANDING TRAFFIC

Teach the student (a) the 90° side power-off approach, or (b) the 360° overhead approach, or both. (See illustrations below.)



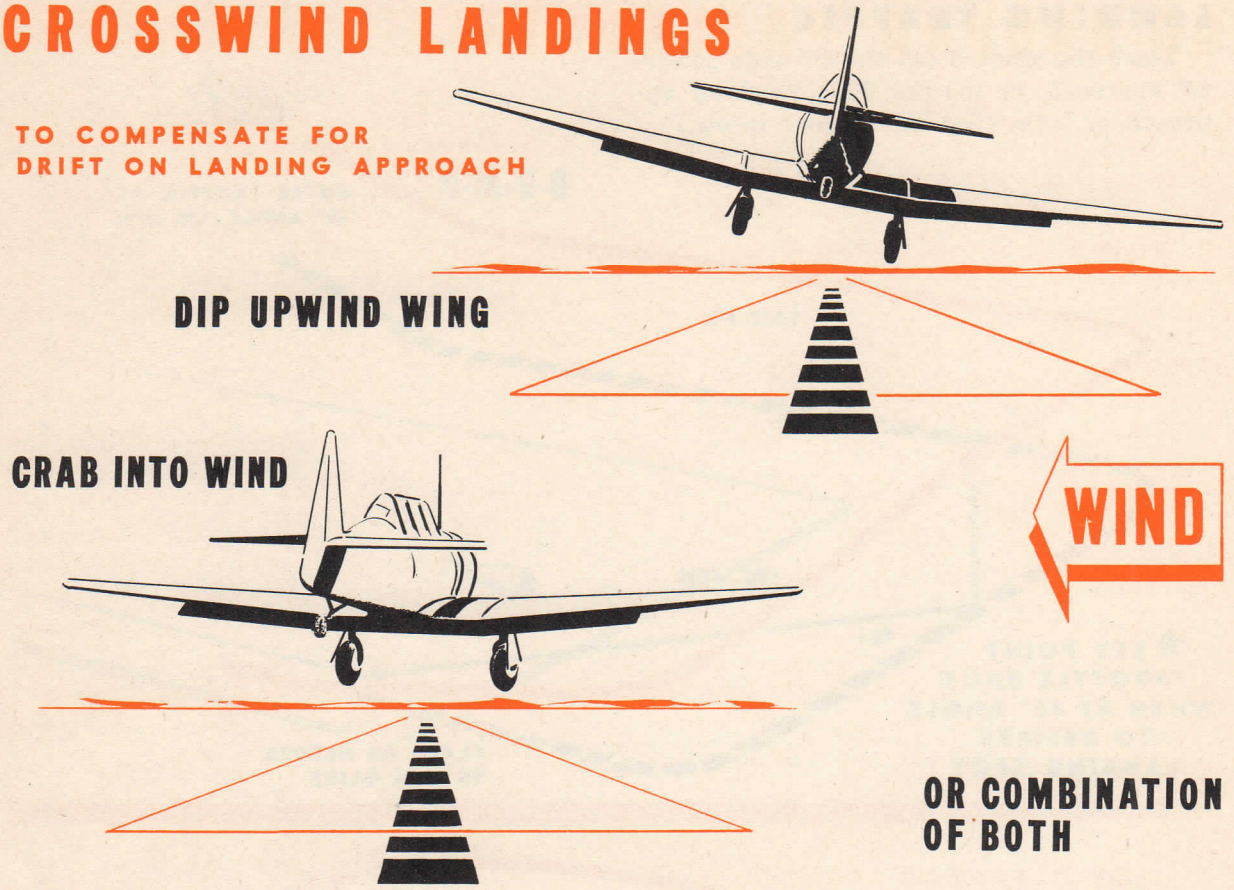


FLAP PROCEDURE

A. Push the hydraulic power button and move the flap lever to full down position and make a normal full flap landing.

B. To give your student an even better idea of flap operation in the AT-6 demonstrate a no-flap landing. DEMONSTRATE the flatter, faster angle of glide, reduced visibility, and longer roll. Tell students that they are expected to judge their landings accurately and compensate for any misjudgment by the use of more or less flaps rather than the application of power.

CROSSWIND LANDINGS



You should demonstrate and instruct your student to become proficient in crosswind landings. Before you try to teach them this important procedure give them the **why** of it.

Tell your students about the crosswind landing problems they are sure to meet in combat. Henderson Field on Guadalcanal is one example of where crosswinds are nearly always encountered. Since the Japs were nice enough to present this field to us we can't complain about the direction of the runway; however, it only points out the need to develop good crosswind landings. It is certain that the Japs will present us with more of the same kind of landing fields.

Crosswind Landing Procedure

A. Be careful on the approach to compensate for drift. The student must THINK and plan his landing pattern carefully.

B. Depending on the type and velocity of the crosswind, the landing should be made with a flap setting between zero and 35°.

C. Explain the need for a little more speed in the glide because of strong side gusts usually encountered in crosswind landings.

D. On the final approach the student can dip his wing into the wind for a straight landing track. Or he can crab into wind and straighten out just before touching ground, or USE a combination of the two.

E. Impress upon your students that no landing is so poor that he can't straighten it out by using his throttle correctly—if he does it soon enough! There is no disgrace IN going around again if the landing appears to be too badly bawled up.

F. **AFTER LANDING,** THE STUDENT MUST HOLD HIS HEADING WITHIN 5° TO AVOID A GROUND LOOP. CROSSWIND LANDINGS ARE A PREPARATION FOR COMBAT CONDITIONS. If you keep this foremost in the student's mind, he'll be eager to perfect the good crosswind landing technique absolutely necessary to a fighter pilot.

GO-AROUND PROCEDURE

If unusually heavy traffic or misjudgment of a landing make go-around necessary, any student properly instructed and checked in both normal landing and go-around procedure will find it no more difficult than normal take-off.

Procedure

A. Open throttle to 30 Hg.
B. Set propeller control at 2000 rpm.
C. Up gear.
D. Milk up flaps.
E. Observe traffic.

Emergency Pull Up

Emergency pull up procedure is necessary only when the student pilot is in danger of crashing unless he uses every bit of available power to pull up and go around.

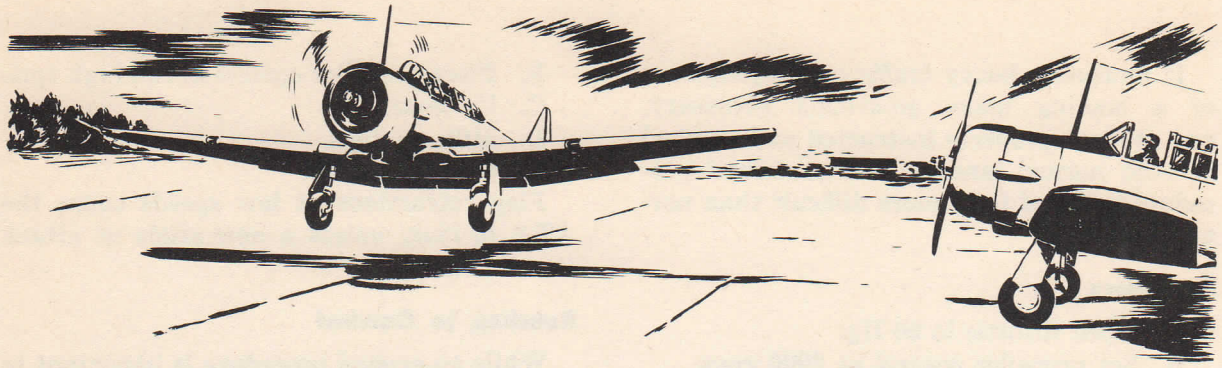
A. Open throttle to sea level stop.
B. Place propeller control in full high rpm.
C. Up gear.
D. Milk up flaps.
E. Observe traffic.

Flap retractions at low speeds cause the AT-6 to sink, unless a new angle of attack is established.

Relation to Combat

While go-around procedure is important to the safety of your class in training, point out its relations to combat. Fighter pilots returning to their home bases have often found that the enemy has bombed the runways and they must pick a precarious landing path between bomb craters. The pilot who suddenly spots a yawning crater just ahead of his landing plane finds that correct go-around procedure is like money in the bank when he needs it most.

ACCURACY LANDING STAGE



The accuracy landing stage comes after the student has soloed, has practiced air work, and is fully confident of his plane. One instructor grades a number of students flying the pattern, landing and taking off directly in front of his plane. He grades them on:

A. Take-off; for proper corrections; for drift and good technique.

B. Pattern flying; regarding altitude and shape. Correct position in pattern for dropping wheels.

C. Judgment on placing the base leg. Cutting throttle.

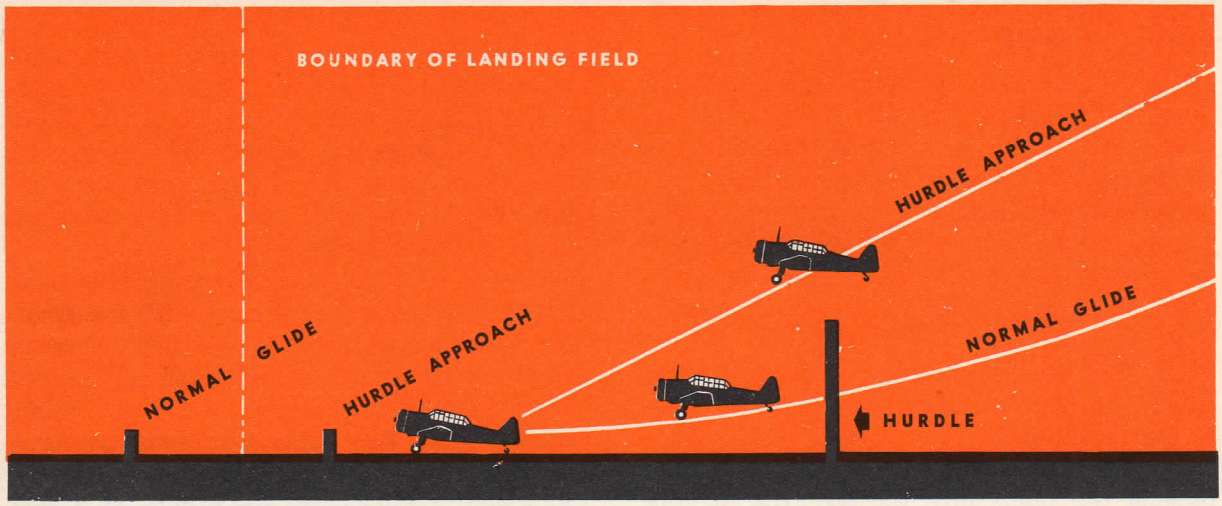
D. Roll out (final approach); use of flaps.

E. Was the landing good? Was it well planned and coordinated for accuracy? Did the student stretch his glide or land too fast as a result of a last minute loss of altitude?

HURDLE LANDING STAGE

The hurdle stage is one of the most important phases of training a fighter pilot. You must make sure that the students who depend on you to make them into top-notch fighter pilots are thoroughly trained in maximum performance landings. Break it down into WHAT, HOW, AND WHY.

WHAT: The hurdle stage is given over any type of hurdle that doesn't present a physical or mental handicap to the student. C.I.S. uses a hurdle consisting of 20-foot uprights spaced a hundred feet apart. A light string runs across the top and alternating yellow and red streamers hang from it.



HOW: Make a straight on approach with full flaps carrying between 15 and 18" Hg. Maintain an air speed of 80 mph indicated. Cut power and clear the hurdle 5 to 10 ft. Make a normal three-point landing. **Angle of descent must be steep and constant.**

Caution students that undershooting the hurdle (less than 5 ft.) is a greater error than overshooting. Translate as many as possible of the maximum performance lessons into combat problems. Let them know that you will demand perfection from them on the hurdle stage because they will soon be flying in and out of impossible fields in the war theaters. Impress upon your student that what you're teaching him today will help him to defeat the enemy tomorrow. YOU CANNOT STRESS THE TIE-UP BETWEEN MAXIMUM PERFORMANCE AND COMBAT PROBLEMS TOO STRONGLY.

SHORT FIELD

OR MAXIMUM PERFORMANCE TAKE-OFFS

Short field take-offs fall into two classes or a combination of the two classes. Your student must develop good judgment in deciding which type of maximum performance take-off he needs.

Short Field Take-Off to Clear High Obstacles

This is what your students will meet most often in operational fields. The problem is a short field with high obstructions at the end of the runway.

Proper procedure for this type of maximum performance take-off in the AT-6:

A. Use every inch of available runway.

B. 20° flaps for take-off.

C. Open the throttle to 30" Hg. Release brakes and open throttle to sea level stop.

D. Take off from a three-point attitude.

E. Climb at about 80 mph until the obstacles are cleared.

F. Milk up the flaps after the obstacles have been cleared and assume a normal climb.

When you use this maximum performance take-off, the airplane will break ground and take-off in a three-point attitude at about 65 mph. It gives you maximum climb to clear the obstructions.

Short Field Take-Off to Clear Ditches or Bomb Craters

This type maximum performance take-off must be impressed on the student as an every day reality in many of the fields in combat. He will face take-offs in which bomb craters or rubble on the runway will wreck him unless he gets into the air—quickly.

Proper procedure for short field take-off:

A. Use every inch of available runway.

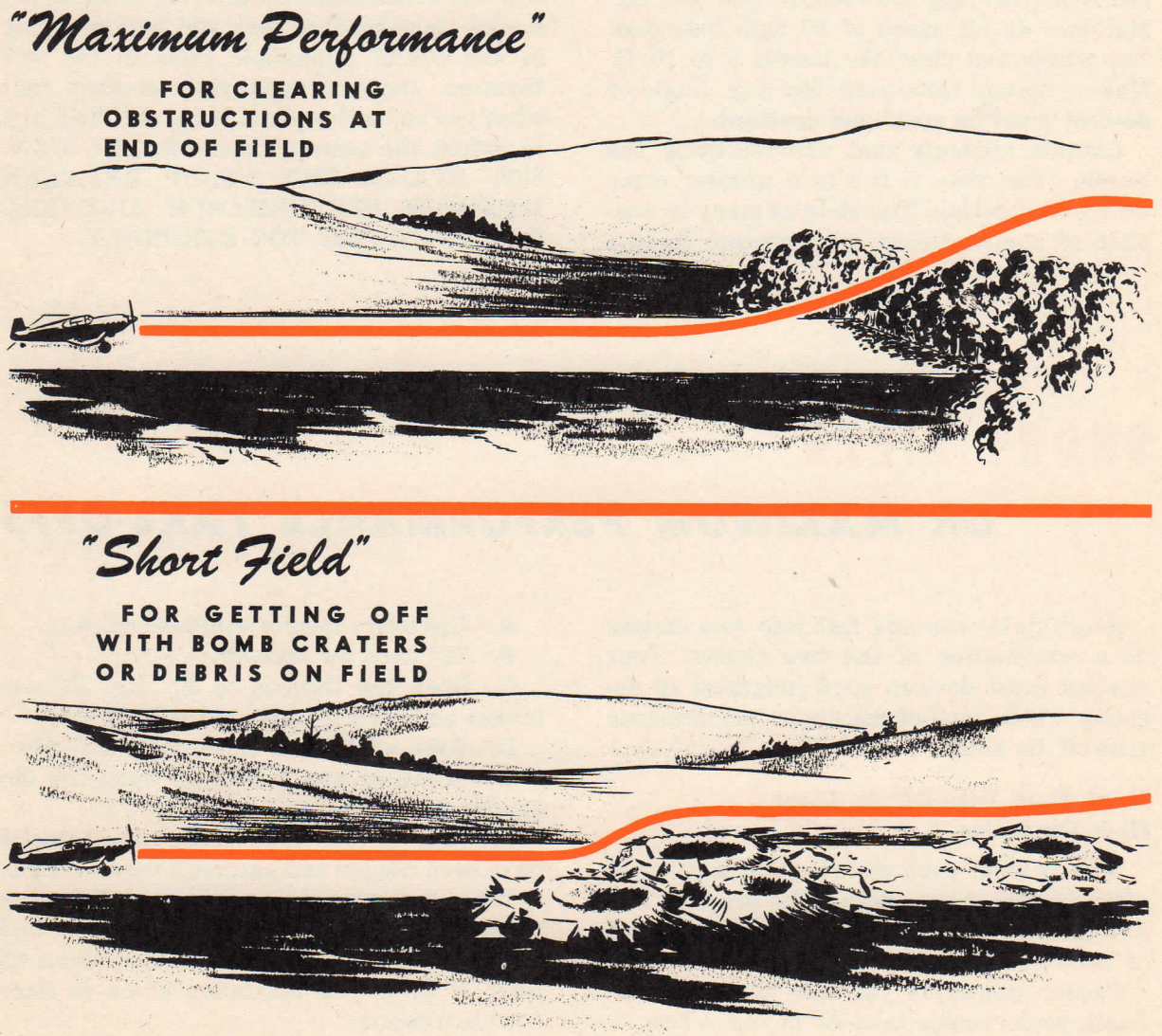
B. Use full flaps.

C. Hold with brakes and advance throttle to 30" Hg. Release brakes and open throttle to sea level stop.

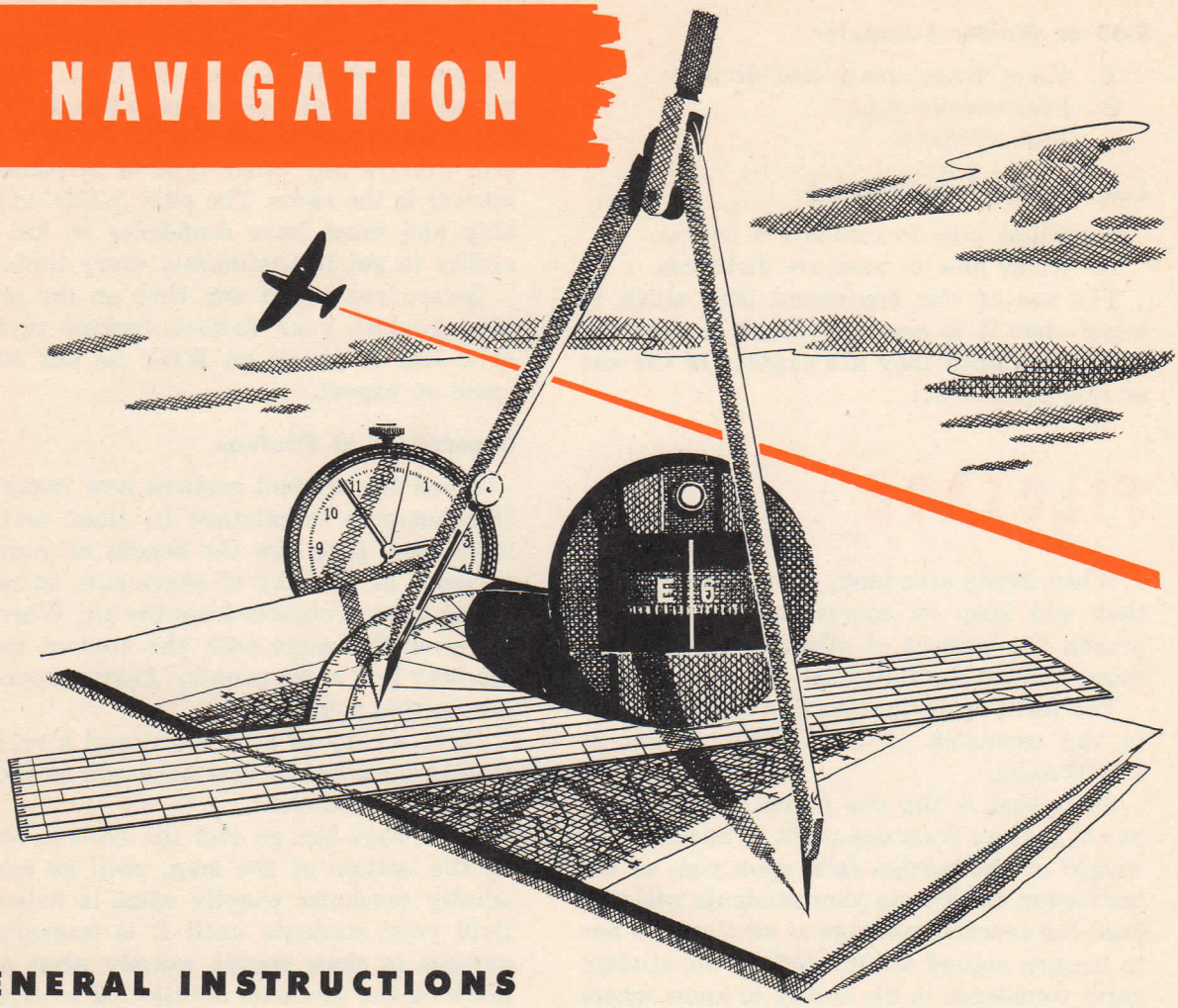
D. Make a three-point take-off. You can balloon the plane into the air after a very short run.

It is very important that your student realizes the difference between these two distinct types of take-offs. Repeat to him the WHAT, HOW, and WHY of each. The maximum performance take-off to clear tall obstructions, using 20° of flaps, gets the plane into the air quickly and gives maximum climb to clear tall obstacles.

The short field take-off, using full flaps, gets the airplane into the air with the shortest possible run, but does not offer maximum climb to clear tall obstructions at the end of the runway. Be sure that your student knows these two basic maximum performance take-offs. Each problem will call for judgment using one or the other—or a combination of the two.



NAVIGATION



GENERAL INSTRUCTIONS

Students often consider navigation a tough subject, and for that reason they don't make a real effort to understand what is being presented to them. Therefore, the first thing to do, is to **stress the importance** of navigation to the single-engine pilot. BUT, before you can sell the idea to your students, you must be sold on the value of navigation yourself.

Answer their questions on the value of navigation, before they ask.

Approach them in this manner:

"I'm going to give you only two reasons for being enthusiastic about navigation. Think them over."

1. Single-engine airplanes have a constantly increasing range of action!

2. You won't be flying the radio range or light lines in combat! You're on your own! **You** have to find the way!

Before going into the subject of navigation, be sure they are interested. Be sure **you have created** an interest.

Then proceed by short, easy steps.

First, tell them they must become expert in the use of the equipment they will use. They must be **expert** to qualify! Outline what skills you expect of them, such as the following:

Weems Plotter

A. Know how to measure a course correctly.

B. Know how to measure distances.

E-6B or Similar Computer

A. Know time, speed, and distance.
B. Fuel consumption.
C. True airspeed.

Lambert Conformal Chart

A. Know how to measure a course.
B. Know how to measure distances.

The use of this equipment isn't much to know—but it **is** essential. **Don't go on to a new phase until they are experts in the use of this equipment!**

PILOTAGE

When flying over land, or in sight of land, they will keep on course by pilotage. Approach the subject of pilotage in a manner suggested by the following:

The form of navigation that the pilot uses to the exclusion of most other forms, is PILOTAGE.

Since that is the one means your student has of getting from one point to another, the weight of the burden falls upon you, as the instructor, to impress your students with the need for exacting pilotage at all times. It has to become second nature, before the student gains confidence in his ability to know where he is **at all times.**

The student may ask WHY a pilot should know how to navigate? Your answer lies in the fact that the fighter craft are constantly increasing their range of action, and when in a fighter craft the pilot is responsible for his own neck. If he can't get back home, it means the loss of a plane and a life. But most important to your student is the fact it is HIS life! In any other type of airplane the answer is the same. The pilot is C.O. of that ship and must have confidence in his own ability to get to destination every time.

Before you spend any time on the art of pilotage with your student, become enthusiastic and emphatic on WHY he has to become an expert.

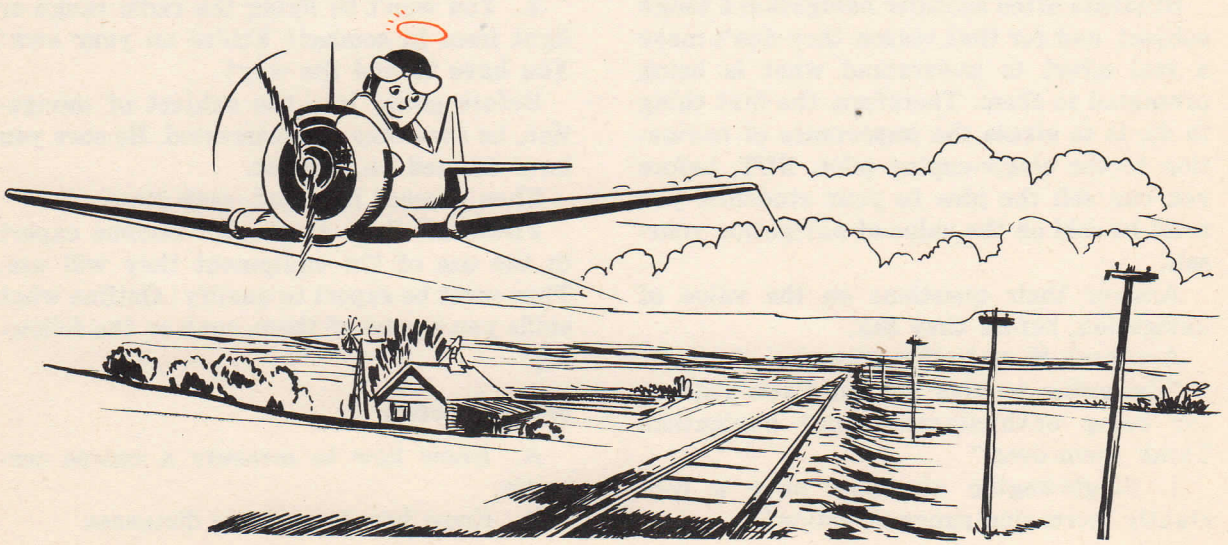
Importance of Pilotage

When the student realizes how important this business of pilotage is, then, and not until then, give him the benefit of your experience in the way of short cuts to recognizing ground objects from the air. When going over the maps with the student before his first few cross country flights, approach him in this manner:

Have a copy of a sectional and a regional map in your hands, and have one of each in front of the student.

First, have him go over the symbols shown on the bottom of the map, until he can instantly recognize exactly what is indicated. Drill your students until it is immediately obvious in their minds, exactly what every mark on the sectional is intended to express.

When you are satisfied that they are experts in immediately knowing what to look for on the ground in relationship to what is shown on the map, take the next step.



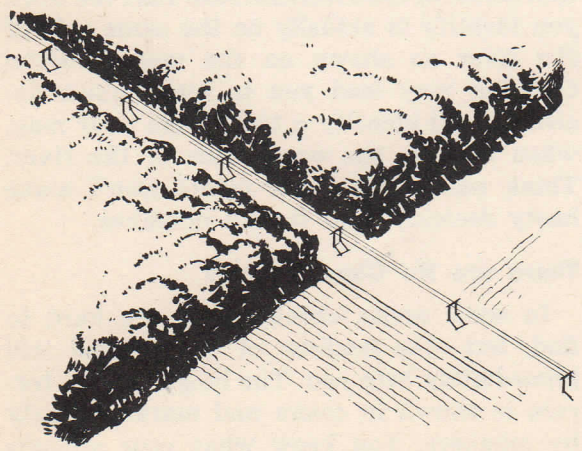
Maps—Sectional and Regional

Impress the student with the fact that the sectional is of a scale of 1 to 500,000, while the regional is of a scale of 1 to 1,000,000 (as taught in navigation classes). In other words, a town on a sectional will look twice as large as a town on a regional. On regional maps, roads are not shown, and most of the details are omitted, such as oil derricks, lookout towers, tall buildings in towns, water towers, etc. The reason for impressing them with this fact is, the student will probably do his pilotage on a sectional during his training, but inadvertently he may pick up a regional at some later date, and because of the lack of detail, and the distortion of size that has been already correlated in his mind from reading sectionals, he will become lost —and afraid. Not only must you tell them of the difference, but have them look at the two maps and see the difference. **Drive this impression home!**

Cite Your Own Experiences

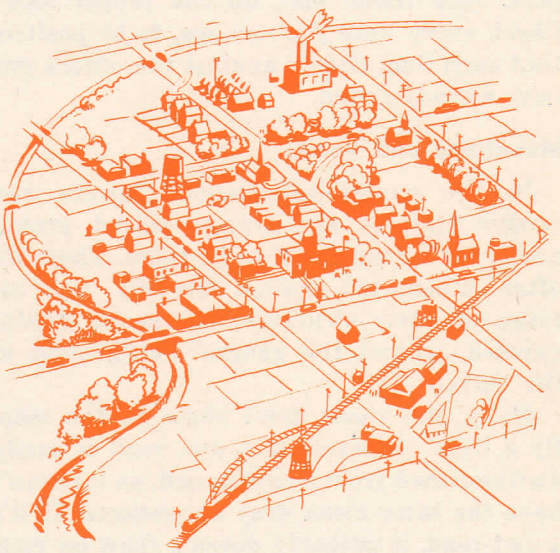
Then, tell him the trade secrets that you have learned by your experience in reading maps from the air—things that he can only learn by experience. Your telling him and going over your own experiences before he attempts his first cross country, will make him gain experience much more readily. Some notes that will help the student with this problem are as follows:

Transmisison lines are often hard to see from the air. However, when passing over wooded country, in erecting the lines, a huge swath had to be cut through the woods. That distinct path cut through a wooded area is immediately recognizable from the air.



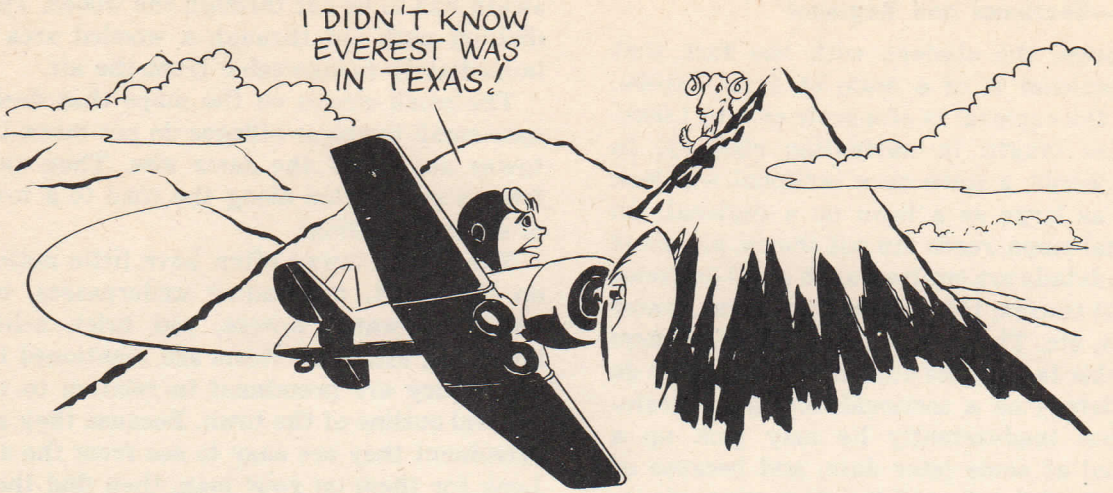
The small circles on the maps that designate small towns or villages do not mean the towns are all of the same size. They vary from a gas station along the road to a town of several buildings.

The larger towns often have little notices on the chart, mentioning underpasses, tall buildings, water towers, red brick school buildings, etc. Such items are mentioned because they are prominent in relation to the general outline of the town. Because they are prominent they are easy to see from the air. Look for them on your map, then find them in the town.



Is That the Town?

When checking a town from the air to ascertain whether it is the one shown on the map or not, look at the general area about the town, the way the roads are leading into or out of it, and the direction of the roads in relation to your compass heading. Is the railroad entering the town with the highway on the proper side of the railroad? If a river or body of water is shown to be at a certain bearing from town, check to see if it is actually that way. Does the river go through the middle of town, on which side of the river should the town be found? Oil derricks and storage tanks are easily recognizable from the air in their relationship to the other features of the town. Is the air-



port, race track, etc., on the proper side? Check every item you can see, to be positive that each item checks against the others you have already found.

Mountains and Roads

In the mountains, lookout towers and ranger stations are always placed prominently on a peak, or a high ridge. They are often silhouetted against the sky, and because of their structure, are easily distinguished against the general background of the terrain.

Many dirt roads don't show on the map. By a little observation, a dirt road is easily distinguished from a paved road, as it doesn't have the same clean grey appearance. If it's a dirt road, it probably doesn't show on your map, so don't mistake it for the correct road, through the process of wishful thinking.

Check to see if the railroad is on the proper side of the highway. Where roads and railroads cross each other, by checking the twists and turns and angles at which they intercept one another, it will immediately become obvious that you have either found the right road, or it is definitely **not** the one you are looking for. Since railroads and roads often run parallel to each other, check the way they enter a town. The railroad is shown to be east of the road on your map, is that the way it actually is?

Bodies of Water

At certain times of the year, bodies of water may be shown on the map and not visible, due to the dry weather that has been prevalent in that area. They have just dried up. If you are sure the water should be there, but you can't find it, let it go, and find some more reliable check point. In other seasons, whole areas of land become inundated, and you see so much more water than is ever shown on your map that you can easily become confused. But, if it is during the rainy season, evaluate what you see in that light, and use check points that do not depend upon the weather for their reliability, such as the roads and railroads, prominent buildings in a small town, etc.

Rivers can be utilized in many different ways. However, if there are no definite patterns to the twists in the river that can be absolutely identified by reference to your map, look for bridges crossing the river, railroads and roads running parallel or crossing the river, and towns that are placed in certain bends of the river. Be sure that the town you identify is actually on the same side of the river as shown on the map. Wishful thinking may lead you to make quick decisions, and identify a town from your map, when it is on the **wrong** side of the river. **Think out every check point!** Don't make hasty decisions and foolish mistakes.

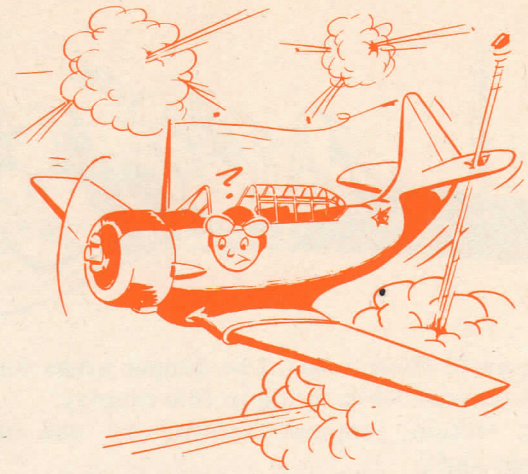
There are No Check Points?

In some areas, check points are hard to find, but—the contour of the ground will immediately help you. The height of the terrain is shown in colors and marked clearly by numbers. You know what your altitude

is, and you can make an estimate of how far off the ground you are. With knowledge of these two factors, you immediately know the general elevation of the ground over which you are flying. That in itself gives you some indication of the area in which you are flying. Many times little isolated mountains out in the middle of a valley or plain, or mere knolls are shown prominently on the map, and easily seen from the air. Use them for check points. In mountainous country, the heights of the outstanding peaks can be estimated. Lakes in relation to mountain peaks are good check points. General mountain ranges can be viewed from a distance, and your destination or a good check point may be found by general reference to its position in relation to the whole mountain range. Ridges and marked erosions from mountain ranges running into valleys are good check points because of their presence in relation to the peaks in the range, as shown on the chart.

Danger areas as outlined on the map often are impossible to distinguish from the air. They don't have a big red line outlining them on the ground as they do on the map. By referring to the check points available, **be sure to avoid these areas.**

Always consider when the map was published. If some time has elapsed, consider the fact that dams may have been built, and



large bodies of water backed up, and distinguishing characteristics of towns may have been altered or changed. If you are using an old map, expect to come across a few items that are in direct divergence to the picture that is shown on your map. **Evaluate** an old map in this manner, but do not excuse every mistaken check point with the thought, "Hell, the map's not right!"

Most important of all! **Use your head!** Look for every check point that can be distinguished, and check each one against the other. When several features have been checked one against the other, **then** you have a substantial check point, but not before this is done!

The above notes are suggested helps to the student. You probably have thought of others. Use them. Anything you have found to help **your** pilotage will probably help your students. Pass it on!

There is **one** way you can help them learn. Tell them everything you know about the subject!

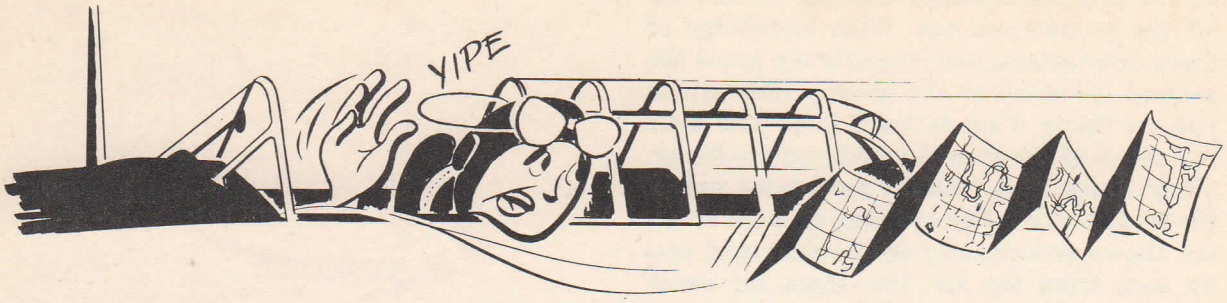
Then give them the procedure for preparation and execution of a cross country as follows:

1. Study the map of the territory over which you intend to fly.

Mark **plainly** and **boldly** the course along which you intend to fly, divided into 10-minute intervals at a groundspeed you expect to be able to maintain.

Mark **plainly** and **boldly** all check points you intend to use including auxiliary or emergency landing strips.

Mark boldly in **red,** any concentrations of enemy opposition, ack ack, or fighters to help



you avoid these areas. Use danger areas for this purpose while flying in this country.

2. Obtain compass heading by use of winds aloft.

3. Use proper altimeter setting from the ground up, and note trend from departure to destination. You don't want to be running into any mountains!

4. Watch for abnormal changes in temperature. Such changes will change your true airspeed, drift, and true altitude. It's worth watching.

When temperature is **lower** than normal, you are **lower** than your altimeter indicates.

When temperature is **higher** than normal, you are **higher** than your altimeter indicates.

5. Check your groundspeed at every opportunity.

Use railroads, roads, water towers, prominent buildings, lake shores, sea coasts, and rivers for check points.

By checking time and distance traveled over definite objects you will obtain an **accurate** groundspeed.

Don't be careless.

Keep your eyes on the terrain at all times while not checking instruments or sky-gazing.

6. Find groundspeed by setting distance over time on the computer.

7. Find estimated time of arrival by computing time to cover remaining distance to destination.

This is the procedure they will use on every cross country flight, so—**stay with it until they can do it in their sleep.**

FUEL CONSUMPTION

When the student has assimilated all the above information, check his use of the computer in solving fuel consumption problems, by getting down to earth as follows:

"**Remember!** Gallons per hour is the same as miles per hour. 'Gallons' replaces 'miles.'

"1. Gallons per hour **always** falls on the outside scale opposite the black hour pointer.

"2. Gallons consumed is always found on the outside scale.

"3. Time taken to consume fuel is always found on the minutes and hours scale. Both minutes and hours are found on the movable disc."

OFF COURSE CORRECTIONS

Then, tell your students how to get back on course in one easy lesson. Answer their questions before they ask them by giving procedure to them in good solid language.

"If you have flown for 60 miles, each mile you are off course is equal to one degree off course.

"For every mile you are off course, correct one degree. You are then paralleling your intended course. By correcting **two** degrees for every mile off course, you will be back on your intended course in 60 miles.

"Corrections can be made proportionately!

"If you are four miles off course after flying 20 miles, that is the same as 12 miles off course in 60 miles."

INTERCEPTION

When your students are ready for interception problems, stress the importance of being at a **certain point** at a **certain time.**

"The idea is to be at a certain point at a certain time!

"The actual working of the interception problem will be done on the ground.

"**In the air,** your job is to control your groundspeed to make rendezvous and properly intercept geographical positions.

"Why be at a rendezvous on time?

"1. If you're early, you'll have to circle the position and will give the enemy notice of impending developments.

"2. If you're late, the flight will have proceeded to the target without you as an escort!

"The success of the mission may well depend upon your being there—ON TIME.

"Your judgment is what counts here!

"Knowing how the wind is acting on your airplane, knowing your groundspeed and the corresponding indicated airspeed, it is up to you to throttle back, or pour on the coal, as the case may be.

"But—**get there on time!**"

Tell them how to estimate true airspeed!

"True airspeed is the speed with which your airplane is moving through the surrounding air mass.

"If there is **no wind,** true airspeed is the same as groundspeed!

"Here's how you can find true airspeed from your indicated airspeed in the air, and in a hurry.

"It isn't exact but it is **practical!** Use it."

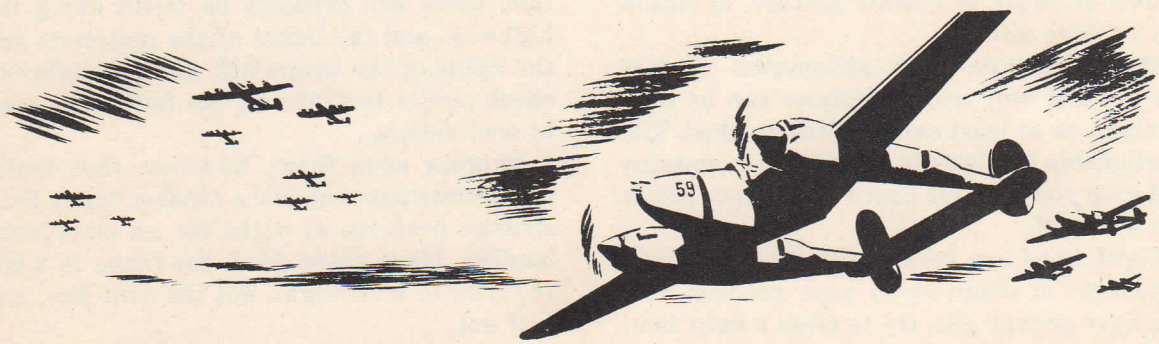
At 5,000 ft. increase your indicated airspeed by 5% to get TAS
At 7,500 ft. increase your indicated airspeed by 10% to get TAS
At 10,000 ft. increase your indicated airspeed by 15% to get TAS
At 15,000 ft. increase your indicated airspeed by 25% to get TAS
At 20,000 ft. increase your indicated airspeed by 35% to get TAS
At 25,000 ft. increase your indicated airspeed by 50% to get TAS
At 30,000 ft. increase your indicated airspeed by 65% to get TAS
At 35,000 ft. increase your indicated airspeed by 80% to get TAS

An easy way to remember this relationship is to notice that at 5,000 ft. the increase is 5%. From 5,000 to 20,000 ft., for each 5,000 ft. increase in altitude the increase is an additional 10%. Above 20,000 ft., for each 5,000 ft. increase in altitude the increase is an additional 15%.

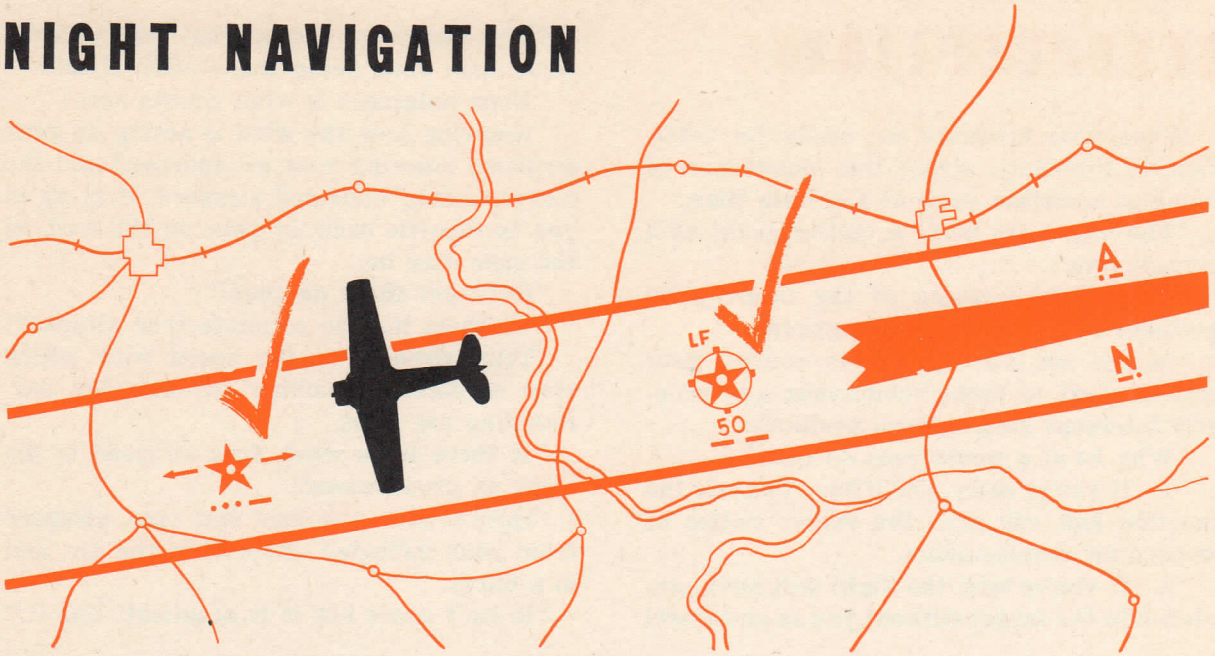
Now you know what your true airspeed is! By judging how strong the wind is blowing, calculate how many miles per hour the wind is adding to or subtracting from your true airspeed.

By applying the effect of the wind to true airspeed, you have your groundspeed.

It is only an estimation, but a **good one.** Practice it on every flight!



NIGHT NAVIGATION



Before your students take a night navigation mission be sure to give them some hints on how to do pilotage at night.

Roads are very easy to see at night by watching for the headlights of the motorists. If ever in doubt as to where you are, and you find a fairly well traveled highway, just follow the road, and you'll be sure to come to a town of some size, and be able to check your position.

Rivers and bodies of water are easy to see in the early evening, and nights when there is a moon, as the sky is reflected in the water, and easily can be seen from the air. In preparing for a night mission it is always well to mark plainly on the map any bodies of water that may be of help.

In checking **towns** from the air at night, practice judging the size of the town. It isn't any easy thing to do, but when at all possible it is well to check a town of one size against a town of larger or smaller stature, to obtain the relative size.

Mountains are often silhouetted against the evening sky, and sometimes can be seen at night, or at least can be distinguished. The relationship of towns to prominent mountains will give you a better check point than either one by itself.

Light lines are very easily distinguished! Whenever in doubt as to your position, and you have enough gas, **try to cross a light line!**

A light line is a series of beacons that flash every six seconds. They are placed from 10 to 15 miles apart, and continually flash a code letter along the direction of the airway. The beacons whose code is in red have no night landing facilities. The beacons whose code is in green, have night landing facilities.

The code is marked prominently on your sectional map, and you can readily tell where you are on the line, or where you are crossing the line. With that information, you can orientate yourself and get a new start for destination. If possible, follow the light line until such a point is reached that the course to destination is practically perpendicular to the light line. That will give you the shortest possible distance to travel away from the light line, and thus less chance of your getting lost.

However, if a highway is running from the vicinity of the light line towards destination, there will probably be towns along the highway, and the lights of the motorists and the lights of the towns will serve as sufficient check points so that you can follow the road to destination.

Impress upon them, however, that under no circumstances should a student try to drag strange pastures at night for an emergency landing. Have them climb the plane to 3,000 ft., trim to level flight, cut the switches, and bail out.

DEAD-RECKONING OVER WATER

When you are convinced that your students **KNOW** their equipment thoroughly, proceed in the following manner.

Introduce the dead-reckoning they will have to do in a manner similar to the following: on most flights you will be over good solid earth, or at least within sight of land. **But**—on occasions when you're out over the briny deep, here are a few good things to know:

1. Use winds aloft to determine heading from departure.

2. To check general accuracy of metro information, obtain general direction and velocity of wind by noting surface of the sea.

The wind is blowing at right angles (or perpendicular to the waves or ripples) and white caps and foam appear to be sliding into the wind.

Remember, you are flying a **Magnetic Heading.** To obtain the true heading of the wind by reference to your compass, you must apply variation!

Below 16-18 mph, the surface of the sea progresses from calm, or slight ripples to white caps giving the ocean a spotted appearance.

Above 18 mph, the foam from the white caps is picked up by the wind and carried over the crest of the wave.

The wind at flight altitude is not the same as the wind at the surface, but it is close enough for practical use.

3. Hold a Constant Heading!

If you don't **positively** know where a change of heading will take you, **don't change!**

You have given them only three definite steps to learn. Go over those three steps as many times as is necessary. But—don't leave the subject until you are positive that each one of your students knows exactly what to do when flying over water.

YOUR STUDENT WON'T NEED A RABBIT'S FOOT IF HE HAS A GOOD INSTRUCTOR

Instructor's Tips

By showing your student how simple good navigation is and by breaking it down into preparation on the ground and procedure in the air, you will reduce what might seem complicated to a simple problem. A certain percentage of students will always get lost, usually for no reason at all. Explain to the student that no stigma is attached to it unless it becomes a habit! A student who gets lost and has found himself generally is better off for his experience.

Encourage your students to think independently. They must be able to think for themselves **in the air!**

On high altitude flights, impress on your students just what high velocity winds can do to their navigation. Make sure they check winds aloft before every flight.

Make them gas conscious! Make them realize that minimum gas consumption settings will enable them to stretch out their gas supply if they get lost or an emergency arises.

Check each student's preparation for a cross country flight **before they take off.** In addition to the preparation for navigation, they must see that:

1. The airplane is fully serviced.

2. The radio receiving and transmitting frequencies are correct.

3. The airplane is equipped with radio facility charts and a cross country envelope.

4. He has general weather and specific wind data along the route.

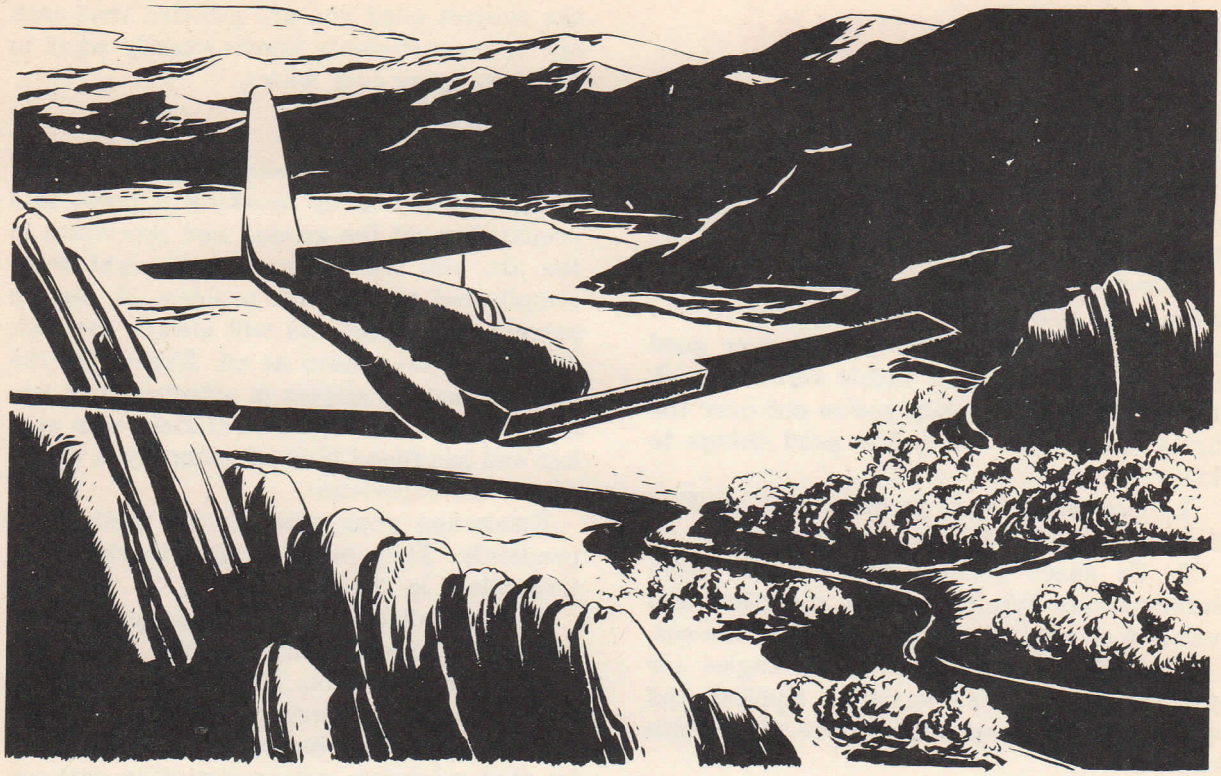
Caution your students against flying in weather! Never permit them to fly through an overcast. If the weather looks threatening along the intended course, the safest thing to do is to make an 180° turn and head for home.

BUT—of paramount importance is your manner of instructing.

BE ENTHUSIASTIC about navigation!

EMPHASIZE the simplicity of the few steps of procedure and preparation!

And, be **TOLERANT** of their mistakes, but **FIRM** in the conviction that to be single-engine pilots, they must be experts in these few down-to-earth navigational procedures.



FULL FLAP EMERGENCY FORCED LANDING

Demonstrate to your student the full flap emergency landing procedure. This is another maximum performance exercise directly connected with combat problems. In combat this is necessary to the pilot if his motor has been shot away and the only possible place to land suddenly presents itself 1,000 ft. below and directly ahead of him.

In training the student may need to know this emergency landing technique if suddenly his oil pressure drops and he finds it necessary to land in a small field 1,000 ft. below him.

Correct Procedure

A. Check the airspeed to make certain it is less than 126 mph indicated and lower full flaps.

B. Put the plane in a steep dive indicated airspeed between 110 and 120 mph. In this steep dive against the flaps the rate of descent will be 2,500 to 3,000 ft. per minute.

C. During this maneuver you have excellent control and visibility. By making a few "S" 's in this diving attitude, you can bring the plane almost straight down and make a landing in a field that seems to the uninformed student impossible.

D. Just before the final approach, the plane should be skidded violently to break the forward speed in preparation for a slow, short field landing.

Wheels Down or Up

You must be certain that your student is able to judge whether an emergency landing should be made with wheels down or wheels up. The answer, of course, depends on the condition of his emergency field.

If the Field Looks Rough

Point out that a rough field often looks smooth from the air. The lush green field is almost always soft. As a general rule, if there are any indications of stumps, ditches, or rough terrain, make emergency landings with wheels up, mixture to idle cut-off, and the ignition cut before touching the ground.

If the Field Looks Good

If an error in navigation, bad weather, or lack of fuel makes an emergency landing necessary, the student drags the field carefully, not once but several times. He lands only when he is fully satisfied that the path in which he intends to land is free from ditches, stumps, wet spots, or hazards that make a wheels down landing inadvisable.

Impress on him the need to check and double check possible ground obstructions as he drags the field. If it still looks good to him he can make a short field approach, using lessons he learned in the accuracy and hurdle stages to make a safe, short roll, maximum performance landing.

Headwork

All through the advanced training course **put emphasis on maximum performance.** This does not mean maximum performance of the airplane alone. It means maximum performance of the airplane and the pilot welded together as a single unit. You cannot **make** a student use good judgment, but you can sharpen whatever natural keenness of mind he has by continually reminding him that flying is 90% headwork and 10% hand and foot work.

Encourage him to use his judgment all the time! If it is bad, correct him. If it is pretty fair, compliment him on it. Good sound thinking is the result of several orderly steps in the mental process.

Encourage Your Student to:

A. Size up the situation quickly. If he gets the facts straight in his own mind he will discard fear.

B. Once he has the facts straight, encourage him to act quickly. A mental fuddy-duddy does not belong in a fighter group. Teach him to act with complete confidence in his own decision. He's got to have confidence to execute any plan for getting out of trouble.

You can help your students by giving them the A-B-C process of thinking and acting. Point out that fear is their greatest enemy in case of trouble in the air. The big battle is won the minute the student gets rid of fear and starts to use his head. From there on it's as simple as A-B-C.

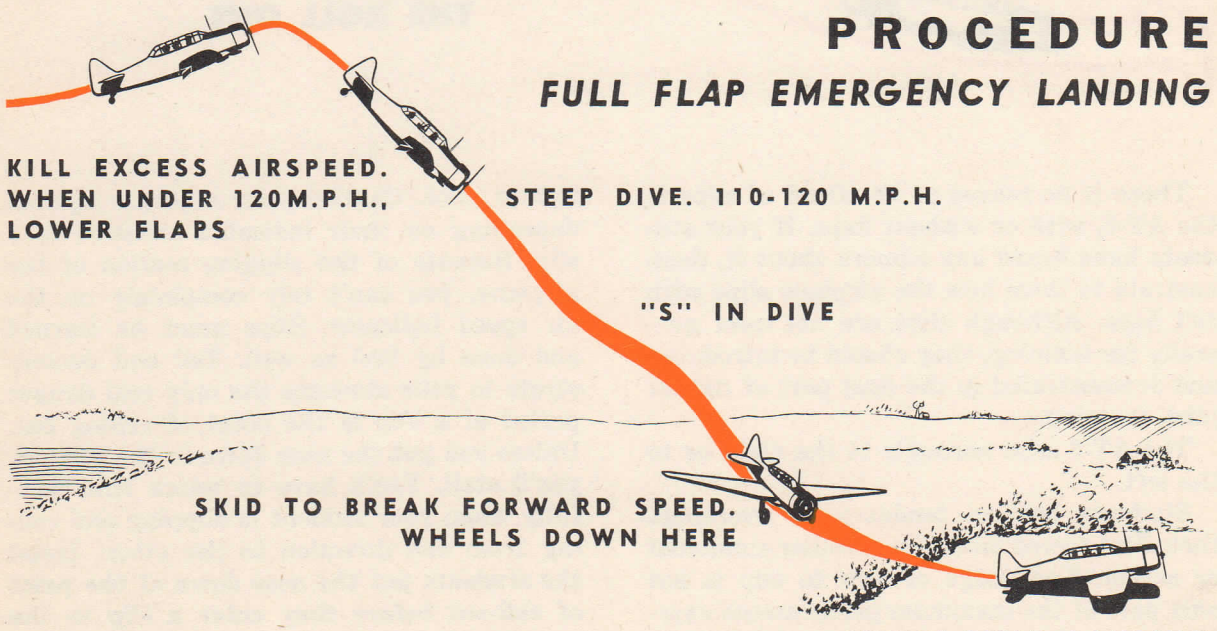
A. To remove fear get the facts straight.

B. Then act immediately.

C. Don't doubt yourself!

PROCEDURE

FULL FLAP EMERGENCY LANDING



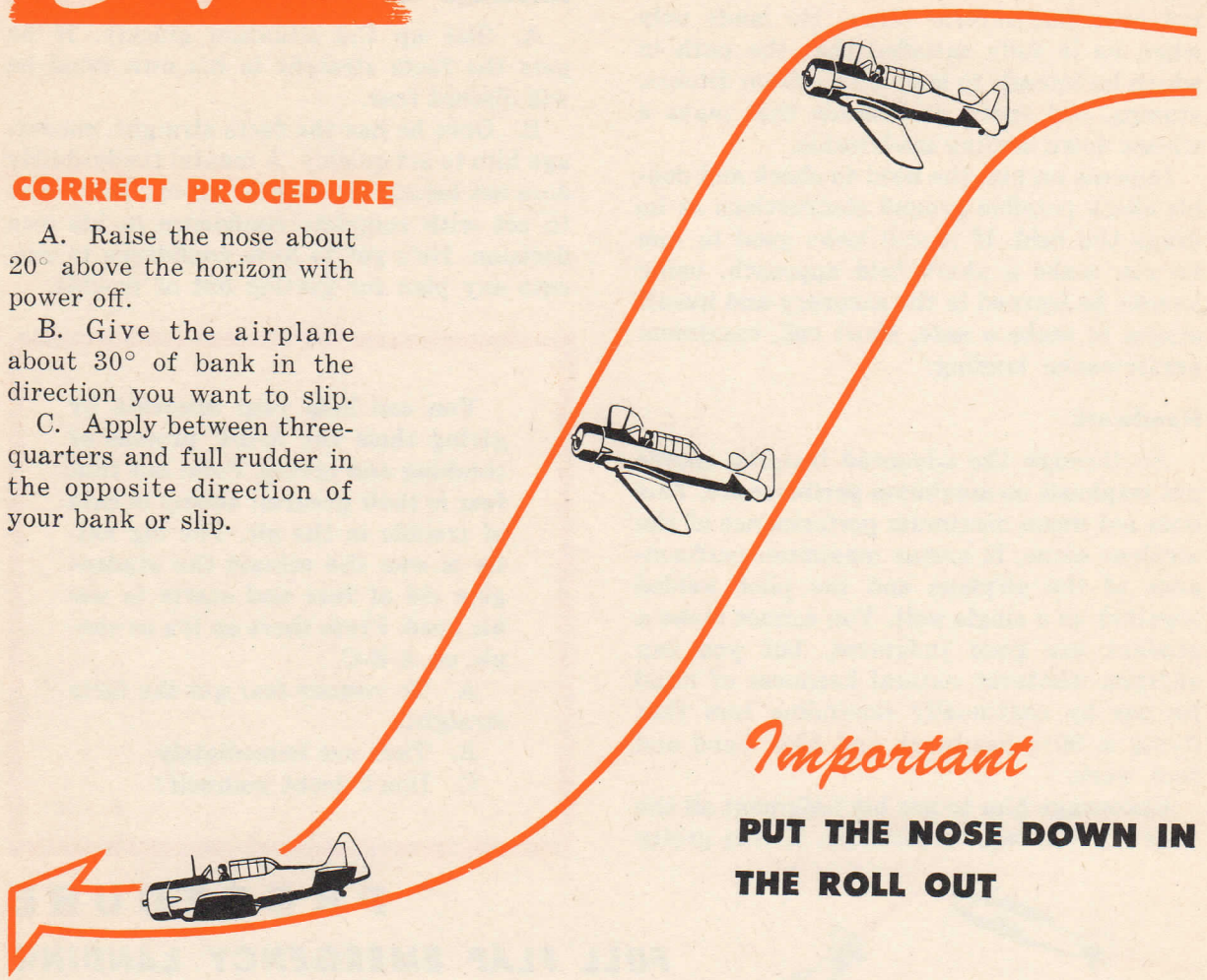
Slips

CORRECT PROCEDURE

A. Raise the nose about 20° above the horizon with power off.

B. Give the airplane about 30° of bank in the direction you want to slip.

C. Apply between three-quarters and full rudder in the opposite direction of your bank or slip.



Important

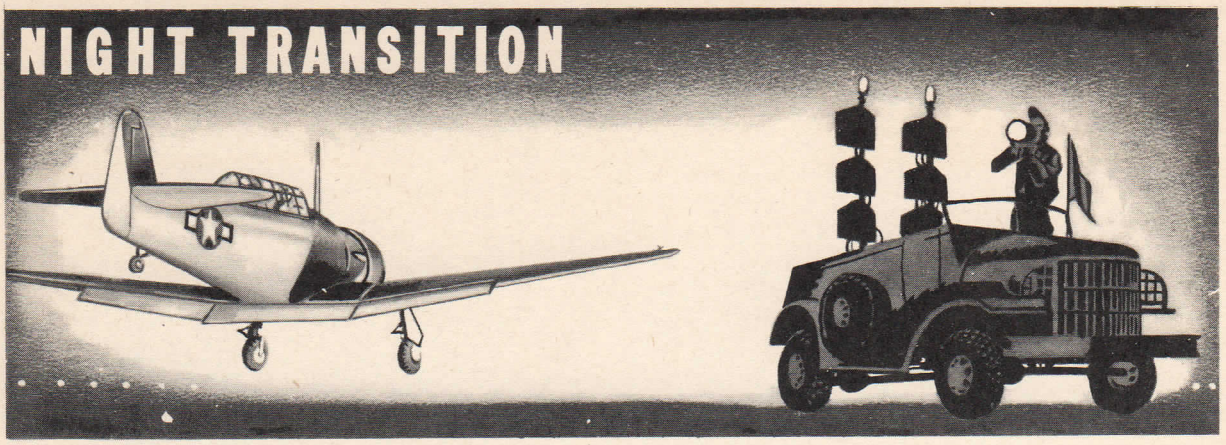
PUT THE NOSE DOWN IN THE ROLL OUT

There is no reason to be afraid of slips in the AT-6, with or without flaps. If your students have heard any rumors about it, demonstrate to them how the airplane slips with full flaps. Although slips are not used generally for training, they should be introduced and demonstrated in the final part of fighter pilot training.

The AT-6 slips normally to the right or to the left.

Students have a tendency to overshoot their first forced landings, whether simulated or actual. Knowledge of how to slip is not only part of the maximum performance exercise required, but a real, practical help to a fighter pilot. Caution your students against depending on their indicated airspeed in a slip. Because of the slipping motion of the airplane, you can't rely completely on the air speed indicator. Slips must be learned and done by feel as well. Tell and demonstrate to your students the only real danger period of a slip is the point of rolling out. Unless you put the nose down in the roll out, you'll stall. You'll have to watch this carefully when your student is slipping and rolling from one direction to the other. **Insist the students put the nose down at the point of roll-out before they enter a slip in the opposite direction.**

NIGHT TRANSITION



Directors of training must schedule night training flights to give each student a maximum number of landings of the type that he will use when he is in combat. That means the use of hooded runway lights and flare pots to make the student ready for the tough operational procedures in war theaters.

Night Cockpit Check

The night cockpit check is a must for any student before he is given night transition. Unless he knows the location of all his switches for lighting his instruments and operating his airplane at night, he will be nervous, possibly dangerous in the air. At the very least, his night transition will be a waste of time. Check each student on:

A. The use of his fluorescent lights. Students must take apart and re-assemble fluorescent lights to understand its workings and adjustments thoroughly before he begins his night cockpit check. Explain to him that fluorescent light **is not meant to shine.** Its purpose is to activate the luminous paint on his instruments.

B. The locations and operation of all switches. The student should be able to identify and operate them by touch blindfolded.

1. Landing light switch.
2. Fuel gage switch.
3. Passing light switch.
4. Running light switch.
5. Fluorescent light switch.
6. Compass light switch and reostat.
7. Cockpit light switch.
8. Adjustable cockpit light switch (used for additional light, map reading, etc.).

Before you start night transition instruction in the air, brief your students well in:

A. Zone or night traffic patterns in use.

B. **Radio check out procedure.** Insist that your students follow it to the letter. Radio horseplay is dangerous.

C. **Use of the Light Gun.** Explain its two uses: to simulate combat radio silence, to be used in case of radio or electrical failure.

Night Flying Musts

Repeat and repeat to your students the need for extra caution for night flying.

A. Make sure students are proficient in instrument take-off prior to night flying.

B. Advise them to use a little power on landings. The rate of descent in the AT-6, with full flaps, without power, is so rapid, students have the tendency to misjudge distances and level off too late. Use of some power aids students in last minute corrections. Impress on them the need to set the altimeter at sea level setting.

C. If bad weather approaches the field, and the ceiling suddenly lowers below minimum, the students may be ordered to the nearest lighted field where they need correct altimeter pressures for let down and landing.

D. Caution the students to be on the alert for symptoms of vertigo. If they feel slight dizziness or loss of faculties students must go on instruments until the feeling passes.

E. Caution your students to sit in the darkened cockpit several minutes before starting. Tell them to avoid brightly lighted rooms, unless red goggles are worn. Night vision isn't completely normal for 30 minutes after leaving a brightly lighted room.

FORMATION FLYING

Formation flying is the coordinated unit flight of a number of aircraft, following a leader to mass a concentration of fire power to destroy the enemy. Two types of formation are taught in Advanced Single-Engine training.

Drill Formation trains the student in technique and air discipline.

Offensive Formation trains the student in the more complex maneuvers and builds the foundation on which combat formation is taught.

Your students come to you with only a beginner's knowledge of formation flying. It's necessary for you, as their instructor, to assume that they have never considered the WHAT, HOW, and WHY of formation flight.

A. **WHAT:** Formation flying means a number of airplanes flying as one unit, with each member fully conscious of his responsibility to accurately maintain his position in all attitudes of flight.

B. **HOW:** Successful formation flying is attained by strict attention to the leader of the flight, and following all signals from the leader. Students must also use good judgment and quick thinking in regard to relative speed and attitude with the other members of the flight.

C. **WHY:** Planes fly formation in order to mass effectively a number of flying gun-platforms to shoot down enemy aircraft or harass enemy ground installation. Formation is used to achieve surprise attack and maintain cooperative protection to each unit in the formation.

DRILL FORMATION

Drill formation teaches air discipline, and provides an exercise for the judgment and headwork necessary in learning more difficult formations. Be sure the student understands that his proficiency in drill formation will come only after a thorough understanding of what is to be done and plenty of hard work doing it.

Formation flight is based entirely on the student's ability to follow the leader. He is not concerned with the horizon or the attitude of his airplane except that it conforms at all times with the exact attitude of his flight leader's airplane.

It is the responsibility of the instructor to make his turns so his students easily anticipate his next maneuver.

He does this by the use of exaggerated laziness in each maneuver. This is important as a safety factor and it develops the student's ability to anticipate his leader.

As the student progresses, he doesn't need as detailed signals for each maneuver and the wing men soon develop a smooth technique of flying with their leader as a unit.

As the student becomes more proficient in formation flying give him more difficult formation maneuvers.

A. DIVING TURNS
B. CLIMBING TURNS
C. CHANDELLES
D. LAZY EIGHTS

All these maneuvers call for another sense in formation flying. It's up to the leader to enter these maneuvers gently and slowly to tip off his wing men. As the maneuver progresses the attitude and speed of the leader's airplane can change quickly with the wing men holding good position—because they have been tipped off.

Instructors should remember to tip off their wing men, by using accelerated control pressures. Ease into every maneuver slowly so you're sure your wing men follow you. Then accelerate your control pressures to perform the maneuver as quickly as you want.

A. Plan your air work. Remember that your wing men are dependent on you. Flight leaders are actually flying six airplanes.

B. Maintain a careful watch for other aircraft during all maneuvers. You must constantly check the area as well as check your student's progress on each maneuver. Nothing destroys a student's confidence and attention to formation flying as much as seeing his flight leader becoming bawled up with traffic or pulling a last minute change of mind.

C. Confidence of the flight in you is absolutely necessary before you can teach them

formation flying. If the student doubts for one minute that his instructor is not following a preconceived, smooth plan, he starts looking out for himself, and loses the entire sense of following the speed and the attitude of the leader's plane.

The leader's responsibility is a big one. Remember that the theory of formation flight is follow the leader. All the headwork of the individual units of the flight are placed in the hands of the leader. Use **strict military air discipline** in all training flights.

Mix Them Up

Keep your eye roving to each one of your students. Carefully note their tendencies to fly one wing position better than the other. Inject a change of pace. Mix them up. **The student pilot must learn to fly each position equally well.**

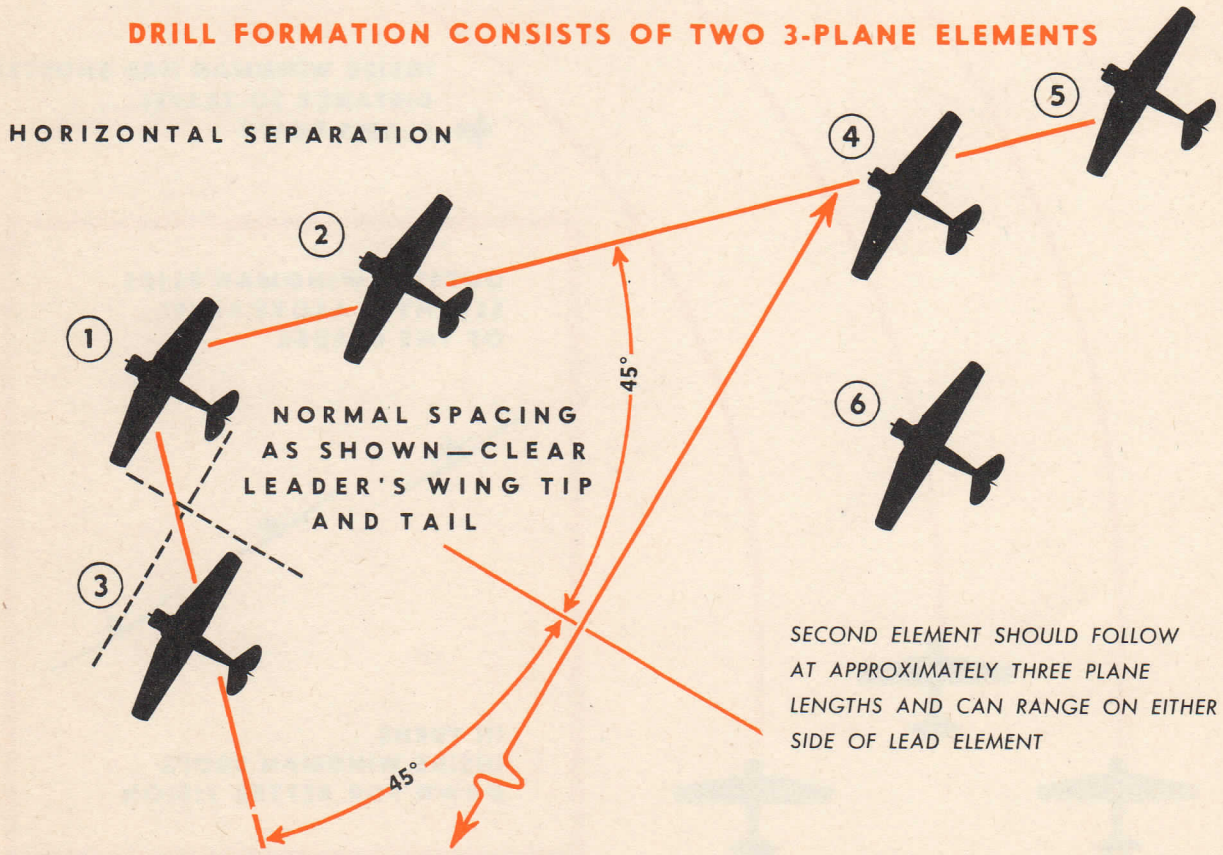
Be on the alert to select natural leaders among your students.

Teach your students to join formation quickly after take-off and develop their ability to break formation and land quickly at the end of a mission. Point out that joining and breaking up a formation in combat must be done quickly. Individual airplanes late in assembling are easy prey for the enemy. Once in formation, with fire power concentrated and tactical plans effective, you are safer since the enemy will respect the formation and keep his distance.

A well-armed, well-flown formation is able to fly against almost impossible odds.

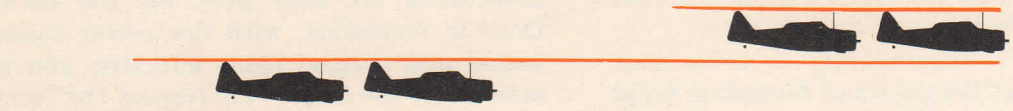
If this formation is maintained, there's little or no danger of the wing men overrunning the leader or colliding in a turn.

A good formation pilot will fly his position where his wings will clear the leader's, should he overshoot the leader's airplane, and where his propeller would clear the leader's tail if he should slide in behind him. The student should never attempt to close the Vee to the point where his airplane's surfaces overlap his leader's. A good student formation is one in which the wing men have room to make a slight mistake without danger of a collision.



DRILL FORMATION

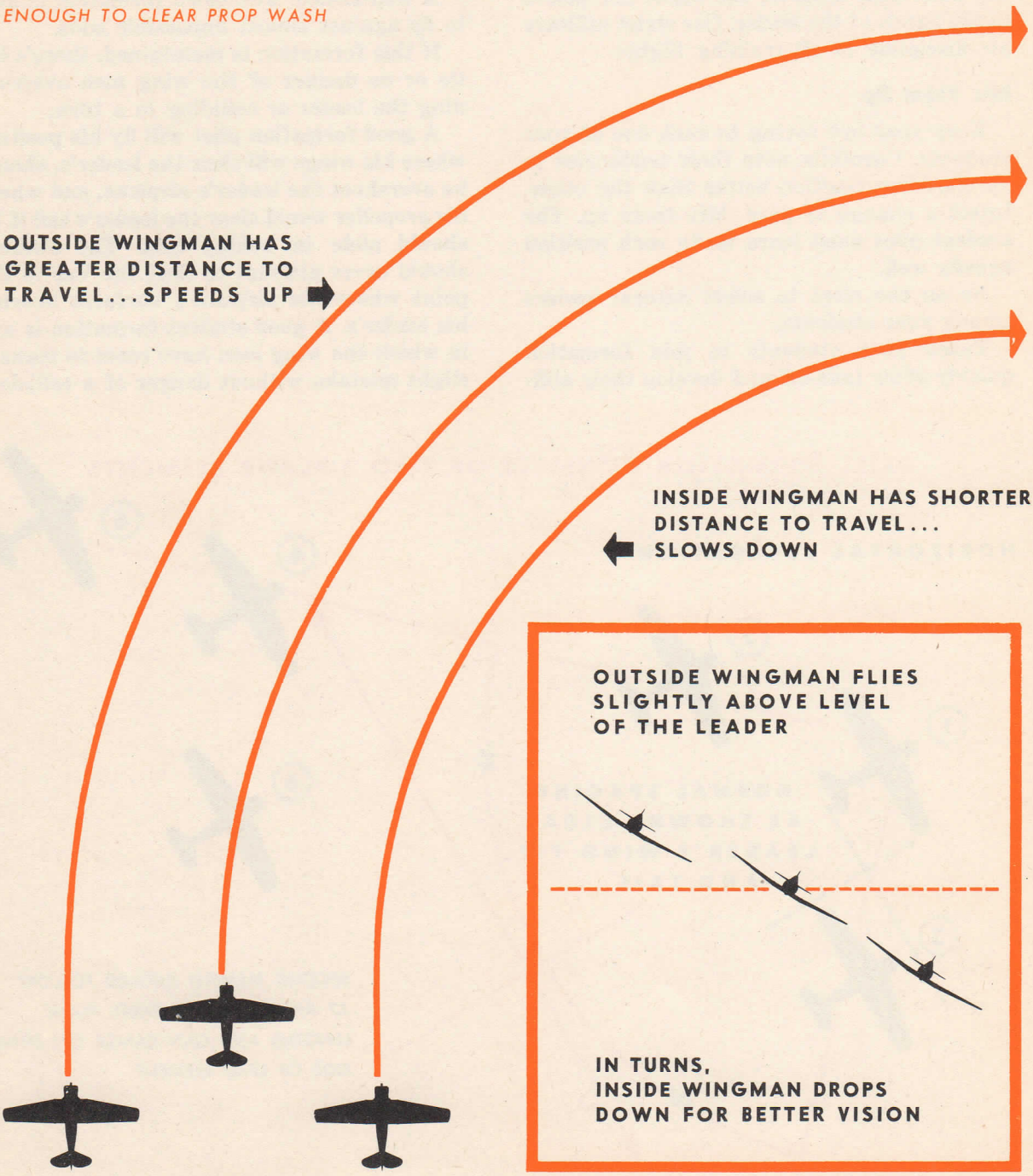
WHEN STRAIGHT AND LEVEL, PLANES IN SAME ELEMENT FLY ON SAME LEVEL



FOLLOWING ELEMENT IS STEPPED DOWN ENOUGH TO CLEAR PROP WASH

OUTSIDE WINGMAN HAS GREATER DISTANCE TO TRAVEL...SPEEDS UP

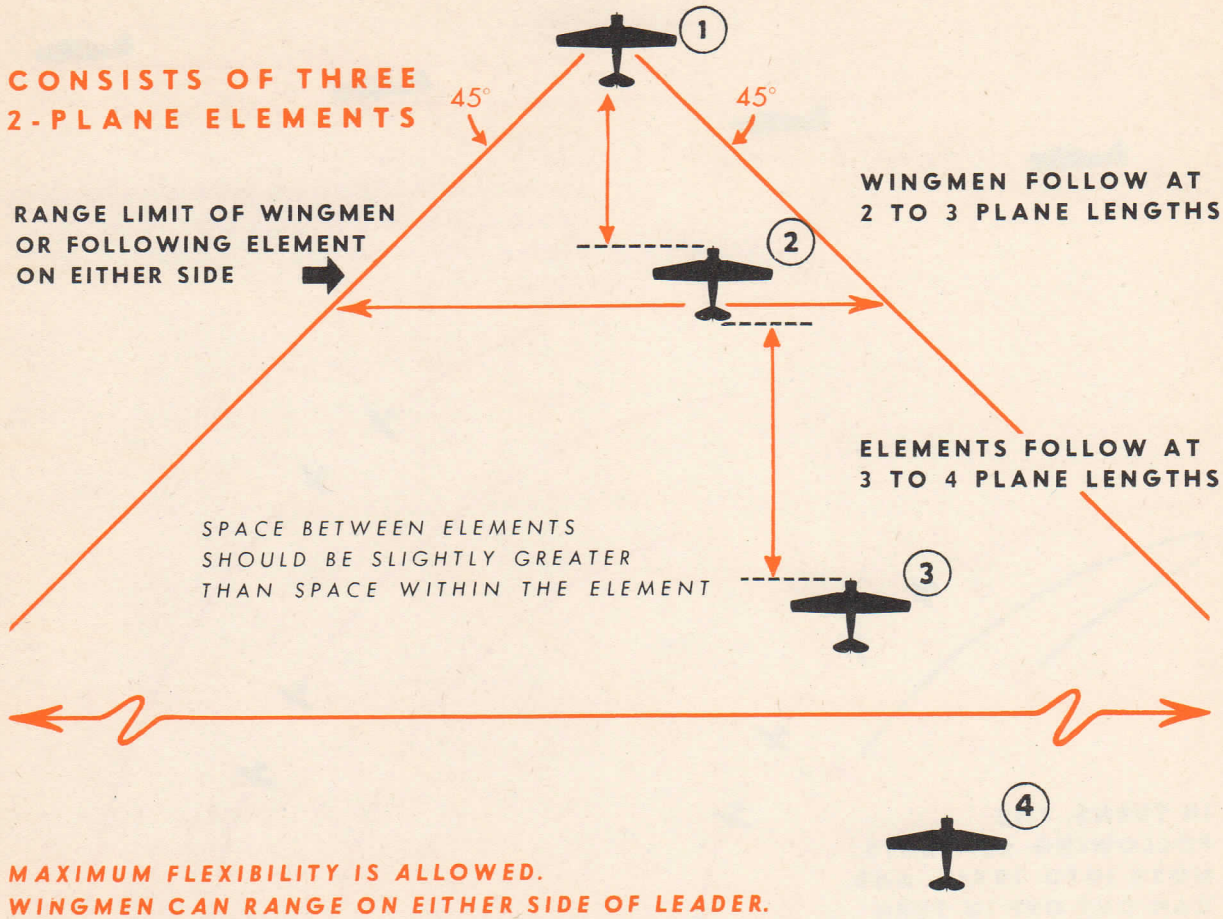
INSIDE WINGMAN HAS SHORTER DISTANCE TO TRAVEL... SLOWS DOWN



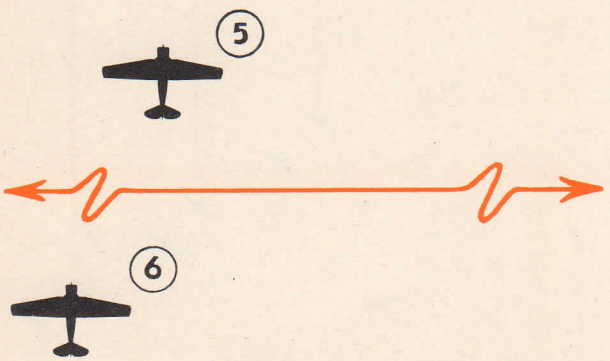
OUTSIDE WINGMAN FLIES SLIGHTLY ABOVE LEVEL OF THE LEADER

IN TURNS, INSIDE WINGMAN DROPS DOWN FOR BETTER VISION

OFFENSIVE FORMATION



MAXIMUM FLEXIBILITY IS ALLOWED.
WINGMEN CAN RANGE ON EITHER SIDE OF LEADER.
FOLLOWING ELEMENTS CAN RANGE ON
EITHER SIDE OF LEAD ELEMENT.



Offensive Formation Maneuvering

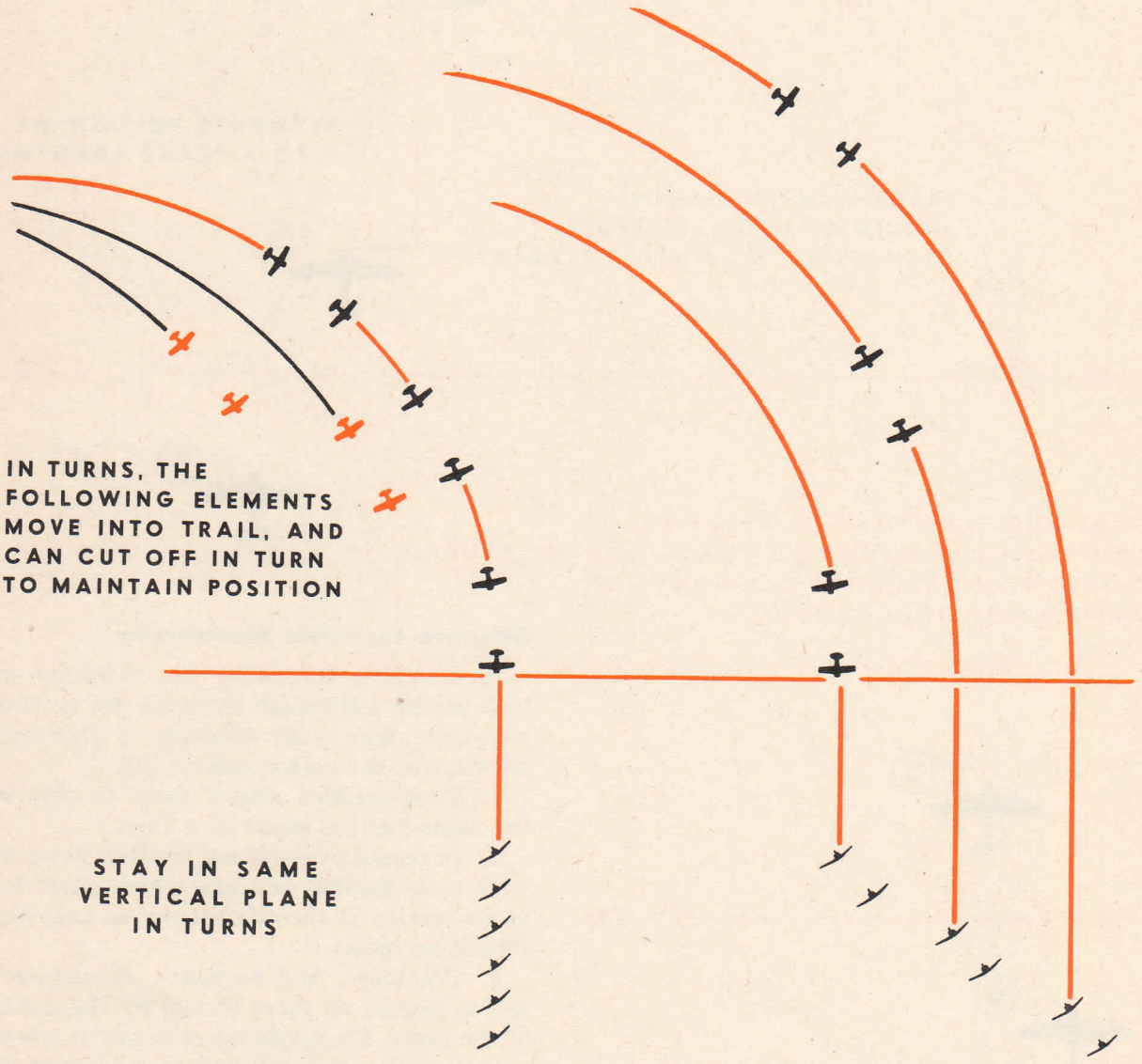
In offensive formation the elements as well as the individual airplanes fly in trail positions. Give your students a thorough briefing for the reason behind this.

1. Trail position allows them to stay in the same vertical plane in a turn.
2. In combat, formation is often flown at wide open throttle settings which allow for no correction in throttle setting to keep the formation intact.
3. Therefore, the airplanes or elements falling behind on turns should fly the inside of the turns. The airplanes or elements creeping up on the elements just ahead should fly the outside of turns.

IN OFFENSIVE FORMATION FLOWN TRAIL POSITION, USE THROTTLE VERY LITTLE FOR SPACING CORRECTIONS, CORRECT ALL ERRORS, AND MAINTAIN FORMATION BY PROPER AIRWORK

OFFENSIVE FORMATION

WINGMEN AND FOLLOWING ELEMENTS SHOULD BE STEPPED DOWN ENOUGH TO CLEAR LEADER'S PROP WASH

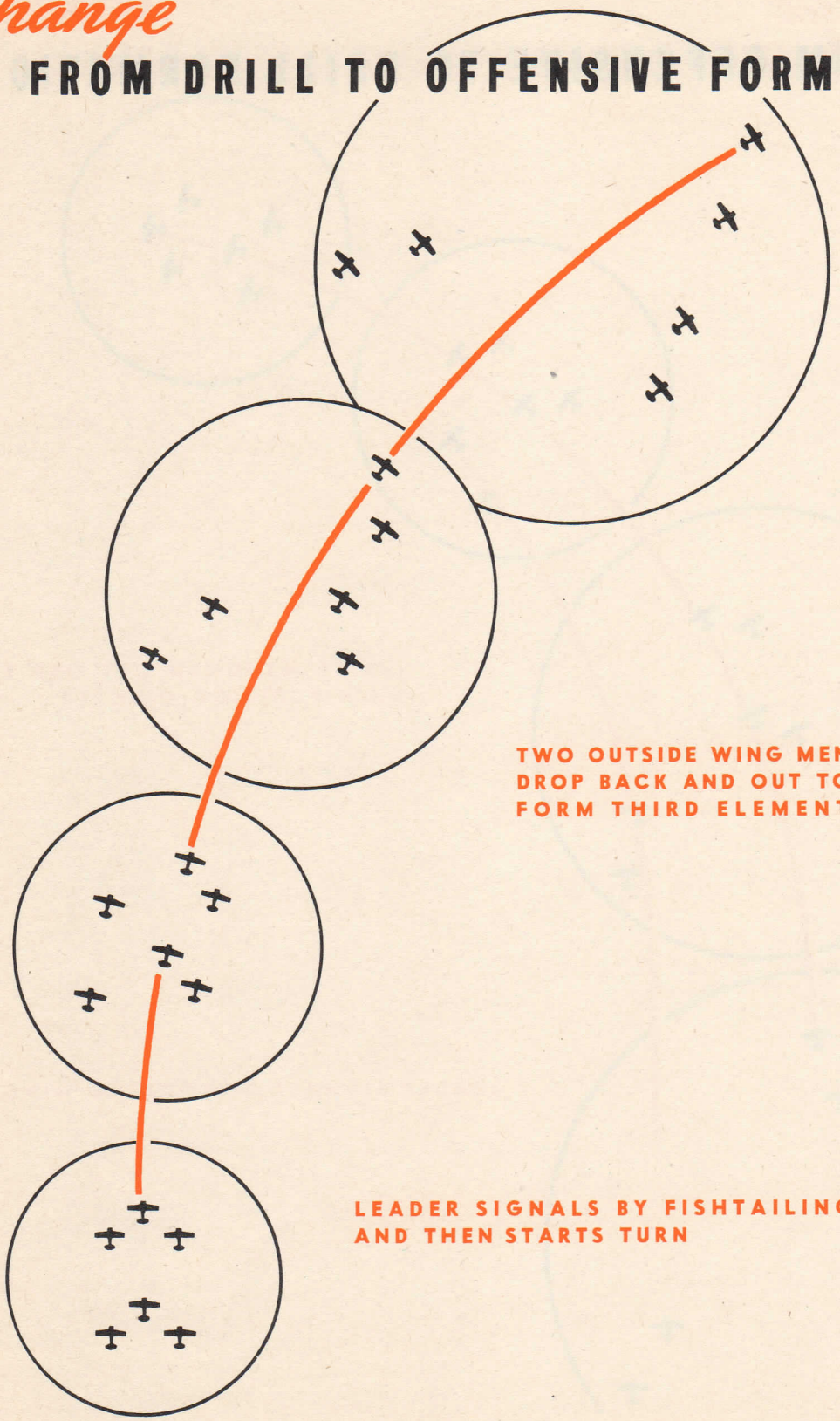


IN TURNS, THE FOLLOWING ELEMENTS MOVE INTO TRAIL, AND CAN CUT OFF IN TURN TO MAINTAIN POSITION

STAY IN SAME VERTICAL PLANE IN TURNS

IF FOLLOWING ELEMENTS DO NOT STAY IN SAME VERTICAL PLANE, THEY WILL HAVE A GREATER RADIUS OF TURN, AND THEY WILL LAG BEHIND

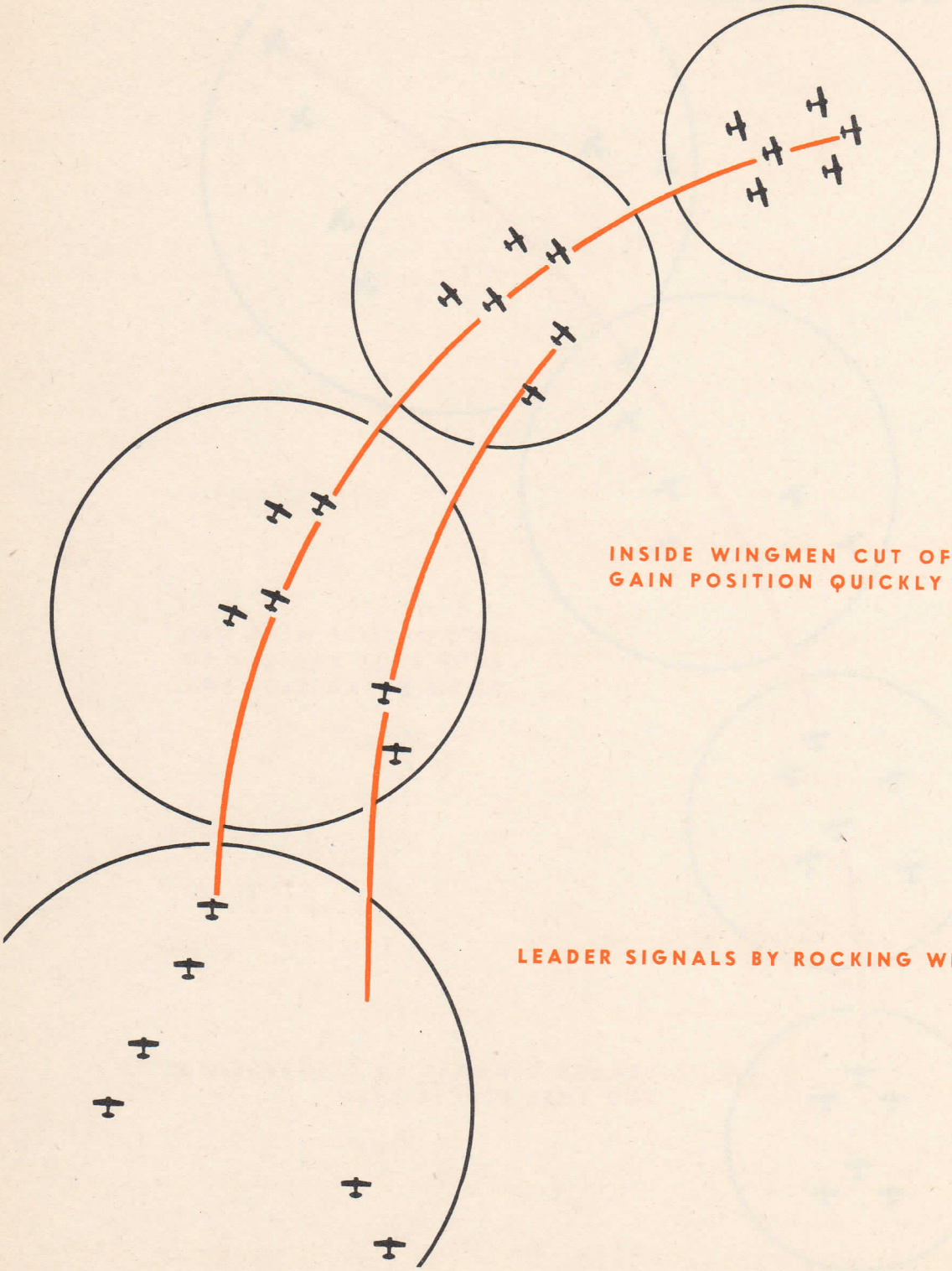
Change
FROM DRILL TO OFFENSIVE FORMATION



TWO OUTSIDE WING MEN DROP BACK AND OUT TO FORM THIRD ELEMENT

LEADER SIGNALS BY FISHTAILING AND THEN STARTS TURN

Change
FROM OFFENSIVE TO DRILL FORMATION



INSIDE WINGMEN CUT OFF TO GAIN POSITION QUICKLY

LEADER SIGNALS BY ROCKING WINGS

SQUADRON FORMATION

To give your students squadron formation experience fly at least one period of your formation schedule with a minimum of 12 planes in the flight. Either the basic offensive formation or the drill formation can be used. The offensive formation can be broken into three flights of four planes each, or two flights of six planes each. Plan your squadron formation to attain the maximum maneuverability, to waste as little time in forming as possible.

High Altitude Formation

Introduce to your students at least one high altitude offensive formation flown above 15,000 ft. Point out by radio the errors in judgment and speed that will show up at this altitude. Increase formation intervals for high altitude flight. **It's your responsibility to keep a constant check on each member of your flight. Make sure they are using their oxygen equipment properly.**

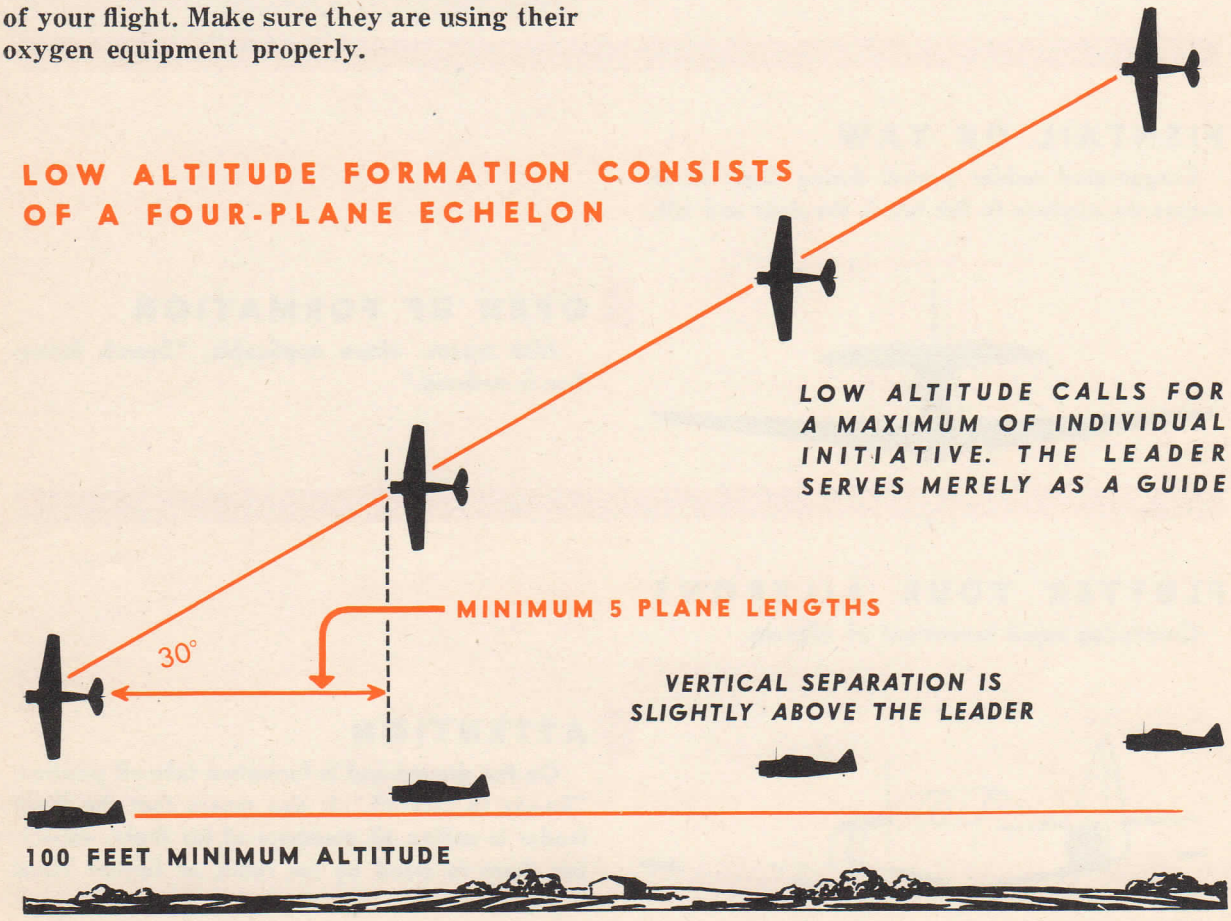
Low Altitude Formation

Explain to your students that low altitude formation is their introduction to surprise attack and ground strafing. Low altitude formation calls for the ultimate in air alertness.

A. Before descending to low altitude instruct each student to check his fuel supply and mixture controls.

B. The leader will fly at a minimum altitude of 100 ft. above the obstruction **holding this altitude as nearly constant as possible.**

C. Specific courses and targets will be designated for this phase. The targets will be attacked with the normal strafing pattern (pull up from 100 ft. altitude to 500 one mile in front of the target to make normal ground gunnery approach). After strafing the target continue the mission at 100 ft.



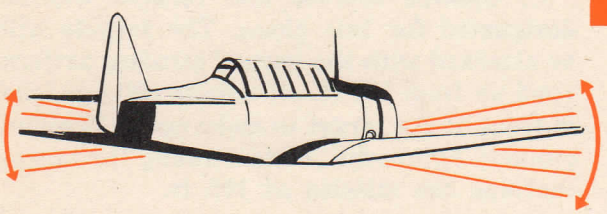
VISUAL SIGNALS FOR FORMATION FLYING

Because of strict radio silence observed in combat theaters, flight leaders use visual signals in formation flight.

The following signals are basic signals (AAF Regulations 60-15). These may be augmented to meet the various needs of practice formations, but avoid confusion. Visual Signals should be held to a minimum number and not be permitted to grow in number until there is danger of misunderstanding.

ROCK WINGS

Slow repeated rocking motion of airplane by gradual use of ailerons. Take care this signal is not confused with the faster flutter of ailerons.

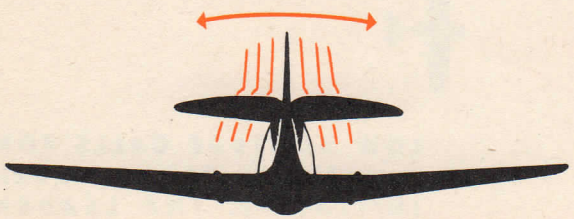


ASSUME NORMAL FORMATION

It means rejoin normal close formation of the unit concerned. The formation itself is to be prescribed by each group or squadron.

FISHTAIL OR YAW

Exaggerated rudder control during flight which causes the airplane to fish tail to the right and left.

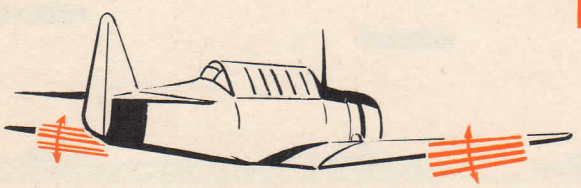


OPEN UP FORMATION

Also means, where applicable, "Search formation is ordered."

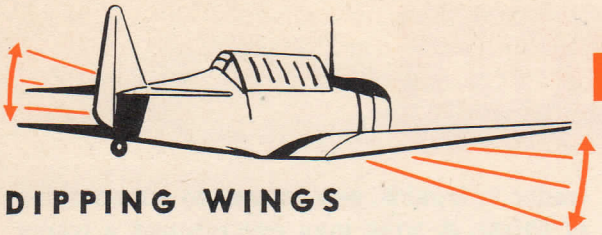
FLUTTER YOUR AILERONS

Continuing rapid movement of ailerons.



ATTENTION

On the ground and in formation take-off position, "Ready to take-off." It also means that the flight leader is calling all members of his flight, expecting them to stand by for radio, or further Visual Signals.



DIPPING WINGS

1. GO INTO ECHELON

In any formation other than echelon the flight goes into echelon (right or left), depending on which wing is dipped.

2. GO INTO ECHELON

Individual airplanes go to the same side. When the formation is in echelon of flights it means doing individual echelon (right or left) depending on which wing is dipped.

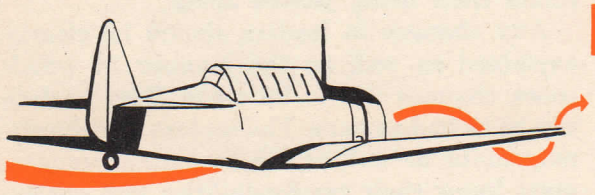
3. FORM ECHELON OF FLIGHTS TO THE SAME SIDE

If the flight is in echelon of individual airplanes, it means go into echelon of flights (right or left), depending on which wing is dipped.

4. ECHELON TO THE OPPOSITE SIDE

If the formation is in an echelon of flights or individual airplanes, the wing is dipped on the side away from the echelonment. It means form the same echelon to opposite side.

A SERIES OF SMALL DIVES OR ZOOMS



PREPARE TO LAND

This signal is the tip off to each pilot in formation to begin the procedures necessary to land (wheels down, prop pitch, mixture, etc.). If this signal is not followed by others, proceed to a normal formation landing.

Pass It Along

Insist that your students pick up the leader's signal and pass it along back through the formation as quickly and accurately as possible. The theory of good formation is the cooperated coordination of each unit of the flight in following the leader. It is important that each student in a formation flight realize that his responsibility does not end until the leader's visual command is passed on back through the formation.

TIPS TO INSTRUCTORS

1. Air discipline through ground discipline.

No formation can be efficient if air discipline and ground discipline are neglected. The sloppy appearance of the pilots of an element, flight or squadron are too often the general characteristics of that unit's flying characteristics. The leaders of those units who permit sloppiness and, in general, poor ground discipline, will have poor formation control and appearance not unlike that on the ground. Formation is to pilots what close order drill is to the ground soldier.

2. Briefing of the flights.

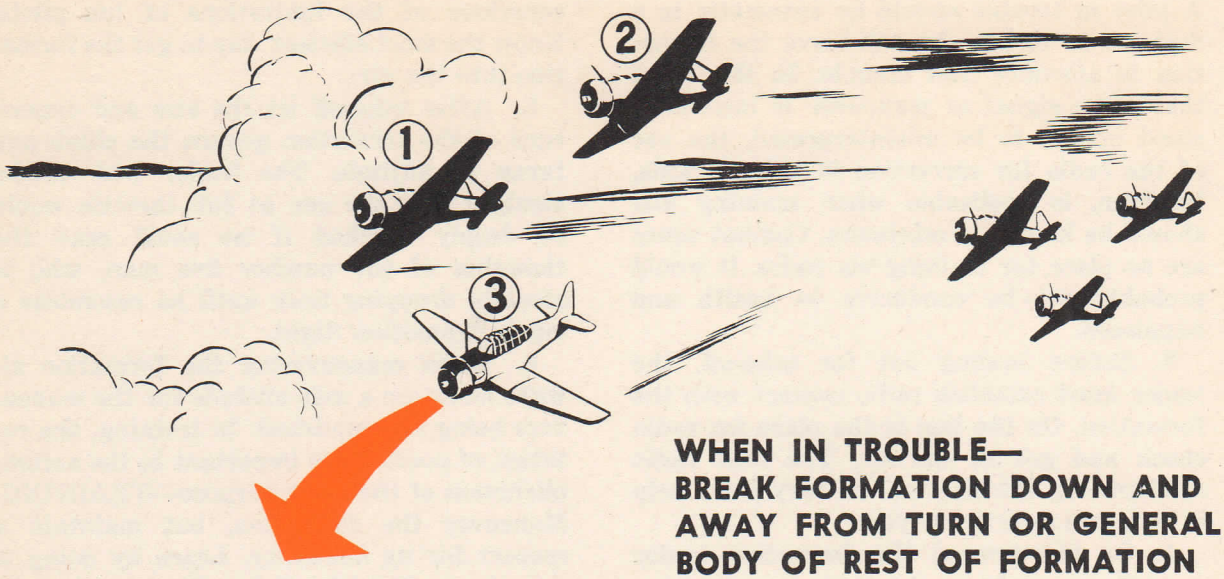
Too much stress cannot be placed on the proper presentation, prior to take-off, of the work to be covered during the flight. In those zones where radio control is impossible, the ground explanation and analysis is the thread from which the safety and well being of the formation hangs. First—be sure that the pilots understand and are familiar with the type of formation to be flown. Positions must be clear in the minds of the pilots as well as the spacing of those positions. A wing man out of firing range is of as little help to a leader in trouble, as a mirage to a man dying of thirst. A wing man overrunning a leader is no longer a supporting unit, but becomes an individual, subject to the concentrated fire power of an enemy aircraft.

Second—know the limitations of the maneuverability of the formation. One weak man lessens the flexibility of the unit to a level commensurate with that man's ability. All pilots must know the type of take-off to be made, they must understand the air maneuvers expected of them, and they must be familiar with the type of landing to be made at the airdromes. If the formation is to be landed in trail, they must space themselves accordingly before arriving at the final approach. If formation landings are to be made the element leaders must know how they are to space themselves. Signals must be especially clear. They must be passed back so that each man sees and understands them. A formation signal to be clear cannot have a double meaning. Rocking of the wings must mean "CLOSE UP;" not "CLOSE UP," "TURN RIGHT," "CHECK GEAR," or "WHO HAS THE DICE?" They must be clearly given. Rocking of the wings which resembles a flutter of the aileron will result in many pleasant surprises for the leader. Hand signals are useless when spacing prohibits their being passed along.

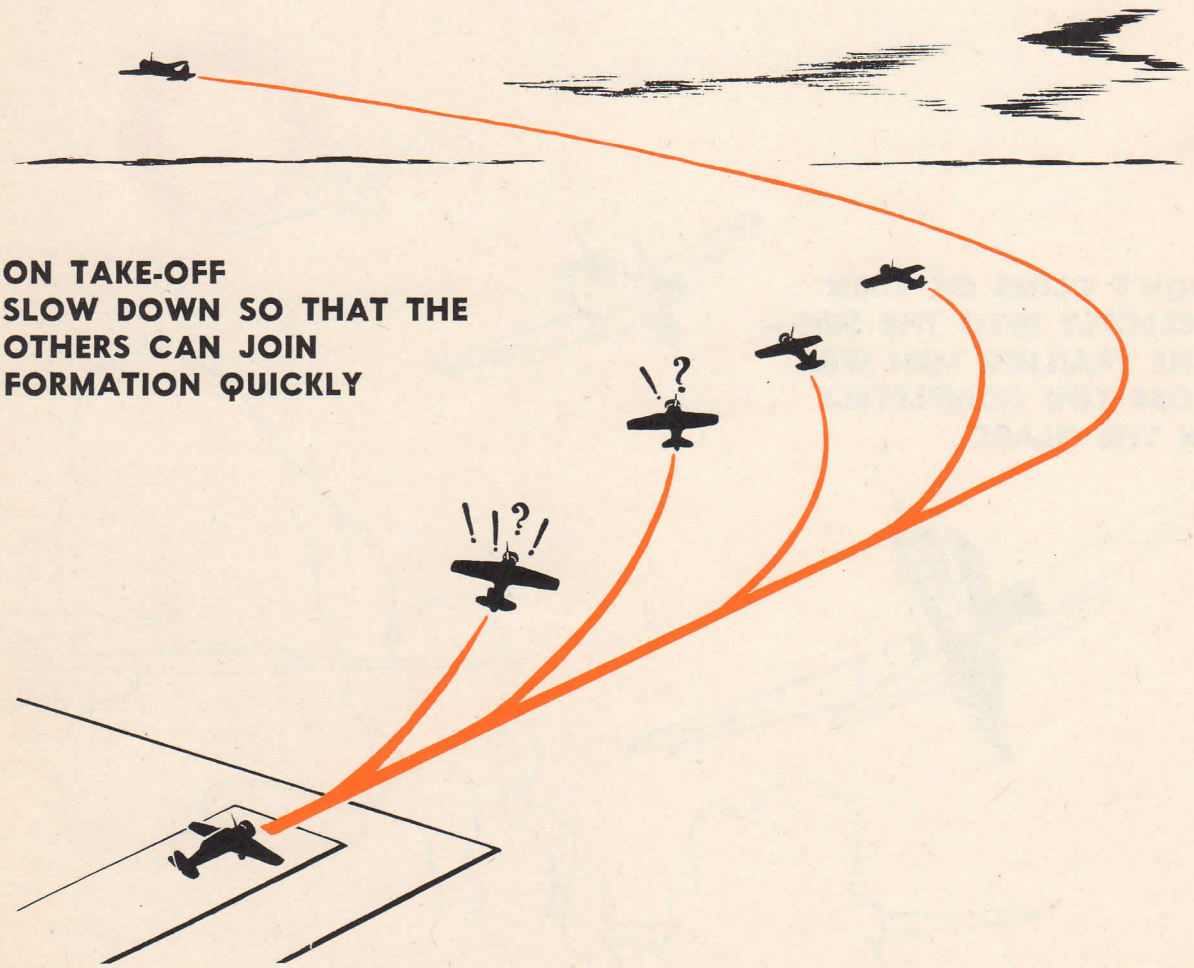
Any changes in leaders should be clearly explained as well as the manner in which those changes are to be made. Two leaders can be as bad as none. The leaders of subordinate units, as well as the formation leaders, must know their responsibilities and duties. They must realize that they are leading a SUBORDINATE UNIT and are not a SEPARATE UNIT. They are as responsible for the safety and welfare of their wing men as the leader is for the formation.

Each pilot must know which aircraft he will fly on the following mission and he must understand in what position he is to fly it.

The leader must always explain the emergency procedure for leaving the formation.



**WHEN IN TROUBLE—
BREAK FORMATION DOWN AND
AWAY FROM TURN OR GENERAL
BODY OF REST OF FORMATION**



**ON TAKE-OFF
SLOW DOWN SO THAT THE
OTHERS CAN JOIN
FORMATION QUICKLY**

A pilot in trouble should be automatic in a decision as to how he will leave the formation to alleviate that trouble. In the event that some signal or maneuver is misunderstood or apt to be misinterpreted, the use of the radio for correction is normal. This, however, is applicable when training and should be kept to a minimum. Combat zones are no place for training via radio. It would probably not be conducive to health and happiness.

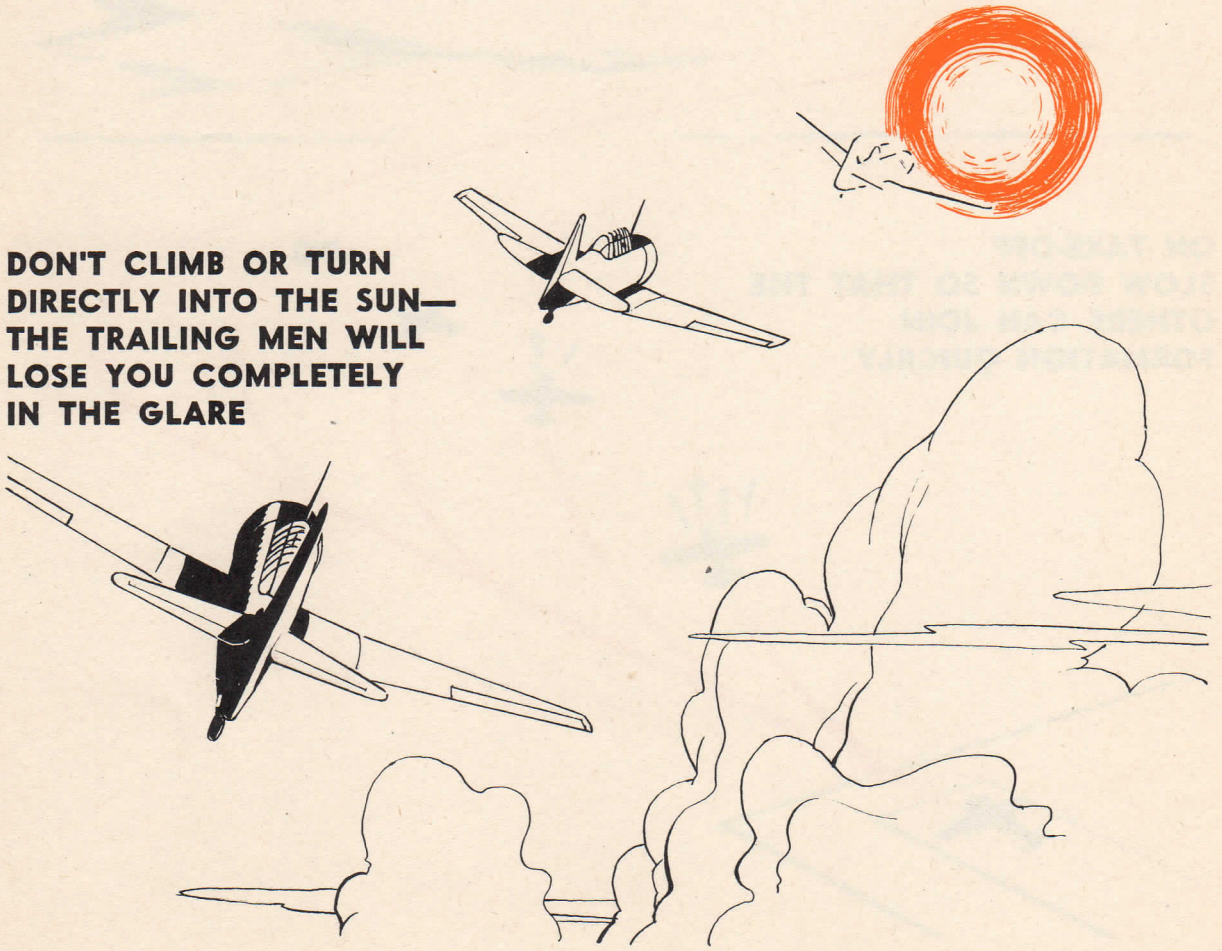
3. Before taxiing out for take-off, the leader must establish radio contact with the formation. On the line is the place for radio check and not in the air. The best radio mechanic on the line will be very little help if he is one mile below you.

4. On the ground the formation leader must maneuver his unit into the best position for take-off. Confusion at the take-off point will lose time that can be more profitably spent in flying. The leader must again be conscious of the limitations of his pilots. Know the most efficient way to get the formation into the air.

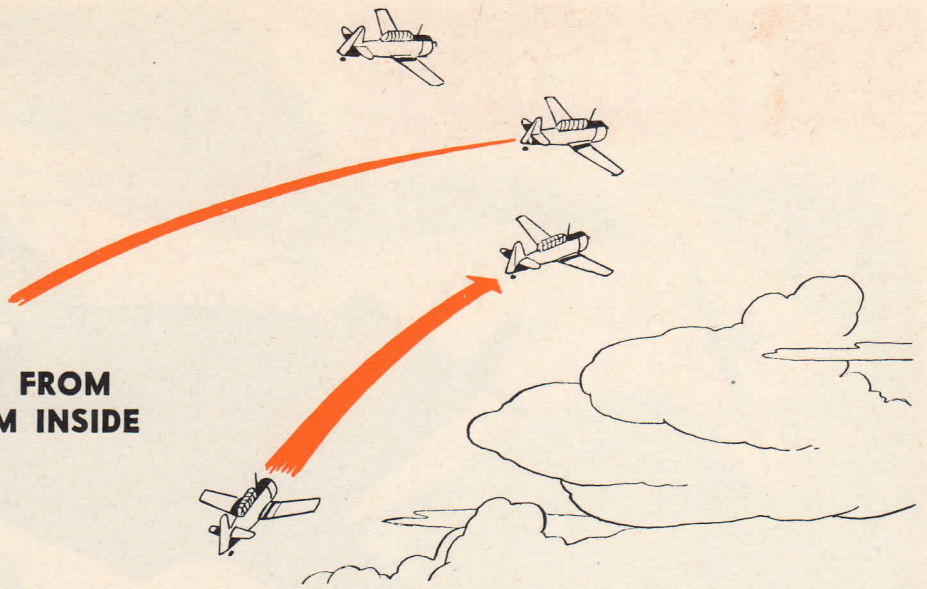
5. After take-off let the size and experience of the formation govern the climb and turns to altitude. The leader who climbs straight into the sun at full throttle would be deeply touched if he could read the thoughts of the number five man, who is steadily dropping back until he resembles a lonely transition flight.

6. When maneuvering the formation always maintain a safe altitude for the maneuvers being accomplished. In training, the rotation of positions is important to the accomplishment of the basic purpose—TRAINING. Maneuver the formation, but maintain a respect for its flexibility. Learn by doing is a good rule. Straight flight will teach straight flight.

7. When bringing the formation in for a landing, consider it as a formation landing.



DON'T CLIMB OR TURN DIRECTLY INTO THE SUN—THE TRAILING MEN WILL LOSE YOU COMPLETELY IN THE GLARE



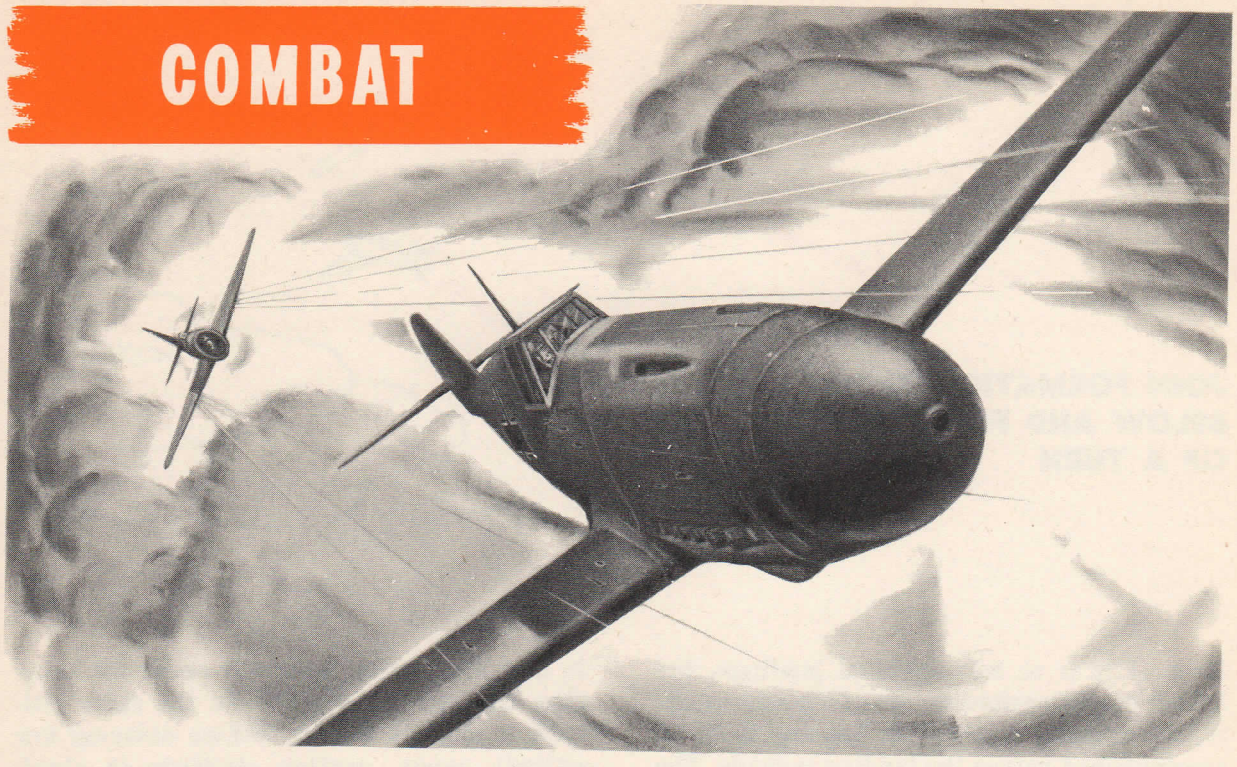
JOIN FORMATION FROM BELOW AND FROM INSIDE OF A TURN

Even if it is to be individual landings, the leader is responsible for the formation until it has returned to the line. Spacing must be accomplished before the landing is made. The leader must insure plenty of room and clear air space for the landing. If it is to be a formation landing, he must plan it as such. Remember—you are leading a formation, not a "bunch" of airplanes. A properly executed formation flight will be a reflection on the leader's ability and not on his luck.

8. Leaders will make sure that individuals in their formation understand that low level missions are flown loose enough so that reference may be had to the ground by each man. In any event wing men will **never** fly lower than the leader but will hold the same altitude or slightly higher. Before entering low altitude range, caution students to check their gasoline supply and mixture controls.

9. Students will be reminded that their judgment of speed and distance will be less accurate at high altitude and formation intervals should be increased accordingly. A constant check will be kept on wing men by the leader to assure that they are using their oxygen equipment properly. Malfunctions of equipment, such as carburetor ice, etc., are more prevalent at high altitude and can become very dangerous in formation.

COMBAT



In the combat phase emphasize the fact that a fighter pilot is merely the operator of a flying fixed gun-platform. Explain to your students that combat, as you will teach it, is practiced as a maximum performance exercise rather than an attempt to simulate actual combat maneuvers.

Set your entire class straight on the following points:

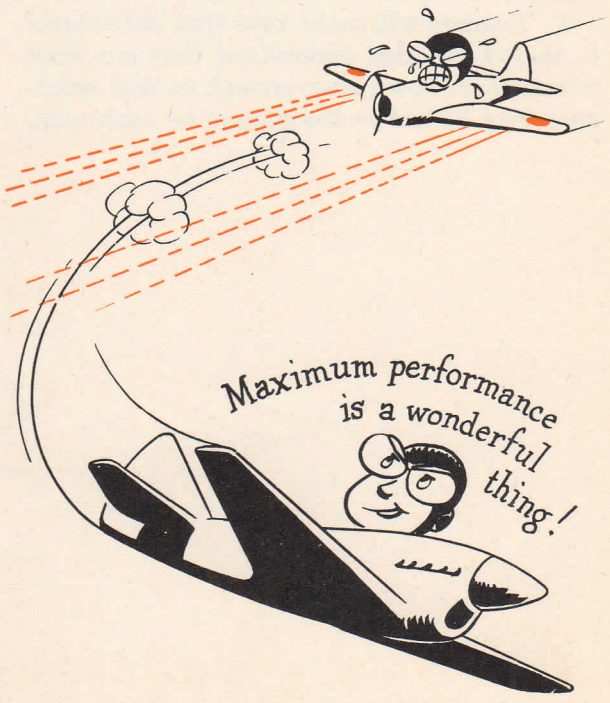
1. Aerobatics are useless in attempting to escape a well-lodged enemy. Individual dog-fighting, a hangover from World War I, was discarded in the very early stages of this war.

2. The best maneuver a fighter pilot can employ when a persistent enemy is on his tail is a tight maximum performance turn. This is effective since it requires a difficult deflection shot on the part of the enemy pilot.

3. Never reverse turns because the interval of roll-out gives the enemy pilot an easy target for a nice "cold turkey" shot.

4. Combat experiences show that a short breakaway dive from the turn is the best way out of trouble. Explain to your student the limitations of the AT-6 which prohibit its use for power dives, and point out that they will practice spiral dives, from tight turns.

5. Explain fully the theory behind modern combat. Emphasize the lessons learned



in formation flying and their use in combat. Each plane in the formation concentrates its fire power and at the same time protects each of its members. Finally, combat can be reduced to two essentials, (a) team work, (b) accurate shooting.

Combat Flight Instruction

During the first dual ride **make your students gun conscious.** Explain that a fighter airplane is nothing more than a rifle barrel on wings. Demonstrate approximate firing ranges and teach the basic aiming and deflection procedures. Ask your students how many of them have been hunters. Explain that the theory of lead in shooting ducks is the same as in shooting enemy aircraft. Remind them that to bring down a duck, you have to aim a gun accurately—to bring down an enemy airplane, you have to aim your airplane accurately. They will learn the fine points of all these things in gunnery school, but it is necessary for you to give them a basic understanding of the principles of aerial gunnery so they can practice combat properly.

Practice combat at different altitudes—from 10,000 ft. to 20,000 ft., so the students will feel the difference in their maximum performance flying at the various altitudes.

Demonstrate the following maneuvers, then have your students practice them solo. In addition to the maximum performance required, impress on your students the need to keep in mind approximate firing positions and leads.

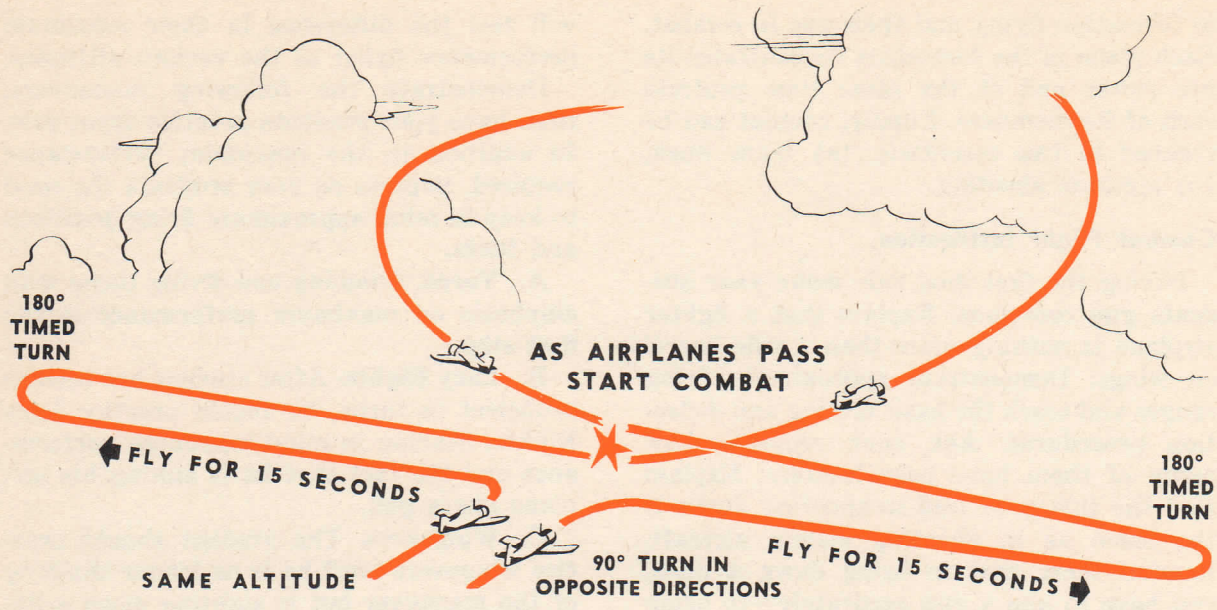
A. Turns. Climbing and diving turns with emphasis on maximum performance is the first step.

B. Lazy Eights. After student has become proficient in turns, he should practice Lazy Eights, bearing in mind maximum performance and the fact that he is aiming his airplane like a gun.

C. Wingovers. The student should practice wingovers until he is no longer thinking of the maneuver but is sighting down a flying gun barrel.

D. Lufberrys. Practice Lufberrys next. All the lessons the student has learned in aerobatics, such as coordination and accelerated control pressures, should be automatically brought to bear now. The student must practice Lufberrys until the airplane, the gun, and he himself are parts of a single coordinated unit.

Be Gun Conscious



Combat Sense

Take the time to hammer home this vital lesson to your students: **all combat tactics and maneuvers are primarily designed to shoot effectively at enemy targets with maximum protection for yourself.**

When the student has become proficient in combat maneuvers, the instructor and the student will fly in close formation until the formation reaches the desired altitude.

Upon a signal from the instructor, each plane will turn 90° away from the other and the two will fly straight and level in opposite directions for 15 seconds.

Then they both turn 180°. Thus the two planes will be on the same level, with the opposing airplane on the left. Start combat the moment the airplanes pass each other. When one or the other of the planes has its opponent at a disadvantage, within gun range, taking into consideration necessary lead, the combat is finished and is to be started again the same way.

Never fail to give all your students at least two missions on combat practice. Insist they practice it themselves, as well.

Basic Combat Tactics

Let your students know they will get a thorough understanding of tactics during the Operational Training Unit Phase, but teach the basic tactics outlined below that serve as foundation for the tactical courses that are constantly changing.

Know your opponent's armament.

Does he out-gun you or do you have the **advantage?**

Know where his armor plate is! Plan your attack for his "soft spot." Plan your breakaways so you have the maximum protection from your own armor plate.

Fighter Against Fighter

Know your enemy! Recognize his airplane, and carry on your mental fingertips the strong points and weak points of your particular opponent. No airplane, ours or the enemy's, is tops in ALL maneuvers.

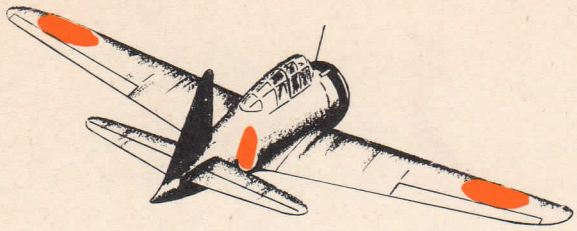
A tight turn (if your plane can out-turn your opponent's) is the best basic maneuver to put the enemy at a disadvantage.

By knowing your enemy, you can fight him at your advantage!

Fighter Against Bomber

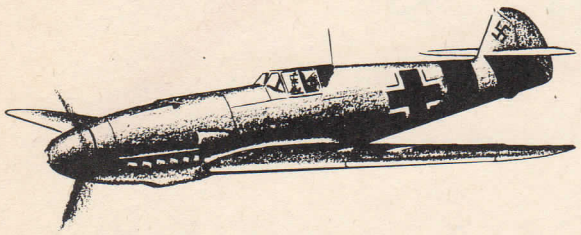
Hammer home to your students the fact that it's a fighter pilot's job to shoot the enemy target—not to be one!

Know your enemy. Recognize the bomber. Remember where his guns are—where his lack of guns make a "soft spot." Plan your



QUICKLY FIND OUT:

CAN I OUT-TURN HIM?
CAN I OUT-CLIMB HIM?
CAN I OUT-RUN HIM?
CAN I OUT-DIVE HIM?



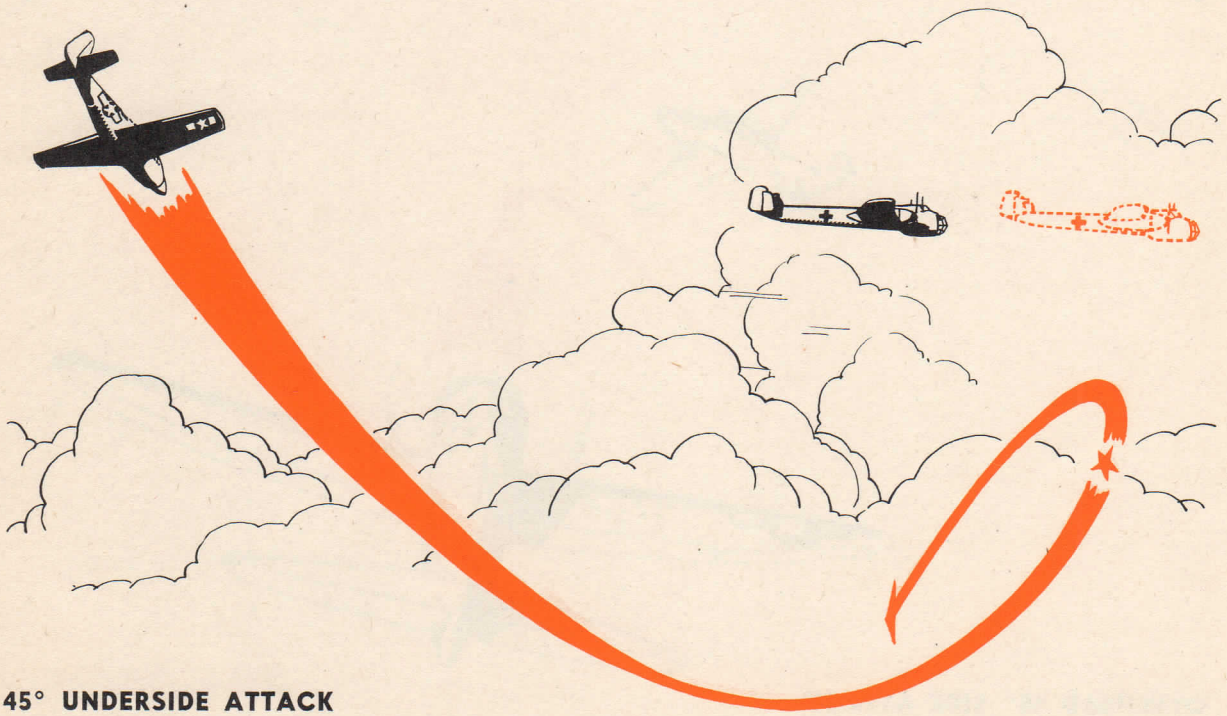
attack to take advantage of the enemy's "blind" and "soft" spots. Depending on his weakness, **plan your attack:**

A. 45° **Underside Attack.** This attack keeps you out of effective gunnery range of the bomber until just before you pull up under the bomber within your shooting range. After attack, break away sharply.

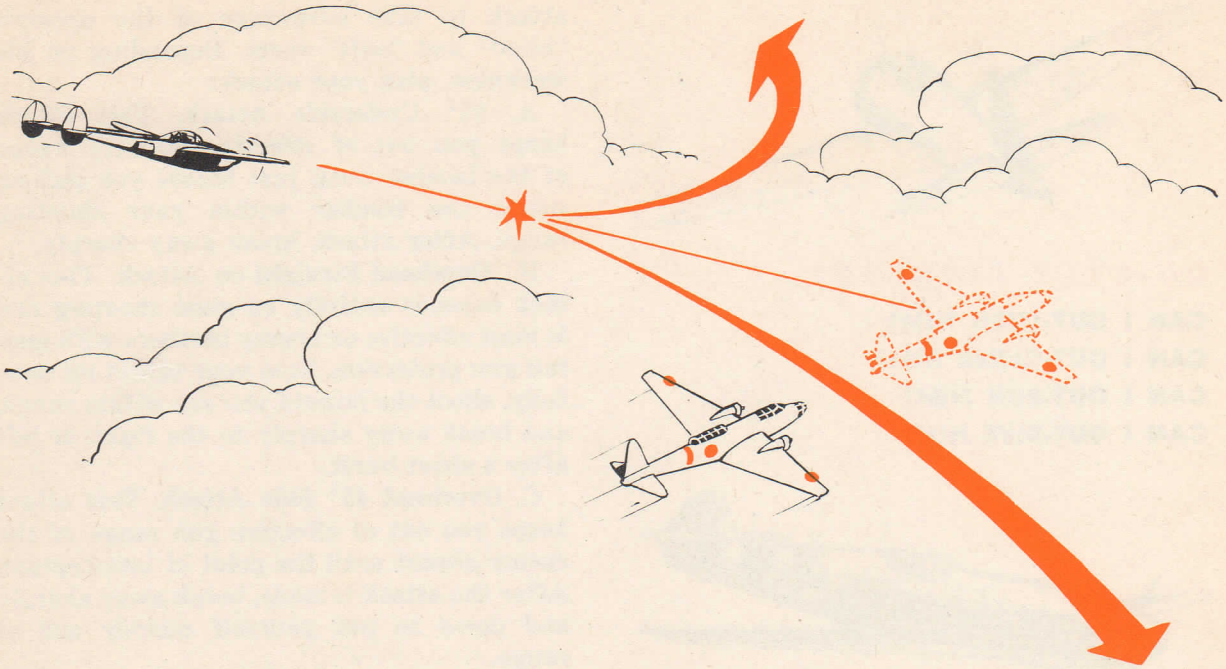
B. **Overhead Straight-on Attack.** This attack depends entirely on good shooting and is most effective on enemy bombers with poor tail gun protection. Line your target up carefully, shoot the minute you are within range, and break away sharply to the right or left after a short burst.

C. **Overhead 45° Side Attack.** This attack keeps you out of effective gun range of the enemy almost until the point of interception. After the attack is made, break away sharply and down to put yourself quickly out of range.

D. **Direct Overhead Attack.** This attack is best on enemy bombers lacking effective top turret protection. Come into the target high, half-roll, and dive directly on it; break away sharply below and behind the enemy after the attack has been made.

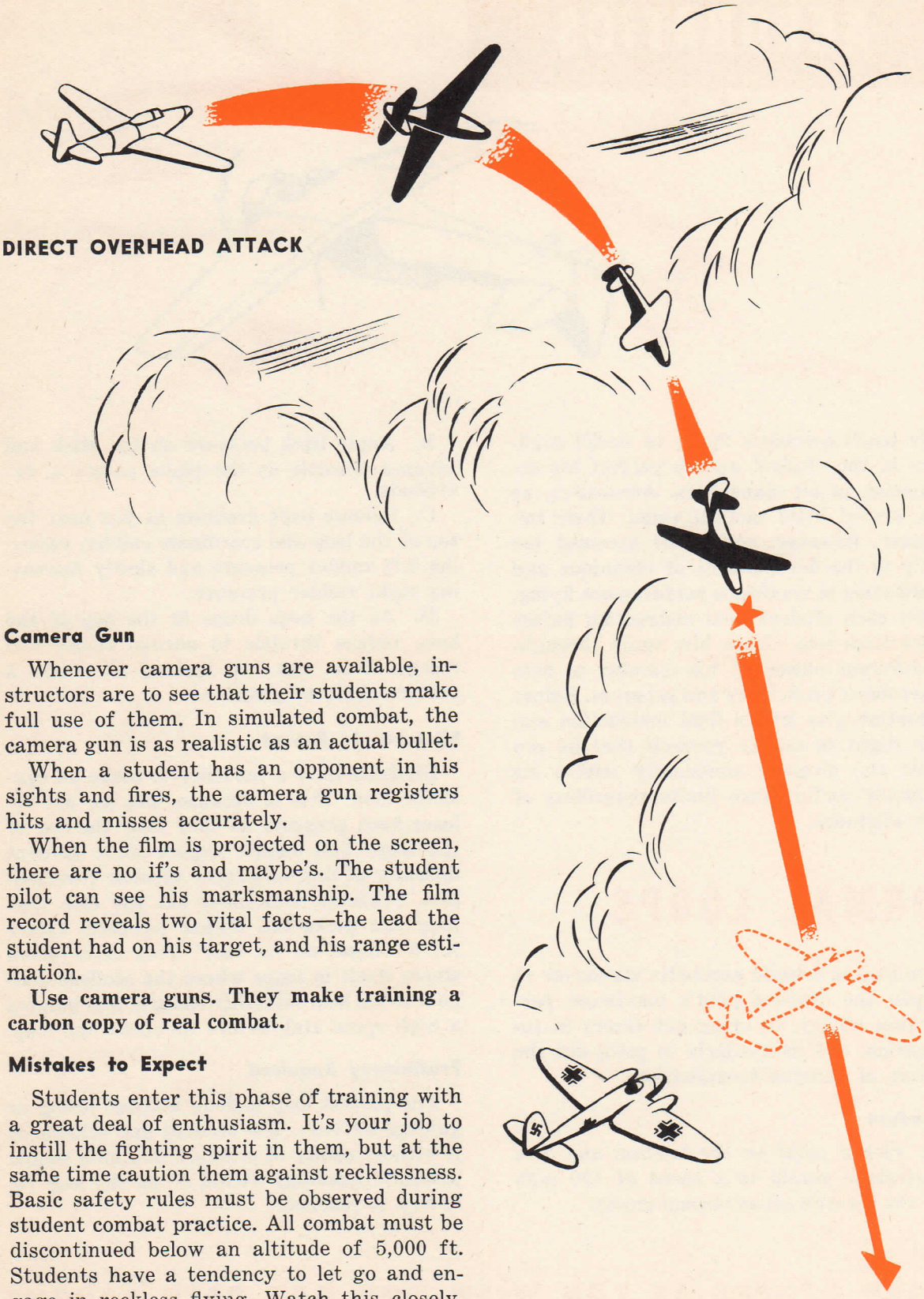


45° UNDERSIDE ATTACK



OVERHEAD STRAIGHT-ON ATTACK

OVERHEAD 45° SIDE ATTACK



DIRECT OVERHEAD ATTACK

Camera Gun

Whenever camera guns are available, instructors are to see that their students make full use of them. In simulated combat, the camera gun is as realistic as an actual bullet.

When a student has an opponent in his sights and fires, the camera gun registers hits and misses accurately.

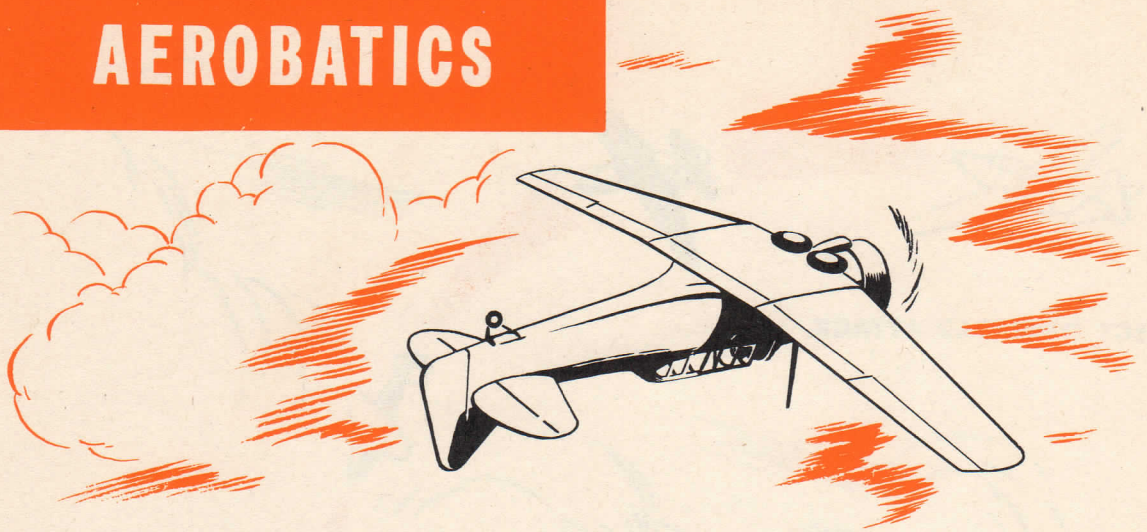
When the film is projected on the screen, there are no if's and maybe's. The student pilot can see his marksmanship. The film record reveals two vital facts—the lead the student had on his target, and his range estimation.

Use camera guns. They make training a carbon copy of real combat.

Mistakes to Expect

Students enter this phase of training with a great deal of enthusiasm. It's your job to instill the fighting spirit in them, but at the same time caution them against recklessness. Basic safety rules must be observed during student combat practice. All combat must be discontinued below an altitude of 5,000 ft. Students have a tendency to let go and engage in reckless flying. Watch this closely.

AEROBATICS



We teach aerobatic flying to instill confidence in the student and to perfect his coordination in all maneuvers. Aerobatics, as such, are of little tactical value. **Their importance, however, cannot be stressed too highly in the development of technique and coordination in maximum performance flying.**

Give each student dual instruction before he practices solo. Check him again throughout different phases of his training to note his aerobatic proficiency and progress. Before graduation give him a final instruction and check flight to satisfy yourself that he can handle the airplane confidently within its maximum performance limits regardless of flight attitudes.

NORMAL LOOPS

The loop is a basic aerobatic maneuver to sharpen the student pilot's maximum performance ability, to bring out errors in coordination, and particularly to point out the problem of throttle coordination.

Procedure

A. Pick a point on the horizon and dive the airplane gently to a speed of 190 mph with the throttle set at normal cruise.

B. Apply back pressure on the stick and advance throttle as the plane passes a 45° attitude.

C. Release back pressure as you near the top of the loop and coordinate rudder, releasing left rudder pressure and slowly increasing right rudder pressure.

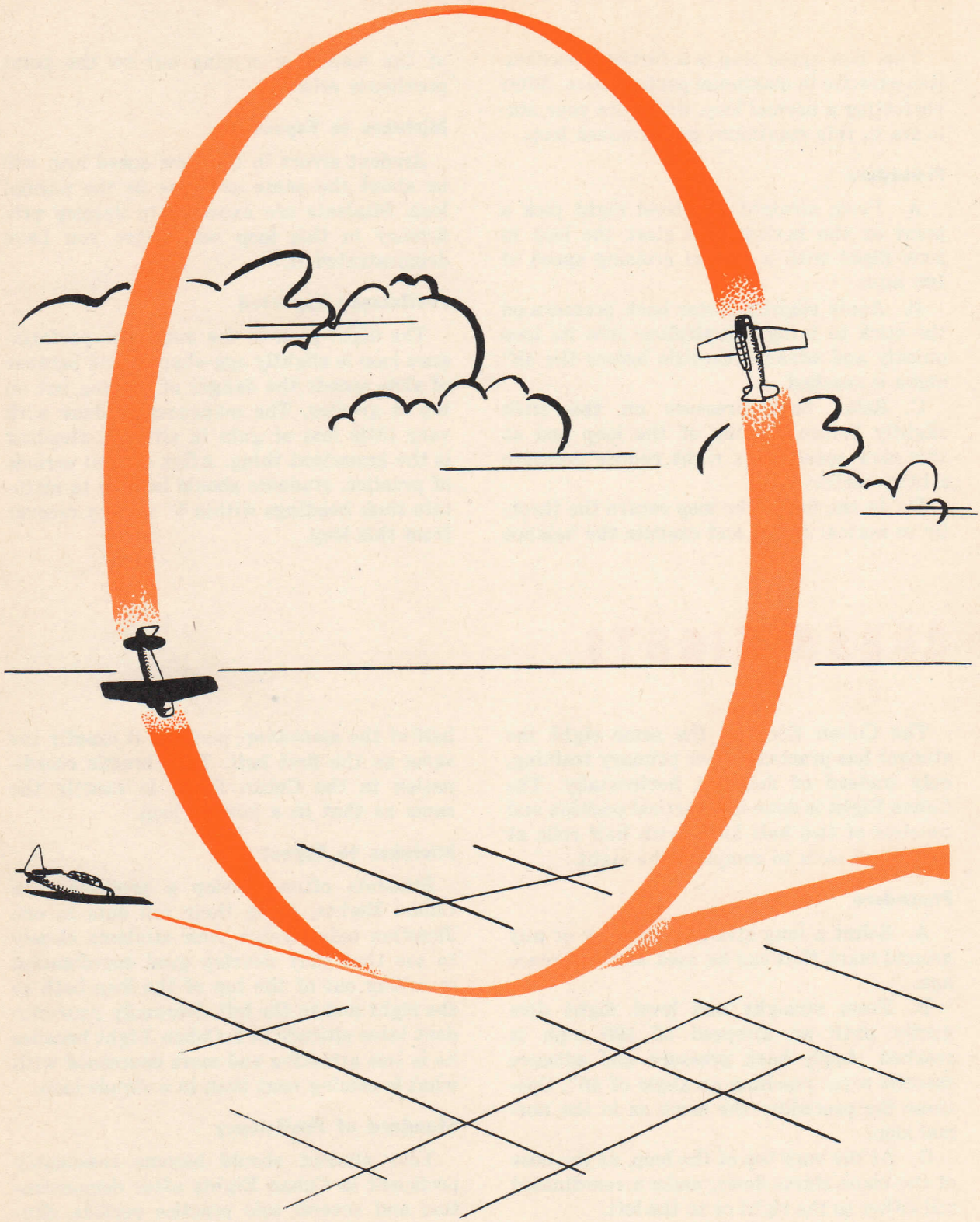
D. As the nose drops in the top of the loop, reduce throttle to normal cruise and recover from the loop making as nearly a perfect circle as possible.

Mistakes to Expect

Students have a tendency to make an egg-shape loop. This is because they do not release back pressure as they near the top of the loop. You should expect some student difficulty at first on proper throttle coordination. Students sometimes get the idea that they can make the higher powered, faster AT-6 "stand on its ear." This error often shows itself in loops where the student does go into his loop smoothly enough, and induces a high speed stall before he starts the loop.

Proficiency Required

The perfect loop is done without losing or gaining altitude. The student can seldom do it without plenty of practice. Students should maintain headings within 5° as the loop recovery is reached.



MAXIMUM PERFORMANCE LOOP

This slow speed loop is a further coordination exercise in maximum performance. After perfecting a normal loop, introduce your students to this maximum performance loop.

Procedure

A. From straight and level flight pick a point on the horizon and start the loop in level flight with a normal cruising speed of 160 mph.

B. Apply slightly faster back pressure on the stick to bring the airplane into its loop quickly and advance throttle **before** the 45° angle is reached.

C. Relax back pressure on the stick slightly before the top of the loop and at this slow speed relax right rudder pressure a little earlier.

D. In the top of the loop return the throttle to normal cruise and execute the balance of the maneuver coming out on the point previously selected.

Mistakes to Expect

Student errors in the slow speed loop will be about the same as those in the normal loop. Students are expected to develop proficiency in this loop soon after you have demonstrated it.

Proficiency Expected

The flight path of the maximum performance loop is slightly egg-shaped, and because of slow speeds the danger of stalling out on top is greater. The maneuver is done with very little loss or gain in altitude. Heading is the important thing. After several periods of practice, students should be able to maintain their headings within 5° as they recover from this loop.

CUBAN EIGHTS

The Cuban Eight is the same eight the student has practiced since primary training, only instead of doing it horizontally. The Cuban Eight is done in a vertical position and consists of two half loops with half rolls at the top of each to complete the eight.

Procedure

A. Select a long straight highway or any ground mark that can be used as a reference line.

B. From straight and level flight dive gently until an airspeed of 190 mph is reached. Apply back pressure and advance throttle after reaching an angle of 45°. Continue the procedure the same as in the normal loop.

C. At the very top of the loop, as the nose of the plane starts down, make a coordinated roll either to the right or to the left.

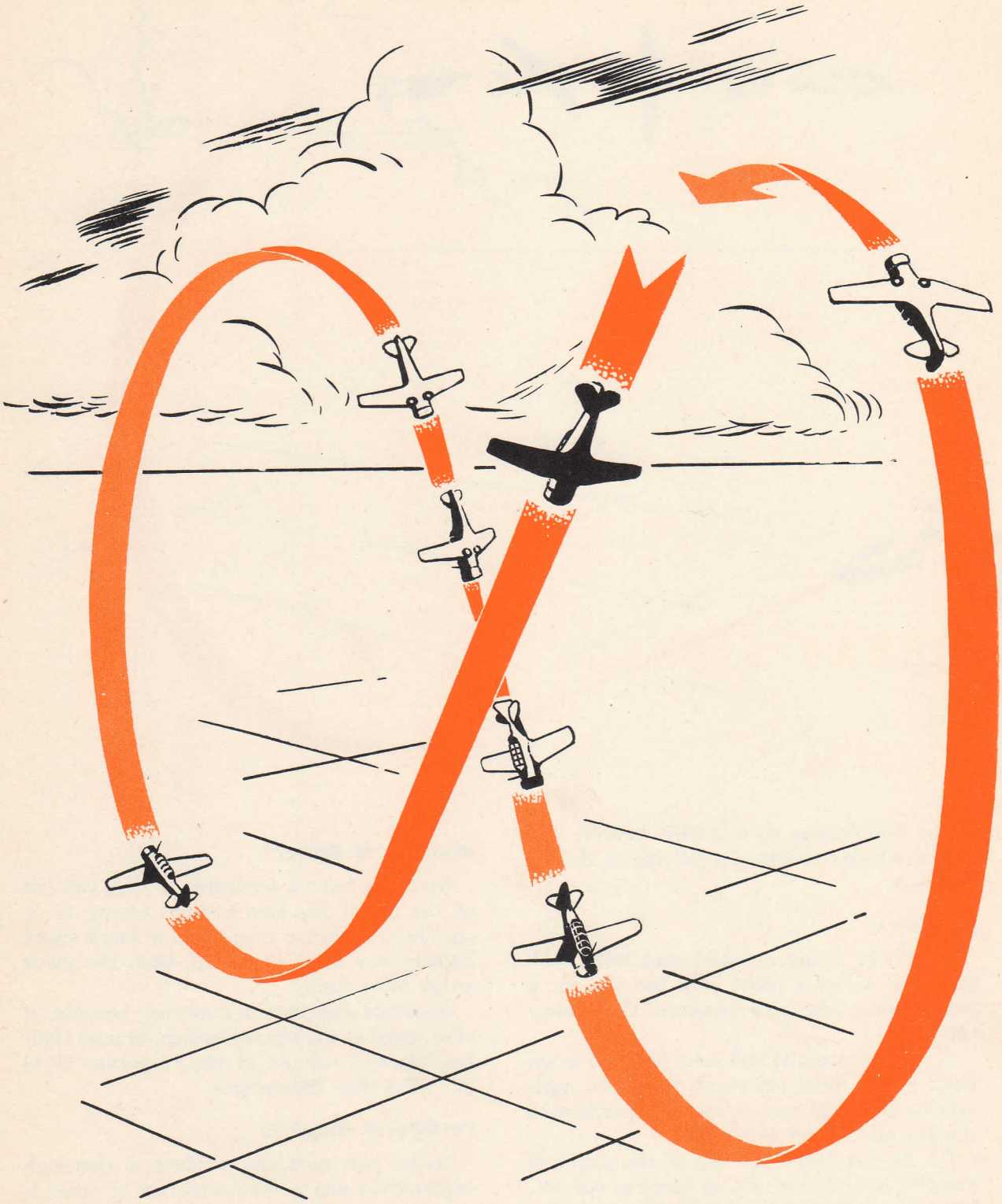
D. At the point of roll out when the plane attains about 190 mph, IAS, start the second half of the maneuver; perform it exactly the same as the first half. The throttle coordination in the Cuban Eight is exactly the same as that in a normal loop.

Mistakes to Expect

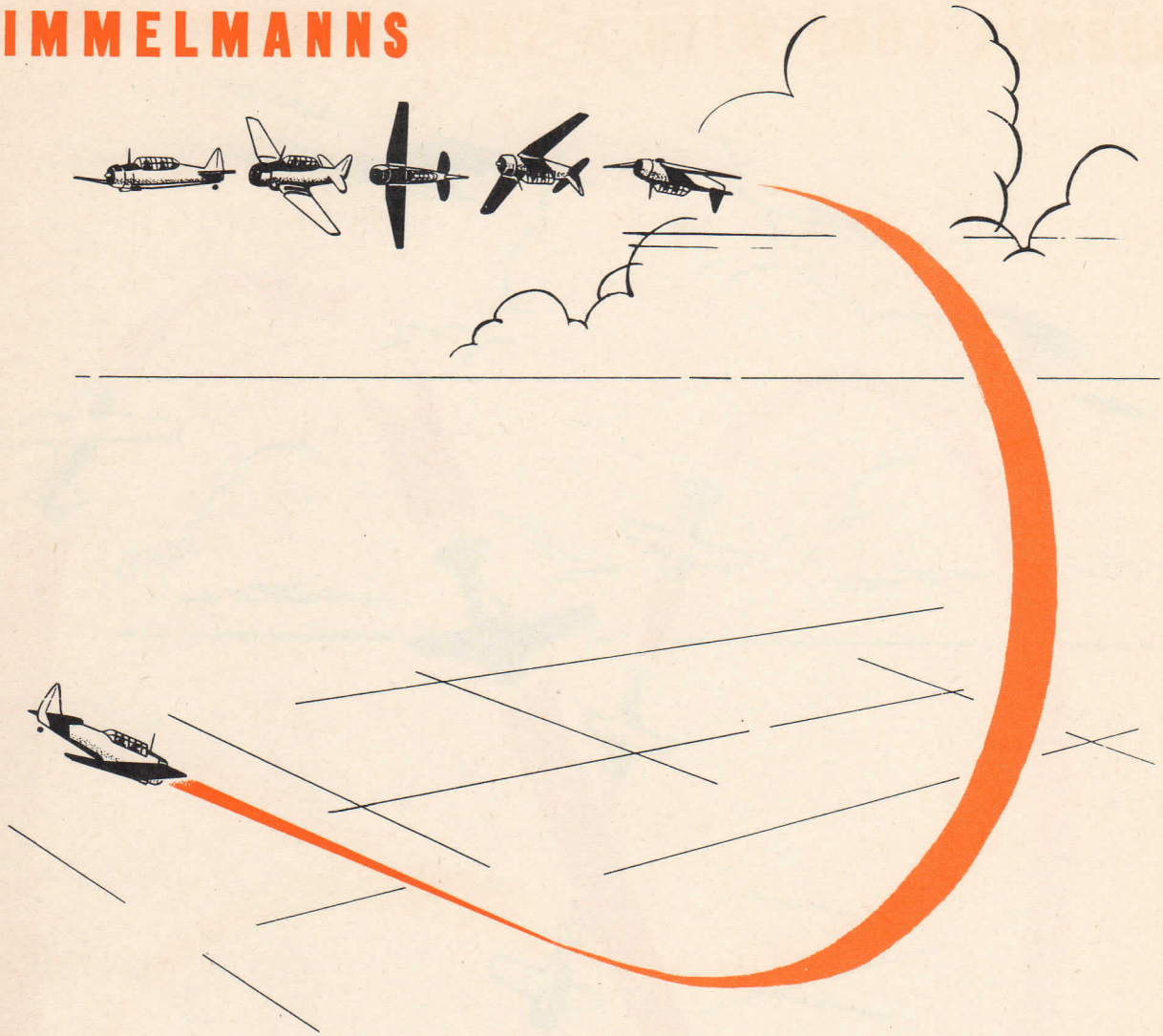
Students often develop a proficiency in Cuban Eights, doing their roll outs in one direction only. Watch your students closely to see that they develop good coordination in rolling out of the top of the loop both to the right and to the left. Normally your student loses altitude in a Cuban Eight because he is less attentive and more concerned with what is coming next than in a simple loop.

Standard of Proficiency

Your student should become reasonably proficient in Cuban Eights after demonstration and several solo practice periods. Students should do this maneuver without losing more than 350 ft. of altitude.



IMMELMANNS



The Immelmann turn is 180° reverse maneuver which consists of a roll out on the top of a loop.

Procedure

A. While flying straight and level, look back and select a point over the tail for a heading once you have completed the maneuver.

B. From straight and level flight dive the plane gently until you reach about 190 mph, making a normal loop entry with coordinated throttle and rudder pressures.

C. As you reach the top of the loop and you still have enough flying speed to roll out, begin the roll and level off 180° from the original heading, checking with the reference point you selected in the first place.

Mistakes to Expect

Students have a tendency to snap roll out of the top of the loop without trying to do so. This is because they lose too much speed before they start their roll, then the plane snaps more easily.

Students also have a tendency, because of slow speed at the top of the loop, to miss their heading and roll out of the maneuver 10 to 30° off a true 180 reverse.

Proficiency Required

After you give the student a thorough explanation and a demonstration of what is expected, he should make this maximum performance reverse turn with an altitude gain of at least 500 ft.

NORMAL LOOP WITH A SNAP ROLL ON TOP

This maneuver which is another maximum performance exercise is another aerobatic test of coordination and technique.

Procedure

A. Enter a normal loop with coordinated throttle and control pressure.

B. At the point in the normal loop, just as you reach the top, snap roll it.

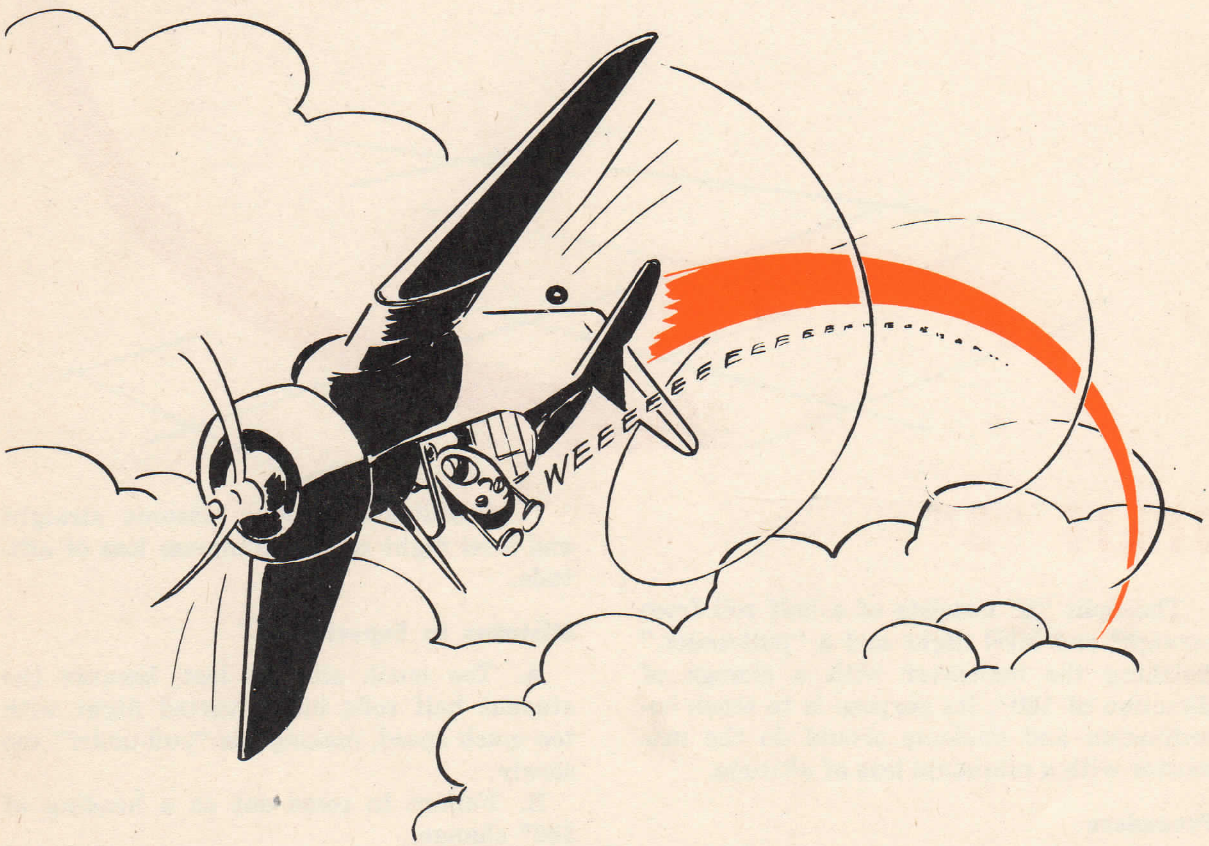
C. After the snap roll, complete the normal loop.

Mistakes to Expect

Normal loop errors and snap roll errors are heightened by this combination of both maneuvers. Its only purpose is to add to the number of things on the student's mind and to test his ability to execute both maneuvers one after another.

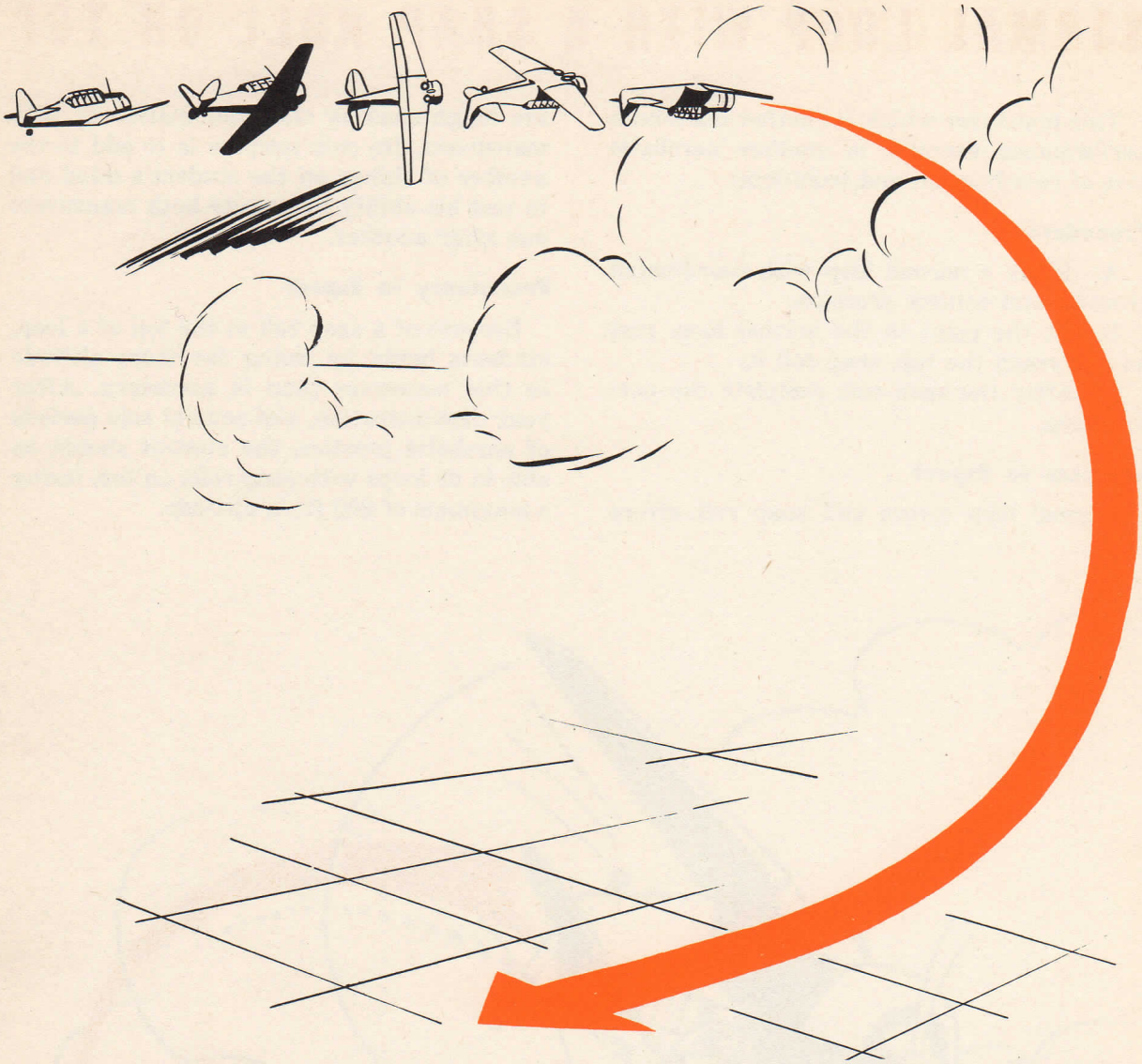
Proficiency to Expect

Because of a snap roll at the top of a loop, students begin by losing far more altitude in this maneuver than is necessary. After your demonstration, and several solo periods of aerobatic practice, the student should be able to do loops with snap rolls on top, losing a maximum of 200 ft. in altitude.



TEACHING TIME, LIKE YOUR MONEY, IS LIMITED—

SPEND IT WHERE IT COUNTS THE MOST



SPLIT "S"

The Split "S" consists of a half roll from straight and level flight and a "pull-under," finishing the maneuver with a change of direction of 180°. Its purpose is to teach coordination and students should do the maneuver with a minimum loss of altitude.

Procedure

A. From straight and level flight at normal cruise, pull the nose up and half roll at a speed of about 120 mph.

B. From this position of inverted flight, reduce throttle, apply back pressure on the stick to "dive under."

C. Coordinate throttle, assume straight and level flight with a minimum loss of altitude.

Mistakes to Expect

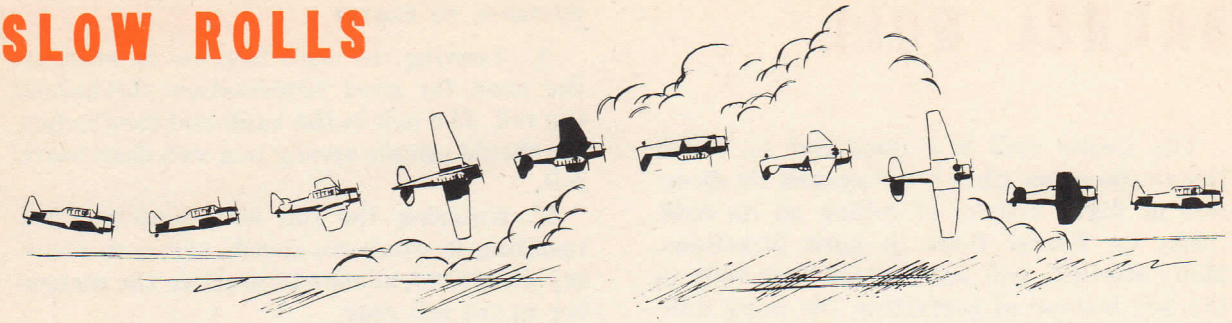
A. Too much altitude lost, because the student half rolls into inverted flight with too much speed, making his "pull-under" too slowly.

B. Failure to come out on a heading of 180° change.

Proficiency Expected

A. After thorough demonstration and several solo practice periods, the student should do a well coordinated Split "S" with loss of no more than 2,000 ft. altitude.

SLOW ROLLS



The Slow Roll is a maneuver calling for coordination and timing as the airplane slowly revolves around its axis.

Procedure

A. From straight and level flight, with cruising throttle pull the nose up.

B. Coordinate stick and rudder pressures (to the right or left) until the airplane has reached an inverted position.

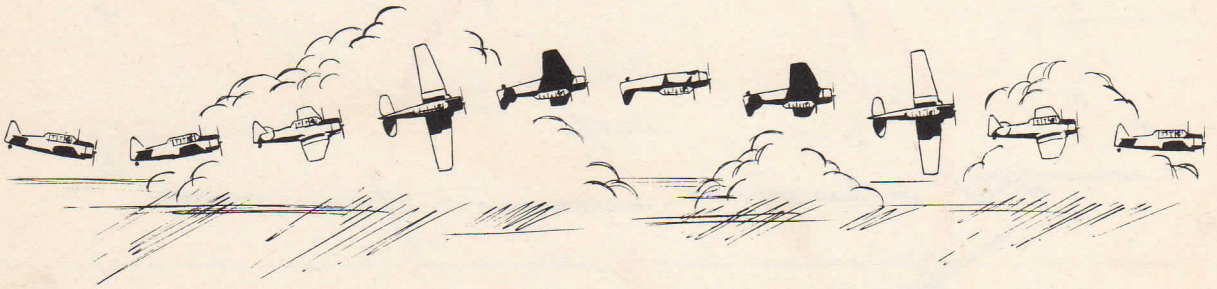
C. Apply forward pressure on the stick to maintain level flight and coordinate aileron and elevator pressure to effect normal recovery.

Mistakes to Expect

Not coming out on original heading. Caution students to select a **distant reference point** for Slow Roll headings. Nose too low in the last half of recovery. Too much rudder control.

Proficiency Required

Students should be able to master Slow Rolls in the AT-6 with little difficulty after a period or two of solo practice. Stress importance of recovery in level flight on the proper heading. This maneuver should be done without loss of more than 200 ft. altitude.



HALF ROLLS

The Half Roll is a maneuver that develops accuracy, orientation, and perfection in inverted flight. The airplane is rolled on its longitude axis until it is inverted. Continue inverted flight for a short while and recover in the direction from which the roll started.

Procedure

A. Enter the Half Roll in the same way as a slow roll.

B. When inverted flight is reached, neutralize the rudder and ailerons and apply opposite rudder and aileron controls for recovery from the inverted position back to straight and normal flight.

Mistakes to Expect

Poor coordination and timing. Loss of altitude while flying inverted (failure to apply forward stick pressure while flying inverted).

Proficiency Required

About the same as in slow rolls. Check students on their ability to maintain altitude while inverted and to accomplish the half roll with a nearly accurate heading upon recovery.

BARREL ROLL

The Barrel Roll is a maneuver in which the airplane describes a roll **around its direction of flight** instead of rolling on its axis. Insist on Barrel Rolls in both directions. Many students will practice on their rolls to the left instead of perfecting the more difficult roll to the right. Good coordination is essential.

Procedure

A. From straight and level flight at cruising speed, pull the nose up and coordinate elevator and rudder pressure in the direction of the roll.

B. Begin recovery in the inverted position of the roll, and pay particular attention to elevator pressures so the roll-out will not result in a zooming attitude.

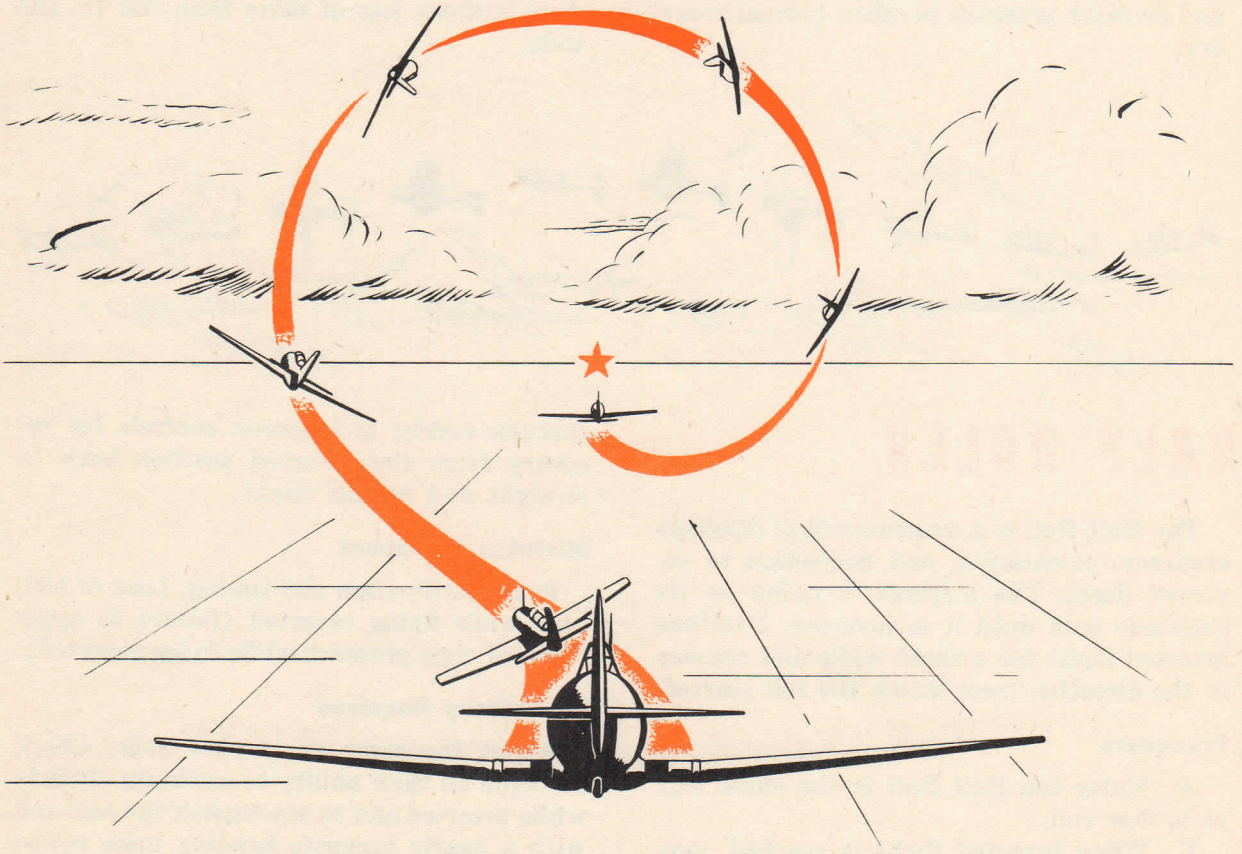
Mistakes to Expect

A. Leaving the seat. Impress on students the need for good coordination throughout the roll. The ball in the bank and turn indicator should remain steady in a well done barrel roll.

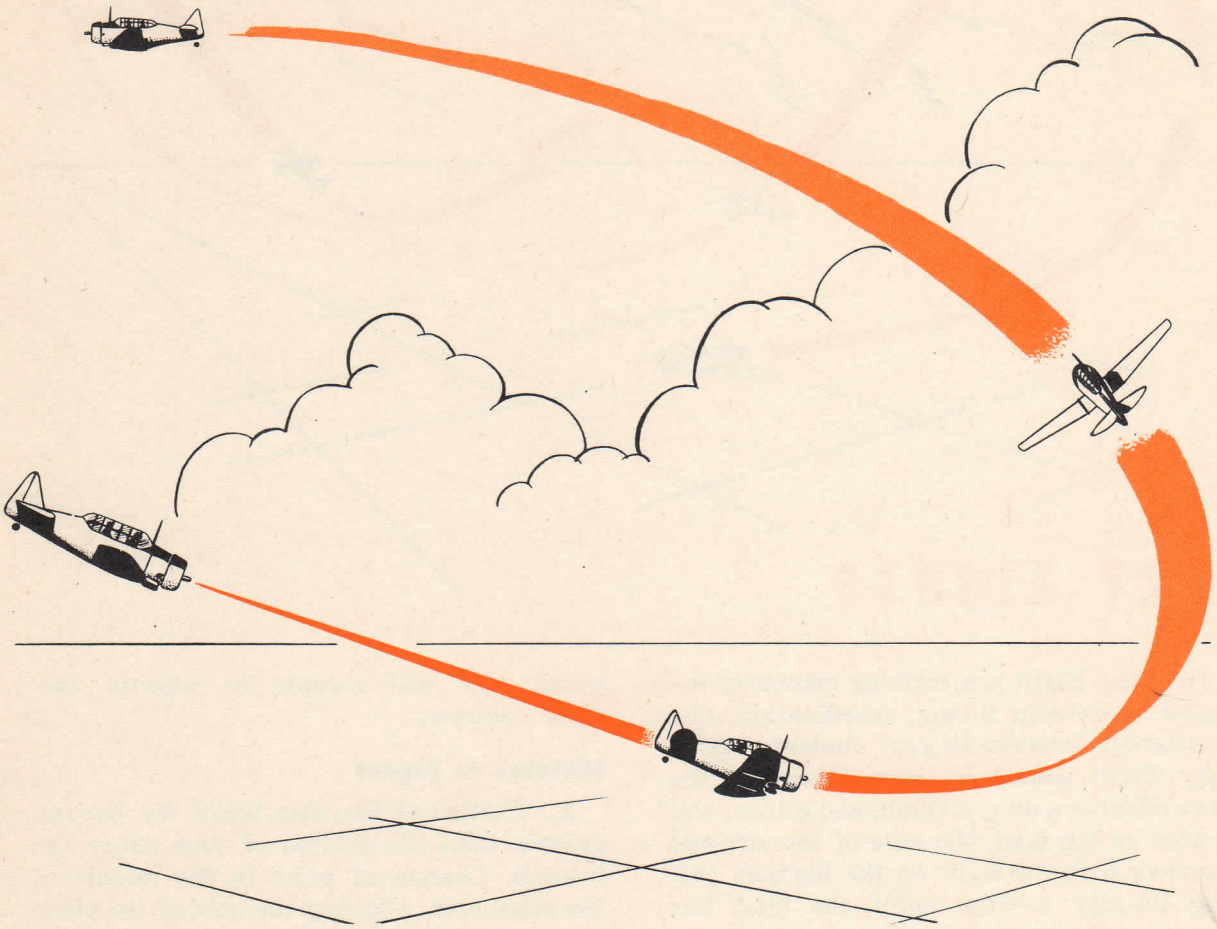
B. Entering the roll with nose too low, resulting in excessive speeds and poor recovery. Student tendency to practice the maneuver to the left only.

Proficiency Required

A. Good coordination and centrifugal feel throughout the maneuver should be accomplished by the student after you have demonstrated it, and he has had several solo periods of practice. The roll-out should be straight and level and within 5° of the original heading. The student should experience little or no loss or gain in altitude and should accomplish the roll with good technique and accurate heading on recovery.



CHANDELLES



The Chandelle is a maximum performance climbing turn of 180° which tests the students' ability to use smooth technique as they achieve limit performance during the climbing turn.

Procedure

A. From straight and level flight (cruising throttle), dive slightly until the speed of about 160 mph is reached.

B. Roll the airplane into a gentle turn.

C. When the bank is established, apply increasing back pressure to achieve climbing turn.

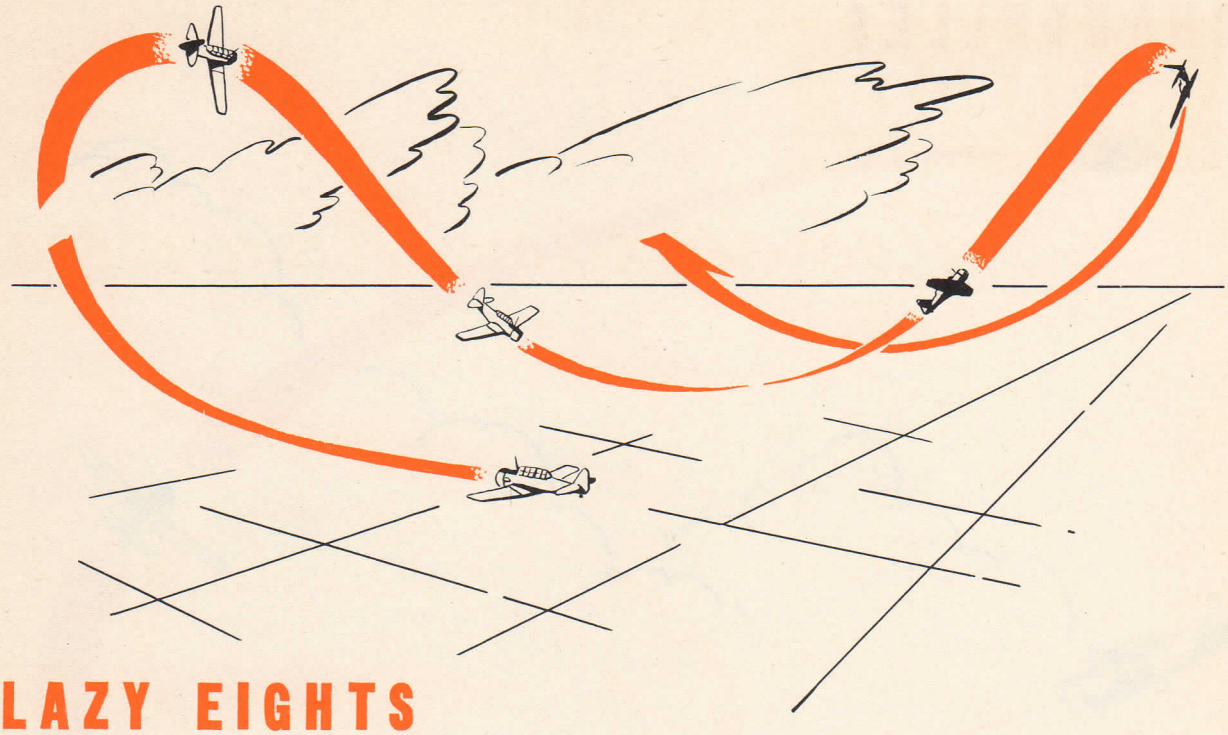
D. Maintain the turn—**without variation throughout**—until your heading has changed to 180°. Level off, and maintain straight and level flight.

Mistakes to Expect

Failure to establish sufficient bank throughout the turn. Partial stall in recovery because of poor timing and failure to release back pressure smoothly. Point out to the student that the Chandelle is a maneuver that must be planned, and **once he has established his flight path he must not change correct bank or rate of turn.**

Proficiency Required

Students are expected to improve continually the smoothness of the Chandelle throughout their training, until they are almost perfect. Tell them that smooth coordination throughout the Chandelle . . . no corrections while executing it . . . will result in a true maximum performance climbing turn.



LAZY EIGHTS

The Lazy Eight is a training maneuver designed to develop timing, coordination, and orientation. Impress on your students that a Lazy Eight **should be lazy.** Basically, the Lazy Eight is a dive, a climb, and a turn, and as seen by the pilot, the nose of the airplane describes a figure eight on the horizon, cutting through a fixed point the pilot has picked on the horizon.

Procedure

A. From straight and level flight (about 140 mph) apply back pressure on the stick, bring the nose of the plane up to the horizon, and start a gentle turn toward the axis or reference point of the eight.

B. Continue the climbing turn until the nose of the airplane cuts through the axis or reference point at 90° from the original heading. At this point of the maximum performance maneuver you should have minimum flying speed.

C. Next, roll up so that the airplane will be level as it passes through the horizon 180° from the original heading.

D. When the nose reaches the horizon, start banking in the opposite direction—starting the next turn of the Lazy Eight, which you will execute in exactly the same manner.

Mistakes to Expect

A. Portion of the turn below the horizon greater than the portion of turn above the horizon. Change of mind in the middle of the maneuver. Allowing the nose of the plane to go either beyond or short of the reference point. Rolling into the climbing turn too fast or too slow.

Stress that proper planning is the important thing in this maneuver. Maximum performance in exhausting all your speed at the top of the eight is important, but that comes later. Smoothness and coordination, the result of proper planning, is the first consideration.

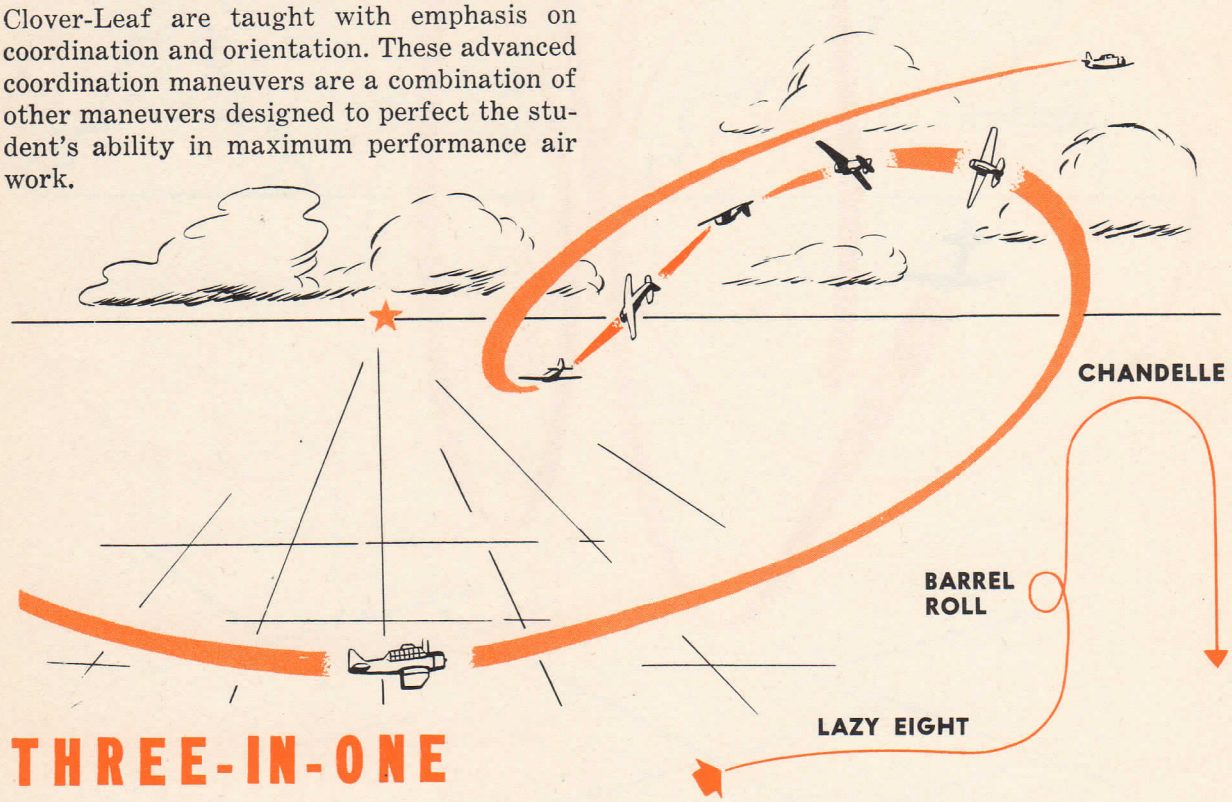
Proficiency Required

A. A student's progress in Lazy Eights should be consistent with his coordination progress in other maneuvers. Performing the maneuver smoothly and accurately without "letting the horizon get away from him" should be expected after you have corrected his original mistakes and he has had several periods to practice the Lazy Eight.

ADVANCED

Coordination Maneuvers

Both the Three-In-One Maneuver and the Clover-Leaf are taught with emphasis on coordination and orientation. These advanced coordination maneuvers are a combination of other maneuvers designed to perfect the student's ability in maximum performance air work.



THREE-IN-ONE MANEUVER

The purpose of the Three-In-One Maneuver is to maintain accurate heading and orientation throughout. It is purposely complicated for that reason.

Procedure

A. From straight and level flight begin a half Lazy Eight at 140 mph.

B. As you pass through the axis point of the Lazy Eight (at 110 mph) do a barrel roll around that point—with nose below horizon (at 160 mph) and then do a Chandelle in the opposite direction.

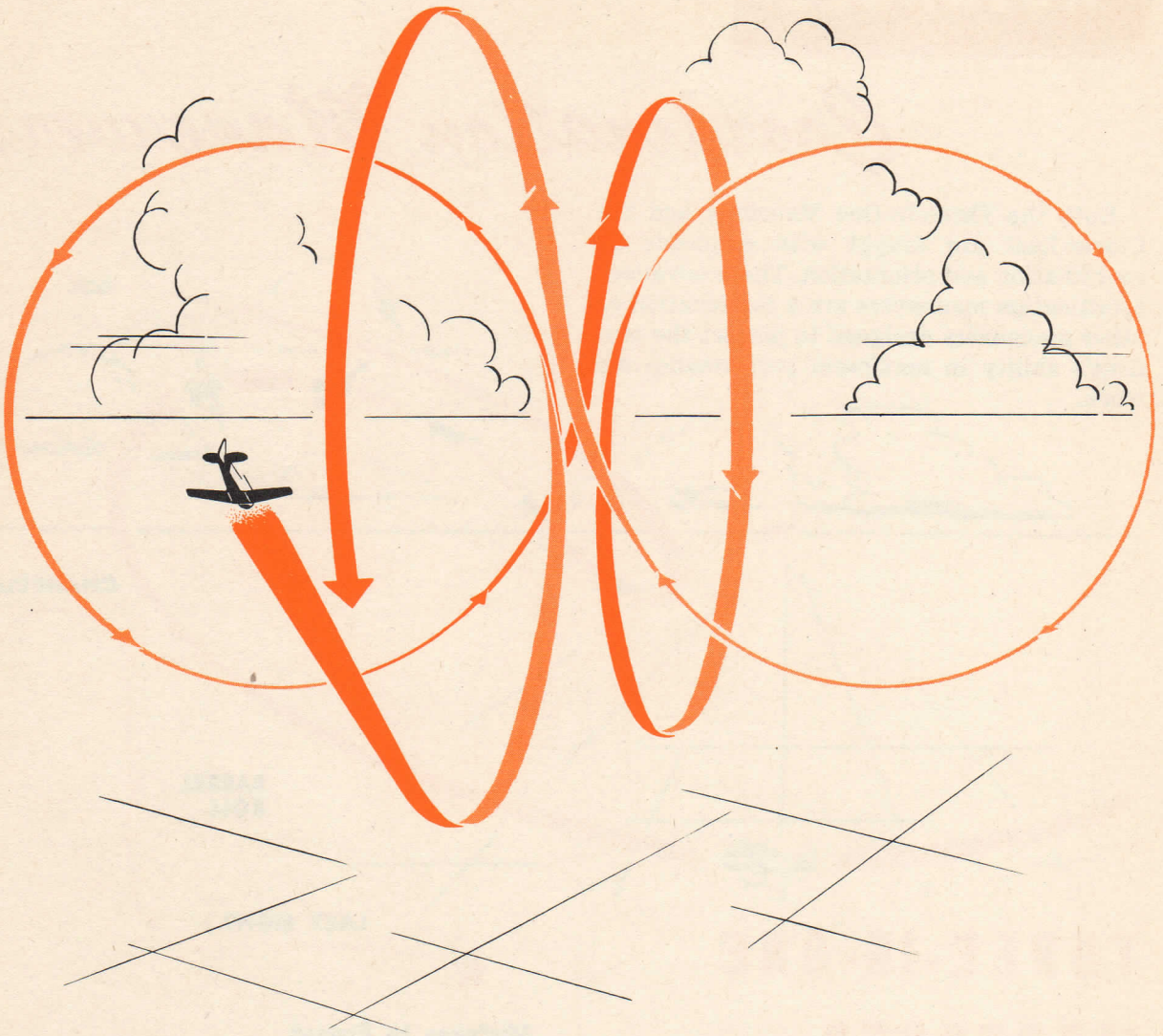
Mistakes to Expect

A. Improper orientation. Getting lost in the maneuver. Losing the point. Entering roll with too much speed. Poor timing on recovery, too much or too little roll.

Proficiency Required

A. The proficiency required in the Three-In-One Maneuver will depend on how thoroughly you have taught the student coordination, timing, and orientation in the basic maneuvers. Students must be able to tie the three maneuvers together without any lost time between maneuvers. Stress **planning** on all your check rides. It's a matter of thinking ahead.

CLOVER-LEAF



The Clover-Leaf consists of four half loops with 90° coordinated half turns in either direction on the top of each loop. It is an orientation exercise in which good heading and smooth flying are the results sought.

Procedure

A. On the top of each loop make a 90° turn.

B. Gain speed and start another normal loop, repeat the 90° inverted turn at the top, finish loop, start another until you have made four complete pull ups and four 90° turns.

Mistakes to Expect

A. Loss of orientation; complete bawl-up on headings. Relaxing of back pressure at top of pull up—too much back pressure resulting in a snap roll.

Proficiency Required

A. Student proficiency on the Clover-Leaf will come only after they have completely mastered normal aerobatics. After several demonstrations and a reasonable amount of practice, students should do Clover-Leafs with good headings, good coordination, and complete orientation throughout.

EMERGENCIES

If a student knows what to do when an emergency arises, he can face the situation with confidence instead of fear.

It is your job to give him the information that will prepare him—first, to recognize an emergency when he sees one; second, to know what to do step by step.

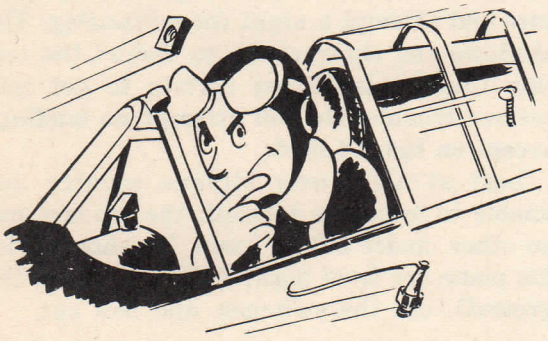
In discussing emergency procedure, never make a villian out of the airplane. Tell your student that, while he can normally rely on the performance of his airplane and his engine, there's always the possibility of failure.

It's no secret that, under severe strain, airplanes sometimes lose a wing; in combat, motors are still shot out, and all operational functions of the airplane are subject to occasional failure. The student must be made to realize, that in combat anything may happen —often does.

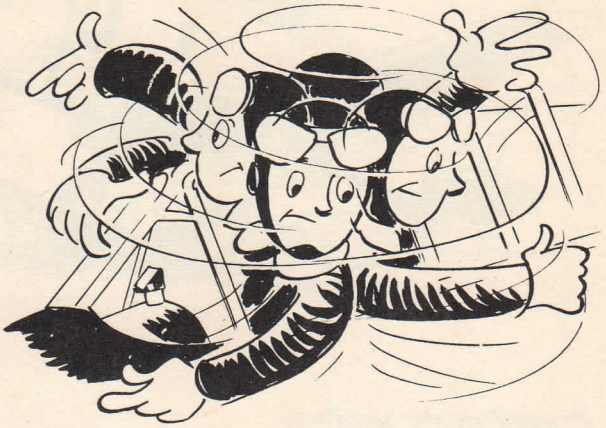
But if he knows what to do and how to do it, a pilot can keep cool and get out of almost anything short of a hopeless situation.

You cannot **make** a student use good judgment, but you **can sharpen** his natural abilities and help channel his scattered thought into logical sequence.

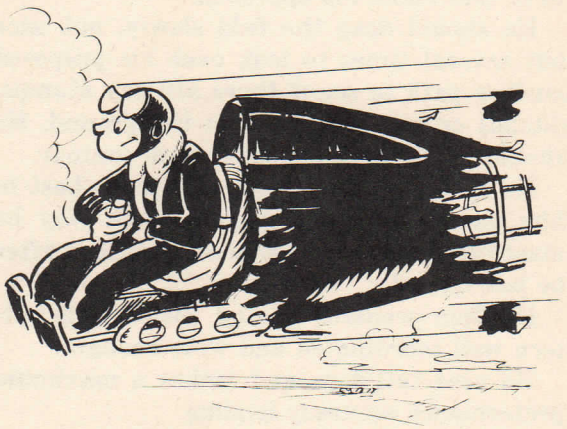
Remind the student that flying is 90% headwork and only 10% hand and foot work.



A. When damage occurs, the student must learn to size up the situation swiftly. Get the facts straight first, that will get rid of fear, and that's a good start—fear paralyzes judgment.



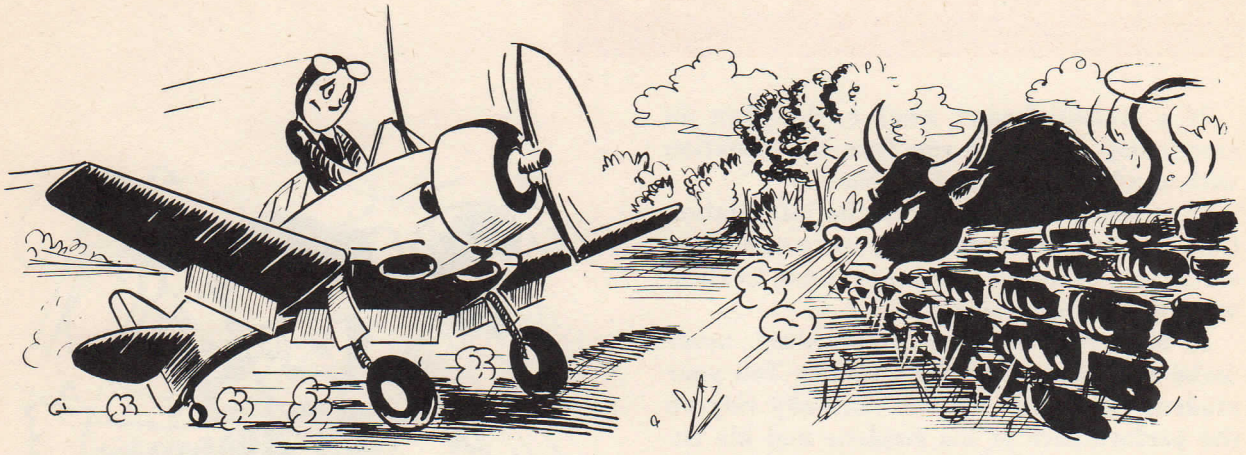
B. Once he has the facts straight, he must act quickly upon these facts. He must act with complete confidence in his decision.



C. He must execute the plan he has conceived. Calm procedure with full confidence that he is doing the right thing is the only way out of trouble.

Forced Landings

The calm, sound thinking necessary in making forced landings is acquired through experience. It's up to you as an instructor to make up for your students' lack of experience by giving them the WHAT, HOW, and WHY of forced landing procedure.



Precautionary Landings

If the student has enough altitude to give him a choice of fields, he should look them all over before deciding on one.

He should pick the largest field, let down to it, and make his approach.

He should drag the field slowly, not once but several times to look over his proposed landing path to see if there are any stumps, ditches or other hazards on the ground. He should check its slope and general contour.

He should pick the spot that looks best to him on the field and decide which way he must turn to clear possible obstructions after he has landed.

He then prepares to land, making his pattern well coordinated and wide enough.

He uses full flaps and makes a maximum performance accuracy landing.

If the field is the best available, but he still has ground hazards in his landing path, he makes a wheels-up landing and cuts the engine switches just before touching ground.

He must have his canopy open and his safety belt and shoulder straps drawn as tight as possible, in order to prevent head injuries should the airplane nose over on landing.

Procedure When Lost at Night

If the student is lost at night he must get hold of himself immediately and think.

His first problem is to figure out approximately the area he is in. He may not know just where he is within this area, but he will have a general idea.

Then he must look at his map and find the beacon light lines in this section, intercept one, circle the light, and read the code. He should be able to determine his position on the light line from this and find the location of the nearest lighted auxiliary field. Explain to him that these fields are spaced at approximately 50-mile intervals on the beacon lighted airways.

If the student is so completely lost that he cannot think or orientate himself, he must under no conditions try to drag a strange pasture and attempt a night forced landing. The shadows and obstructions so distort the terrain that he is almost certain to get into serious trouble. **He will attempt no landings except on lighted fields.**

Lost at night over strange country and unable to orientate himself, the student has no other choice but to jump. He should trim his plane for level flight (3000 ft. above the ground), cut the switches, and bail out.

Lost and Low On Fuel Over Rough Country

The student who finds himself lost and low on fuel over rough country that offers little or no possibilities for a forced landing should

fly his plane to 3000 ft. above the ground, trim it for level flight, cut the switches, and bail out. This type emergency occurs over mountainous country, over swamps, water—such as lakes or oceans—or over heavily wooded areas.

Bad Weather

If the student finds lowering ceiling all about him and dangerous weather closing in, he must determine:

1. Whether or not he has enough instrument flying experience to get through the weather.
2. If he lacks the experience (and this is no time for a student to kid himself) he should descend to tree top level and start looking immediately for an emergency field. If he finds a suitable field he can then drag it and decide whether or not to go in wheels up or wheels down. If he can't find a suitable field he must climb his plane to an altitude of at least 3000 ft., trim it for level flight, cut the switches, and bail out.

Emergency, Engine Failure

Students will not realize unless you tell them that engine failure, reduced to a minimum in training, is always possible in combat. That's why you have to be sure your students know what to do in this emergency, for they may go entirely through their training period without ever having engine failure.

If a broken fuel or oil line causes failure, or if the student has run out of fuel, he must think quickly, make a plan, and execute it calmly.

First he must look around for a field.

Then he must take the most direct path possible to that field.

CAUTION HIM THAT ALTITUDE IS MONEY IN THE BANK—HE MUST SPEND IT WISELY.

He must plan his approach to the field he has picked. He must make his approach so he will be in a position to turn and reach the field immediately if he has misjudged the landing.

Since he cannot drag the field with a dead engine he must decide quickly and surely, before turning into his final approach, whether or not he will go in with wheels up or down. When in doubt he should go in wheels up. There's less danger of injury landing wheels up on a rough field.

Emergency, Structural Damage

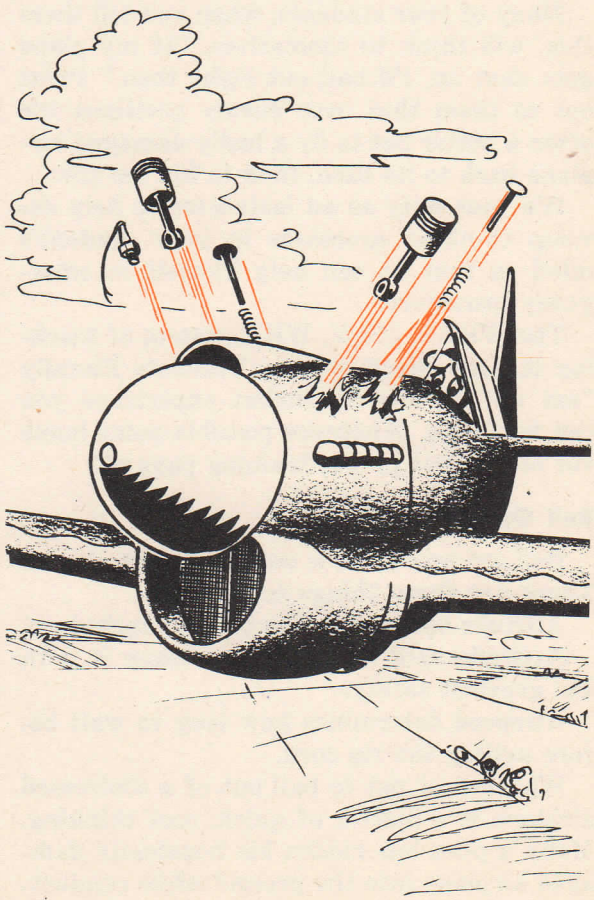
Every student, once he graduates into combat, will face the possibility of handling a damaged plane. He must be ready for this emergency. If you have done your job, he will be ready.

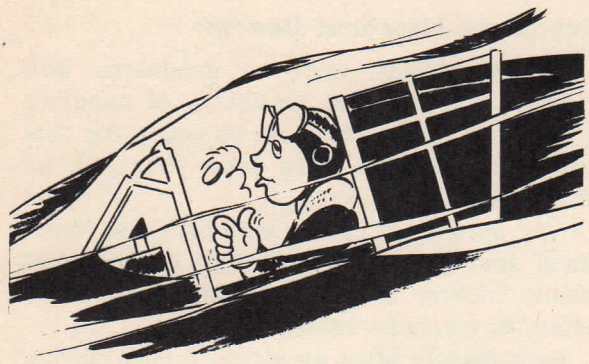
Any number of causes may bring on structural damage—a collision with another airplane, hitting a bird in flight—and more often, in combat—enemy flak.

Immediately after an airplane is damaged, the pilot must make a quick survey of the extent of injury.

Next, if possible, he must test the flying characteristics of the plane. If the plane has any climb left, the pilot should get it up to 8,000 or 9,000 ft., then do a series of stalls with wheels and flaps down and up.

The pilot should test the airplane for trim, aileron and elevator control, gliding speeds, and general airworthiness.





To Bail Out or Not to Bail Out

Having these facts, he must decide whether or not he will attempt to bring his airplane back to its home base or bail out.

Many of your students, when you tell them this, will think to themselves, "If my plane gets shot up, I'll bail out right then." Point out to them that over enemy positions it's often a better bet to fly a badly damaged airplane back to its base, than to hit the silk.

It's your duty as an instructor to help develop thinking processes in your student's mind so that he can help himself in emergency procedure.

The WHAT, HOW, WHY system of teaching is very effective here. Students literally "eat up" stories of combat experience you can tell them. Wherever possible point home the moral that proper training pays off.

Bail Out Procedure

Bail out procedure is comparatively simple. There are three things to consider:

Altitude determines the bail out technique.

Attitude determines how to leave it with the greatest safety.

Airspeed determines how long to wait before pulling the rip cord.

Whether or not to bail out of a distressed airplane is a matter of quick, cool thinking. Many a pilot has ridden his hopelessly damaged airplane into the ground while conducting a one-man debate as to whether or not he should jump. Remember the motto of bailing out. When you've gotta go—you've gotta go **fast!**

Minimum Jumping Altitude

Minimum safe altitudes for jumping depend on:

1. The speed of the plane.
2. The altitude of the plane.
3. The amount of control you have over the plane.
4. The length of time it will take your chute to open. Good judgment is the only possible solution to the minimum altitude problem.

If you have control of your plane at 200 ft., it would be foolish to try and bail out. A crash landing is your best bet.

If your plane is hopelessly out of control, it's obvious you've got to jump, even at low altitudes.

Any maneuver in which the airplane is partially or wholly out of control, don't delay your jump below 1000 ft. above the ground.

Delayed Jumps

Delayed jumps are those in which the pilot permits himself a free fall before pulling the rip cord.

In combat a parachuting pilot makes a beautiful target. Delayed jumping in combat (where altitude permits) is the rule.

High Altitude Jumps

If the pilot has to bail out at 30,000 ft., where lack of oxygen and cold are a real factor, he must make a delayed jump out of the thin strata of air to avoid anoxia and frost bite. Make a free fall of 10,000 to 15,000 feet. You should caution your student, however, not to wait too long to pull his rip cord. Often the lack of oxygen will render the pilot incapable of pulling the rip cord. Unless the pilot is equipped with oxygen tube for descent, he must take several breaths of pure oxygen before he jumps and hold his breath during his free fall until he has fallen through the strata of thin air.

Impress on the students the need for proper parachute fitting. Chest and leg fittings must be snug, even tight for complete safety.

GRADING SYSTEM

Your responsibility to your student and to your job doesn't end with giving flying instruction. You must analyze daily performance, weigh his progress, and grade him carefully on every training flight.

The record of his progress—or lack of it—should be clearly outlined in the daily logs you have prepared. They should represent your best thought and honest evaluation of everything your student does under your instruction.

Inexperienced instructors need some set of standards to help them in keeping logs. Instructors who have grown careless in grading need to be reminded of essential considerations, so that all may conform to a reasonably uniform standard.

This handbook outlines essentials that should be useful in preparing your student logs. It is not intended as a cut and dried procedure that will kill your individuality—far from it! It is designed to aid you in developing sound analysis, accurate grading, and clear explanations for the evaluation you have given your student's work.

GENERAL CONSIDERATIONS OF THE STUDENT'S LOG

Instructors are charged with the responsibility of keeping a daily record of every student's progress. These daily log forms are printed in color to serve specific purposes and to provide ready visual classification.

These records are filed where they are readily available to instructors, squadron commanders, and other higher authorities. They may be used to select or classify students, or for final review by the academic board which convenes to decide upon the disposition of an eliminated student.

Others besides yourself have to use these records, and to be fully useful they must be neat, easy to read, and accurate.

NEATNESS—A log that is disfigured by erasures, write-overs, ink spots, misspelled words, scrawling, careless writing, etc., is a reflection on the instructor. Use a typewriter if possible. Otherwise, use pen and ink. Print name and initials and grades. Write remarks carefully! Take time to do a job worthy of yourself.

Take ten to fifteen minutes—often more—preparing each log. The instructor who says, "Hey, wait just a minute—I have to make out my grade slips," is certainly running out on his responsibilities.

ACCURACY—You owe it to your student and to the Air Forces to be as accurate and fair in the evaluation of every student as is humanly possible.

Accuracy will grow with experience and practice; but a new instructor can and should make use of every help and "tip" he can get.

THE GRADING SYSTEM

You will grade your students by using the letters "A" through "F." You are **expected** to make use of all six letters. **"A" does not represent perfection.** You will have occasional students who deserve it; and you will often have "B" students.

In order to obtain a useful index of students' relative abilities, all six grades should be used. In arriving at a fair and accurate grade on a student's work for a day, a week, or the whole course, you must base your decision upon four qualities of each student's work:

1. JUDGMENT
2. ATTITUDE
3. PROGRESS
4. TECHNIQUE

Keep these four qualities in mind and everything your student does for you. Remember the check list J*A*P*T*; and you have a key to a sound and fair grade.

HOW TO APPLY THE GRADING SYSTEM

For a practical application of the grading system, study the following:

Grade of "A"

A training flight, a mission, or a maneuver completed in which you do not find any serious flaw. The student shows sound **Judgment.** His **Attitude** is all you could ask from a candidate for a commission and pilot rating. He shows **Progress** by remembering and applying every important thing you have taught him. His **Technique** is sound for the amount of time and instruction he has had. Briefly:

J. Mature, sound, and trustworthy.

A. Alert—seriously interested in becoming a military pilot and officer.

P. Remembers and applies all the **important** things you have taught him.

T. Above serious criticism. You feel like saying (and should say it) "O.K.!"

Grade of "B"

In **Judgment** and **Attitude,** a student must leave you fully satisfied. His **Progress** is such that you enjoy working with him. His **Technique** shows no serious flaw, yet you find you have to say "you forgot this or that."

Briefly:

J. Same as for an "A."

A. Same as for an "A."

P., T. May make some small slip in either P or T (not in both) but nothing serious or dangerous.

Grade of "C"

A majority of your students will fall in the "C" classification. But do not use it as a "so-what" grade. You must arrive at it fairly—with as much consideration as you give any other grade. Never give it merely because you don't know what grade your student deserves.

Briefly:

J., A. Must still be above serious criticism. Student may show occasional lapses—but must not show any habitual characteristics of poor **Judgment** or indifferent **Attitude.**

P., T. Small deficiencies — occasional poor performance, but still nothing habitually dangerous.

Grade of "D"

This student is slow to take instruction. You find that you must constantly repeat yourself, **but he finally gets it.** His progress is characterized by inconsistency. You find yourself wondering how to make him understand. "How am I going to get this across?"

Briefly:

J. Faults of sound **Judgment,** but faults that you believe are correctable—not likely to be habitual or dangerous.

A. His **Attitude** must still be good. Any habitual indifference calls automatically for an "E" or "F."

P. His **Progress,** though slow, must still be fairly sure.

T. Not good—but not dangerously bad.

Grade of "E"

A student who shows little or no improvement after intensive instruction, who is unreliable under pressure, or who gives any indication that he is developing dangerous traits belongs in the "E" grade group.

Briefly:

J. If you have any serious doubt of a student's ability to correct his faults of **Judgment**—as long as it is a **doubt** in your mind give him an "E."

A. Unstable, "hot and cold," or lukewarm.

P. Slow—so slow you doubt his ability to get by.

T. Erratic—or consistently below par for his flying time and experience.

If, because of a dangerous performance, you give an "E" to a student who is on solo status, you and your flight commander should consider taking the student off solo until he has corrected the fault for which you gave him the "E."

Grade of "F"

If a student's performance makes you feel that he has dangerous characteristics, which after repeated instructions he does not overcome, you must give him an "F." In judging what is dangerous or hazardous, you must remember that all students do dangerous things in the early stages of training. But they learn better in the natural course of instruction. It is those students who **repeatedly show dangerous traits,** so much so that it is a characteristic, that should be eliminated. Briefly:

J. Any exhibition of dangerous quality—Unpredictable or downright bad **Judgment.**

A. If he has the best **Attitude** in the world, and is still dangerous in his **Judgment** or **Technique,** he should be eliminated.

P. Slow—or none.

T. Definitely dangerous.

At any time you give the grade of "F" you automatically make your student a candidate for elimination. You are through with him; you turn him over to a supervisory officer. You have to write up a final statement on him. Do not give an "F" therefore, without serious consideration; be sure that, as far as you are concerned, the student is a dangerous risk. He will not make a military pilot.

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FOR PURPOSES OF TRAINING, CERTAIN VARIANCES FROM AAF TECHNICAL ORDERS HAVE BEEN INDICATED IN THIS MANUAL PENDING DECISIONS ON PROCEDURE FROM HIGHER HEADQUARTERS