SECTION 4
NORMAL PROCEDURES

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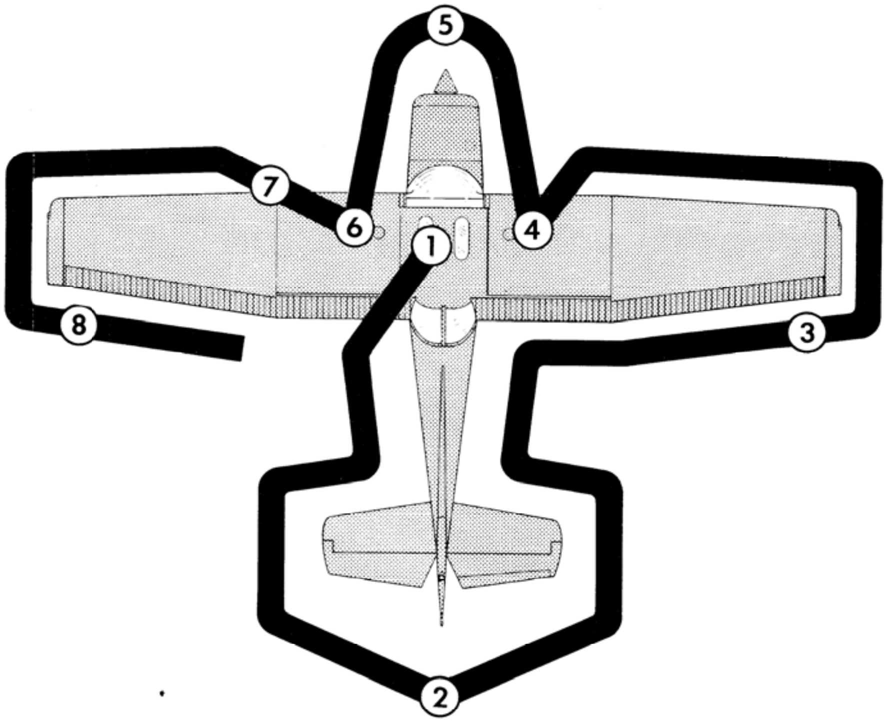
INTRODUCTION

Section 4 provides checklist, amplified and aerobatic procedures for the conduct of normal operation. Normal procedures associated with optional systems can be found in Section 9.

SPEEDS FOR NORMAL OPERATION

The following speeds are based on a maximum weight of 1670 pounds and may be used for any lesser weight.

Takeoff:	
Normal Climb Out	65-75 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet	54 KIAS
Climb, Flaps Up:	
Normal	70-80 KIAS
Best Rate of Climb, Sea Level	67 KIAS
Best Rate of Climb, 10,000 Feet	61 KIAS
Best Angle of Climb, Sea Level thru 10,000 Feet	55 KIAS
Landing Approach:	
Normal Approach, Flaps Up	60-70 KIAS
Normal Approach, Flaps 30°	55-65 KIAS
Short Field Approach, Flaps 30°	54 KIAS
Balked Landing:	
Maximum Power, Flaps 20°	55 KIAS
Maximum Recommended Turbulent Air Penetration Speed	108 KIAS
Maximum Demonstrated Crosswind Velocity	12 KNOTS



NOTE

Visually check airplane for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Also, make sure that control surfaces contain no internal accumulations of ice or debris. Prior to flight, check that pitot heater (if installed) is warm to touch within 30 seconds with battery and pitot heat switches on. If a night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-1. Preflight Inspection

CHECKLIST PROCEDURES

PREFLIGHT INSPECTION

(1) CABIN

1. Pilot's Operating Handbook -- AVAILABLE IN THE AIRPLANE.
2. Control Wheel Lock -- REMOVE.
3. Ignition Switch -- OFF.
4. Master Switch -- ON.

WARNING

When turning on the master switch, using an external power source, or pulling the propeller through by hand, treat the propeller as if the ignition switch were on. Do not stand, nor allow anyone else to stand, within the arc of the propeller, since a loose or broken wire, or a component malfunction, could cause the propeller to rotate.

5. Fuel Quantity Indicators -- CHECK QUANTITY.
6. Avionics Cooling Fan -- CHECK AUDIBLY FOR OPERATION.
7. Master Switch -- OFF.
8. Fuel Shutoff Valve -- ON.
9. Door Release Pins -- CHECK prior to aerobatic flight.
10. Seat Belts and Shoulder Harnesses -- CHECK condition and security.
11. Seat Cushions -- STOW prior to aerobatic flight as required.

(2) EMPENNAGE

1. Rudder Gust Lock -- REMOVE.
2. Tail Tie-Down -- DISCONNECT.
3. Control Surfaces -- CHECK freedom of movement and security.

(3) RIGHT WING Trailing Edge

1. Aileron -- CHECK freedom of movement and security.

(4) RIGHT WING

1. Wing Tie-Down -- DISCONNECT.
2. Main Wheel Tire -- CHECK for proper inflation.
3. Before first flight of the day and after each refueling, use sampler cup and drain small quantity of fuel from fuel tank sump quick-

drain valve to check for water, sediment, and proper fuel grade.
4. Fuel Quantity -- CHECK VISUALLY for desired level.
5. Fuel Filler Cap -- SECURE.

(5) NOSE

1. Engine Oil Level -- CHECK, do not operate with less than four quarts. Fill to six quarts for extended flight.
2. Before first flight of the day and after each refueling, pull out strainer drain knob for about four seconds to clear fuel strainer of possible water and sediment. Check strainer drain closed. If water is observed, the fuel system may contain additional water, and further draining of the system at the strainer, fuel tank sumps, and fuel line drain plug will be necessary.
3. Propeller and Spinner -- CHECK for nicks and security.
4. Carburetor Air Filter -- CHECK for restrictions by dust or other foreign matter.
5. Landing Light(s) -- CHECK for condition and cleanliness.
6. Nose Wheel Strut and Tire -- CHECK for proper inflation.
7. Nose Tie-Down -- DISCONNECT.
8. Static Source Opening (left side of fuselage) -- CHECK for stoppage.

(6) LEFT WING

1. Main Wheel Tire -- CHECK for proper inflation.
2. Before first flight of day and after each refueling, use sampler cup and drain small quantity of fuel from fuel tank sump quick-drain valve to check for water, sediment and proper fuel grade.
3. Fuel Quantity -- CHECK VISUALLY for desired level.
4. Fuel Filler Cap -- SECURE.

(7) LEFT WING Leading Edge

1. Pitot Tube Cover -- REMOVE and check opening for stoppage.
2. Stall Warning Opening -- CHECK for stoppage. To check the system, place a clean handkerchief over the vent opening and apply suction; a sound from the warning horn will confirm system operation.
3. Fuel Tank Vent Opening -- CHECK for stoppage.
4. Wing Tie-Down -- DISCONNECT.

(8) LEFT WING Trailing Edge

1. Aileron -- CHECK freedom of movement and security.

BEFORE STARTING ENGINE

1. Preflight Inspection -- COMPLETE.
2. Seats, Seat Belts, Shoulder Harnesses -- ADJUST and LOCK.
3. Fuel Shutoff Valve -- ON.
4. Radios, Electrical Equipment -- OFF.
5. Brakes -- TEST and SET.
6. Circuit Breakers -- CHECK IN.

STARTING ENGINE (Temperatures Above Freezing)

NOTE

For cold weather starting procedures, refer to page 4-19.

1. Mixture -- RICH.
2. Carburetor Heat -- COLD.
3. Prime -- AS REQUIRED (up to 3 strokes - none if engine is warm).
4. Throttle -- OPEN 1/2 INCH (CLOSED if engine is warm).
5. Propeller Area -- CLEAR.
6. Master Switch -- ON.
7. Ignition Switch -- START (release when engine starts).
8. Throttle -- ADJUST for 1000 RPM or less.
9. Oil Pressure -- CHECK.
10. Flashing Beacon and Navigation Lights -- ON as required.
11. Radios -- ON.

BEFORE TAKEOFF

1. Parking Brake -- SET.
2. Cabin Doors -- CLOSED and LATCHED.
3. Flight Controls -- FREE and CORRECT.
4. Flight Instruments -- SET.
5. Fuel Shutoff Valve -- ON.
6. Mixture -- RICH (below 3000 feet).
7. Elevator Trim -- TAKEOFF.
8. Throttle -- 1700 RPM.
   a. Magnetos -- CHECK (RPM drop should not exceed 125 RPM on either magneto or 50 RPM differential between magnetos).
   b. Carburetor Heat -- CHECK (for RPM drop).
   c. Engine Instruments and Ammeter -- CHECK.
   d. Suction Gage -- CHECK.
9. Throttle -- 1000 RPM OR LESS.
10. Radios -- SET.
11. Strobe Lights -- AS DESIRED.
12. Throttle Friction Lock -- ADJUST.
13. Brakes -- RELEASE.

TAKEOFF

NORMAL TAKEOFF

1. Wing Flaps -- 0°- 10°.
2. Carburetor Heat -- COLD.
3. Throttle -- FULL OPEN.
4. Elevator Control -- LIFT NOSE WHEEL at 50 KIAS.
5. Climb Speed -- 65-75 KIAS.

SHORT FIELD TAKEOFF

1. Wing Flaps -- 10°.
2. Carburetor Heat -- COLD.
3. Brakes -- APPLY.
4. Throttle -- FULL OPEN.
5. Mixture -- RICH (above 3000 feet, LEAN to obtain maximum RPM).
6. Brakes -- RELEASE.
7. Elevator Control -- SLIGHTLY TAIL LOW.
8. Climb Speed -- 54 KIAS (until all obstacles are cleared).
9. Wing Flaps -- RETRACT slowly after reaching 60 KIAS.

ENROUTE CLIMB

1. Airspeed -- 70-80 KIAS.

NOTE

If a maximum performance climb is necessary, use speeds shown in the Maximum Rate Of Climb chart in Section 5.

2. Throttle -- FULL OPEN.
3. Mixture -- RICH below 3000 feet, LEAN for maximum RPM above 3000 feet.

CRUISE

1. Power -- 1900-2550 RPM.
2. Elevator Trim -- ADJUST.
3. Mixture -- LEAN.

DESCENT

1. Mixture -- ADJUST for smooth operation (full rich for idle power).
2. Power -- AS DESIRED.
3. Carburetor Heat -- FULL HEAT AS REQUIRED.

BEFORE LANDING

1. Seats, Seat Belts, Shoulder Harnesses -- ADJUST and LOCK.
2. Mixture -- RICH.
3. Carburetor Heat -- ON (apply full heat before reducing power).

LANDING

NORMAL LANDING

1. Airspeed -- 60-70 KIAS (flaps UP).
2. Wing Flaps -- AS DESIRED (below 85 KIAS).
3. Airspeed -- 55-65 KIAS (flaps DOWN).
4. Touchdown -- MAIN WHEELS FIRST.
5. Landing Roll -- LOWER NOSE WHEEL GENTLY.
6. Braking -- MINIMUM REQUIRED.

SHORT FIELD LANDING

1. Airspeed -- 60-70 KIAS (flaps UP).
2. Wing Flaps -- 30° (below 85 KIAS).
3. Airspeed -- MAINTAIN 54 KIAS.
4. Power -- REDUCE to idle as obstacle is cleared.
5. Touchdown -- MAIN WHEELS FIRST.
6. Brakes -- APPLY HEAVILY.
7. Wing Flaps -- RETRACT.

BALKED LANDING

1. Throttle -- FULL OPEN.
2. Carburetor Heat -- COLD.
3. Wing Flaps -- RETRACT to 20°.
4. Airspeed -- 55 KIAS.
5. Wing Flaps -- RETRACT (slowly).

AFTER LANDING

1. Wing Flaps -- UP.
2. Carburetor Heat -- COLD.

SECURING AIRPLANE

1. Parking Brake -- SET.
2. Radios, Electrical Equipment -- OFF.
3. Mixture -- IDLE CUT-OFF (pull full out).
4. Ignition Switch -- OFF.
5. Master Switch -- OFF.
6. Control Lock -- INSTALL.

AMPLIFIED PROCEDURES

STARTING ENGINE (Temperatures Above Freezing)

During engine starting, open the throttle approximately 1/2 inch. In warm weather, one stroke of the primer should be sufficient. In temperatures near freezing, up to 3 strokes of the primer may be necessary. As the engine starts, slowly adjust the throttle as required for 1000 RPM or less. If the engine is still warm from previous operation, it may be started with the throttle closed and no priming.

Weak intermittent firing followed by puffs of black smoke from the exhaust stack indicates overpriming or flooding. Excess fuel can be cleared from the combustion chambers by the following procedure: set the mixture control in the idle cut-off position, the throttle full open, and crank the engine through several revolutions with the starter. Repeat the starting procedure without any additional priming.

If the engine is underprimed (most likely in cold weather with a cold engine) it will not fire at all, and additional priming will be necessary.

After starting, if the oil gage does not begin to show pressure within 30 seconds in the summertime and about twice that long in very cold weather, stop the engine and investigate. Lack of oil pressure can cause serious engine damage. After starting, avoid the use of carburetor heat unless icing conditions prevail.

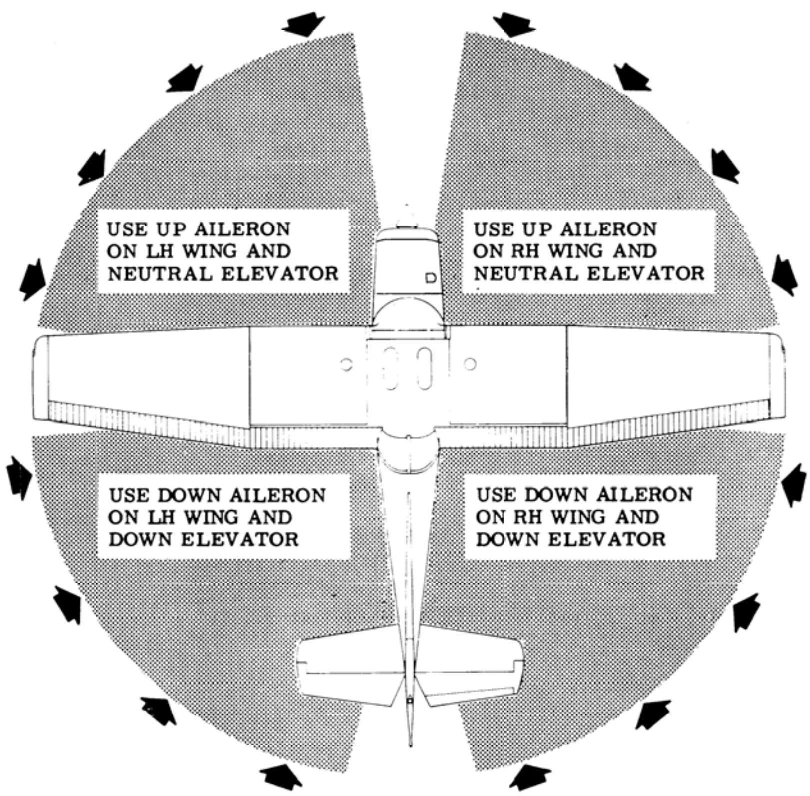
NOTE

Details concerning cold weather starting and operation at temperatures below freezing may be found under Cold Weather Operation paragraphs in this section.

TAXIING

When taxiing, it is important that speed and use of brakes be held to a minimum and that all controls be utilized (see Taxiing Diagram, figure 4-2) to maintain directional control and balance.

The carburetor heat control knob should be pushed full in during all ground operations unless heat is absolutely necessary. When the knob is pulled out to the heat position, air entering the engine is not filtered.



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WIND DIRECTION ➡

NOTE

Strong quartering tail winds require caution. Avoid sudden bursts of the throttle and sharp braking when the airplane is in this attitude. Use the steerable nose wheel and rudder to maintain direction.

Figure 4-2. Taxiing Diagram

Taxiing over loose gravel or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips.

The nose wheel is designed to automatically center straight ahead when the nose strut is fully extended. In the event the nose strut is over-inflated and the airplane is loaded to a rearward center of gravity position, it may be necessary to partially compress the strut to permit steering. This can be accomplished prior to taxiing by depressing the airplane nose (by hand) or during taxi by sharply applying brakes.

BEFORE TAKEOFF

WARM-UP

Most of the warm-up will have been conducted during taxi, and additional warm-up before takeoff should be restricted to the checklist procedures. Since the engine is closely cowled for efficient in-flight cooling, precautions should be taken to avoid overheating on the ground.

MAGNETO CHECK

The magneto check should be made at 1700 RPM as follows. Move ignition switch first to R position and note RPM. Next move switch back to BOTH to clear the other set of plugs. Then move switch to the L position, note RPM and return the switch to the BOTH position. RPM drop should not exceed 125 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speeds will usually confirm whether a deficiency exists.

An absence of RPM drop may be an indication of faulty grounding of one side of the ignition system or should be cause for suspicion that the magneto timing is set in advance of the setting specified.

ALTERNATOR CHECK

Prior to flights where verification of proper alternator and alternator control unit operation is essential (such as night or instrument flights), a positive verification can be made by loading the electrical system momentarily (3 to 5 seconds) with the landing light, or by operating the wing flaps during the engine runup (1700 RPM). The ammeter will remain within a needle width of its initial position if the alternator and alternator control unit are operating properly.

TAKEOFF

POWER CHECK

It is important to check full-throttle engine operation early in the takeoff run. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff. If this occurs, you are justified in making a thorough full-throttle static runup before another takeoff is attempted. The engine should run smoothly and turn approximately 2280 to 2380 RPM with carburetor heat off and mixture leaned to maximum RPM.

Full throttle runups over loose gravel are especially harmful to propeller tips. When takeoffs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it. When unavoidable small dents appear in the propeller blades, they should be immediately corrected as described in Section 8 under Propeller Care.

Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full-throttle, static runup.

After full throttle is applied, adjust the throttle friction lock clockwise to prevent the throttle from creeping back from a maximum power position. Similar friction lock adjustment should be made as required in other flight conditions to maintain a fixed throttle setting.

WING FLAP SETTINGS

Normal takeoffs are accomplished with wing flaps 0°- 10°. Using 10° wing flaps reduces the total distance over an obstacle by approximately 10%. Flap deflections greater than 10° are not approved for takeoff. If 10° wing flaps are used for takeoff, they should be left down until all obstacles are cleared and a safe flap retraction speed of 60 KIAS is reached.

On a short field, 10° wing flaps and an obstacle clearance speed of 54 KIAS should be used. This speed provides the best overall climb speed to clear obstacles when taking into account turbulence often found near ground level.

Soft or rough field takeoffs are performed with 10° wing flaps by lifting the airplane off the ground as soon as practical in a slightly tail-low attitude. If no obstacles are ahead, the airplane should be leveled off immediately to accelerate to a higher climb speed.

CROSSWIND TAKEOFF

Takeoffs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after takeoff. With the ailerons partially deflected into the wind, the airplane is accelerated to a speed slightly higher than normal, and then pulled off abruptly to prevent possible settling back to the runway while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

ENROUTE CLIMB

Normal climbs are performed with flaps up and full throttle and at speeds 5 to 10 knots higher than best rate-of-climb speeds for the best combination of performance, visibility and engine cooling. The mixture should be full rich below 3000 feet and may be leaned above 3000 feet for smoother operation or to obtain maximum RPM. For maximum rate of climb, use the best rate-of-climb speeds shown in the Rate Of Climb chart in Section 5. If an obstruction dictates the use of a steep climb angle, the best angle-of-climb speed should be used with flaps up and maximum power. Climbs at speeds lower than the best rate-of-climb speed should be of short duration to improve engine cooling.

CRUISE

Normal cruising is performed between 55% and 75% power. The engine RPM and corresponding fuel consumption for various altitudes can be determined by using your Cessna Power Computer or the data in Section 5.

NOTE

Cruising should be done at a minimum of 75% power until a total of 25 hours has accumulated or oil consumption has stabilized. Operation at this higher power will ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The data in Section 5 shows the increased range and improved fuel economy that is obtainable when operating at lower power settings. The use of lower power settings and the selection of cruise altitude on the basis of the most favorable wind conditions are significant factors that should be considered on every trip to reduce fuel consumption.

THIS DATA APPLICABLE ONLY TO AIRPLANES WITH LYCOMING O-235-L2C ENGINE. FOR AIRPLANES WITH ENGINE MODIFIED TO O-235-N2C, REFER TO DATA IN SECTION 9 SUPPLEMENT.

	75% POWER		65% POWER		55% POWER	
ALTITUDE	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
Sea Level	99	16.3	93	17.6	86	19.1
4000 Feet	102	16.8	96	18.1	88	19.6
8000 Feet	106	17.4	99	18.7	90	20.1
Standard Conditions					Zero Wind	

Figure 4-3. Cruise Performance Table

The Cruise Performance Table, figure 4-3, shows the true airspeed and nautical miles per gallon during cruise for various altitudes and percent powers. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude and power setting for a given trip.

To achieve the recommended lean mixture fuel consumption figures shown in Section 5, the mixture should be leaned until engine RPM peaks and drops 25-50 RPM. At lower powers it may be necessary to enrichen the mixture slightly to obtain smooth operation.

Carburetor ice, as evidenced by an unexplained drop in RPM, can be removed by application of full carburetor heat. Upon regaining the original RPM (with heat off), use the minimum amount of heat (by trial and error) to prevent ice from forming. Since the heated air causes a richer mixture, readjust the mixture setting when carburetor heat is to be used continuously in cruise flight.

The use of full carburetor heat is recommended during flight in very heavy rain to avoid the possibility of engine stoppage due to excessive water ingestion. The mixture setting should be readjusted for smoothest operation.

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

Exhaust gas temperature (EGT) as shown on the optional Cessna Economy Mixture Indicator may be used as an aid for mixture leaning in cruising flight at 75% power or less. To adjust the mixture, using this indicator, lean to establish the peak EGT as a reference point and then enrichen the mixture by the desired increment based on figure 4-4.

MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Pilot's Operating Handbook and Power Computer)	25°F Rich of Peak EGT
BEST ECONOMY	Peak EGT

Figure 4-4. EGT Table

As noted in this table, operation at peak EGT provides the best fuel economy. This results in approximately 8% greater range than shown in this handbook accompanied by approximately a 4 knot decrease in speed.

Under some conditions, engine roughness may occur while operating at peak EGT. In this case, operate at the Recommended Lean mixture. Any change in altitude or throttle position will require a recheck of EGT indication.

FUEL SAVINGS PROCEDURES FOR FLIGHT TRAINING OPERATIONS

For best fuel economy during flight training operations, the following procedures are recommended.

1. Lean the mixture for maximum RPM during climbs above 3000 feet. The mixture may be left leaned for practicing such maneuvers as stalls.
2. Lean the mixture for maximum RPM during all operations at any altitude, including those below 3000 feet, when using 75% or less power.

NOTE

When cruising at 75% or less power, the mixture may be further leaned until the RPM peaks and drops 25-50 RPM. This is especially applicable to cross-country training flights, but may also be practiced during transition flights to and from the practice area.

Using the above recommended procedures can provide fuel savings of up to 13% when compared to typical training operations at a full rich mixture.

STALLS

The stall characteristics are conventional for the flaps up and flaps down conditions. The stall warning horn produces a steady signal 5 to 10 knots before the actual stall is reached and remains on until the airplane flight attitude is changed. Stall speeds for various combinations of flap setting and bank angle are summarized in Section 5.

LANDING

Normal landing approaches can be made with power-on or power-off at speeds of 60 to 70 KIAS with flaps up, and 55 to 65 KIAS with flaps down. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds.

Actual touchdown should be made with power-off and on the main wheels first. The nose wheel should be lowered smoothly to the runway as speed is diminished.

SHORT FIELD LANDING

For a short field landing in smooth air conditions, make an approach at 54 KIAS with 30° flaps using enough power to control the glide path. After all approach obstacles are cleared, progressively reduce power and maintain 54 KIAS by lowering the nose of the airplane. Touchdown should be made with power-off and on the main wheels first. Immediately after touchdown, lower the nose wheel and apply heavy braking as required. For maximum brake effectiveness, retract the flaps, hold full nose-up elevator, and apply maximum brake pressure without sliding the tires.

Slightly higher approach speeds should be used under turbulent air conditions.

CROSSWIND LANDING

When landing in a strong crosswind, use the minimum flap setting required for the field length. Use a wing low, crab, or a combination method of drift correction and land in a nearly level attitude.

BALKED LANDING

In a balked landing (go-around) climb, the wing flap setting should be reduced to 20° immediately after full power is applied. Upon reaching a safe airspeed, the flaps should be slowly retracted to the full up position.

COLD WEATHER OPERATION

Prior to starting with temperatures below freezing, it is advisable to pull the propeller through several times by hand to "break loose" or "limber" the oil, thus conserving battery energy.

NOTE

When pulling the propeller through by hand, treat it as if the ignition switch is turned on. A loose or broken ground wire on either magneto could cause the engine to fire.

Preheat is generally required with outside air temperatures below -18°C (0°F) and is recommended when temperatures are below -7°C (20°F).

Cold weather starting procedures are as follows:

With Preheat:

1. Ignition Switch -- OFF.
2. Throttle -- CLOSED.
3. Mixture -- IDLE CUT-OFF.
4. Parking Brake -- SET.
5. Prime -- 2 to 4 STROKES as the propeller is being turned over by hand. RECHARGE for priming after engine start.

NOTE

Caution should be used to ensure the brakes are set or a qualified person is at the controls.

6. Mixture -- RICH.
7. Throttle -- OPEN 1/2 to 3/4 INCH.
8. Propeller Area -- CLEAR.
9. Master Switch -- ON.
10. Ignition Switch -- START (release when engine starts).
11. Prime -- AS REQUIRED until the engine runs smoothly.

12. Throttle -- ADJUST for 1200 to 1500 RPM for approximately one minute after which the RPM can be lowered to 1000 or less.
13. Oil Pressure -- CHECK.
14. Primer -- LOCK.

Without Preheat:

The procedure for starting without preheat is the same as with preheat except the engine should be primed an additional two strokes while pulling the propeller through by hand. Carburetor heat should be applied after the engine starts. Leave the carburetor heat on until the engine runs smoothly.

NOTE

If the engine fires but does not start or continue running, repeat the above starting procedure beginning with step 6. If the engine does not start during the first few attempts, or if engine firing diminishes in strength, it is possible that the spark plugs have been frosted over, in which case preheat must be used before another start is attempted.

During cold weather operations, no indication will be apparent on the oil temperature gage prior to takeoff if outside air temperatures are very cold. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), accelerate the engine several times to higher engine RPM. If the engine accelerates smoothly and oil pressure remains normal and steady, the airplane is ready for takeoff.

When operating in temperatures below -18°C, avoid using partial carburetor heat. Partial heat may increase the carburetor air temperature to the 0° to 21°C range, where icing is critical under certain atmospheric conditions.

NOISE CHARACTERISTICS

Increased emphasis on improving the quality of our environment requires renewed effort on the part of all pilots to minimize the effect of airplane noise on the public.

We, as pilots, can demonstrate our concern for environmental improvement, by application of the following suggested procedures, and thereby tend to build public support for aviation:

1. Pilots operating aircraft under VFR over outdoor assemblies of

persons, recreational and park areas, and other noise-sensitive areas should make every effort to fly not less than 2000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.

2. During departure from or approach to an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas.

NOTE

The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet is necessary for him to adequately exercise his duty to see and avoid other aircraft.

The certificated noise level for the Model A152 at 1670 pounds maximum weight is 64.8 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

AEROBATIC PROCEDURES

RECOMMENDED ENTRY SPEEDS FOR AEROBATIC MANEUVERS

The following speeds are based on a maximum weight of 1670 pounds and may be used for any lesser weight.

MANEUVER	RECOMMENDED ENTRY SPEED
Chandelles	105 KIAS
Lazy Eights	105 KIAS
Steep Turns	100 KIAS
Stall (except whip stalls)	Use Slow Deceleration
Spins	Use Slow Deceleration
Loops	115 KIAS
Cuban Eights	130 KIAS
Immelmanns	130 KIAS
Aileron Rolls	115 KIAS
Barrel Rolls	115 KIAS
Snap Rolls	80 KIAS
Vertical Reversements	80 KIAS

AEROBATIC CONSIDERATIONS

The 152 Aerobat is certificated in the Acrobatic Category for the maneuvers listed in this section. All of these maneuvers and their various combinations can be performed well within the +6.0 to -3.0g flight maneuvering envelope approved for the airplane. However, before attempting any of the approved aerobatics, each of the following items should be considered to assure that the flights will be safe and enjoyable.

MANEUVER LIMITATIONS

Aerobatic maneuvers (including spins) with flaps extended are not approved since the high speeds which may occur during recovery are potentially damaging to the flap/wing structure. Inverted flight maneuvers are not approved. Refer to Section 2 for additional information on aerobatic limitations.

DUAL INSTRUCTION

No aerobatic maneuvers should be attempted without first having received dual instruction from a qualified aerobatic instructor.

PHYSICAL CONDITION

The pilot should be in good physical condition and mentally alert. Initial indoctrination flights should be limited to a maximum of 30 to 45 minutes so that the pilot can become gradually conditioned to the unusual flight attitudes that are typical of this type of flying.

LOOSE EQUIPMENT AND BAGGAGE

The cabin should be clean and all loose equipment (including the microphone) should be stowed. For solo aerobatic flight, the co-pilot's seat belt and shoulder harness should be secured. Aerobatic maneuvers with baggage loadings are not approved.

SEAT BELTS AND SHOULDER HARNESSES

The seat belts and shoulder harnesses should be adjusted to provide proper restraint during all anticipated flight conditions. However, care should be taken to ensure that the pilot can easily reach the flight controls and produce maximum control travels.

PARACHUTES

It is recommended that parachutes be worn during aerobatic flight, as required by government regulations. The parachutes must be inspected to determine that they are in good condition and are within the packing dates required by government regulations.

If a back pack parachute is used, the seat backs can be unfastened and temporarily stowed by attaching them to the aft surfaces of the individual seat backs. If a seat pack is used, the bottom cushion should be removed from the airplane. This is done by simply pulling the cushion away from the adhesive material on the seat pan.

FEDERAL AVIATION REGULATIONS

The pilot should be familiar with government regulations pertaining to aerobatic flight. In the United States, 1500 feet above the surface is the minimum legal altitude for conducting aerobatic maneuvers. However, higher altitudes are recommended. The selection of aerobatic practice areas should be in accordance with government regulations and in some cases, after consulting local aviation authorities.

CABIN DOOR JETTISON SYSTEM

The cabin door jettisoning mechanism should be actuated on the ground to demonstrate to each student the sequence of operation and physical results of this action. An outside attendant should be standing by to catch the door when it is released from inside the cabin.

The pilot should be thoroughly familiar with the bail-out procedures listed in Section 3 of this handbook.

APPROVED MANEUVERS

The same training maneuvers approved for the Model 152 are also approved for the 152 Aerobat. These include spins, chandelles, lazy eights, steep turns (over 60° bank), and stalls (except whip stalls). Additional aerobatic maneuvers authorized for the 152 Aerobat are loops, barrel rolls, aileron rolls, snap rolls, Cuban 8's, Immelmanns, and vertical reversements.

Recommended procedures and techniques for performing the more advanced maneuvers are on the following pages.

SPIN

The spin is a prolonged stall that results in a nose-down rapid rotation of the airplane following a helical path. The rotation is the result of a dropping wing experiencing a higher angle of attack than the rising wing (the dropping wing is in effect "more stalled") which produces an increased lift on the rising outer wing and increases drag on the dropping inner wing which leads to a sustained "autorotation." During the first two to three turns, the spin accelerates until the aerodynamic forces are balanced by the centrifugal and gyroscopic forces produced by the airframe. Beyond this point, the rotation rates tend to be more stable and repeatable. Spin recovery requires that this balance of forces be broken by a combination of control inputs which generate aerodynamic forces to oppose the spin.

It is recommended that, where feasible, entries be accomplished at high enough altitude that recoveries are completed 4000 feet or more above ground level. At least 1000 feet of altitude loss should be allowed for a 1-turn spin and recovery, while a 6-turn spin and recovery may require somewhat more than twice that amount. For example, the recommended entry altitude for a 6-turn spin would be 6000 feet above ground level. In any case, entries should be planned so that recoveries are completed **well above** the minimum 1500 feet above ground level required by FAR 91.71. Another reason for using high altitudes for practicing spins is that a greater field of view is provided which will assist in maintaining pilot orientation.

The normal entry is made from a power-off stall. As the stall is approached, the elevator control should be smoothly pulled to the full aft position. Just prior to reaching the stall "break", rudder control in the desired direction of the spin rotation should be applied so that full rudder deflection is reached almost simultaneously with reaching full aft elevator. A slightly greater rate of deceleration than for normal stall entries or the use of partial power at the entry will assure more consistent and positive entries to the spin. Both elevator and rudder controls should be held full with the spin until the spin recovery is initiated. An inadvertent relaxation of either of these controls could result in the development of a nose-down spiral.

NOTE

Careful attention should be taken to assure that the aileron control is neutral during all phases of the spin since any aileron deflection in the direction of the spin may alter the spin characteristics by increasing the rotation rate and changing the pitch attitude.

For the purpose of training in spins and spin recoveries, a 1 to 2-turn

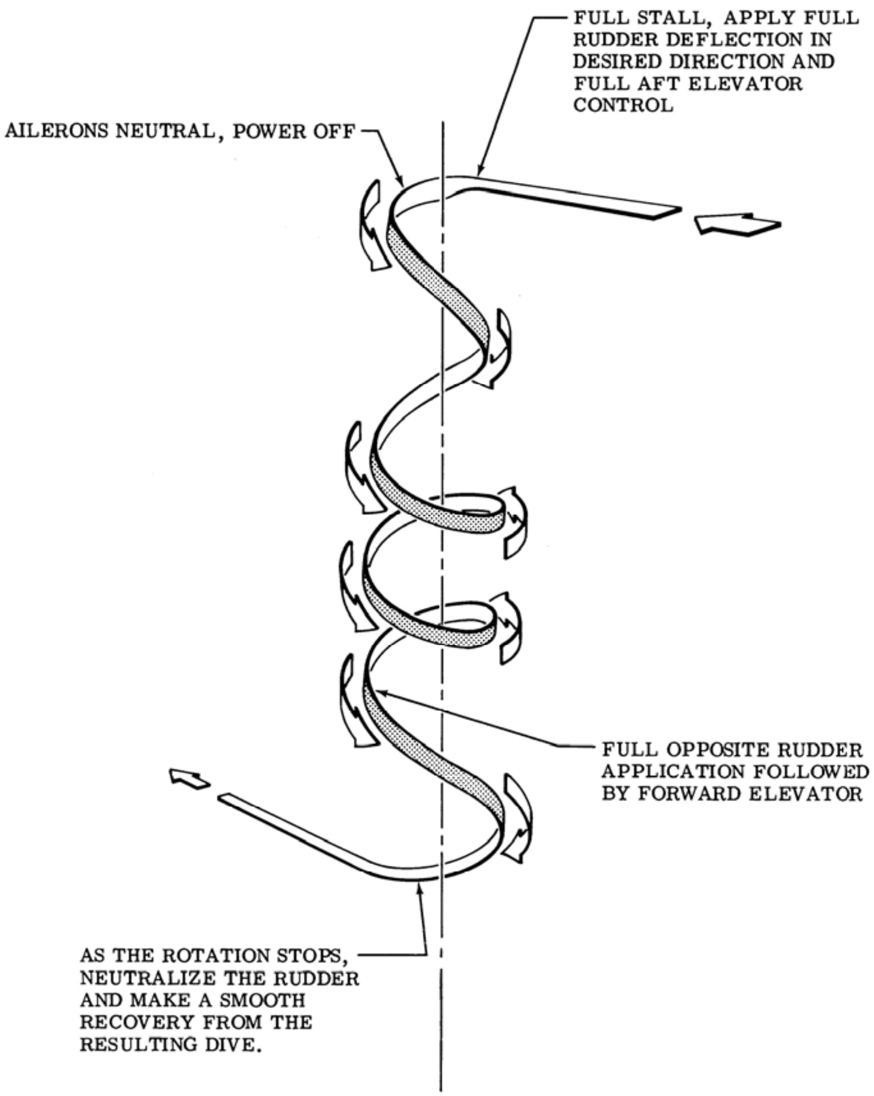

Figure 4-5. Spin

spin is adequate and should be used. Up to 2 turns, the spin will progress to a fairly rapid rate of rotation and a steep attitude. Application of recovery controls will produce prompt recoveries of from 1/4 to 1/2 of a turn.

If the spin is continued beyond the 2 to 3-turn range, some change in character of the spin may be noted. Rotation rates may vary and some additional sideslip may be felt. Normal recoveries may take up to a full turn or more.

Regardless of how many turns the spin is held or how it is entered, the following recovery technique should be used:

1. VERIFY THAT AILERONS ARE NEUTRAL AND THROTTLE IS IN IDLE POSITION.
2. APPLY AND **HOLD** FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.
3. JUST **AFTER** THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL **BRISKLY** FORWARD FAR ENOUGH TO BREAK THE STALL. Full down elevator may be required at aft center of gravity loadings to assure optimum recoveries.
4. **HOLD** THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the recovery control inputs may result in extended recoveries.
5. AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane in the turn coordinator or the needle of the turn and bank indicator may be referred to for this information.

Variations in basic airplane rigging or in weight and balance due to installed equipment or cockpit occupancy can cause differences in behavior, particularly in extended spins. These differences are normal and will result in variations in the spin characteristics and in the recovery lengths for spins of more than 3 turns. However, the above recovery procedure should always be used and will result in the most expeditious spin recovery.

LOOP

The normal loop is basically a 360 degree turn executed in the vertical plane. The maneuver consists of a climb, inverted flight, dive, and recovery to straight and level flight conducted in a series. The entire loop should be conducted with a positive g level on the airplane and at maximum power (within 2550 RPM limits).

The loop is entered from a shallow dive at 115 KIAS. A 2.5 to 3.0g pullup is initiated and a continuous elevator back pressure maintained throughout the inverted position. A slight relaxation of back pressure may be necessary to prevent stall buffeting from occuring through the downward side of the loop and to maintain the symmetrical pattern of the maneuver. Observation of landmarks through the skylight windows will aid in keeping the pilot oriented throughout the inverted portion of the loop.

Interesting variations of the basic loop may be performed by (1) including a quarter roll in the recovery dive, and (2) describing a cloverleaf pattern through a series of four consecutive loops with quarter rolls.

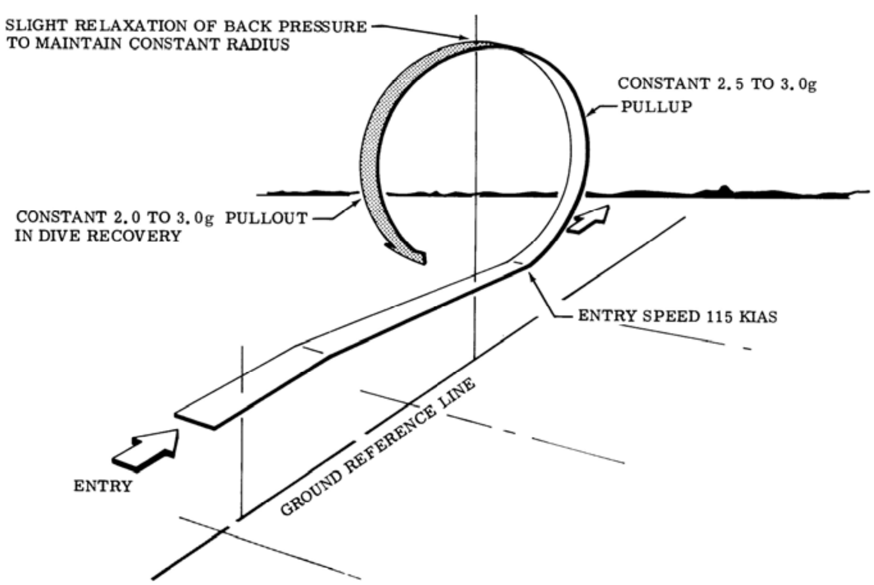

Figure 4-6. Loop

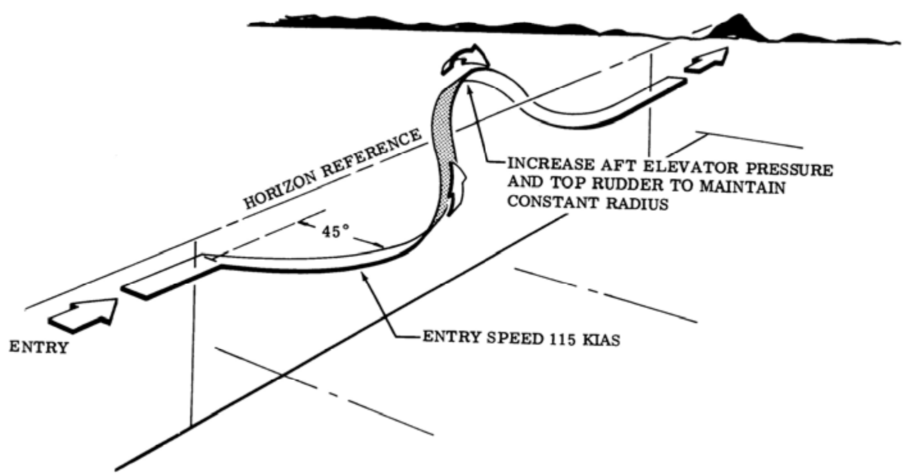

Figure 4-7. Barrel Roll

BARREL ROLL

The barrel roll is a coordinated maneuver in which the airplane is rolled 360 degrees around the longitudinal axis of the airplane while maintaining a constant radius around a point on the horizon. Particular emphasis is made on actually "flying" the airplane around the reference point.

The barrel roll is entered by diving the airplane to 115 KIAS while simultaneously turning to an entry heading approximately 45 degrees off of a selected reference point. During the entry, a gradual pullup is initiated and as the nose passes through the horizon a coordinated turn begun. After 45 degrees of turn, the airplane should be positioned in a 90 degree bank and the nose at its highest point. The roll is continued at a constant rate to the inverted position with the nose pointing 90 degrees from the original direction of entry. The nearly constant roll rate is continued until reaching the original entry heading in straight and level flight. A continuous elevator back pressure is required to maintain a positive g level throughout the maneuver. The recovery should be completed at or below the entry speed of 115 KIAS.

AILERON ROLL

The aileron roll is a coordinated maneuver in which the airplane is rolled 360 degrees around the longitudinal axis of the airplane. Unlike the barrel roll, the aileron roll is flown as a "tighter" maneuver and is accompanied by higher roll rates.

The maneuver is entered from a straight wings level dive at 115 KIAS. Then the nose is pulled up to 10 to 15 degrees above the horizon and a coordinated steep turn entry initiated. Aileron deflection is progressively increased until maximum deflection is obtained. Rudder and elevator should be coordinated throughout the maneuver to maintain the airplane nose position in the desired general direction. Full aileron deflection is held until a recovery to level flight is initiated. Recovery should be completed at or below the entry speed of 115 KIAS.

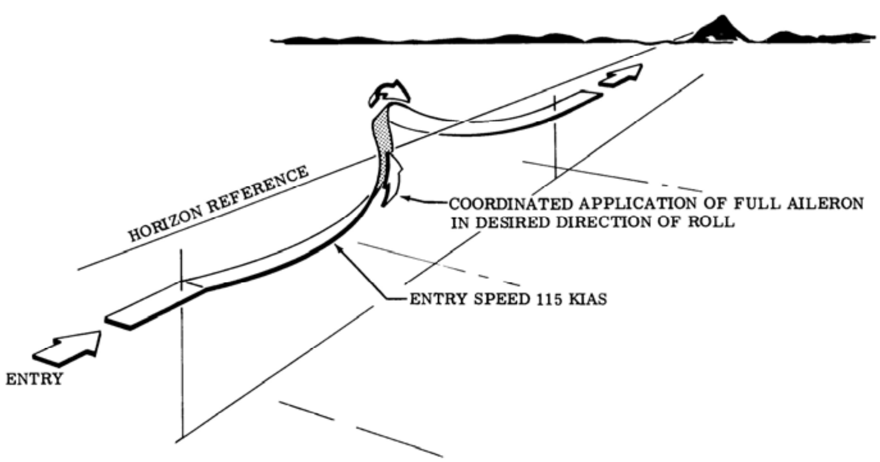

Figure 4-8. Aileron Roll

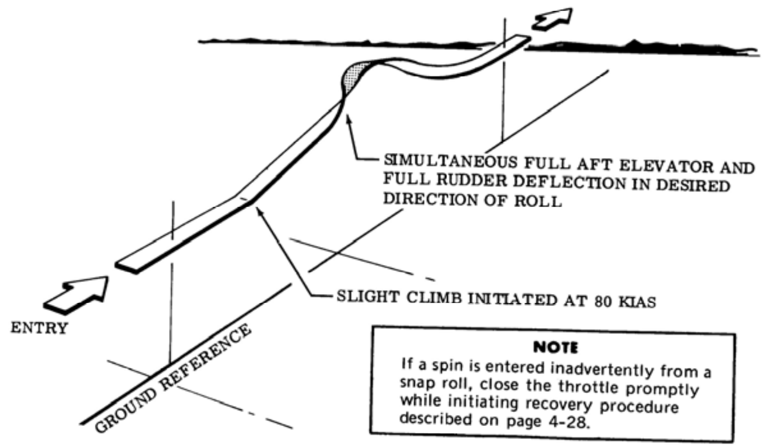

Figure 4-9. Snap Roll

SNAP ROLL

The snap roll is an accelerated stall maneuver in which yaw from full rudder deflection produces a roll. This results in a "spin" in a horizontal direction.

The entry to the snap roll is accomplished from a slight climb at 80 KIAS. At this speed the elevator control is abruptly pulled back to the full aft position while simultaneously applying full rudder in the desired direction of roll. The use of aileron in the direction of roll will prevent the nose from rising too high prior to the stall and will improve control through the roll. Recovery is accomplished by rapidly applying full rudder in the direction opposite to the roll followed by forward elevator control to break the stall. Timing of the recovery is highly dependent upon entry techniques. The use of aileron throughout the roll gives more latitude in timing the recovery control inputs which should be initiated after 2/3 to 3/4 of the roll is completed.

CUBAN EIGHT

The Cuban eight consists of approximately three-fourths of a normal loop and a diving half-roll followed in the opposite direction by another three-fourths of a loop and a half-roll.

The maneuver is entered from a dive at 130 KIAS. During the entry, the throttle is gradually retarded to prevent engine overspeed. A 3.5 to 4.0g pullup is initiated followed by a progressive throttle application to full power by the time a vertical position is reached. A positive g level should be pulled through the inverted portion of the maneuver to a point where the nose of the airplane is approximately 45 degrees below the horizon. At this point, the back pressure is slightly relaxed and a half aileron roll initiated.

A slight forward control pressure may be required on the last half of the roll to hold the nose on the desired heading and to keep the airplane in a diving configuration. The dive is continued until the entry speed of 130 KIAS is again reached and the same procedure should be repeated in the opposite direction. The throttle should be retarded on the diving portion of the maneuvers in the same manner as was done on the initial entry. The maneuver may be completed by a dive recovery to level flight.

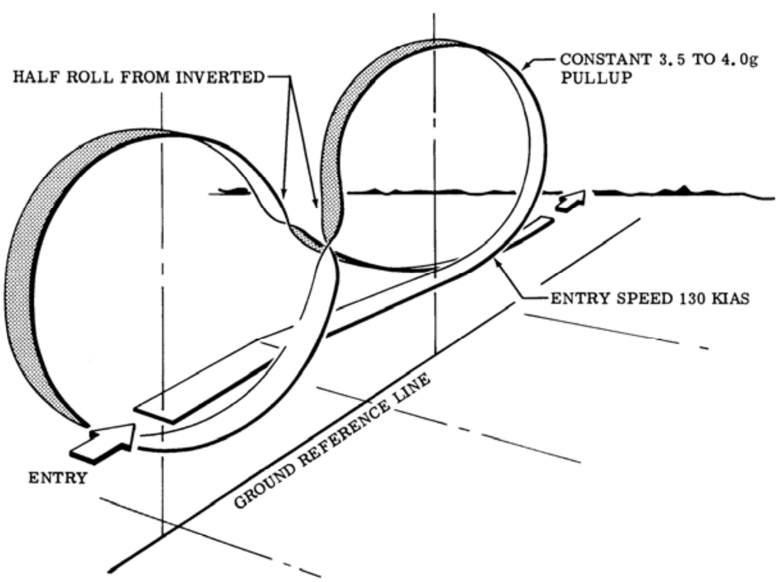

Figure 4-10. Cuban Eight

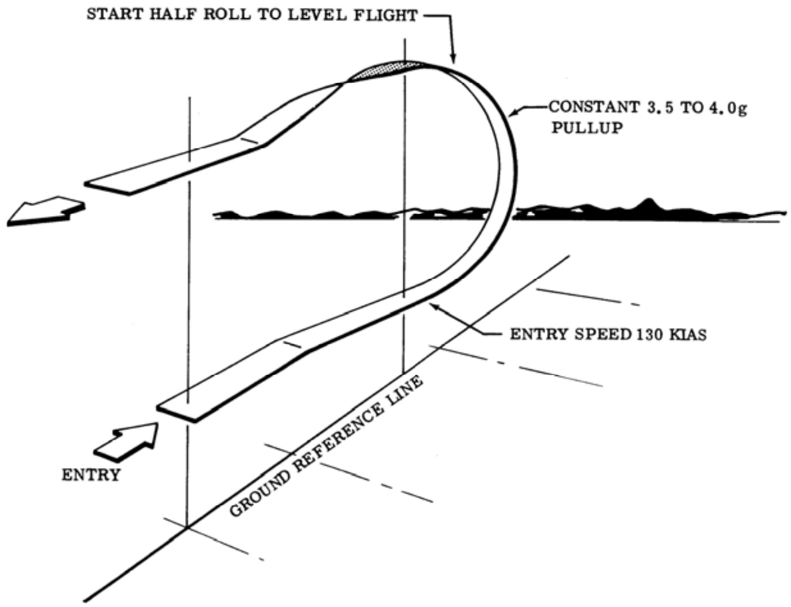

Figure 4-11. Immelmann

IMMELMANN

The Immelmann is a combination half loop followed by a half roll. A positive g level should be maintained throughout the maneuver.

The Immelmann is entered from a dive at 130 KIAS. During the entry, the throttle is gradually reduced to prevent engine overspeed. A 3.5 to 4.0g pullup is initiated followed by a progressive throttle application to full power by the time a vertical position is reached. As the airplane nears the inverted position, a slight relaxation of elevator back pressure should be accomplished and full aileron control deflection rapidly made in the direction of the desired roll. A smoother maneuver can be achieved by initiating the half roll with the nose approximately 30° above the horizon as viewed through the overhead skylight. As the half roll is executed, the nose is allowed to move smoothly down to the horizon. A slight forward pressure on the control wheel and bottom rudder are used initially followed by a smooth application of full top rudder in the final portion of the half roll.

VERTICAL REVERSEMENT

The vertical reversement is a half snap roll from a steep turn in one direction to a steep turn in the opposite direction.

Entry is accomplished from a 60 to 70-degree bank at 80 KIAS. Full top rudder should be applied followed by an application of full aft elevator control. As the airplane snaps over the top, aileron control is added in the direction of roll. The control wheel should then be eased forward and appropriate rudder and aileron controls used to re-establish a steep turn in the opposite direction. On recovery, the airplane should smoothly resume a banked turn with no distinct break in the turning motion. This maneuver may be performed in a sequence by turning 180° between each vertical reversement.

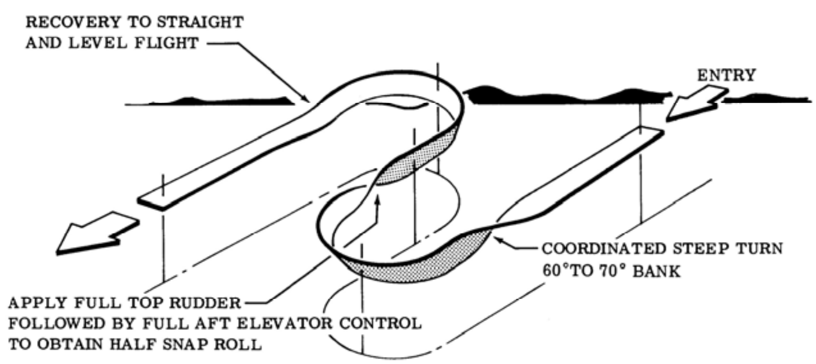

Figure 4-12. Vertical Reversement