# ALL-WEATHER OPERATION

section

IX

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The procedures set forth in this section may be repetitious, different from, or in addition to, the normal operating procedures in section II. Particular emphasis should be placed upon the recommendations shown in the instrument flight procedures of this section, because these steps and procedures are the minimum requirements whenever you are operating in IFR conditions.

NOTE

This airplane is in approach category E.

## INSTRUMENT FLIGHT PROCEDURES

This airplane has all the basic flight instruments and radio-navigation equipment for IFR flights, as well as the UHF command radio required to control the flight. The airplane can be flown on instruments at speeds in excess of Mach 1, and, though it is not ordinarily practical because of high fuel consumption, it can be flown at such speeds in cases of military or tactical necessity. The characteristic of the airplane in any asymmetric external load configuration presents somewhat of a problem during instrument flight. The use of the dampers will improve this characteristic. Refer to Flight With External Loads in section VI for recommended flight procedures with an asymmetrical configuration.

**WARNING**

Instrument flight in case of failure or suspected unreliability of the attitude indicators should be considered as an emergency situation. All available alternatives should be considered before partial panel techniques for weather penetration are attempted.

# JET PENETRATION- (TYPICAL)

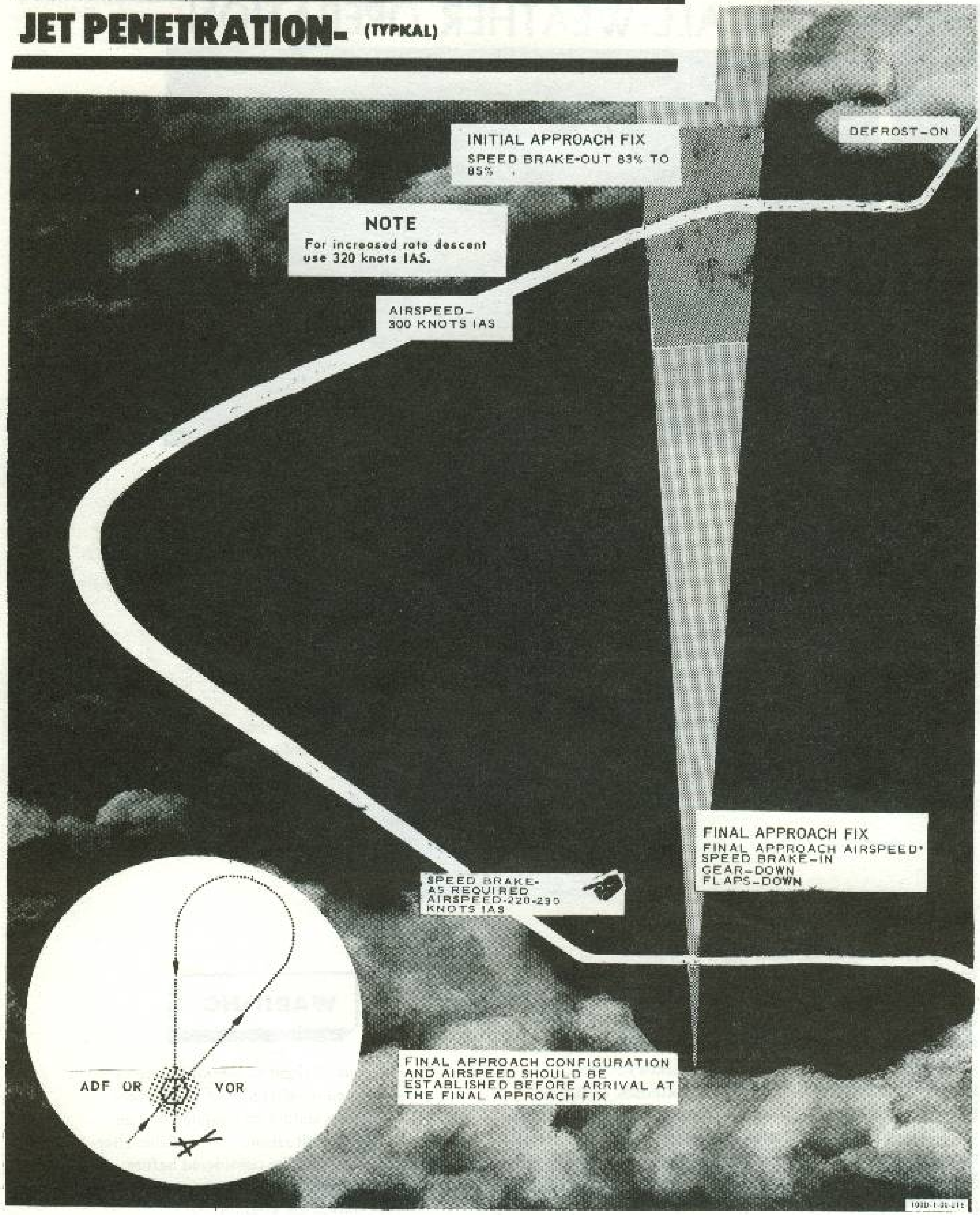


Figure 9-1 (Sheet 1 of 2)

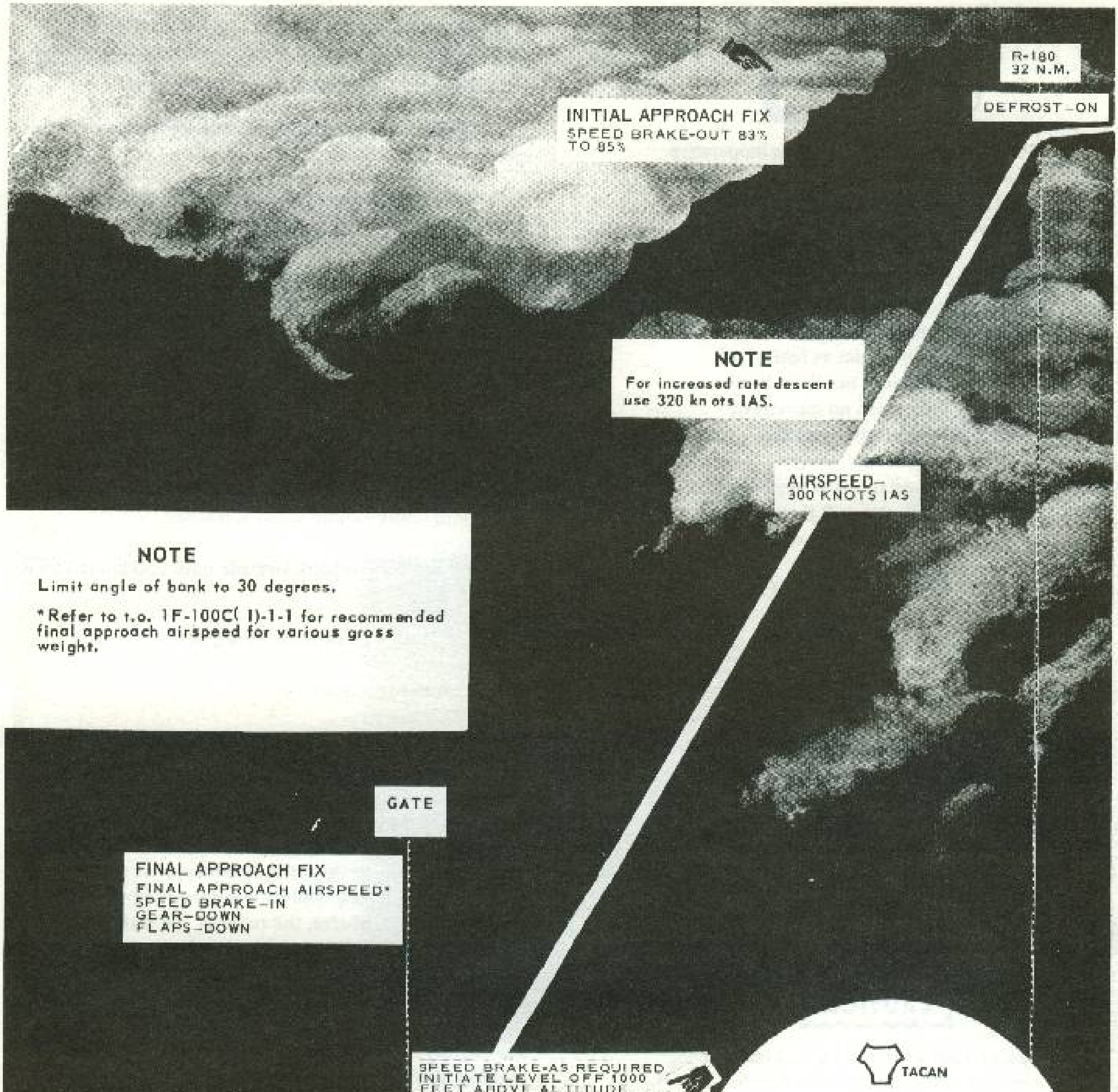


Figure 9-1 (Sheet 2 of 2)

**WARNING**

When the attitude indicator is inoperative and the turn-and-slip indicator is being used as a primary flight instrument, observe the following instructions.

- Avoid excessive rate of roll. The turn needle indicates a turn in the opposite direction during all entries into turns, and the error increases as rate of roll increases. The turn needle indicates correctly only when no movement occurs around longitudinal axis.

- Maintain a constant bank angle during turn. The indicator will then show correct direction and rate of turn.

## BEFORE INSTRUMENT TAKEOFF.

1. Line up visually with centerline of runway.

2. Heading indicator – Check with runway heading.

3. Attitude indicator – Set to level flight indication. Use the pitch trim knob to superimpose the miniature aircraft over the horizon bar.

4. Windshield exterior air switch – ON if ice has accumulated on windshield, or if forward visibility is restricted by rain. (Refer to Ice and Rain in this section.)

**CAUTION**

To prevent windshield glass breakage, use anti-ice system only to the degree required to ensure visibility.

5. Guidevane anti-icing switch-ON if icing conditions will be encountered during departure.

6. Canopy and windshield defrost level – INCREASE.

7. Hold brakes, and advance throttle to full MILITARY.

8. Check engine instruments and recheck all flight instruments.

## INSTRUMENT TAKEOFF AND CLIMB.

1. Release brakes and move throttle to AFTERBURNER.

2. Maintain zero net runway heading error with nose wheel steering. Use whatever outside reference is available, and use heading indicator for heading reference.

3. Initiate nose rotation at normal VFR nose rotation speed.

4. Rotate airplane approximately 8 to 10 degrees.

5. Landing gear and wing flaps up.

**NOTE**

Because of the reversal errors in the altimeter and vertical velocity indicator, do not retract the landing gear and wing flaps until a definite climb indication is established.

6. Maintain heading and attitude until 1000-feet-per-minute rate of climb is reached; then maintain this rate of climb until desired climb speed is reached.

7. Do not turn or bank airplane until 250 knots IAS is reached.

8. Limit angle of bank to 30 degrees.

9. Throttle as required.

**NOTE**

Continuous climbs using the afterburner should be avoided when possible because of the difficulty in detecting small pitch changes on the attitude indicator at steep climb angles. During afterburner climbs at low altitudes, the range of the vertical velocity indicator is exceeded.

## INSTRUMENT CRUISING FLIGHT.

Use normal techniques and procedures for instrument cruising flight.

## RADIO-NAVIGATION EQUIPMENT.

The radio compass and TACAN are provided for en route navigation. Because the radio compass is highly susceptible to precipitation and electrical static, its reliability is considerably reduced by thin overcasts, haze, dust, and thunderstorm activity. Because of these characteristics, the automatic features of the radio compass should not be depended upon during flight under these weather conditions. When flying through areas of interference-type weather, the TACAN should be used because of clearer reception and a more stable heading indication of the visual features of the system.

## HOLDING OR LOITERING ON INSTRUMENTS.

Ease of handling and minimum fuel consumption are major factors to be considered in determining loitering or holding speed. The maximum endurance speeds are based on these factors. For the recommended holding or loitering speed which varies with altitude, gross weight, and drag, refer to T.O. 1F-100C(I)-1-1.

**NOTE**

When air traffic procedures require holding at a specific airspeed not compatible with maximum endurance speed, fuel consumption will be higher.

- Holding above 30,000 feet with asymmetrically mounted loads is not practical because of thrust requirements.

## INSTRUMENT LETDOWNS.

On IFR cross-country flights, the letdown procedures at the destination should be checked and fuel allowances made as part of preflight planning.

**NOTE**

Because precipitation impairs forward visibility during approach, turn on windshield anti-icing and rain removal system for landing.

Descents on instruments can be made without difficulty at any speed, though care should be taken not to get into too steep a descent.

### Jet Penetration and Approaches.

**NOTE**

This airplane is in approach category E. Approach categories are based on airplane approach speed at maximum landing gross weight. Category E is approach speed greater than 165 knots, weight not considered.

Penetrations have been set up to provide a high-speed and high-rate-of-descent letdown from altitudes to a point where a VFR approach or an instrument approach (radio range, ADF, TACAN, radar, or ILS) can be made. (See figures 9-1 and 9-2, for typical penetrations and approaches.)

### Low-speed Penetrations.

If the speed brake is unusable for any reason, a low-speed penetration will provide a rate of descent similar to a normal speed brake extended penetration. The initial penetration is accomplished at 220 knots IAS with landing gear and wing flaps down, and 85% rpm. Before final approach, the landing gear and wing flaps may be positioned as desired.

**NOTE**

If utility hydraulic system failure has occurred, leave landing gear and wing flaps down.

On final approach, lower landing gear and wing flaps.

## CIRCLING APPROACH.

1. Landing gear down and flaps intermediate prior to final approach fix.

2. Airspeed 200 KIAS or computed final approach speed plus 20 knots whichever is higher.

3. On base leg, lower full flaps and fly a normal approach.

**NOTE**

A circling approach is difficult and demanding because of the reduced maneuverability in the circling configuration and a visual perspective that differs considerably from a normal VFR approach. The normal tendency when flying a low altitude circling approach is to fly the pattern too tightly and overshoot the turn to final. Aircraft turning radius is larger when making the level or slightly descending turn to final involved in a circling approach.

- The slab will retrim nose down when the flaps are moved from intermediate to full down.

### Missed Approach.

1. Advance throttle as required and check speed brake in.

2. Establish climb attitude.

3. Retract landing gear after vertical velocity indicator and altimeter show a positive rate of climb.

4. Flaps up at no flap final approach speed for weight (half flap setting may be used to aid in acceleration).

5. Accelerate to 230 knots IAS or as desired.

# RADAR APPROACH (TYPICAL)

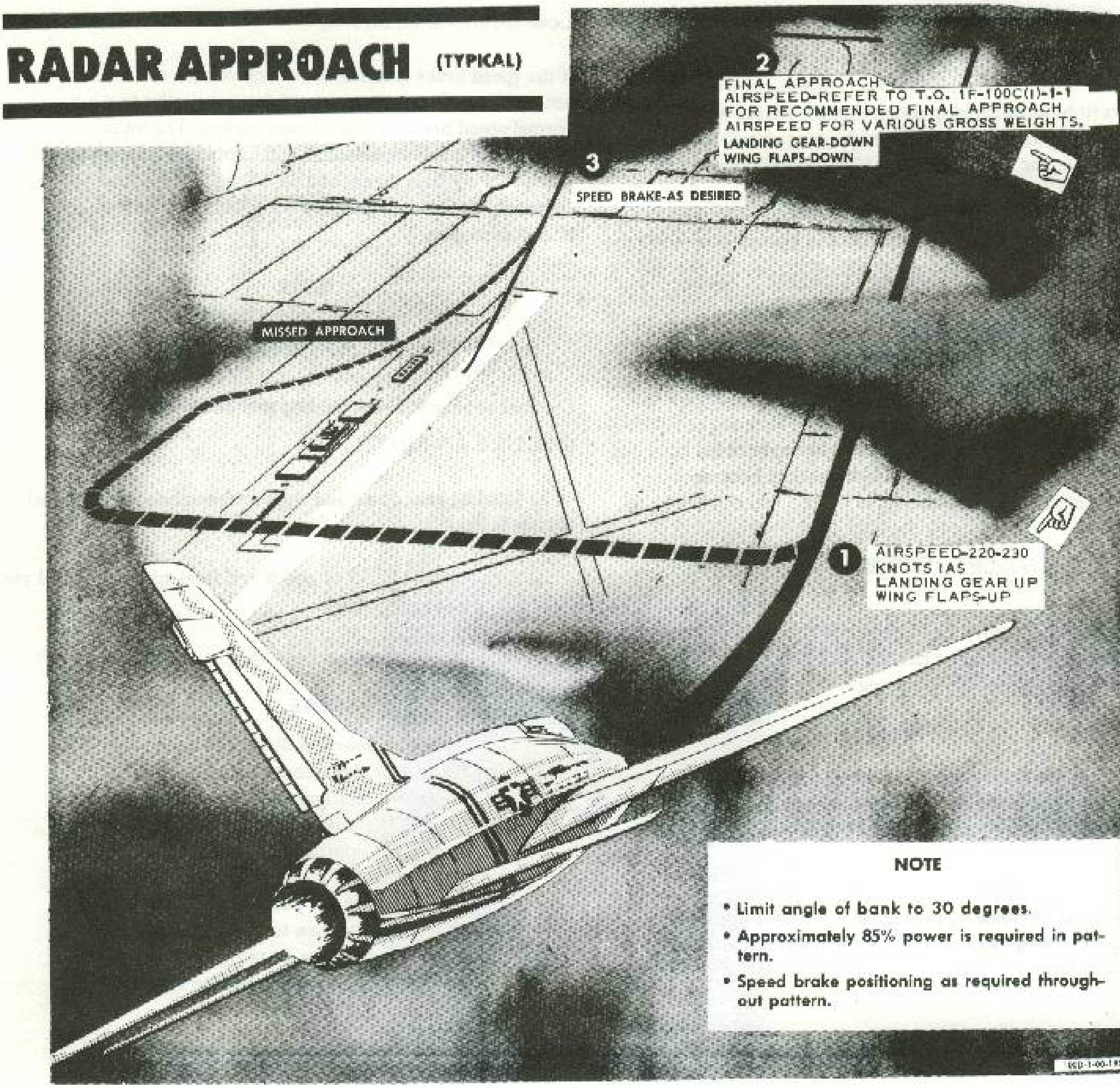


Figure 9-2

6. Fly missed approach as published or as instructed by the controlling agency.

## ICE AND RAIN

This airplane does not have a wing and tail surface anti-icing system. Flights under icing conditions may be made, provided a speed of Mach .85 to Mach .90 (depending on outside air conditions) is maintained. At slower speeds, in case of ice formation on the airplane, airspeed should be increased, altitude should be changed, or the icing region should be left. The windshield anti-icing outlets are capable of anti-icing the windshield and removing rain of moderate intensity. However, under certain conditions in the rain, visibility will be affected. If mist or light rain is encountered, visibility will not be affected. In moderate rain, use of the windshield anti-icing system will improve vision. The windshield will be streaked, but reasonable visibility will be retained. In heavy rain, visibility will be completely obscured except for a small area next to the outlets of the anti-icing system.

**CAUTION**

The forward windshield may become completely obscured in heavy rain, particularly when power is reduced toward IDLE during approach and landing. Visual reference to the runway can then be maintained only through the sides of the canopy behind the canopy bow.

The anti-icing and rain removal system should be turned on only to the degree required to ensure visibility under the following circumstances:

1. Ice accumulation on the windshield in normal flight.

2. In rain during normal approach and landing.

3. During letdown when it is known or suspected that icing or rain may prevail at low altitudes or on the ground.

4. Removal of ice or rain when the airplane is on the ground.

5. During takeoff into anticipated icing conditions or when forward visibility is restricted because of rain.

6. When approaching a thunderstorm.

The cockpit temperature should be set as cold as practical for operation of the airplane in conditions where it is necessary to use the windshield anti-icing or rain removal system.

**NOTE**

If the heat and vent caution light comes on, or if the cockpit pressure selector switch is in the OFF or RAM AIR ON position, the windshield anti-icing and rain removal system should not be operated unless a clear windshield is absolutely necessary.

Icing of the engine air inlet area is always possible during operation in weather with temperatures at or near the freezing point. An engine surge with a loss of thrust (no mechanical difficulties present) can indicate engine icing. A major rise in exhaust temperature will normally not be experienced with engine icing on this type of engine.

**CAUTION**

If engine icing occurs, the throttle should be retarded immediately to about 85% rpm until the engine stabilizes, and an effort should be made to leave the icing area. Low airspeed and high engine rpm are most conducive to engine icing.

During takeoff into fog or low clouds, when temperatures are at, or near freezing, the engine could be subject to icing. When these conditions exist, the airplane should be accelerated to 275 knots IAS as rapidly as possible. Avoid atmospheric icing conditions whenever feasible. Many areas of probable icing conditions can be avoided by careful flight planning, using available weather information. The following are conditions under which engine icing can occur without wing icing when the temperature is between -10°C (14°F) and 5°C (41°F), if fog is present, or if the dew point is within 4°C (7°F) of the outside temperature. If the outside air temperature is in the range of 0°C (32°F) to 5°C (41°F), the speed of the airplane should be maintained at 275 knots IAS or above to prevent inlet duct icing. If engine icing conditions are encountered at freezing atmospheric temperatures, immediate action should be taken as follows:

1. Change altitude rapidly, or vary course to avoid icing conditions.

2. Establish 275 knots IAS to minimize rate of ice build-up.

3. Maintain a close watch of exhaust temperature, and reduce engine rpm as necessary to prevent excessive exhaust temperature.

4. Guide-vane anti-ice switch – ON.

Another serious form of engine icing that should be avoided, if possible, is that of ice going into the engine. Flight tests have proved that engine flame-outs can occur because of heavy ice accumulating around the inlet duct, dislodging, and entering the engine. Flame-outs due to this condition can occur within 4 to 5 minutes after entering an area of severe icing conditions. To reduce this hazard, avoid flight conditions that are conducive to the rapid accumulation of ice. Flame-out from this type of weather hazard is recognized by a pronounced compressor stall, followed by a drop in rpm and exhaust temperature. When a flame-out has occurred from ice entering the engine and an air start has been successful, maintain the lowest rpm permissible to make a safe landing. After landing, make a notation in the Form 781 to request an engine damage inspection.

**WARNING**

Heavy ice accumulations can cause wing slats to function incorrectly and/or stall speeds to be greatly increased; therefore, extreme caution must be used when landing under such conditions, and increased approach speed may be necessary.

## TURBULENCE AND THUNDERSTORMS

Before entering an area of turbulence and thunderstorms, throttle and pitch attitude required for the desired penetration airspeed should be established, for they are the keys to proper flight technique in turbulent air. Throttle setting and pitch attitude, if maintained throughout the storm, will normally result in constant airspeed, regardless of any false readings of the airspeed/Mach indicator.

**BEST PENETRATION SPEED**

**275**

**KNOTS IAS**

### ENGINE SURGE AND FLAME-OUT CAUSED BY ADVERSE WEATHER CONDITIONS.

The following factors, singly or in combination, can cause engine flame-out:

1. Penetration of cumulus build-ups with associated high liquid content.

2. Engine icing of either nose accessory section cover or inlet guide vanes.

3. Turbulence associated with penetration can result in excessive nose-up angles of attack, causing marginal engine performance.

4. Above 40,000 feet, the surge margin of the engine is reduced and there is poor air distribution across the face of the compressor.

**CAUTION**

Flying in turbulence or hail may increase inlet duct distortion. At higher altitudes, this distortion can result in engine surge and possible flame-out. However, normal air starts may be accomplished, as outlined in section III.

Areas of turbulent air, hail storms, or thunderstorms should be avoided whenever possible, because of the increased danger of engine flame-out. Exhaust temperature gage and engine pressure ratio gage should be monitored continuously during weather penetration. Exhaust temperature indication alone may come too late to enable the pilot to take timely corrective action. The engine guide vane anti-icing system prevents the formation of ice and is not a de-icer. Whenever possible, icing conditions should be anticipated in advance and the engine guide vane anti-icing switch should be turned to ON to warm up the engine air inlet. If ice has already begun to build up before the engine guide vane anti-icing system is turned on, reduce the throttle setting to minimize the danger of internal engine damage until all ice has broken off and been ingested by the engine. When the presence of ice is no longer evident, check the engine at IDLE, then advance the throttle to any desired setting.

## NIGHT FLYING

There are no specific techniques for flying this airplane at night that differ from those for day flight.

**CAUTION**

- Landing and taxi lights may be used during takeoff; however, the moving light beams may cause disorientation during airplane rotation.
- [F] During night operation, refraction of light through the canopy to the rear cockpit may cause what appears to be a shift of runway lights. Caution must be used during night landing to accurately align with the runway.

## COLD-WEATHER PROCEDURES

Cold-weather procedures differ from normal procedures in that additional precautions are required during ground operation. Flight operations are identical for the most part, and over-all problems are considerably reduced with jet engines. Icing conditions are not covered here, but are covered under Ice and Rain. Because cold-weather procedure is concerned primarily with extreme low-temperature operation, the procedures set forth are additions or exceptions to the normal operating procedures in section II

**NOTE**

When using the alternate fuel (JP-5), refer to Alternate and Emergency Fuel Limitations in section V and Operation on Alternate or Emergency Fuel in section VII.

### BEFORE ENTERING AIRPLANE.

1. Check that all surfaces, ducts, struts, drains, and vents are free of snow and ice.

**CAUTION**

Remove all snow and ice from the wings, fuselage, and tail before flight. Depending on the weight and distribution of the snow and ice, takeoff distances and climb-out performance can be adversely affected. The roughness, pattern, and location of the snow and ice can affect stall speeds and handling characteristics to a dangerous degree. In-flight structural damage also may result, due to the vibrations induced by unbalanced loads of accumulated ice and snow.

2. Make sure airplane has been carefully inspected for fuel or hydraulic leaks caused by contraction of fittings or by shrinkage of packings.

3. Inspect area behind airplane to make sure water or snow will not be blown onto personnel or equipment during start.

### STARTING ENGINE.

JP-4 fuel has good starting characteristics for low-temperature starts and permits normal starting procedures.

**CAUTION**

To prevent possible damage to the ac generator drive unit, the engine should not be started following "cold-soaking" at temperatures below -40°C (-40°F), unless generator drive unit has been preheated to -40°C (-40°F) or warmer.

### WARM-UP AND GROUND CHECK.

Normally, engine warm-up is unnecessary. However, when the outside air temperature is below -35°C (-31°F) and the engine is started cold, it should be warmed up at idle rpm for about 2 minutes. Use firmly anchored wheel chocks for engine run-up.

CAUTION

To prevent possible damage to ac-powered electronic equipment, the following starting procedures should be observed: When outside air temperature is between -29°C (-20°F) and -34°C (-30°F), leave throttle at IDLE for 2 minutes before advancing to 72% rpm. When air temperatures are between -34°C (-30°F) and -40°C (-40°F), leave throttle at IDLE for 4 minutes before advancing to 72% rpm; however, during a start and warm-up following "cold soak" at -34°C (-30°F) to -40°C (-40°F), the ac generator caution light may go out at idle speed. In this event, no additional warm-up is required and the throttle may be advanced as desired. Operation of the ac generator drive unit should be normal on subsequent starts after it has been warmed up.

1. If there has been heavy rain, turn on canopy and windshield defrosting immediately after engine start.

2. Cycle flight controls four to six times. Check hydraulic pressure and control reaction.

## TAXIING.

1. Avoid taxiing in deep snow, as taxiing and steering are extremely difficult, and the brakes may freeze.

2. Increase distance between airplanes while taxiing at subfreezing temperatures to ensure safe stopping distance and to prevent icing of airplane surfaces by melted snow and ice in the jet blast of a preceding airplane.

3. Minimize taxi time to reduce amount of ice fog produced by engine.

## BEFORE TAKEOFF.

Make normal full-power engine check. However, if field conditions make this impossible, final checks must be made during the first part of the takeoff run.

## AFTER TAKEOFF.

NOTE

Under extreme cold-weather conditions, action of the burner pressure limiter in the engine fuel control unit could cause thrust surge or slight loss of rpm just after takeoff and before initial climb. (Refer to Engine Fuel Control Unit in section I.)

1. After takeoff from a wet snow-covered or slush-covered field, operate landing gear through several complete cycles to prevent gear freezing in retracted position. (Expect considerably slower operation of landing gear in cold weather due to stiffening of all lubricants.) Also, cycle wing slats by varying airspeed or applying G, to prevent their freezing in position.

2. Cross-check flight instruments continuously, as they may become unreliable during cold-weather operation.

## DESCENT.

The windshield and canopy defrosting system should be operated throughout the flight at the highest possible heat, consistent with pilot comfort, to preheat the canopy and windshield and maintain the glass temperature above the cockpit dew point in case circumstances require a rapid descent from altitude.

## BEFORE LEAVING AIRPLANE.

1. Leave canopy partially open to allow air circulation within cockpit to prevent canopy cracking and to decrease windshield and canopy frosting.

2. Whenever possible, leave airplane parked with full fuel tanks.

3. Check that battery is removed when airplane is parked outside at temperature below -29°C (-20°F) for more than 4 hours.

4. Check that proper protective covers are installed on airplane.

## HOT-WEATHER AND DESERT PROCEDURES

Hot-weather and desert procedures differ from normal procedures mainly in that additional precautions must be taken to protect the airplane from damage due to high temperatures and dust. Particular care should be taken to prevent the entrance of sand into the various airplane parts and systems (engine, fuel system, pitot-static system, etc.).

### BEFORE ENTERING AIRPLANE.

1. Check exposed portions of shock strut pistons for dust and sand, and have them cleaned if necessary.

2. Check inflation of shock struts and tires which may have become overinflated because of temperature increases.

3. Check tires carefully for blistering or cord separation, and be sure all protective covers are removed from airplane.

4. Check intake duct for accumulations of dust or sand.

5. Inspect area behind airplane to make sure sand or dust will not be blown onto personnel or equipment during starting operations.

### ON ENTERING AIRPLANE.

1. Check cockpit for excessive accumulation of dust or sand.

2. Check instruments and controls for moisture from high humidity, and ground-heat them if necessary to dry them.

3. Cockpit temperature rheostat – COLD.

4. Console air lever – INCREASE.

5. Cockpit temperature master switch – AUTO.

6. Complete as much of preflight cockpit check as possible before starting, to avoid prolonged ground running.

### BEFORE TAKEOFF.

Limit use of brakes as much as possible, because brake cooling is reduced when outside air temperature is high.

### TAKEOFF.

**NOTE**

It is imperative that takeoff be made at recommended speeds. When outside air temperature is high, do not lift nose wheel from runway too soon, because more than usual takeoff run will be required to obtain recommended takeoff speed.

### BEFORE LEAVING AIRPLANE.

1. Make sure that protective covers are installed immediately on pitot boom, canopy, and intake and exhaust ducts.

2. Before covering, the canopy should be opened slightly to permit air circulation within the cockpit.