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EMERGENCY PROCEDURES

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INTRODUCTION

This section provides recommended procedures for use in the event of emergency or abnormal operating conditions. It does not cover multiple emergencies. Pilots must recognize that single malfunctions will often affect operation of other aircraft systems and require corrective actions in addition to those contained in a specific emergency procedure.

Use of Checklists

Critical emergency checklist items are those actions which must be performed immediately if an emergency is not to be aggravated. These steps appear in CAPITAL letters to permit immediate identification. They must be committed to memory to permit accomplishment without reference to the Abbreviated Checklist.

Definitions of Landing Situations

The terms "land when practicable" and "land as soon as possible" are not used interchangeably. The direction to "land when practicable" means to land at home base or other suitable alternate. Air refueling is allowed when necessary in order to reach the suitable destination. Alteration of the original flight plan may or may not be required, depending on the flight limits which are imposed because of the emergency or abnormal operating situation.

The direction to "land as soon as possible" means land at the nearest suitable facility.

GROUND OPERATION

ENGINE FIRE

ENGINE FIRE DURING GROUND START

If there is evidence of fire during ground start, attempt to keep the engine rotating until the fire is out. Apply chemicals from outside the engine only as a last resort.

If a fire is evident during a start, or on notification:

1. THROTTLE - OFF.
2. CONTINUE CRANKING ENGINE.

NOTE

Continue motoring the engine when the starter remains engaged and fire is contained in the tailpipe. If the starter unit has disengaged, it can not be re-engaged until the engine has come to a complete stop.

3. EMERGENCY FUEL SHUTOFF SWITCH - FUEL OFF.
4. Battery switch - OFF.
5. Abandon aircraft.

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EMERGENCY OVER THE SIDE EGRESS

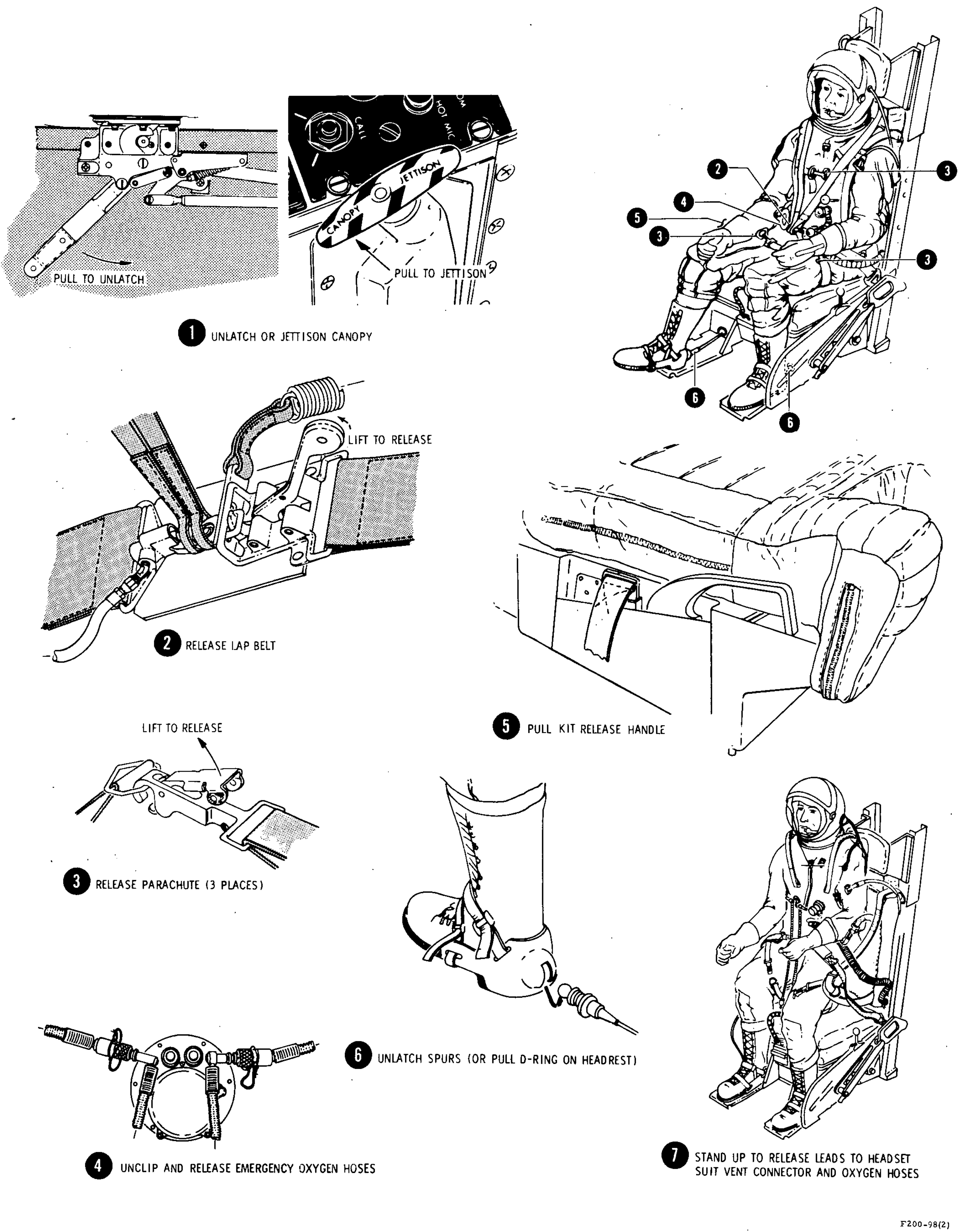

Figure 3-1

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ENGINE FIRE AFTER SHUTDOWN

Use applicable steps of Engine Fire During Ground Start procedure.

ABANDONING THE AIRCRAFT ON THE GROUND

In an emergency requiring ground abandonment, the primary concern is to leave the immediate area of the aircraft as soon as possible. The following procedures should be used when fire or explosion are probable. Salvaging emergency and survival equipment has not been considered. These procedures provide the fastest means of abandoning the aircraft and they should be accomplished as rapidly as possible after the decision to abandon the aircraft is made.

This procedure may be initiated while the aircraft is in motion; however, the lap belt should remain fastened until the aircraft is stopped.

To accomplish an emergency exit on the ground, proceed as follows:

1. Ejection seat safety pin - Install if time permits.
2. Survival kit release handle - Pull.
3. Seat belt and shoulder harness - Release.
4. Personal leads - Disconnect.
5. Parachute harness attachments - Release.
6. Foot spurs - Manually release, (use cable cutter if otherwise unable to release spurs).
7. Canopy - Unlatch or jettison as applicable.
8. Evacuate aircraft.

BRAKE, STEERING, OR TIRE FAILURE

Without anti-skid operating, extreme caution must be utilized to prevent wheel skid, as skidding is hard to detect due to aircraft size and weight. Tires may fail before a skid condition can be recognized and corrected. A main landing gear tire blow-out may be sensed by the pilot as a thump or muffled explosive sound.

If the ANTI-SKID OUT warning light illuminates or anti-skid braking is not effective:

1. Brake switch - ANTI-SKID OFF.

If normal brakes and/or nosewheel steering are not effective, or if L system hydraulic pressure is not available:

2. Brake switch - ALT STEER AND BRAKE.

NOTE

> If both engines are shut down with the aircraft moving, the brake switch should be left in the ANTI-SKID OFF position and steady brake pressure applied to a complete stop. The brakes should not be pumped, as accumulator pressure would be lost.

At landing weights, the aircraft can be taxied safely so long as one tire per main gear remains inflated. At takeoff weights, taxi distance should be minimized if one or two tires per main gear are flat in order to minimize the probability of further tire failures. Taxiing as necessary is permitted to clear a runway with all tires failed on a main gear, as the massive tire bead tends to protect the wheels for some distance.

EMERGENCY ENTRANCE

In the event that qualified ground personnel are not available, emergency entrance to the aircraft can be accomplished using the procedures illustrated by figure 3-2.

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CRASH RESCUE PROCEDURES

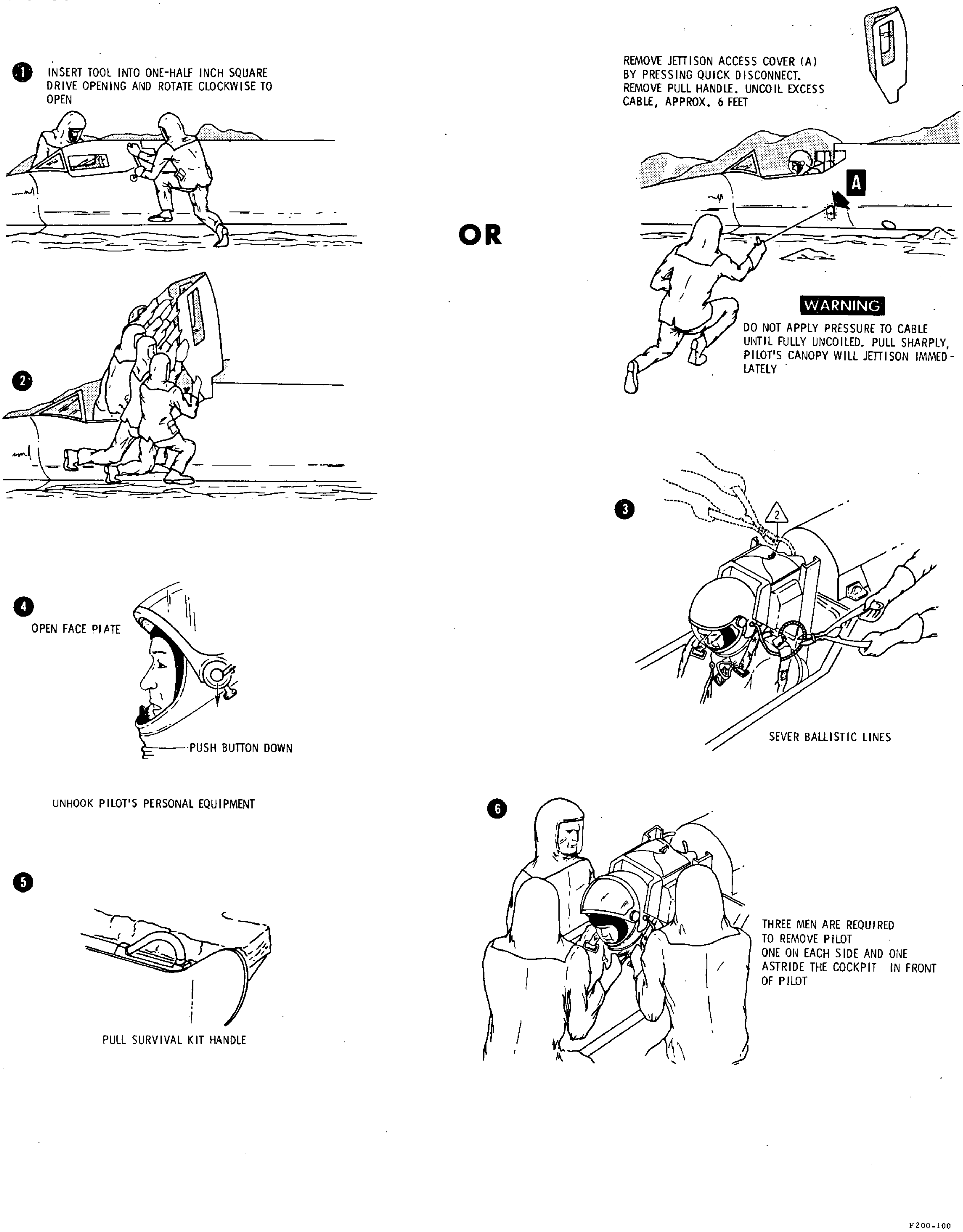

Figure 3-2

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TAKEOFF EMERGENCIES

PROPULSION SYSTEM

The components considered as parts of the propulsion system include the main engines, afterburners, inlets, nozzles, tailpipes, fuel controls, and fuel-hydraulic, lubrication, and ignition systems. If abnormal operation of any of these components is indicated prior to reaching the acceleration check distance, the takeoff should be aborted. Refer to ABORT procedure, this section. The following procedures apply after satisfactory completion of the acceleration check.

THRUST FAILURE DURING TAKEOFF, TAKEOFF REFUSED

If the acceleration check speed is marginal, or if the thrust of either engine decays or fails, and conditions permit:

1. ABORT.

   Refer to abort procedure, this section.

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

If an engine fails immediately after takeoff and the decision is made to continue, maintain Maximum thrust on the operating engine. Lateral and directional control can be maintained when airspeed remains above the minimum single engine control speed. See figure 3-3. However, ability to maintain altitude and to accelerate or climb depends on weight, drag, altitude, airspeed, and temperature. Refer to the appendix for takeoff climb capability data. When at heavy weight for the existing air temperature, dumping fuel may reduce weight sufficiently to remain airborne.

If able to maintain altitude or accelerate:

1. THROTTLES - MAXIMUM THRUST.

   Recheck position of both throttles to assure that maximum power is being obtained.

2. LANDING GEAR LEVER - UP.

3. CROSSFEED SWITCH - PRESS ON.

4. Fuel dump switch - DUMP (if necessary).

   Fuel dumping in addition to consumption by operating engine lightens the aircraft at an appreciable rate. If turning at sufficient speed, the inoperative engine will also discharge fuel from its afterburner.

5. Rudder trim - As necessary.

   Bank and sideslip toward the operating engine as necessary to maintain directional control and minimize drag. 7 to 9 degrees of rudder trim with bank and sideslip as needed to maintain course yields minimum drag in the critical speed range from 220 to 250 KIAS.

6. Throttle (failed engine) - OFF.

   WARNING

   Positively identify the failed engine before retarding the throttle.

If not mechanical failure:

7. ATTEMPT AIR START (refer to Air Start Procedure this section).

For obvious mechanical failure:

8. Emergency fuel shutoff switch - FUEL OFF.

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SINGLE ENGINE MINIMUM AERODYNAMIC CONTROL SPEED

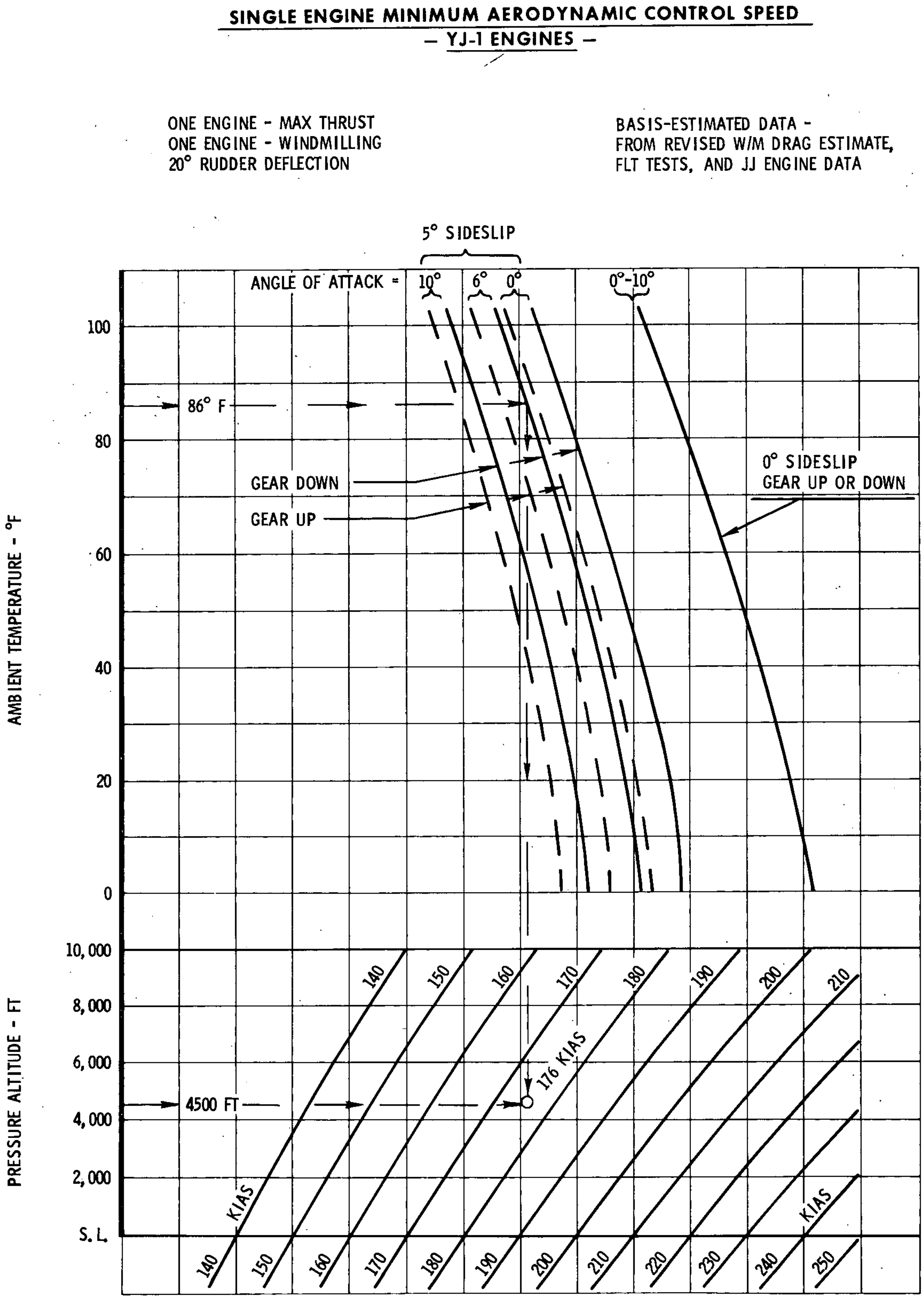

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Figure 3-3

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DOUBLE ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

If a double engine failure occurs, proceed as follows:

1. IF GEAR IS DOWN AND CONDITIONS PERMIT - LAND STRAIGHT AHEAD.

2. IF GEAR RETRACTION HAS BEEN INITIATED OR CONDITIONS DICTATE-EJECT.

WARNING

Decay of engine rpm will result in rapid loss of A and B hydraulic system pressure and subsequent loss of aircraft control.

AFTERBURNER FAILURE DURING TAKEOFF, TAKEOFF CONTINUED

If an afterburner fails before leaving the ground and a decision is made to continue, control failed engine as follows:

1. THROTTLE - MILITARY.

2. THROTTLE - MAXIMUM THRUST.

If unable to light afterburner:

3. THROTTLE - MILITARY.

4. Trim - As necessary.

5. Abort mission.

AFTERBURNER NOZZLE FAILURE

Nozzle failure may be indicated by nozzle position, excessive rpm fluctuations, or failure of the engine to control to scheduled speed. This may be accompanied by compressor stall and exhaust gas overtemperature. Engine shutdown may be necessary.

Nozzle Failed Open Immediately After Takeoff

In the event of a nozzle failed open indication:

Affected engine:

1. Throttle - Afterburner range.

2. RPM & EGT - Maintain within limits.

NOTE

In the event of extreme engine overspeed, if flight condition permits, retard throttle below Military or shut down.

3. Land as soon as practicable.

Nozzle Failed Closed

In the event of a nozzle failed closed condition:

Affected engine:

1. Throttle - Military or below, as required.

   Do not attempt to relight the afterburner as the engine may flameout (after which it cannot be restarted due to reduced rpm).

2. RPM and EGT - Maintain within limits.

   Compressor stall is likely, and EGT will probably rise.

3. **Land as soon as practicable.**

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FIRE

ENGINE FIRE DURING TAKEOFF - TAKEOFF REFUSED

If either fire warning light illuminates before leaving the ground and the takeoff is refused:

1. ABORT.

   Accomplish ABORT procedure, this section, as necessary.

2. THROTTLE - OFF.
   Affected engine only.

   Positively identify the affected engine before retarding the throttle.

3. EMERGENCY FUEL SHUTOFF SWITCH - FUEL OFF.

4. Shutdown operating engine after stopping.

5. Seat pin - Insert if time permits.

6. Abandon aircraft.

ABORT

The abort procedure assumes that a decision to abort will be made before rotation speed is reached. Aborts from above rotation speed are not prohibited, but the risks associated with aborting from such a high initial speed at takeoff weight must be balanced against those of continuing a takeoff when making the decision. In general, after rotation speed is reached, the most reasonable course of action is to continue rather than abort unless the emergency is such that the aircraft can not fly.

Engine Management

Both throttles should be retarded to IDLE and the brakes applied with the nose down as soon as the decision to abort is made. Reaction time and residual thrust will usually cause airspeed to continue increasing until engine rpm begins to decrease. The planned rotation speed may be exceeded as a result; however, the nosewheel should be kept on the runway to take advantage of nosewheel steering in combination with rudder control. Shutdown of one engine will shorten the stopping distance, but shutdown is not necessary unless the drag chute does not operate properly. In the event of chute failure, shutdown the right engine after both are idling, or complete the shutdown of a failed or flamed out engine.

WARNING

Wait until rpm and EGT show that both engines are idling or that one engine is failing before selecting the engine to shutdown. Loss of both engines may result in loss of hydraulic pressure for braking.

Aircraft Attitude, With Decision to Abort

Lower the nose and energize the brakes simultaneously with nosewheel contact. When rotation is well advanced, the aircraft may accelerate beyond takeoff speed and lift off before rotation can be checked. In this case, hold the aircraft off sufficiently to regain control and then touch down without sideslip if possible. Fly the aircraft back to the runway, attempting to regain the center.

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Page 3-10 Aircraft Attitude, With Decision to Abort

Delete the present text and replace with the following:

Lower the nose and energize the brakes simultaneously with nosewheel contact. When rotation is well advanced, the aircraft may accelerate beyond takeoff speed and lift off before rotation can be checked. In this case, hold the aircraft off sufficiently to regain control and then touch down without sideslip if possible. Fly the aircraft back to the runway, attempting to regain the center.

Page 3-11 Chute Deployment

Delete the present text and replace with the following:

The drag chute requires 4 to 5 seconds for deployment after drag chute actuation. It is permissible to actuate the deploy handle while decelerating in anticipation of reaching 210 KIAS; however, premature deployment can result in destruction of the chute. Actuation of the chute system so as to reach 210 KIAS simultaneously with loading of the chute is not recommended unless the risk is justified by a very marginal distance remaining situation.

Page 3-11 ABORT PROCEDURE

Step 4 DRAG CHUTE DEPLOY

Change to 210 KIAS (was 190 KIAS).

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Chute Deployment

The drag chute requires 4 to 5 seconds for deployment after drag chute actuation. It is permissible to actuate the deploy handle while decelerating in anticipation of reaching 210 KIAS; however, premature deployment can result in destruction of the chute. Actuation of the chute system so as to reach 210 KIAS simultaneously with loading of the chute is not recommended unless the risk is justified by a very marginal distance remaining situation.

Brake Switch

The normal ANTI-SKID ON brake switch setting provides nosewheel steering and braking power from the L hydraulic system and anti-skid protection. It is not necessary to change the switch setting unless the left hydraulic pressure has failed or anti-skid off is desired. Selection of ANTI-SKID OFF or ALT STEER & BRAKE causes the ANTI-SKID OUT warning light on the annunciator panel to illuminate.

ABORT PROCEDURE

WARNING

Do not unfasten the lap belt or shoulder harness until the aircraft has come to a stop.

The landing gear should be left in the extended position.

1. THROTTLES - IDLE.

Retard both throttles to IDLE. Do not attempt to shut down either engine immediately unless failure to do so would vitally endanger the aircraft.

2. NOSEWHEEL STEERING - ENGAGE.

3. BRAKES - OPTIMUM BRAKING.

For dry runway: use moderate to heavy brake pressure.

For wet runway: use light to moderate brake pressure.

4. DRAG CHUTE - DEPLOY.

The limit airspeed for drag chute deployment is 210 KIAS.

5. BRAKE SWITCH - As required.

Set the brake switch to ALT STEER & BRAKE when the L hydraulic system is below normal pressure due to system or left engine failure.

CAUTION

Selection of ALT STEER & BRAKE changes the source of brake pressure from the L to the R hydraulic system and disables the anti-skid system.

6. Shut down one engine (if necessary).

Shut down of one engine is considered necessary in the event of drag chute failure.

If drag chute fails to deploy, use DRAG CHUTE FAILURE Procedure, this section.

Shut down the right engine if both engines are idling or if the right engine has failed.

Shut down the left engine if it has failed.

WARNING

Positively identify the failed engine before attempting engine shutdown.

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DRAG CHUTE FAILURE

If the drag chute should fail to deploy and stopping distance is critical, proceed as follows:

Dry Runway

1. LOWER NOSE IMMEDIATELY.
2. NOSEWHEEL STEERING - ENGAGE.
3. BRAKES - AS REQUIRED UP TO MAXIMUM BRAKING.
4. RIGHT ENGINE THROTTLE - OFF, IF REQUIRED.
5. HOLD AS MUCH UP ELEVON AS POSSIBLE AND STILL KEEP THE NOSEWHEEL ON RUNWAY FOR DIRECTIONAL CONTROL.

Wet Or Icy Runway

1. LOWER NOSE.
   a. LANDING - AT 110 KIAS
   b. ABORT - IMMEDIATELY AT 190 KIAS.
2. NOSEWHEEL STEERING - ENGAGE.
3. BRAKES SWITCH - NORM.
4. BRAKES - MAXIMUM PRESSURE.
5. RIGHT ENGINE THROTTLE - OFF.
6. HOLD AS MUCH UP ELEVON AS POSSIBLE, BUT KEEP THE NOSEWHEEL ON THE RUNWAY FOR DIRECTIONAL CONTROL.

NOTE

This wet or icy runway technique will probably blow the tires early in the landing roll; however, directional control can still be maintained and the blown tires will remain on the wheels. Additional pedal pressure will be required as each tire blows. Maximum wing aerodynamic braking is more effective than wheel braking on a wet or icy runway until the nose is lowered but the nose up attitude must not be held to a point that the nosewheel will slam onto the runway. Use of maximum possible up elevon after the nose is lowered while keeping the nosewheel on the runway provides aerodynamic drag and additional down load on the main wheels.

FUEL SYSTEM

FUEL PRESSURE LOW WARNING

If one or both FUEL PRESS LOW warning lights illuminate during takeoff, abort if airspeed and runway length remaining permit. If airborne or if an abort is not possible:

1. CROSSFEED - PRESS ON.
2. Tanks with fuel - Press on.
3. Analyze difficulty and attempt to restore normal sequencing.

   Illumination of both fuel pressure low warning lights indicates loss of all boost pumps. This can only result from multiple failures. If this occurs during takeoff, tank pressurization will supply sufficient fuel to the engine driven pumps to maintain engine operation.

WARNING

Fuel can not be dumped with complete boost pump failure. Use caution and observe operating limits of Section V if a heavy weight landing is required.

After fuel pressure restored:

4. Crossfeed - Press off.

If normal operation can not be restored:

5. Land as soon as possible.

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With crossfeed on, more fuel may tend to feed from the forward tanks and cause an aft c.g. shift. Before landing, c.g. should be checked carefully.

LANDING GEAR AND TIRES

MAIN OR NOSE GEAR TIRE FAILURE

Failure of a main gear tire during takeoff will overload the remaining tires on that side when takeoff weight exceeds 120,000 lb. This may be precipitate additional tire failures before normal takeoff speed can be reached or before the aircraft can be stopped, depending on speed and the time of failure. As each main gear tire loss decreases the available brake energy capacity by one-sixth, ability to stop from high speed is largely dependent on effectiveness of the drag chute.

Failure of a nosewheel tire is not expected to generate a second tire failure, but it may not be possible to determine immediately whether a nose or main gear tire has failed. In either case, engine or structural damage may be sustained from tire fragments.

Depending on the airspeed attained and whether or not engine damage is indicated, a takeoff may be preferable to aborting.

The following procedure is recommended when a main or nose gear tire failure is suspected during the takeoff run:

1. ABORT IF SPEED PERMITS.

2. ANTI-SKID OFF.

   Set the anti-skid switch OFF prior to brake application. Brake with steady application of pressure to avoid spin-up of the blown tire.

If takeoff is continued:

3. DO NOT RETRACT GEAR until checked.

4. Brake switch - NORM-SKID OFF.

   Anti-skid off must be selected in order to stop the wheels rapidly after takeoff, as braking is disabled with anti-skid ON when gear down selected and there is no weight on the gear.

5. Brake wheels to a stop.

   The blown tire(s) must be stopped in order to minimize the possiblility of damage to the aircraft.

6. Request confirmation of tire and aircraft condition.

   The gear should not be retracted until a visual check has been made by another aircraft or by ground personnel. If loss of one or more tires is verified, the gear should be left extended and a landing made as soon as practicable.

7. Land when practicable.

EMERGENCY GEAR RETRACTION

If the gear lever cannot be moved to the UP position after takeoff:

1. Gear override button - Press and hold.

2. Landing gear lever - UP.

This overrides the solenoid which is normally actuated by the landing gear switch.

WARNING

Improper use of this procedure may cause gear retraction while on the ground.

Once energized, the gear lever must be recycled to the DOWN position in order to bring the ground safety switch back into the circuit.

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IN-FLIGHT EMERGENCIES

EMERGENCY ESCAPE

Escape from the aircraft in flight should be made with the ejection seat. The following is a summary of ejection expectations:

a. At sea level, wind blast exerts only minor forces on the body up to 525 KIAS; appreciable forces from 525 to 600 KIAS; and excessive forces above 600 KIAS. The aircraft limit airspeed is below these speeds.

CAUTION

Flights with oxygen mask and regulator are restricted to below FL 500 and below 420 KEAS because of wind blast forces anticipated in the event of ejection. Before actual ejection,airspeed should be reduced to subsonic and as slow as conditions permit.

b. Ejection at 65 KIAS and above during takeoff or landing run results in successful chute deployment.

c. The free fall from high altitude down to 15,000 feet with drogue chute stabilization will result in stabilized descent in the quickest manner.

During any low altitude ejection, the chance for success can be greatly increased by zooming the aircraft to exchange excess airspeed for altitude. Ejection should be accomplished while the aircraft is in a level or climbing attitude. A climbing or level attitude will result in a more nearly vertical trajectory for the seat and crew members, thus providing more altitude and time for seat separation and parachute deployment.

The zero altitude capability of this aircraft should not be used as a basis for delaying ejection if ejection is necessary. Aircraft accident statistics emphatically show a progressive decrease in successful ejections as ejection altitude is decreased below 2000 feet; therefore, whenever possible, eject above 2000 feet.

BEFORE EJECTION

Before ejection, when time and conditions permit:

1. Altitude - Reduce so that the pressure suit is not essential to survival.
2. Airspeed - Reduce to subsonic and as slow as conditions permit.
3. Head aircraft toward unpopulated area.
4. Transmit location and intentions to nearest radio facility.
5. IFF - EMER position.
6. Lower helmet visor.
7. Green apple - Pull if above 15,000 feet.

EJECTION

To accomplish an emergency escape using the ejection seat proceed as follows:

1. ASSUME PROPER BODY POSITION.

   Sit erect with head against head rest. If possible, cross arms to pull ejection ring to assist in keeping arms close to body.

2. PULL EJECTION "D" RING.

If seat fails to eject after normal delay, continue with the following:

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3. JETTISON CANOPY.

Use canopy jettison handle. If canopy still does not jettison, open canopy and allow it to blow off into the air stream.

4. PULL EJECTION T-HANDLE.

WARNING

Do not pull the T-handle with the canopy still in place.

Keep elbows close to sides and feet firmly against seat while pulling the ejection T-handle since the foot retractors and knee guards will not actuate.

AFTER EJECTION

After clear of aircraft if not automatically separated from seat:

1. Manual cable cutter ring - Pull.
2. Seat belt - Open.
3. Kick loose from seat.
4. Parachute arming lanyard - Pull.

If at high altitude after drogue chute stabilizes free fall:

5. Extend arms to control spinning.

When drogue chute releases:

6. Feet together.

CAUTION

After drogue chute separation, backward tumbling tendency occurs. Feet together prevents pilot chute deployment between legs.

PARACHUTE LANDINGS

After main chute opens:

Over Land - High Altitude

a. At approximately 2000 feet, release your survival kit. Pull handle completely free of the kit.

b. At approximately 1000 feet, roll - safety Rocket Jet roll bars up.

c. Prepare to land.

d. After landing, release one side of your parachute to prevent being dragged by winds.

Over Land - Low Altitude

a. Release kit immediately after parachute opening shock.

b. Prepare to land.

Over Water - High Altitude

a. Open face plate and extend microphone boom to hold open.

b. Disconnect emergency oxygen hose leads.

c. Loosen chest strap.

WARNING

Failure to loosen chest strap before inflating flotation gear may result in inability to breathe.

d. Pull out life vest oral inflation tube and check open valve.

e. Disconnect vent hose.

f. Inflate life vest - time permitting, close oral inflation valve.

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g. 1500 to 2000 feet, release survival kit.

h. Roll riser release safety bars to the up position (RJ releases).

i. Place left forearm through the "V" formed by the left risers.

j. Place right hand on left riser release, feet together and knees slightly bent.

k. Push up on the left riser release on contact with water, releasing canopy.

l. Release other (right) side of the canopy.

m. Pull raft to you for additional support.

n. Disconnect the survival kit lanyard from the right side of the parachute harness.

o. Remove spurs before boarding raft.

CAUTION

Spurs must be removed to prevent puncturing raft.

p. Remove parachute harness before boarding raft.

q. Board raft.

<u>Over Water - Low Altitude</u>

a. Immediately inflate outer garment after parachute opens.

b. Release survival kit.

c. Roll Rocket Jet release roll bars up. Jettison canopy upon contact with water.

d. Follow standard procedures in water.

BAILOUT WITH EJECTION SEAT INOPERATIVE

If the seat fails to eject, the following procedure should be used to leave the aircraft.

1. Airspeed - 250 to 300 KEAS.
2. Green apple - Pull.
3. Foot spurs - Release.
4. Personal leads - Disconnect.

   Disconnect oxygen supply hoses at the quick disconnect, and suit vent hose at the controller.

5. Trim full nose down, roll inverted.
6. Lean forward.
7. Release seat belt (and control stick, simulataneously) and drop out.

When clear of aircraft:

8. Pull parachute arming lanyard.
9. Prepare for landing.

   Preparations for landing are the same as for ejection procedure.

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FIRE

FIRE WARNING IN FLIGHT

Illumination of a FIRE warning light indicates a nacelle compartment temperature above approximately 1050°F. An immediate check should be made for abnormal EGT and, if possible, for trailing smoke or any other indication of fire. In case of doubt, assume that a fire does exist and proceed as follows:

1. THROTTLE - MILITARY (AFFECTED ENGINE).

If light remains on:

2. THROTTLE - IDLE ABOVE MINIMUM CONTROL SPEED.

If light still remains on:

3. THROTTLE - OFF.

   If fire warning light extinguishes while shutting down the engine, do not attempt a restart.

4. EMERGENCY FUEL SHUTOFF SWITCH-FUEL OFF.

WARNING

Shutting off the fuel if speed above approximately Mach 2.2, may cause engine oil to overheat and result in engine failure. Shutting off the fuel may also cause additional emergencies due to loss of the associated aircraft cooling systems. Reduced Mach number decreases cooling requirements because of lower environmental temperatures.

NOTE

If it is the left engine which is suspected and has been shut down, the cockpit air switch should be placed in the EMER position.

5. CHECK FOR OTHER INDICATIONS OF FIRE.

At pilot's discretion, if fire confirmed or confirmation not possible and light remains on:

6. EJECT. Attempt to descend from extremely high altitude prior to ejection.

If there is no fire:

7. Land as soon as possible.

SMOKE OR FUMES

The pilot cannot detect fumes when wearing a pressure suit. The helmet oxygen system is independent of the cockpit and suit air supply. Smoke can be eliminated promptly by dumping cabin pressure unless smoke is entering the cockpit from the air conditioning system.

WARNING

Cockpit depressurization will occur at an extremely rapid rate and the pilot will be dependent on his pressure suit for altitude protection.

If the smoke is introduced by the cockpit air supply system, switch the cockpit system to EMERG. The defog system should be off at all times when not required.

If smoke is entering the cockpit from the air conditioning system:

1. Cockpit air switch - EMER.

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2. Defog switch - OFF if not required.

If smoke or fumes cannot be controlled:

3. Initiate emergency descent.

ELECTRICAL FIRE

The pilot must depend on visual detection of electrical fire when wearing a pressure suit since he cannot smell the characteristic odor.

1. Isolate the malfunction.

   Turn off electrical systems in order to isolate the malfunction(s). If necessary, deactivate suspected systems by pulling circuit breakers. The battery and one generator may be turned off without adverse effect on essential systems; however, both generators should not be off simultaneously unless absolutely necessary as this would shut down all fuel boost pumps.

2. Leave failed system off.

If required:

3. Cockpit pressure dump switch - DUMP.
4. Land as soon as possible.

EMERGENCY DESCENT

If extreme conditions require a rapid descent:

1. THROTTLES - IDLE.
2. RESTART SWITCHES - BOTH ON (SIMULTANEOUSLY)

   CAUTION

   When initial CIT is high, engine damage can be expected as the deceleration Mach rates specified in Section V will be exceeded.

3. AFT BYPASS SWITCHES - OPEN.

Setting this configuration provides the least probability of asymmetric unstart, high drag, and the best means for avoiding inlet roughness during the descent.

CAUTION

Set the aft bypass CLOSED if engine speed is maintained at or near the Military rpm schedule. Engine stalls will occur below Mach 2.6 if the forward and aft bypass are open with rpm at or near Military speed.

4. Airspeed - Adjust between 350 to 400 KEAS.

   WARNING

   Do not exceed 450 KEAS or 1.6 g load factor.

   If necessary, reduce rate of descent to maintain positive fuel tank pressure.

   Increase rpm if high suit inflow temperatures are experienced.

5. Forward transfer switch - FWD TRANS.

For rapid descents during which aircraft control has become or may become critical (i. e., pilot emergency, aft c. g. location with boost pumps inoperative) a minimum use of flight controls is recommended. This may include non-turning flight until lower speeds are attained. If aircraft control is not a critical consideration (i. e., low oxygen quantity) a spiral descent is very effective in providing a more rapid loss of altitude.

In descending through the transonic region, the nose will be between 10 and 30 degrees below the horizon.

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CAUTION

Turns causing appreciable load factor should be avoided while descending through the 50,000 foot level as the pitch SAS gain switching will cause a transient "bump" which may increase load factor to near limit value.

When subsonic:

6. Landing gear lever - DOWN. (Below gear limit speed.)

WARNING

Gear extension at supersonic speeds is forbidden.

CAUTION

If the landing gear is extended above 300 KEAS or Mach 0.9, the landing gear doors will be damaged if sideslip exists.

Extending the landing gear at speeds above Mach 2.3 may cause heat damage to tires and result in a hazardous landing condition. With gear extended, a large nose-up pitch moment occurs in the speed range of Mach 1.6 to 0.9. Full nose-down elevon will be insufficient to maintain 1-g flight at high KEAS and/or aft c.g. in this area.

FUEL DUMPING PROCEDURE

Normal fuel dumping provides a means of reducing gross weight rapidly in the event of an emergency. All tanks containing fuel except for tank 1 will empty in the normal fuel tank usage sequence. Tank 1 will not be dumped, as its boost pumps are held off by actuation of the fuel dump switch and manual actuation of the tank 1 boost pump selector turns dumping off. When the fuel dump switch is in the DUMP position, fuel dumping will continue only until the fuel level in tank 4 reaches 5000 pounds. When the EMER position is selected, dumping will continue until all fuel excluding tank 1 is expended. To increase the dump rate, manually select boost pumps for all tanks containing fuel (except tank 1).

NORMAL FUEL DUMPING

Accomplish normal fuel dumping as follows:

1. Fuel dump switch - DUMP.

2. Fuel quantity - Alternately monitor TOTAL fuel and tank 4 fuel.

3. Fuel dump switch - OFF when 5000 pounds remain in tank 4.

EMERGENCY FUEL DUMPING

If the fuel level in tank 4 has prematurely reached the 5000 pound level and dumping is required (excessive fuel in tanks 3, 5 or 6), proceed as follows:

1. Fuel dump switch - EMER.

2. Tanks 3, 5 or 6 containing fuel - Press on.

3. Forward transfer switch - FWD TRANS (if required).

4. Fuel quantity - Alternately monitor tanks 1 and 4.

When tank 1 quantity reads 4000 pounds:

5. Forward transfer switch - OFF.

When required amount of fuel remains:

6. Fuel dump switch - OFF.

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WARNING

The boost pumps in tank 1 are inoperative until the EMER dump is turned OFF or tank 1 pumps are selected manually. The EMER dump must be turned to OFF or DUMP to assure automatic availability of fuel remaining in tank 1 at termination of fuel dumping.

FORWARD FUEL TRANSFER AND FUEL DUMPING PROCEDURE

Forward fuel transfer and fuel dumping may be accomplished simultaneously as follows:

1. Fuel dump switch - DUMP.
2. Forward transfer switch - FWD TRANS.
3. Fuel quantity - Alternately monitor tanks 1 and 4.

When tank 1 fuel quantity reads 4000 pounds:

4. Forward transfer switch - OFF.
5. Fuel dump switch - OFF when 5000 pounds remain in tank 4.

FORCED LANDING OR DITCHING

Ditching, landing with both engines inoperative, or other forced landing should not be attempted. Ejection is the best course of action. All emergency survival equipment is carried by the pilot; consequently, there is nothing to be gained by riding the airplane down.

At least one engine must be operating if a forced landing is to be attempted. All forced landings should be made with the landing gear extended regardless of terrain. High airspeed or nose high angle of impact during landings with gear retracted causes the aircraft to "slap" the ground on impact, subjecting the pilot to possible spinal injury. It is recommended that a gear up landing not be attempted with this aircraft; EJECT instead.

PROPULSION SYSTEM

The following procedures are to be accomplished in the event of abnormal operation or failure of a propulsion system component, i.e., inlet, engine, afterburner, nozzle, fuel control, or lubrication, fuel-hydraulic, or ignition system.

INLET DUCT UNSTART

Inlet duct unstarts can only occur after supersonic speeds are reached and an inlet has been "started", that is, supersonic flow conditions established inside part of the inlet. Normally, the supersonic flow region extends from the cowl entrance to a position near the inlet throat when inlet flow conditions are optimized. A shock wave is formed at the boundary between supersonic and subsonic flow conditions in the inlet. When an inlet unstarts, the internal shock wave is expelled and a "normal" shock wave forms ahead of the cowl. Flow within the inlet becomes subsonic and pressure in the inlet decreases. When an inlet alternately starts and unstarts rapidly, the change in inlet pressure which occurs results in severe airframe roughness.

Shock expulsion, or unstart, may be caused by inlet airflow becoming greater than

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engine requirements and duct bypass capability, spike position too far aft, or abrupt aircraft attitude changes. Improper spike or door positions can result from inlet control error, loss of hydraulic power, or electrical or mechanical failure. Unstarts are usually associated with climb or cruise operations above Mach 2 when at normal engine speeds; however, they may be encountered during reduced rpm descents at speeds above Mach 1.3. Between Mach 1.3 and 2.2, when near Military rpm, recovery procedures using the restart switch ON position may result in compressor stall.

Unstarts are generally recognizable by airframe roughness, loud "banging" noises, aircraft yawing and rolling, and decrease of compressor inlet pressure toward 4 psi. Fuel flow decreases quickly and the afterburner may blow out. EGT usually rises, with the rate of increase being faster when operating near limit Mach number and ceiling altitudes. A distinct increase in drag and loss of thrust occurs because of increased air spillage around the inlet and reduced airflow through the engine.

The aircraft yaws toward the unstarted inlet during an unstart. This yaw causes a roll in the same direction. Pitch rates are not developed by the inlet unstart, but pitch control problems can occur during associated maneuvering and will be accentuated by aft c.g., high Mach numbers and any pitch rate which existed prior to inlet unstart. During the unstart, primary emphasis must be placed upon maintaining pitch control in order to prevent nose up pitch rates and angles of attack in excess of eight degrees. Thrust asymmetry should be reduced as soon as possible.

Aileron effectiveness is reduced at high altitudes and high angles of attack. Roll control may become critical if the unstart occurs on the inboard inlet during a bank. At altitudes above 75,000 feet, aileron control may be ineffective in controlling roll during an unstart unless the angle of attack is immediately reduced. Aileron effectiveness increases rapidly as the angle of attack is reduced and only moderate aileron inputs will be required to control the roll. An excessive nose down attitude may result in an over speed in KEAS and Mach if the inlets are restarted during a recovery maneuver. Therefore the restart switches should remain on until speed and attitude are fully under control.

The roughness usually clears after the forward bypass doors open and the spikes are started forward manually or automatically; however, as much as five to eight seconds may be required for the spikes to reach the full forward position. Roughness may persist until the spikes are fully forward during restarts at design Mach number.

Inlet pressure should be checked during recovery. Moderate CIP increases will occur as the inlet "clears" or restarts, and when the spike retracts to form the inlet throat farther aft. Return of the forward bypass doors to their normal operating schedule should result in a further CIP increase to normal operating values.

In automatic operation, unstarts which are caused by improper spike scheduling limit aircraft speed to Mach numbers below that for the unstarted condition. Manual scheduling procedure is necessary if the aircraft is to be accelerated further. If an unstart results from marginal bypass scheduling however, it may be possible to continue at speed by adjusting the forward or aft inlet bypass doors to positions which maintain stable flow conditions. In general, if engine speed is maintained, less bypass area is required as limit Mach number is approached.

Figure 3-4 shows the operating conditions where airframe roughness will occur due to unstable inlet airflow conditions. The unstart boundaries are a function of Mach number, engine speed, and spike and bypass door positions. The smallest roughness area occurs below the idle rpm range with the forward and aft bypass doors open and spike full forward. A more extensive area occurs with the bypass doors open but with

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INLET UNSTART BOUNDARIES

SPIKE: FORWARD
FORWARD BYPASS: OPEN
OR
RESTART : ON

STANDARD DAY -
Based On Mach And FAT
For Std. Day At 400 KEAS

NOTE: Unstart boundaries will increase approximately 150 RPM for each 10°C temperature increase above ambient standard day temperature.

Unstart Boundaries Indicate The Minimum RPM Obtainable Without Unstart For A Specific Mach And Inlet Configuration

YJ ENGINES - YJ-1 ENGINES
WITH HAMILTON STANDARD
MAIN FUEL CONTROL

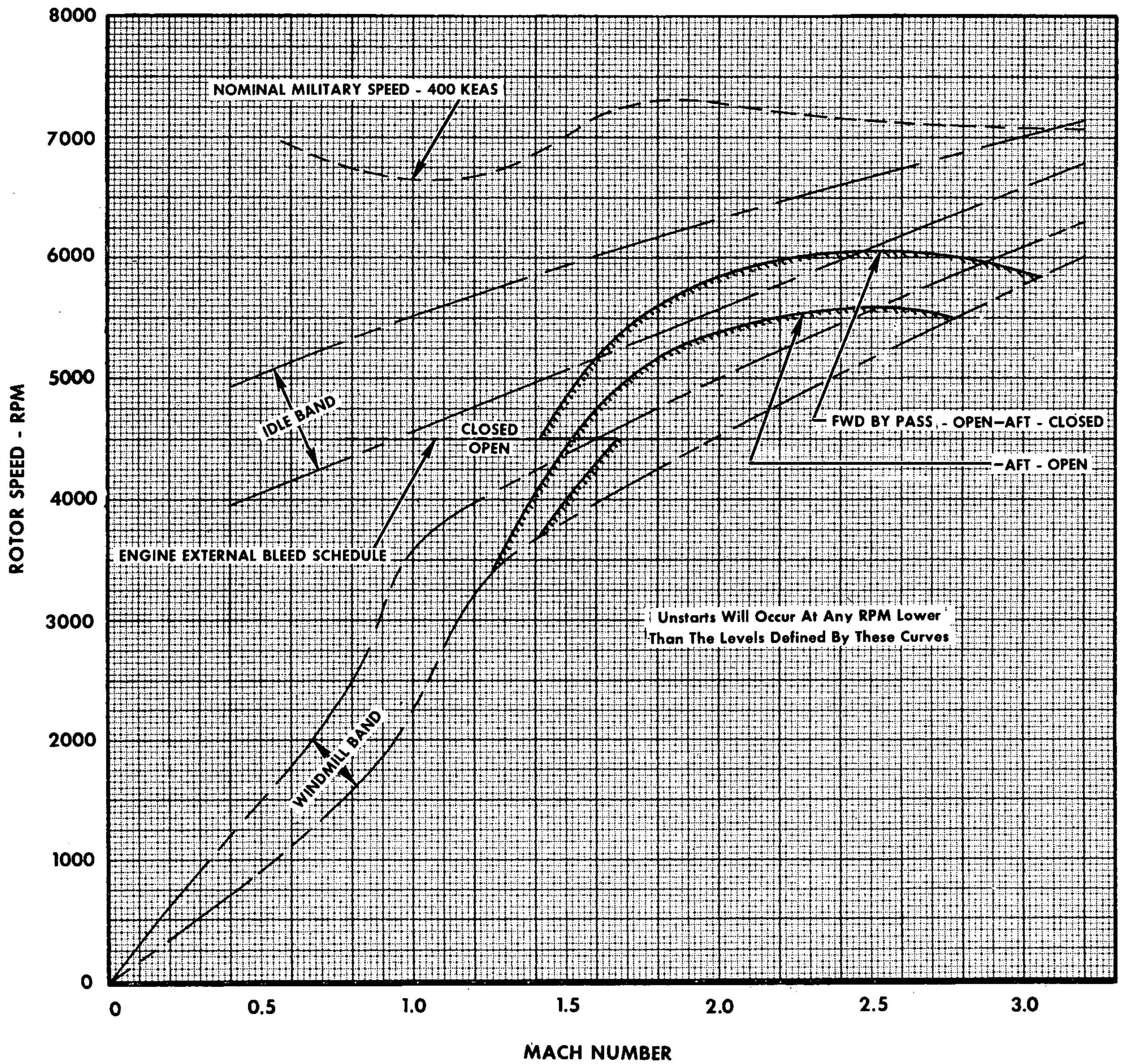

Figure 3-4
(Sheet 1 of 2)

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INLET UNSTART BOUNDARIES

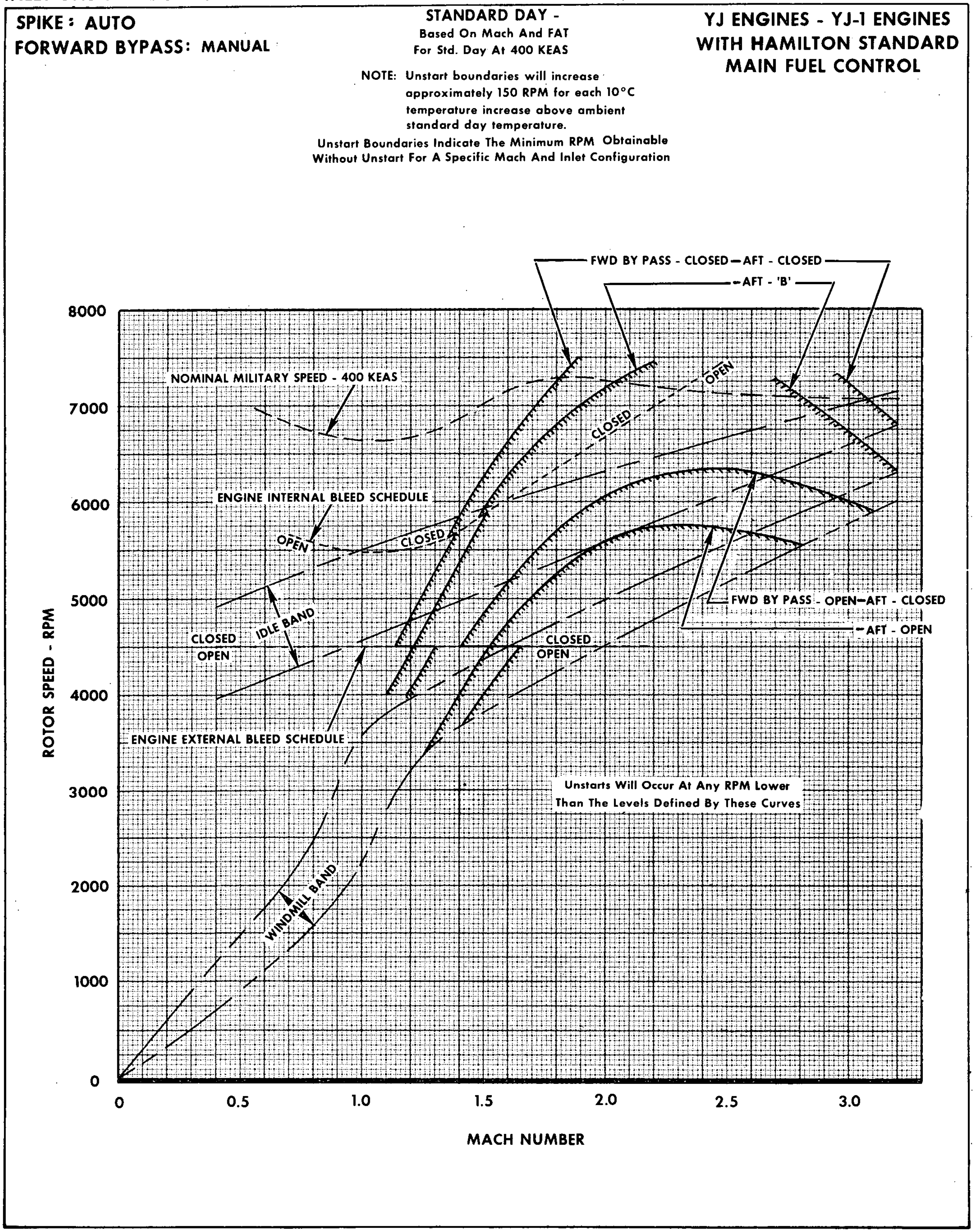

Figure 3-4
(Sheet 2 of 2)

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A-12

the spike moving in accordance with the automatic schedule. In both cases, the onset of inlet airflow instability occurs earlier, i.e., at higher engine speeds, with the bypass doors closed. At windmilling rpm, heavy roughness will occur in the speed range above Mach 1.3 regardless of spike and door positions.

In the event of an unstart, accomplish only those of the following steps which are necessary to clear the inlet and return to normal operation.

CAUTION

Shut down the engine if an EGT overtemperature exists for more than five seconds, then restart the inlet and the engine as soon as possible.

In the event an inlet duct unstarts, proceed as follows:

1. SIMULTANEOUSLY DISENGAGE AUTOPILOT, REDUCE ANGLE OF ATTACK, AND SELECT BOTH RESTART SWITCHES ON.

WARNING

Do not attempt to clear the unstarted inlet by placing only one restart switch on.

2. BOTH THROTTLES - MILITARY.
3. MAINTAIN ATTITUDE CONTROL - OPTIMIZE PITCH AND ROLL.
4. AIRSPEED - ADJUST TOWARD 350 KEAS. DO NOT EXCEED MACH 3.1.

If roughness does not clear after 10 seconds:

5. AFT BYPASS switch - OPEN.

When roughness clears:

6. Aft bypass switch - Normal schedule.
7. Restart Switches - FWD BYPASS OPEN (individually)
8. Restart switches - OFF (individually).

After inlet starts:

9. Fuel derichment arming switch - Recycle below 790°C EGT if derich actuated.
10. Throttles - As required.

If unstarts repeat or inlet roughness does not clear:

11. Engine and inlet instrument and hydraulic pressure - Check.
12. Repeat procedure.

If unstarts persist:

13. Attempt inlet restart and operation using manual inlet controls.

INLET CONTROL MALFUNCTION

Automatic Spike Control Malfunction

Manual spike control is necessary if an automatic spike control manfunctions. In this event, the spike and forward and aft bypass must be operated manually as prescribed in the schedule table. Use of the AUTO forward bypass setting results in open forward doors when manual spike positions are selected.

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Automatic Forward Bypass Control Malfunction

With the automatic spike control operating normally, there are two options available for control of the forward bypass doors in the event their automatic control malfunctions. The manual bypass schedule table may be used, or, if the opposite side inlet controls are operating normally, the forward bypass manual setting may be adjusted to provide CIP which is at least 1 psi below the normal side indication. Note that during automatic spike and manual bypass operation, bypass position is controlled only by the pilot, and bypass position is not affected by spike position. Therefore, it is necessary to anticipate changes in flight speed or attitude which affect matching of the CIP indications.

Operation With Manual Inlet Control

Maximum allowable speed is Mach 3.0.

Manual inlet scheduling must not be used above 80,000 feet.

To increase longitudinal stability, sufficient fuel should be transferred forward to obtain at least 0° pitch trim. This decreases the possibility of making inadvertent attitude changes which would affect CIP matching. Nose down pitch trim is an indication of adverse cg for this condition. However, the need for forward transferring should be weighed against the decrease in ceiling and range capability associated with increased pitch trim requirements at forward c. g.

Maximum bank angles of 30 degrees are permissible at speeds up to Mach 3.0. However, when a small heading change is desired, using a smaller bank angle will reduce the possibility of an unstart.

When 20 degrees bank angle will be exceeded, the forward bypass should be adjusted to one position number lower than specified in the manual schedule; then the spike should be adjusted to 0.1 Mach number position less than indicated by the TDI. After completion of the turn, the inlet controls may be readjusted to the manual schedule. The spike should be reset first, then the forward bypass.

MANUAL SPIKE SCHEDULE

The following schedule must be used when automatic scheduling is ineffective.

Acceleration - Lag Mach number by 0.1 Mach

Cruise - Match Mach number.

Deceleration - Lead Mach number by 0.1 Mach (e.g., spike at 1.9, Mach setting at 2.0 Mach on TDI).

MANUAL BYPASS SCHEDULE

The following schedule must be used with manual spike scheduling. It is optional when the spike and opposite inlet are operating normally.

Condition	Mach	Fwd Byp.	Aft Byp.
Acceleration & Cruise	Above 1.7	Set at least 1 psi CIP below the stripped pointer. (both rows)	Pos. B
Accelerration & Cruise	Above 2.8		CLOSED
Deceleration	ALL	Open	CLOSED

INLET UNSTABLE

Unstable inlet conditions which produce inlet and airframe roughness occur at supersonic speeds when an inlet alternately unstarts and restarts rapidly, usually during deceleration at reduced rpm. Inlet unstart procedures are used first, except that the

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throttle normally is reset to provide Military rpm instead of afterburning thrust after the unstart is cleared. Subsequent settings may be made as desired. Refer to procedure for compressor stalls in descent.

Failure of a Spike to Schedule or Inlet Spike Unstable

A combination of unsymmetrical thrust and low compressor inlet pressure on one side when accelerating between Mach 1.6 and Mach 2 indicates that a spike has failed to move aft on the proper schedule. This may be caused by failure of the spike forward lock to disengage above 30,000 feet altitude.

Spike instability is reflected by fluctuations of the respective hydraulic pressure gage. If spike oscillations are of large amplitude the gage fluctuations will be several hundred psi and will be indicated on the spike position indicators. If an unstable spike or failure to schedule is suspected, proceed as follows:

1. Spike position - Check while between 1.6 and 2.0 Mach number.

2. Spike control - Cycle FWD then return to AUTO.

If condition continues:

3. Forward bypass control - Manual schedule.

4. Spike control - Manual schedule.

As higher Mach number is reached:

5. Spike and forward bypass controls - AUTO.

If condition recurs or continues:

6. Operate per spike and bypass manual schedule.

COMPRESSOR STALLS

Acceleration and/or Overtrim

These stalls usually result from EGT uptrim and are most prevalent during throttle application at subsonic speeds and low compressor inlet temperatures. They may also occur with constant throttle settings at or below Military at any airspeeds. Retarding the throttle should result in the fastest stall recovery. Downtrim and readjustment of the throttle should result in proper engine operation.

1. THROTTLES - RETARD UNTIL STALL CLEARS.

2. EGT trim switches - HOLD DOWN 1 to 3 seconds.

3. THROTTLES - As desired.

4. If stall persists repeat above procedure.

5. If stall cannot be cleared - Land as soon as possible.

Compressor Stalls in Descent

The airframe roughness characteristics felt during compressor stalls at supersonic speeds are very similar to those which occur during inlet unstarts. If roughness is encountered, an unstart condition is more likely while above Mach 2.5 when spike scheduling is at fault. A compressor stall condition is more likely at lower supersonic speeds when at or near Military rpm with excessive bypass door opening. The normal descent procedure tends to avoid conditions which may result in compressor stalls, but excessive rpm reduction or spike too far aft precipitates unstarts. (See figure 3-4.) It is best to employ the unstart procedure first in the event of inlet disturbances until it is apparent that the spike is scheduling and that spike forward

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STALL BOUNDARIES

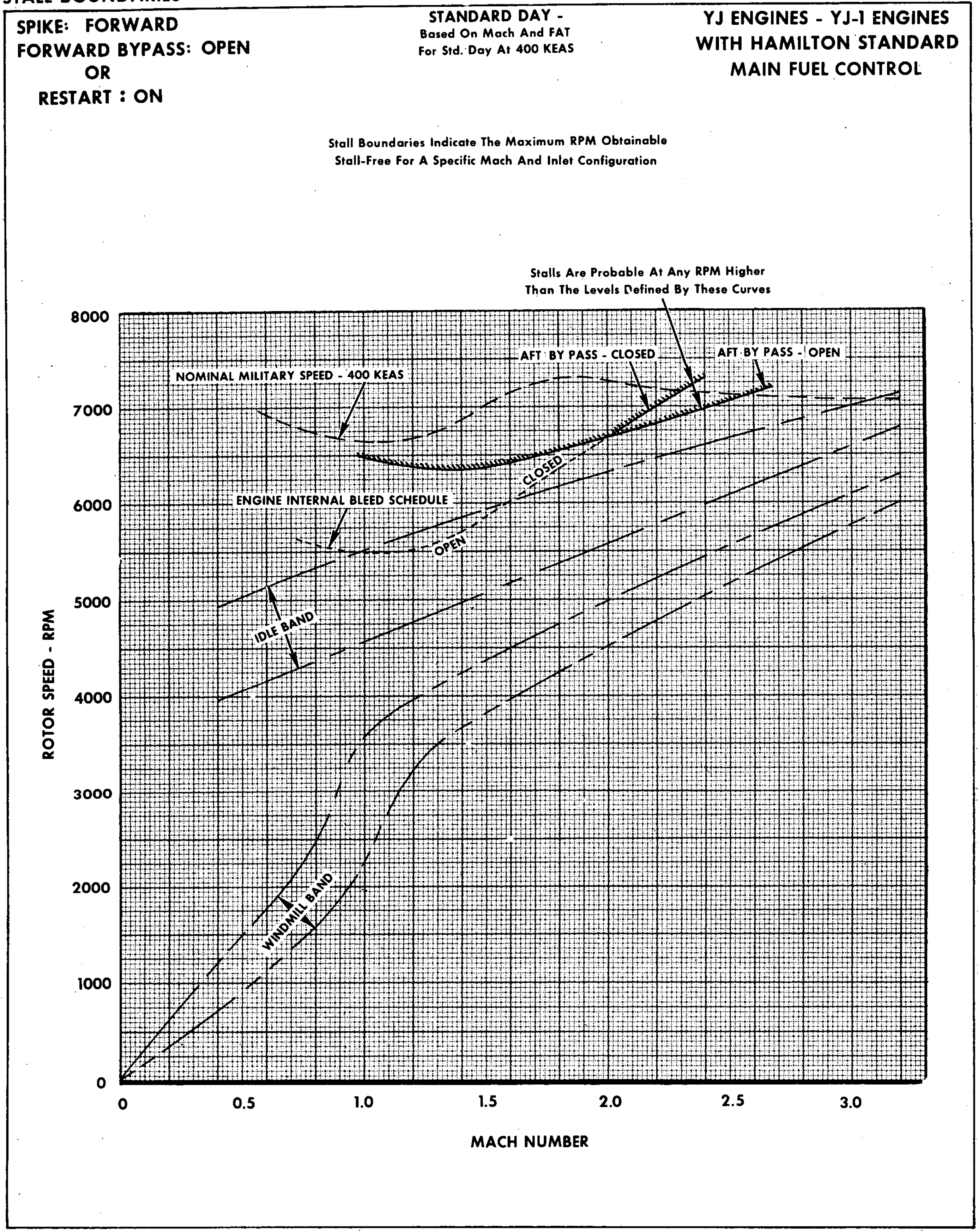

Figure 3-5

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is ineffective in clearing the roughness. The throttle should then be retarded slowly to the idle stop if necessary, until roughness stops and the compressor stall is cleared. Maintain this configuration for the remainder of the descent until subsonic airspeeds are reached.

1. Restart switch - ON.

2. Throttle - Reduce rpm slowly until stall clears.

When subsonic:

3. Restart switch - OFF.

ENGINE FLAMEOUT

Windmilling operation at speeds between Mach 1.5 and 2.3 may result in heavy inlet roughness as illustrated by figure 3-4. If an immediate airstart cannot be obtained before the engine stabilizes at windmilling speeds, adjust airspeed to obtain 375 KEAS or at least 7 psia CIP before making further attempts. Engine flameout with afterburners on or off should be treated identically except for initial throttle positioning after the flameout occurs. If flameout occurs with afterburners ON, the throttles should be retarded to minimum afterburner position to reduce thrust asymmetry. If afterburners are OFF at flameout the operating engine should be set to the thrust required by flight conditions. When an engine flameout is confirmed by crosschecking EGT, fuel flow, rpm and ENP, proceed as follows:

1. THROTTLES - AS REQUIRED.

2. DETERMINE FLAMED OUT ENGINE.

3. ACCOMPLISH AIRSTART PROCEDURE.

If start is not successful - Failed engine:

4. Throttle - OFF.

5. Generator - TRIP.

6. CROSSFEED light - Check on.

7. Compressor inlet pressure normal range - Check above 7 psia.

8. Throttle - Half open. (Check TEB remaining).

NOTE

If necessary, continue airstart attempts as long as TEB supply remains unless an obvious mechanical failure has occurred.

After start:

9. Throttles and cockpit switches - As required.

If mechanical failure obvious or unable to start engine:

10. Throttle - OFF.

11. Failed engine inlet air forward and aft bypass door controls - OPEN above Mach 1.4.

12. Cockpit air switch - EMER if left engine failed.

13. Establish single engine cruise.

DOUBLE ENGINE FLAMEOUT

When altitude permits:

1. ATTEMPT AIRSTART.

When altitude is critical, or engines will not start:

2. EJECT.

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WINDMILLING GLIDE DISTANCE

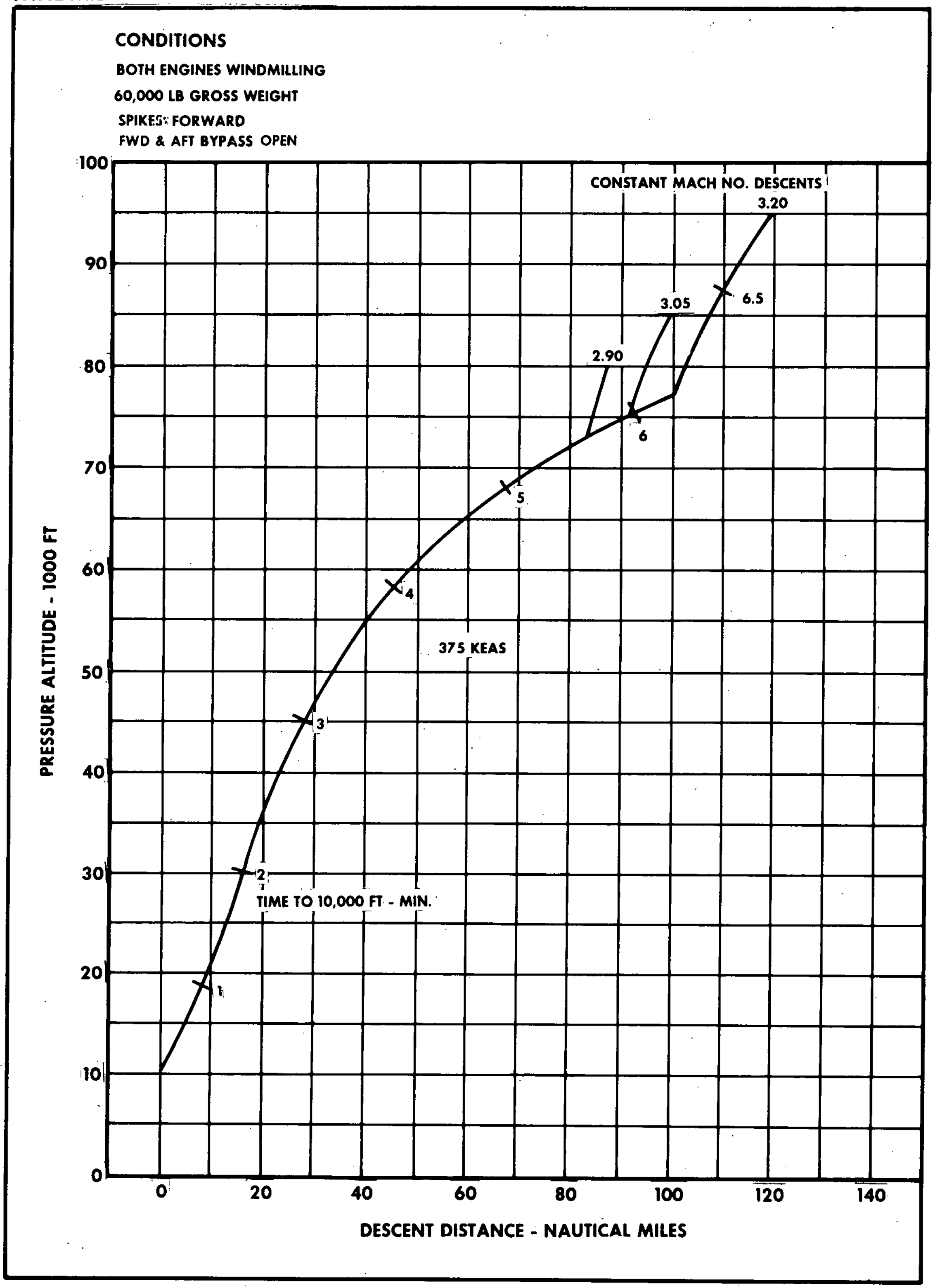

Figure 3-6

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AIRSTART PROCEDURE

NOTE

The reason for initial engine shut-down must be considered prior to initiation of restart.

The recommended condition for airstarts at any Mach number is 375 KEAS with CIP 7 psi or greater. Airstarts should not be attempted at lower inlet pressures, and airspeeds in excess of 400 KEAS should not be required in obtaining 7 psia. Conditions for airstart are more favorable when stable inlet condition exist; however, starts have been obtained while in roughness. Monitor rpm, EGT and fuel flow while making the start attempt. Allow 15 seconds, after advancing the throttle, for rpm and EGT rise as an indication of successful start. The recommended procedure for airstarts is as follows:

1. THROTTLE - OFF.
2. AIRSPEED - ADJUST TO OBTAIN 7 PSIA CIP.
3. FORWARD BYPASS SWITCH - OPEN.
4. CROSSFEED - ON.
5. THROTTLE - HALF OPEN.

After start:

6. Throttle and cockpit switches - As required.

If start unsuccessful (after 30 seconds):

7. Throttle - OFF.
8. Repeat AIRSTART attempt (check TEB counter).

CAUTION

- The engine shall not be intentionally windmilled at subsonic conditions when CIT is less than 15°C (60°F). If it is necessary to windmill the engine for more than five minutes the engine should not be restarted.
- If the engine must be restarted during an in-flight emergency after windmilling in excess of the above limit maintain as high an airspeed as possible to raise the inlet air temperature prior to starting. The engine should then remain at idle until there is an indication the oil has warmed up either by extinguishing of the oil temperature warning light if it has illuminated or by a normal response of oil pressure to throttle movement to slightly above IDLE.
- If, following windmill operation in excess of the above limit, the engine must be restarted and operated at high thrust levels while the oil temperature light is illuminated, duration of such operation shall be as brief as possible.

GLIDE DISTANCE-BOTH ENGINES INOPERATIVE

The windmilling Glide Distance chart, figure 3-6, shows zero-wind distances with both engines windmilling. The glide speeds are in the same range as for airstart. Somewhat slower speeds provide greater range, but reduced capability for successful airstarts. There is sufficient engine rpm for adequate hydraulic pressure to approximately 10,000 feet.

WARNING

Landing with both engines inoperative should not be attempted.

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ENGINE SHUTDOWN

Engine shutdown should be accomplished in the event of complete engine failure such as seizure or explosion, or in the event of mechanical failure within the engine or engine accessories in order to avoid or delay complete engine failure. Mechanical failure situations include uncontrollable oil temperature, EGT, or rpm, and abnormal oil pressure, fuel flow, or vibration. Complete failure probably will not permit normal windmilling operation but, if the engine continues to rotate, cooling fuel will circulate through the engine and aircraft cooling loops with the throttle OFF. An airstart should not be attempted since doing so can result in fire or explosion. Normal windmilling speeds can be expected after shutdown for mechanical failure and fuel cooling will continue unless the fuel is shut off. In some cases, airstart may be attempted after mechanical failure when conditions are favorable for control of oil temperature or pressure or EGT.

WARNING

Positively identify the failed engine before employing the engine shutdown procedure.

If engine shutdown is necessary:

1. AFT BYPASS SWITCH - OPEN.

   For the affected engine, select the OPEN position of the inlet aft bypass switch in order to delay onset of roughness or inlet unstart when the engine is shut down.

2. THROTTLE - OFF.

   As the throttle is retarded, pause momentarily at the Military and Idle positions.

3. RESTART SWITCH - ON (in roughness).

   Set the Restart switch for the affected engine inlet ON when roughness encountered.

   This causes the forward bypass to open and the spike to move forward. Roughness will be encountered at approximately Mach 2.4 and may persist to low supersonic speed. If an engine is shut down at subsonic speed, setting the Restart switch ON only opens the forward bypass as the spike is already forward.

4. Generator switch (affected engine) - OFF.

   Setting the generator switch OFF before the automatic cutout feature operates avoids the possiblity of electrical transients which might affect the navigation system.

5. Emer fuel shutoff switch - Fuel off if necessary.

   Fuel shutoff stops flow through one fuel cooling loop system. Depending on existing circumstances, this step may not be desirable or necessary.

WARNING

Shutting off fuel to a windmilling engine while at high Mach numbers may cause additional emergencies due to loss of cooling fuel for the engine and aircraft systems.

If left engine shutdown:

6. Cockpit air switch - EMER.

7. Hydraulic system - Review SAS and hydraulic services available.

   Refer to procedures for SAS, flight control system, and hydraulic system emergencies for operating procedures.

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8. Control c. g.

   Refer to use of forward transfer and crossfeed as described under fuel system emergency operating procedures to control c. g. during single engine operation.

9. Land as soon as possible.

SINGLE ENGINE FLIGHT CHARACTERISTICS

The aircraft design is such that no flight system is dependent on a specific engine; therefore, the loss of an engine will not result in subsequent loss of all hydraulic or electrical systems. If an engine fails at low speed just after takeoff, the large amount of asymmetric thrust may require bank toward the good engine and full rudder for directional control. Refer to figure 3-3 for minimum single engine control speeds. After regaining control, however, 7° to 9° rudder trim with bank and sideslip toward the good engine provide minimum drag during acceleration to climb-out speed. Charts showing single engine climbout capabilities are included in the performance data appendix. Acceleration to climb speed and climb to landing pattern altitude can be accomplished with Maximum thrust on the operating engine when a climb capability exists for the operating condition. During single engine cruise, or after climbout, reduction to zero rudder trim and use of bank and sideslip to maintain course provides minimum drag. Up to 10° bank toward the good engine may be required.

Pitch trim changes can be expected while dumping fuel due to shifting center of gravity as the tanks empty. Directional trim is quite sensitive to changes in airspeed and power settings during landing pattern operation.

At high speed, engine failure or engine flameout could cause yaw angle to become critical at high rates if an effective damper were not operating. Temporary thrust reduction on the good engine helps to counteract the asymmetric thrust condition. Follow-up rudder action is necessary. If large yaw angles develop, inlet duct airflow disturbances may cause the other engine to stall or flame out.

Roughness, if encountered, is more intense with increasing KEAS and Mach number. The maximum structural loads imposed are severe, but are well below design limits.

If airstart attempts are unsuccessful, or if engine failure has occurred, a descent to intermediate altitudes will be necessary. The spike should be forward and bypass doors open on the windmilling engine to delay onset of roughness. Note the effect of Mach number and engine rpm on inlet roughness as shown by the Inlet Unstart Boundaries chart, figure 3-5. Descent range can be extended by decelerating with minimum afterburning or Military thrust on the good engine. Base the choice on the power condition to be used for single engine cruise. When no airstart is to be attempted, decelerate at 300 KEAS until subsonic cruise altitude is reached. A bank of up to 10 degrees with zero rudder trim should be used to achieve best cruise performance.

Fuel management during protracted engine out operation should be directed toward maintaining optimum center of gravity conditions, making all of the fuel available to the operating engine and, when possible, continuing the fuel cooling of necessary systems. Improper c. g. conditions will be indicated by abnormal pitch trim requirements.

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Single-Engine Air Refueling

Single engine air refueling may be accomplished using either normal or alternate refueling procedures. Approximately the same control trim and forces as for single engine cruise may be used with bank angles up to 10°. Afterburning on the operative engine will be necessary when near 30,000 feet at normal refueling speed, and a toboggan may be necessary after approximately 15,000 pounds of fuel are on board. Refuel hook-up may be accomplished with the operative engine near Military power at low altitudes, although lack of excess thrust will make the hook-up more difficult and a continued descent may be necessary as fuel is onloaded.

NOTE

- Trimming EGT up toward limit values improves refueling altitude capability.
- If the left engine or the left hydraulic system is inoperative, right hydraulic pressure may be used by placing the brake switch in the ALT STEER & BRAKE position.
- When using minimum afterburner at intermediate altitudes or with small quantities of fuel remaining, it may be necessary to hook-up while climbing in order to avoid overrunning the tanker.

SINGLE ENGINE CRUISE

Minimum A/B thrust and Military thrust provides the best levels of single engine cruise performance. Military provides the best range performance, but penalizes the aircraft in altitude capability especially at heavy gross weights. Minimum A/B provides good range performance with an ample altitude capability. The Maximum A/B single engine cruise has poor range performance and should be only used in cases where the required cruise altitude is higher than the minimum A/B cruise capability.

Since hot temperatures adversely effect aircraft ceiling, an altitude capability lower than shown on the charts must be expected on a Hot Day.

Refer to Appendix Part IV for single engine cruise performance.

AFTERBURNER FLAMEOUT

Afterburner flameout can be expected as a result of engine stall or abnormal inlet operation, or insufficient airspeed at altitude. Afterburner flameout may be detected by a loss of thrust and by comparison of nozzle position indicators. The flamed-out afterburner nozzle will be noticeably more closed. Fuel will continue to flow from the spray bars until the throttle is retarded to MILITARY. Correct the inlet, engine, or airspeed and altitude condition before attempting afterburner relight. At high Mach numbers, the minimum airspeed necessary for afterburner operation is lower with automatic scheduling than with spike forward.

In the event of afterburner flameout, attempt to relight as follows:

1. Throttle - Retard to Military.
2. Throttle - A/B midrange.

   Note TEB shot counter number and fuel flow increase.

3. Nozzle position - Check.

   Check for more open nozzle position.

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8. Control c. g.

   Refer to use of forward transfer and crossfeed as described under fuel system emergency operating procedures to control c. g. during single engine operation.

9. Land as soon as possible.

SINGLE ENGINE FLIGHT CHARACTERISTICS

The aircraft design is such that no flight system is dependent on a specific engine; therefore, the loss of an engine will not result in subsequent loss of all hydraulic or electrical systems. If an engine fails at low speed just after takeoff, the large amount of asymmetric thrust may require bank toward the good engine and full rudder for directional control. Refer to figure 3-3 for minimum single engine control speeds. After regaining control, however, 7° to 9° rudder trim with bank and sideslip toward the good engine provide minimum drag during acceleration to climb-out speed. Charts showing single engine climbout capabilities are included in the performance data appendix. Acceleration to climb speed and climb to landing pattern altitude can be accomplished with Maximum thrust on the operating engine when a climb capability exists for the operating condition. During single engine cruise, or after climbout, reduction to zero rudder trim and use of bank and sideslip to maintain course provides minimum drag. Up to 10° bank toward the good engine may be required.

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Fuel management during protracted engine out operation should be directed toward maintaining optimum center of gravity conditions, making all of the fuel available to the operating engine and, when possible, continuing the fuel cooling of necessary systems. Improper c. g. conditions will be indicated by abnormal pitch trim requirements.

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NOTE

- Trimming EGT up toward limit values improves refueling altitude capability.
- If the left engine or the left hydraulic system is inoperative, right hydraulic pressure may be used by placing the brake switch in the ALT STEER & BRAKE position.
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In the event of afterburner flameout, attempt to relight as follows:

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2. Throttle - A/B midrange.

   Note TEB shot counter number and fuel flow increase.
3. Nozzle position - Check.

   Check for more open nozzle position.

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If relight not successful:

4. EGT - Increase trim.

   For CIT above 5°C, trim toward 805°C EGT.

   For CIT below 5°C, trim toward 825° to 845°C EGT range.

   CAUTION

   Uptrim to the 825° - 845°C EGT range carefully due to possibility of engine surge.

If relight by catalytic igniters not successful:

5. Igniter purge switch - On for two seconds.

   CAUTION

   The TEB supply will be depleted rapidly if the igniter purge switch is held on for more than two seconds.

If relight not successful:

6. Throttle - Military.

AFTERBURNER CUTOFF FAILURE

If the afterburner does not cut off when the throttle is retarded to Military, an attempt can be made to vary the thrust by retarding the throttle below Military. The engine should be shut down if thrust cannot be modulated satisfactorily. The fuel may have to be shut off if the flowmeter indicates that the afterburner is dumping fuel.

AFTERBURNER NOZZLE FAILURE

Nozzle malfunctions may be indicated by the nozzle position indicator, excessive rpm fluctuations, or failure of the engine to control to schedule speed. This may be accompanied by compressor stall and exhaust gas overtemperature. Precautionary engine shut down may be necessary.

A nozzle failed open condition will be more difficult to recognize at high altitude during afterburner operation near limit KEAS because open nozzle position is normal in these conditions. As altitude increases and KEAS decreases, the nozzle gradually closes to 60 to 80% open as limit altitude is approached. A failed open nozzle will result in abnormally high engine speeds under these conditions. An increase in afterburning throttle position or a reduction in cruise altitude while maintaining cruise Mach number (increasing KEAS) may permit cruise to be continued until the scheduled descent point is reached. Nozzle position and rpm of the normally operating engine can be used as a guide in selection of the lower cruise altitude range where an open nozzle position is normal. Be prepared to use less than Military throttle when the afterburner is shut down.

At intermediate altitudes, the nozzle failed open condition may be recognized by reduction of thrust and an increase in rpm. At low altitude and Mach number it will be necessary to rapidly retard the throttle to a point midway between IDLE and MILITARY to keep rpm within limits. The same procedure will apply when altitude and Mach number are decreased and the nozzle failure is detected. If the thrust requirement is critical, such as for takeoff, it may be practical to retain Maximum thrust, even with engine overspeed, until safe airspeed and altitude are attained.

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A nozzle-closed failure can, in most cases, be detected by referring to the nozzle position indicator on the instrument panel and by analyzing engine symptoms. There are no obvious symptoms of a nozzle failed closed without afterburning because the nozzle is already closed, or nearly so, at Military thrust. EGT and rpm may fluctuate together. Either down trim the engine or retard the throttle slightly and check for rpm suppression or ENP change. A normally functioning nozzle will open slightly to maintain engine rpm. In the case of the nozzle failing closed, do not attempt to light the afterburner because the engine may flame out (after which it cannot be restarted due to reduced rpm). If the nozzle fails closed with afterburning, rpm suppression will occur, probably unstarting the inlet shock wave. Compressor stall and afterburner flame out are extremely likely and EGT will probably rise.

Nozzle Failed During Cruise

When a reduction in thrust or rpm is desirable or nozzle failed closed:

1. Throttle - MILITARY or below, as required.
2. RPM and EGT - Maintain in limits.
3. Land as soon as practicable.

OIL PRESSURE ABNORMAL

Low Oil Pressure

A low oil pressure generally indicates an oil system malfunction. If the malfunction causes oil starvation of the engine bearings, the result will be a progressive bearing failure, loss of oil, and subsequent engine seizure. Bearing failure due to oil starvation is generally characterized by rapidly increasing vibration. If this occurs in conjunction with gage indication of pressure loss, reduce Mach number and altitude and do the following:

1. Throttle - OFF.
2. Land as soon as practicable.

High Oil Pressure

High oil pressure does not necessarily indicate a hazardous engine operation condition unless accompanied by high oil temperature; however, the high pressure condition must be reported after flight and the landing should be accomplished as soon as practicable.

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OIL TEMPERATURE ABNORMAL

Abnormal high or low oil temperature is indicated by illumination of the OIL TEMP warning light. It is unlikely that low oil temperature will occur in flight with the engine operating, and a high oil temperature should be assumed. Abnormally high oil temperature could be caused by deficient lubrication flow or insufficient fuel/oil cooling. Abnormally low oil temp may be indicated before start or after extended windmilling operation at subsonic speeds. In the event of an L or R OIL TEMP warning light illumination in flight, proceed as follows:

1. Oil pressure - Check for normal indication.
2. Speed and altitude - Reduce as required if at high Mach number.
3. Fuel flow - Maintain over 12,000 pph (if practicable).

If temperature can not be controlled:

4. Throttle - OFF.
5. Land as soon as possible.

NOTE

If L or R OIL TEMP warning light illuminates after extended windmilling operation, refer to AIRSTART procedure, this section.

FUEL CONTROL FAILURE

If a fuel control malfunction is suspected, minimize throttle movements and monitor rpm and EGT closely.

FUEL-HYDRAULIC SYSTEM FAILURE

Fuel hydraulic system failure may be caused by a failed pump or a broken line or connector. A failed pump is indicated by inoperative exhaust nozzle and start and bypass bleed valves. Line failure is indicated by excessive fuel flow.

If engine fuel-hydraulic system failure is suspected:

1. Fuel flow - Check.

If fuel flow is excessive:

2. Throttle - Military.

CAUTION

Overspeed may occur.

3. ENP and rpm - Check.

If exhaust nozzle position indicator does not reflect a more closed position:

4. Throttle - Between Idle and Military.
5. Fuel flow - Check.

   A fuel flow of approximately 8000 to 9000 pph above normal will confirm a broken line.

When below Mach 1.7:

6. Throttle - OFF.
7. Emergency Fuel Shutoff switch - Fuel off.

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FUEL SYSTEM

FUEL QUANTITY LOW WARNING

If the fuel quantity low warning light comes on with appreciably more than 5000 pounds of fuel indicated remaining in tank 4, determine total fuel from the individual tank quantities. Monitor tank 4 quantity and land as soon as practicable. Quantity indications are affected by pitch attitude and longitudinal acceleration. Total quantity indication is also affected by the fuel distribution in the individual tanks.

If the fuel quantity low warning light does not come on with less than 5000 pounds of fuel indicated in tank 4, test warning light and land as soon as possible.

FUEL PRESSURE LOW

If one or both FUEL PRESS LOW warning lights illuminate:

1. CROSSFEED - PRESS ON.
2. Tanks containing fuel - Press on.
3. Analyze difficulty and attempt to restore normal sequencing. The difficulty may be due to low rpm while transferring or dumping.

When fuel pressure is restored:

4. Crossfeed - Press off.

If pressure cannot be restored:

5. Land as soon as possible.

FUEL TANK PRESSURIZATION FAILURE

Fuel tank pressurization failure is indicated by the tank pressure gage and illumination of the TANK PRESSURE LOW warning light. It may be confirmed by liquid nitrogen quantity remaining gage indications. Impending failure is indicated by illumination of the N QTY LOW warning light.

No corrective action is possible after both liquid nitrogen systems are depleted except to limit rates of descent to minimize the difference between fuel tank and ambient pressures. In descent, the fuel tank suction relief valve in the nose wheel well opens when slightly negative tank pressures occur. Rates of descent should be limited so that tank pressure does not become less than -1/2 psi.

WARNING

> Limit tank pressure is -1/2 psi. This limit is based on structural capabilities of the fuselage tanks.

To descend:

1. Descend so that minimum tank pressure limit is not exceeded.

   Adjust power and airspeed as required.

If flight included cruise over Mach 2.6:

2. Loiter at subsonic long range speed for 10 minutes if possible.

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If loiter not possible:

3. Descend from FL 400 to FL 350 as slowly as possible.

4. Continue descent so that minimum tank pressure limit is not exceeded.

NOTE

Cooling will be accelerated and pressure may be relieved faster after reaching subsonic speeds if the nose gear is extended.

FUEL BOOST PUMP FAILURE

Loss of all boost pumps can only result from multiple failures. It would be indicated by illumination of both fuel pressure low lights.

WARNING

Fuel cannot be dumped with complete boost pump failure. Use caution if heavyweight landing is required.

Partial boost pump failure may not be indicated by the fuel pressure low lights. Incorrect fuel sequencing and center-of-gravity shift may be the first indication. Proceed as directed for Fuel Sequencing Incorrect. Crossfeed may be required; however, when crossfeed is on, more fuel will tend to feed from the forward tanks which have boost pumps operating. This could cause an aft c. g. shift which might be hazardous when operating with a failed pitch SAS.

FUEL SEQUENCING INCORRECT

Incorrect automatic fuel sequencing is indicated primarily by the fuel boost pump lights. (A light may illuminate out of normal sequence, or fail to illuminate on schedule.) In this event, control the boost pumps manually until correct automatic sequencing resumes or a landing is made. It is possible that faulty fuel sequencing may manifest itself by secondary indications, such as a fuel low level light coming on prematurely, or an abnormal adjustment required in pitch trim due to c. g. change by faulty fuel distribution. Note that forward c. g. requires increased power to maintain speed and altitude. If normal sequencing does not resume, and manual sequencing is either inconvenient or impossible, turn crossfeed on or transfer fuel to ensure that any available fuel will get to the engines.

CAUTION

Do not permit a manually selected fuel boost pump to continue running in an empty fuel tank. The boost pump will be damaged.

NOTE

Crossfeed may be required to provide fuel to both engines during fuel sequence malfunctions.

Fuel System Management With Engine Shutdown

During single engine operation with the left engine failed, the crossfeed valve should be opened after tanks 5 and 6 are emptied by right engine consumption. If the right engine has failed, empty tanks 5 and 6 by successive forward transfer operations. This accomplishes the dual purpose of maintaining c. g. and using all available fuel.

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NOTE

Fuel transfer capability is lost when operating on battery power and the crossfeed valve position cannot be changed. An aft c. g. shift can be expected as fuel is consumed.

Fuel cooling is continued automatically when the inoperative engine is windmilling unless its emergency fuel shutoff switch is actuated.

Crossfeed should never be used during forward transfer when fuel remains in tanks 5 or 6. If it were, most of the fuel transferred would come from the operating tank(s) of group 2, 3, or 4 because of the aircraft nose up attitude and lower fuel pressure head these pumps would have to overcome. Only a small forward c. g. shift would result.

EMERGENCY FUEL OPERATION

The design and specification operating envelope of the JT11D-20 engine necessitates operation with a fuel having special characteristics. During high Mach number operation the fuel serves not only as the source of energy but is used in the engine hydraulic system and serves also as a heat sink for cooling the various aircraft and engine accessories heated by the high ambient air temperatures. This requires a fuel having high thermal stability so that it will not break down and deposit coke and varnishes in the fuel system passages. A high luminometer number (brightness of flame) is required to minimize transfer of heat to the burner parts. Other items are also significant, such as the amount of sulphur impurities tolerated. An advanced fuel, PWA 523E, was developed to meet the above requirements.

In addition to the fuel requirements, a special lubricity additive is used with PWA 523E to insure adequate lubrication of fuel and hydraulic pumps.

Fuels such as JP-4, JP-5, and JP-6 may be used only for emergency requirements such as air refueling when standard fuel is not available and air refueling must be accomplished or risk loss of the aircraft. Air refueling procedures with JP fuel are the same as for the approved fuel.

When these JP fuels are used, operation should be restricted to a maximum speed of Mach 1.5.

ELECTRICAL POWER SYSTEM FAILURE

SINGLE AC GENERATOR FAILURE

Failure of one ac generator will be indicated by illumination of the warning light. One generator in normal operation is sufficient to support the entire electrical load. In the event of generator failure, proceed as follows:

1. Generator switch - RESET then release.

If the generator fault has been corrected, the generator will be reconnected to the system and the warning light will go out.

If the light remains on:

2. Failed generator switch - TRIP.
3. Land as soon as practicable.

If flight is continued with an inoperative engine or generator:

4. Affected generator - TRIP.

If EWS equipment is operating:

5. TACAN - OFF.

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CAUTION

- Do not manually select additional fuel tank pumps.
- HF radio transmissions are limited to one minute of any ten minute period.

DOUBLE AC GENERATOR FAILURE

If both ac generators fail the dc monitored bus will be dead, however, INS equipment will continue to be powered by the INS battery. Manual trim will not be available. The dc essential bus will automatically receive power from the emergency batteries. The battery switch must be in the BAT position to power the essential dc bus. Some dc systems which may not always be essential for flight cannot be turned off by the pilot unless the circuit breakers are pulled. These are difficult to reach when wearing a pressure suit. The UHF radio should be used only when absolutely necessary because its large power requirement will deplete battery power rapidly. With complete generator failure, fuel boost pumps are inoperative. Proceed as follows:

1. Battery switch - Check BAT.
2. Generator switches - RESET.
3. If only one generator resets - Land as soon as practicable.
4. If neither generator resets - Conserve batteries and land as soon as possible.

AC GENERATOR UNDERSPEED

The minimum windmill speed at which the ac generators will supply power is approximately 2800 rpm. If the left engine is below approx 4500 rpm the HF and TACAN radio will be inoperative. The left generator may be tripped to restore operation if the right engine is above 4500 rpm.

TRANSFORMER RECTIFIER FAILURE

One transformer rectifier will supply the normal electrical demands. Variable frequency ac power systems will continue to operate normally. A double failure of the transformer rectifiers removes power from the dc monitored bus but the INS will be operated from the INS battery. The batteries will operate the dc essential bus and should be managed as for double generator failure.

INVERTER FAILURE

The inverter powered systems operate from separate inverters. Refer to Electrical Power Distribution diagram, Section I. No. 1 inverter is the most important with No. 2 and No. 3 following in order of lesser importance. The No. 4 inverter is installed to serve as a backup in the event of failure of any one inverter. It is placed in operation by turning the failed inverter switch to the EMER position. If a second inverter failure should occur the No. 4 inverter will power the lowest numbered inverter bus whose switch is in the EMER position.

If an inverter failure is indicated by illumination of an INVERTER OUT warning light, proceed as follows:

1. Failed inverter switch - EMER.

Check that INVERTER OUT light extinguishes:

2. Illuminated SAS recycle lights - Press.

HYDRAULIC POWER SYSTEM FAILURE

With both engines out, the hydraulic pumps provide sufficient flow for satisfactory flight control system operation at windmill speeds above 3000 rpm. Reduced control system capability is available down to a windmilling speed of approximately 1500 rpm. With one engine windmilling, all pri-

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mary and most utility services are supplied by the operating engine hydraulic systems. The windmilling engine utility system pressure and flow may be sufficient to supply service until the engine is almost stopped.

PRIMARY HYDRAULIC SYSTEM FAILURE

The loss of either A or B hydraulic system will be indicated by the warning light on the pilot's center console, the master caution light, and the dual A and B hydraulic pressure gage. Reduce speed to less than 350 KEAS if either A or B system fails and turn Reserve Hydraulic Oil System switch on to the operative system (A or B). This will ensure a minimum of at least 3 hours of flight control time remaining at high speed cruise schedules.

Disengagement of the failed hydraulic system SAS channels is necessary to maintain full yaw and roll damping capability. As a hydraulic system failure is not sensed by the SAS equipment, it is necessary to double the SAS signal gain of the operating channel to give the equivalent control response in yaw and roll. Airspeed reduction with a single hydraulic system is a precautionary procedure which allows for the reduction in available hinge moment capability. Disengagement of the failed system SAS pitch channel is not mandatory, but it may be more desirable to disengage all three channels than only the yaw and roll switches. Monitor all system operations closely and attempt to determine if a complete failure is imminent. Be prepared for ejection prior to complete failure.

UTILITY HYDRAULIC SYSTEM FAILURE

The loss of L or R hydraulic system will be indicated by the dual L and R hydraulic pressure gage. If the pressure of the L system falls below 2000-2200 psi, crossover for gear retraction is automatic. The manual release must be used to lower the gear. Items which are affected by the L hydraulic system are normal brakes, nosewheel steering, aerial refueling system and the left inlet control actuators. Items which are affected by the R hydraulic system are right inlet control actuators, alternate steer and brakes and air refueling system.

FLIGHT CONTROL SYSTEM FAILURE

With both engines out, the ac generators furnish rated electrical power at windmill speeds above 2800 rpm. The emergency batteries provide SAS operation at lower windmill speeds. There is sufficient hydraulic flow to operate the control surfaces at satisfactory rates above 3000 rpm and operation at reduced rates is available to a windmilling speed of approximately 1500 rpm.

NOTE

During single engine operation, a windmilling engine may not develop sufficient system hydraulic pressure to maintain operation of its associated SAS servo channels. To avoid nuisance disengagement of SAS channels, turn off all three SAS channel switches for the windmilling engine hydraulic system when lower than normal pressure is indicated. Pitch and Yaw SAS damping will continue on one channel. The operative engine SAS roll channel must be cycled OFF then ON to maintain damping in the Roll axis.

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With both engines out, the ac generators furnish rated electrical power at windmill speeds above 2800 rpm. The emergency batteries provide SAS operation at lower windmill speeds. There is sufficient hydraulic flow to operate the control surfaces at satisfactory rates above 3000 rpm and operation at reduced rates is available to a windmilling speed of approximately 1500 rpm.

NOTE

> **During single engine operation, a windmilling engine may not develop sufficient system hydraulic pressure to maintain operation of its associated SAS servo channels. To avoid nuisance disengagement of SAS channels, turn off all three SAS channel switches for the windmilling engine hydraulic system when lower than normal pressure is indicated. Pitch and Yaw SAS damping will continue on one channel. The operative engine SAS roll channel must be cycled OFF then ON to maintain damping in the Roll axis.**

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FLIGHT CONTROL SYSTEM EMERGENCY OPERATION

If either the A or B hydraulic system fails, the control forces will not change. Either system will operate the control surfaces, but at a slower rate and with some reduction in control responsiveness at high KEAS and Mach numbers.

If control difficulties are encountered:

1. Check A and B hydraulic system pressures. If either A or B hydraulic system has failed proceed as directed for A or B hydraulic system failure this section.
2. Disengage autopilot and check control.
3. Check SAS warning lights. If SAS failure has occurred, proceed as directed under SAS Emergency Operation this section.

A OR B HYDRAULIC SYSTEM FAILURE

1. Reduce speed to less than 350 KEAS.

CAUTION

Do not exceed 350 KEAS with either an A or B hydraulic system inoperative. If either system fails above this speed, reduce speed as soon as possible. Flight control responsiveness will be reduced during single hydraulic system operation at high KEAS and Mach numbers, and flight maneuvers under these conditions should be held to a minimum.

2. Affected SAS yaw and pitch switches - OFF.
3. SAS roll switches - OFF.
4. Operative roll channel switch - ON.

NOTE

When one roll SAS channel is disengaged or turned off the simplified logic circuit will disengage the other roll channel. The desired roll channel switch must be turned OFF and then re-engaged to regain single channel roll SAS operation.

5. Reserve hydraulic oil switch - To operative system (A or B).

BOTH A & B HYDRAULIC SYSTEMS FAILED

1. EJECT.

WARNING

If both the A and B hydraulic systems have failed all flight controls will be inoperative.

SAS EMERGENCY OPERATION

SAS emergency operating procedures and the applicable flight limitations should be used whenever there has been a channel disengagement or a reduction in SAS effectiveness. Disengagement may result from failures of any of the following systems or components: SAS gyro or electronics circuitry, flight control servos, or electrical power supply. Disengagement or loss of effectiveness may occur as a result of complete or partial loss of A or B System hydraulic power. Disengagement of any channel is indicated by illumination of the master caution light, the SAS CHANNEL OUT light on the annunciator panel, and one or more of the recycle indicator lights on the SAS control panel.

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MINIMUM AIRSPEED LIMITS WITH PITCH SAS INOPERATIVE

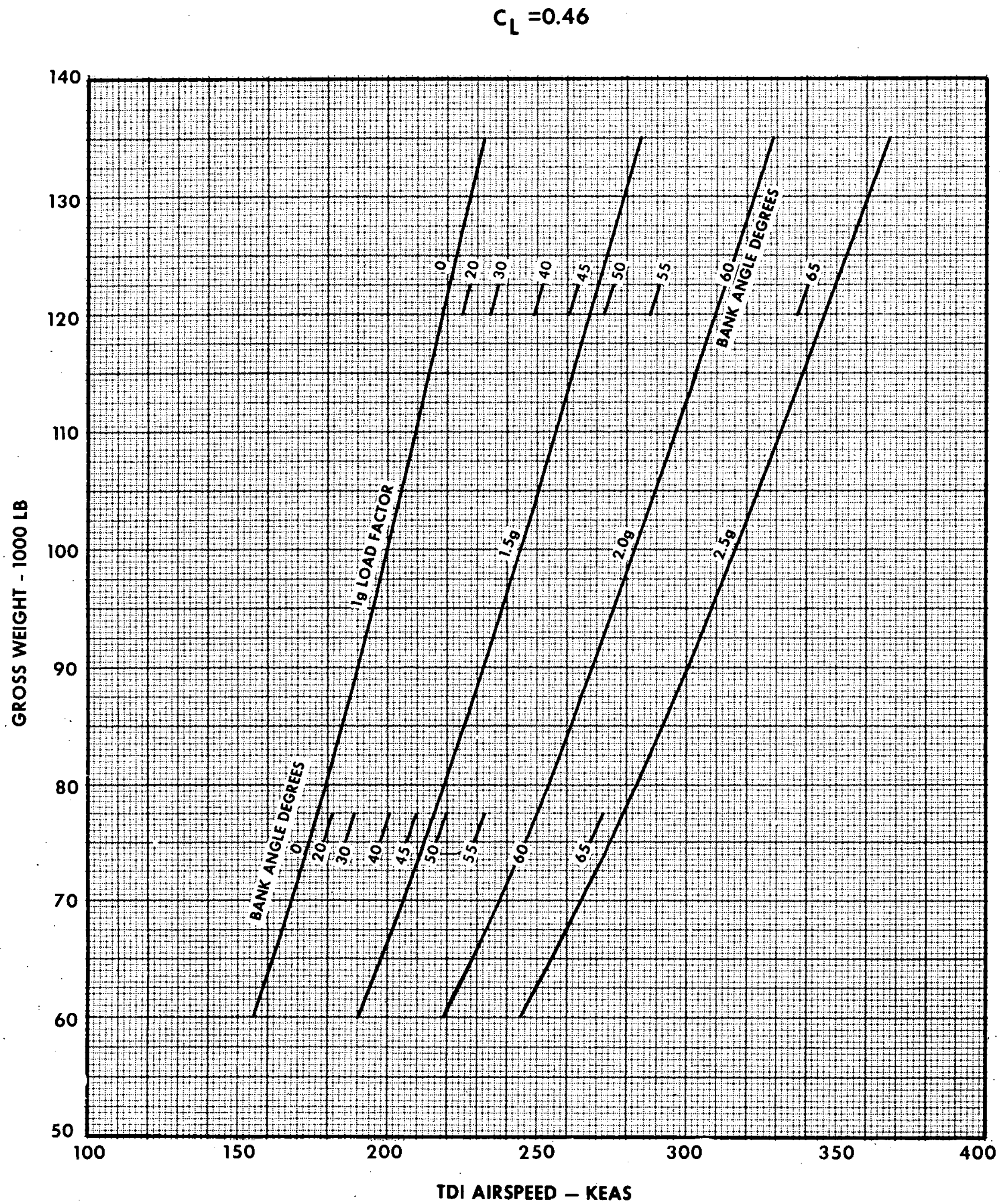

Figure 3-7

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When a malfunction is indicated in any SAS axis, initiate the following preliminary actions:

a. A & B hydraulic system pressures- Check normal. If hydraulic system failure is indicated, follow A and/ or B Hydraulic System Failure procedure, this section.

b. INVERTER OUT Warning Lights - Check.

If illuminated, use Inverter Failure procedure, this section.

c. Proceed to appropriate Pitch and Yaw axis or Roll Axis Failure procedures, this section.

A single failure or sequence of failures in the pitch and yaw axes which leaves one A or B channel operating in each of these axes does not change the aircraft flight characteristics. However, some undesirable cross-coupling in the pitch and yaw axes may result from failure of one roll channel. Characteristics which change as a result of failures affecting both the A and B channel servos in an axis are described as second condition failures with the appropriate procedures. Also refer to the SAS Warning Lights charts, Figure 3-8, which illustrate the probable causes of failure indications, remaining capabilities, procedures, and limits which apply after channel disengagement.

Pitch and Yaw Axis Failures

A "first" condition failure exists after attempts to extinguish one or more recycle lights are ineffective and either an A or B channel is operating (light Off) in each of the pitch and yaw axes. A "first" condition failure exists with a single A, B, or M channel light illuminated or in some cases after simultaneous or progressive illumination of two or more of these lights, as illustrated by the SAS Warning Lights Chart, Figure 3-8, Sheets 1 and 2.

NOTE

Consider that no failure exits when all pitch and yaw recycle lights have been extinguished, regardless of previous combinations of illumination, if normal operation of the recycle lights is verified by depressing the SAS Lights Test button.

Flight may be continued without restriction when a first condition failure exists except that maximum airspeed is limited to 350 KEAS in the case of combined channel failures due to low hydraulic system pressure.

A "second" condition failure is defined as existing whenever the A and B recycle lights in one axis remain illuminated after attempts to extinguish them are ineffective. When a "second" condition failure exists, flight speed is restricted to Mach 2.8 and 350 KEAS. Transfer fuel as required to obtain either 2^{o} nose up trim or 4000 pounds in tank 1.

NOTE

Each instance of recycle light illumination presents a new situation and, if the light(s) can not be extinguished, the condition must be determined as being a "first" or "second" condition of failure in accordance with the definitions provided above.

Logic override procedures are usable after a "second" condition failure when the sequence of light illumination indicates that a channel with operative servos is available. Refer to After Second Failures, SAS Warning Lights Chart. When use of logic override is effective, flight characteristics are the same as with SAS fully operational. However as a precaution against subsequent hardover failures signals, the autopilot must not be engaged in that channel and second condition failure limits apply.

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WARNING

If logic override is recommended, use it only in the channels specified and only after decelerating to second condition failure limit speeds in order to prevent excessive structural loads which could result from a hardover failure at higher speeds.

Neither logic override nor BUPD operation should be attempted with either channel known to have a failed servo.

BUPD plus logic override procedures are available after a "second" condition failure in the pitch axis. The BUPD is optimized for operation at air refueling speeds, and it should not be operated above 330 KEAS or 0.85 Mach. It may or may not improve flight characteristics at other flight conditions.

Logic override or BUPD plus logic override may not be usable or effective after a second condition failure in the pitch axis. If neither can be employed, some longitudinal overcontrol probably will occur when at high Mach numbers. Observance of second failure limits is required, and descent to subsonic operating speeds is recommended when practicable. Air refueling and landing may present some difficulties in maintaining precise attitude control. With pitch SAS off and neutral c.g. there is no tendency for the aircraft to return to a trimmed attitude when a displacement occurs at landing pattern speeds. However, divergent speed and attitude tendencies occur slowly enough to be completely controllable. Minimum airspeed limits with pitch SAS inoperative (Figure 3-7) should be observed.

If logic override procedures are not effective or possible after a second condition failure in the yaw axis, tests at high Mach numbers indicate that neutral to slightly positive stability exists but that there is little damping of yaw oscillations after they commence. Automatic scheduling of the inlet components may induce neutrally damped directional oscillations while above Mach 2.8. Directional and roll control could become difficult in the event of an unstart or flameout while above Mach 2.9 as a result of large bank angles generated by yawing motion. Pilot rudder inputs usually tend to aggravate this condition. These conditions could also result in excessive rudder surface loads at airspeeds above 400 KEAS. Use of both restart switches is recommended while decelerating in order to avoid asymmetric nacelle drag conditions or unstarts.

1. Illuminated recycle light(s) - Depress and release.

If light stays on or reilluminates:

2. Channel switch - OFF.

   No further action is required unless a 2nd condition failure exists.

If another failure should occur in the same axis:

3. Illuminated recycle light(s) - Depress and release.
4. If lights do not extinguish - Comply with limits.

For second condition failure above Mach 2.8 or 350 KEAS:

5. Restart switches - ON (simultaneously) except during climb.

NOTE

If climbing, bleed speed below 350 KEAS.

6. Throttles - Minimum A/B.

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SAS WARNING LIGHTS CHART

PITCH OR YAW RECYCLE LIGHTS ON

INDICATIONS AFTER FIRST FAILURE

PITCH OR YAW Light(s) on (● 1st, 2 2nd)										
	A	●	○	○	●	○	●	○	2	○
	B	○	●	○	○	●	○	●	○	2
	M	○	○	●	●	●	2	2	●	●
SEQUENCE OF ILLUMINATION	FIRST	A servo	B servo	M gyro	A gyro	B gyro	A servo	B servo	M gyro	M gyro
	SECOND						M or A gyro	M or B gyro	A servo	B servo
CHANNELS REMAINING OPERABLE		B	A	A and B	B	A	B	A	B	A
ACTION: First try to press light(s) off		then ➡ No further action when first failure lights stay on A or B light is off								
LIMITS		NONE								

INDICATIONS AFTER SECOND FAILURE

PITCH OR YAW (● 1st, 2 2nd)								
	A	2	●	2	●	2	●	2
	B	2	2	●	2	●	2	●
	M	●	●	●	2	2	○	○
SEQUENCE OF ILLUMINATION	FIRST	M gyro	A gyro	B gyro	A servo	B servo	A servo	B servo
	SECOND	A or B gyro	B or M gyro or B servo	A or M gyro or A servo	B gyro	A gyro	B servo	A servo
FUNCTIONS OPERABLE		A or B Channel	A servo's possibly B channel	B servo possibly A channel	B servo	A servo	NONE	
ACTION First try to press lights off If A and B lights stay on (then ➡)		pitch or yaw: Try Override — A or B first	B / A — Unless subsonic then BUPD plus pitch override — A / B	If pitch Try BUPD plus override — B / A	If Yaw No Action		NO ACTION — UNUSABLE pitch or yaw SAS	
Note: Use of Logic Override is not mandatory		To use pitch or yaw Logic Override: A and B Channels off. Select A or B override. Beep Channel switch ON. To use BUPD: A and B channels OFF. BUPD - ON Select A or B Override. Beep one Channel on. Channel off if no improvement.					Do not use Logic Override or BUPD	
LIMITS		Mach 2.8 and 350 KEAS maximum. Fuel transfer is necessary for 2° noseup trim up to 4000 lb. With override - No autopilot that axis With BUPD - Mach 0.85 and 330 KEAS						

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Figure 3-8 (Sheet 1 of 2)

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SAS WARNING LIGHTS CHART

COMBINATIONS OF PITCH, ROLL AND YAW DISENGAGE LIGHTS
INVERTER OUT AND A OR B HYDRAULIC LOW
WARNING LIGHTS ON

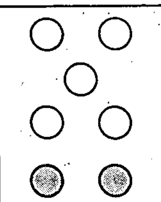
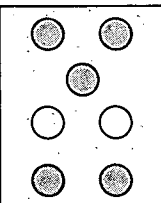
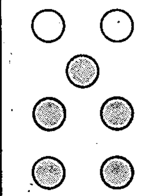
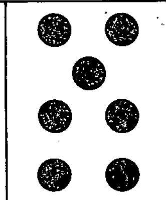
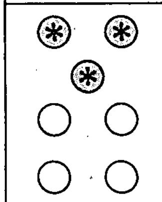
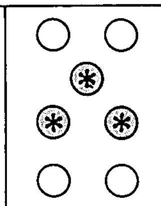
INDICATION	ELECTRICAL FAILURE				HYDRAULIC FAILURE		
PITCH YAW A A ROLL B B M M							No lights on but operation poor
CHECK	INV 3	INV 1	INV 2	ANY TWO	A System	B System	BOTH A and B
ACTION	1 Check circuit breakers a Inv 3 ØB-SAS pitch-yaw mon b Ess DC bus-SAS M 2 Inverter Switch - EMER 3. Press recycle lights off 4 Recycle roll channel switch if light is on 5 Do not use logic override	1 Check circuit breakers a Inv 1 ØB-SAS yaw A b Ess DC bus-SAS A	1 Check circuit breakers a Inv 2 ØB-SAS yaw B b Ess DC bus-SAS B	1 Check circuit breakers a Inv 1,2,3 b Ess DC bus-SAS A,B,M Note: M Channels will be inoperative	Channel off if pressure is low With normal pressure: 1 Cycle roll channel switch 2 Press recycle lights off Note: Any combination of A, B, and/or roll lights may occur (✱) Lights may illuminate simultaneously or progressively		
LIMITS	NONE			2nd Failure	350 KEAS maximum		

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Figure 3-8 (Sheet 2 of 2)

When speed is stabilized below Mach 2.8 and 350 KEAS:

7. Restart switches - OFF.

8. Aft bypass switches - Normal schedule.

9. Throttles - As required.

10. Forward transfer switch - Transfer as required to maintain at least 2^{o} nose up trim up to 4000 lb.

If SAS lights indicate a good servo is available:

11. A or B logic override - Engage as indicated by servo availability.

a. Pitch or yaw logic override switch - A or B position depending on failure analysis.

NOTE

Refer to SAS Warning Light Chart.

b. Appropriate A or B channel switch - Beep ON.

Recycle light should extinguish.

c. If control does not improve - Channel switch - OFF.

d. Logic override switch - OFF.

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For pitch axis second condition failure; when speed is below 330 KEAS and 0.85 Mach:

12. BUPD - Engage as required.

    a. Pitch SAS A and B channel switches - OFF.

    b. BUPD switch - ON.

    c. Pitch logic override switch - A or B position as indicated by servo availability.

    d. Appropriate A or B pitch SAS channel switch - Beep ON. Recycle light should extinguish.

    e. If control does not improve - Channel switch OFF.

    f. Logic override switch - OFF.

    g. BUPD switch - OFF.

    h. Depending on failure analysis this procedure may be repeated using other SAS channel if indicated.

Roll Axis Failures

Illumination of the roll channel disengage light shows that both roll channels and the roll autopilot are disengaged. When there is no apparent fault in the hydraulic systems or electrical power supply which would cause disengagement, check for a transient disengagement as follows:

1. A or B channel switch - OFF, then ON.

A transient or intermittent fault existed if the light then remains off. If the light does not extinguish, or reilluminates while maneuvering, a first condition failure exists in the roll mode.

For a first failure:

2. A and B channel switches - OFF.

Unless the failure can be associated with a specific hydraulic or electrical power supply, regain the use of one channel by the following arbitrary step sequence:

3. A channel switch - ON.

NOTE

> Be prepared to move the switch to OFF immediately if a hardover signal results, indicating that the failed channel was inadvertently selected.
>
> Operation with only one roll channel engaged results in overriding of logic circuitry. There is no automatic protection against inadvertent selection of a failed channel, or against subsequent failure of a properly operating channel which has been engaged.

If a hard-over signal is obtained on engagement or during subsequent operation, or if no improvement is noted in flight characteristics:

4. A channel switch - OFF.

5. B channel switch - ON.

NOTE

> Be prepared to disengage the channel immediately if a hardover signal results.

If a hard-over signal is obtained on engagement or during subsequent operation, or if no improvement is noted in flight characteristics, a dual or second condition failure exists.

For a second condition failure:

6. Roll channel switches - Both OFF.

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Some undesirable cross-coupling may occur during single roll SAS channel operation. This appears as small amplitude oscillations in the pitch and yaw axes, as the elevons on only one side of the aircraft respond to roll signals during single channel operation and compensation for the asymmetric roll signals is provided by pitch and yaw axis control operation.

Scheduled activity may be continued for the remainder of the flight with a single roll SAS channel operating. The roll autopilot may be engaged and the automatic navigation feature of the INS used as desired.

NOTE

- Operation with both roll channels disengaged is permitted if cross-coupling about the pitch and/or yaw axes prevents precise aircraft control with one roll channel engaged.
- In the event of single engine failure at low speed, or during single engine landing, failure of one roll SAS channel and simultaneous automatic disengagement of the other roll channel may occur due to loss of hydraulic power from the windmilling engine.

To avoid changes in control characteristics at a critical time during single engine landings, either make the approach with both roll SAS channels disengaged or with the roll channel which is powered by the inoperative engine disengaged.

A second roll SAS channel failure while at high speed will probably be indicated by abnormal pitch transients and small roll transients without illumination of either pitch or roll SAS indicator lights. The symptoms may be difficult to attribute to roll channel failure. When pitch transients occur with one roll channel engaged, disengage both roll SAS channels and check for control improvement. If no improvement is noted, the single roll channel may be reengaged if desired.

Failure or intentional disengagement of both roll SAS channels is expected to increase pilot fatigue, reduce mission effectiveness, and will disable the roll autopilot; however, no hazard to safety should result and there are no flight restrictions on continued operation.

TRIM FAILURES

Pitch, yaw or roll trim malfunctions may be of the inoperative type or the runaway type. Runaway trim failures in pitch may occur at slow speed (0.15°/sec change in elevon deflection) if due to automatic trim motor operation or at fast speed if due to manual trim motor operation (1.5°/sec change in elevon deflection). A low speed runaway type of malfunction will be apparent by the need for constant manual pitch trimming. The runaway yaw trim rate is approximately 1.5° per second trim change. The roll trim rate is approximately 1°/sec. Runaway yaw trim will be accompanied by rudder pedal deflections as the surfaces move. Runaway pitch or roll trim will not be accompanied by stick movement due to surface movement.

In the event trim runaway failure is suspected, proceed as follows:

1. TRIM POWER SWITCH - OFF.

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If circumstances permit:

2. Reduce speed to below 350 KEAS and 2.5 Mach number.

With runaway nose up pitch trim:

3. Transfer fuel forward to reduce forward stick force requirement.

WARNING

Do not transfer fuel if nose down pitch trim has occurred.

When time and conditions permit:

4. Autopilot - ON. Check for control improvement.

5. Affected trim circuit breakers - Pull.

NOTE

Both A & C phase circuit breakers must be pulled on the suspected circuit.

Trim Malfunctions:

a. If runaway slow speed pitch trim - Pull auto pitch trim circuit breakers.

b. If runaway high speed pitch trim - Pull manual pitch trim circuit breakers.

c. If runaway roll or yaw trim - Pull roll or yaw circuit breakers.

6. Trim power switch - ON.

With manual pitch trim inoperative and auto trim available, engagement of the pitch autopilot will gradually correct an out of pitch trim condition. This will relieve the pilot of a need for maintaining stick deflection to maintain attitude. The pitch autopilot can also be used when the auto trim motor is inoperative, but automatic pitch trim synchronization will not be available.

CAUTION

Disengagement of the pitch autopilot when not in trim may be accompanied by a considerable transient.

If the trim malfunction is a runaway in the roll axis, right or left stick deflection will be required for the rest of the flight but stick force will not be more than normally required for the same amount of deflection. If the malfunction was a runaway in the yaw axis, rudder pedal force will be required to maintain neutral rudder pedal position.

AIR DATA COMPUTER FAILURE

If malfunction or failure of the air data computer (ADC) is suspected, proceed as follows:

1. Cross check TDI instrument against pitot-static operated airspeed and altimeter.

If cross check shows TDI to be inaccurate:

2. Revert to use of pitot-static operated instruments for aircraft control.

3. Autopilot - OFF.

PITOT-STATIC SYSTEM FAILURE

Under some conditions both of the pitot-static operated systems may become inaccurate or inoperative from a common malfunction. Failure of the pitot heater may simultaneously affect both normal sys-

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tems in icing conditions. The pitot probe could be plugged by a foreign body of sufficient size. If both systems fail, proceed as follows:

1. Attempt to restore operation by selecting alternate static source.
2. Maintain aircraft control by use of attitude and power indicating instruments.
3. Request escort aircraft for letdown and landing.

AIR CONDITIONING AND PRESSURIZATION FAILURES

LEFT ENGINE OR COCKPIT SYSTEM INOPERATIVE

If the left engine is shut down:

1. Cockpit system switch - EMER.

COCKPIT DEPRESSURIZATION

Cockpit depressurization above approximately 35,000 feet will be indicated by pressure suit inflation. If suit inflates, proceed as follows:

1. Cockpit altitude - Check.

If increasing or at actual aircraft altitude:

2. Nose air - OFF.

CAUTION

When the nose air valve is OFF it will shut off pressurization and cooling air to the nose compartment and possibly result in loss of UHF, HF and IFF equipment. TACAN and normal ADF equipment located in the E-bay will still be available.

If cockpit altitude does not decrease:

3. Nose radio equipment UHF, HF and IFF - OFF.
4. Nose hatch seal lever - OFF.

NOTE

If cockpit repressurizes the pressurization loss is due to failure of the nose hatch seal and periodically the nose air and desired radio may be turned on for possible short time usage.

WARNING

During this time the pilot will be depending on the pressure suit only for altitude protection.

If cockpit still does not repressurize:

5. Nose air handle and nose hatch seal - ON.
6. Suit ventilation boost lever - EMERG.
7. Reduce altitude if possible.
8. Radio equipment - ON only as necessary after altitude is reduced.

COCKPIT AND VENTILATED SUIT ABNORMAL TEMPERATURE

1. Defog switch - OFF.
2. Cockpit temperature indicator - Check.

If temperature indication is abnormal:

3. Cockpit auto temperature rheostat - Rotate as desired.

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NOTE

The temperature control bypass valves are motor operated and travel from full hot to full cold or vice versa in approximately 7 to 13 seconds.

If auto temperature control is not effective and cockpit temperature remains too high or low:

4. Cockpit temperature control switch - HOLD in COLD or WARM as desired.

NOTE

In this position the temperature control bypass valves take 7 to 13 seconds to travel from full hot to cold or the reverse.

If no correction in temperature occurs in 30 seconds:

5. Cockpit system switch - EMER.

If cockpit temperature is still abnormal:

6. Q-Bay or emer cockpit auto temperature rheostat - Rotate toward COLD or WARM as required.

If suit temperature cannot be controlled by the preceding steps:

7. Suit flow valves - OFF.

8. Reduce altitude and speed as required.

Q-BAY ABNORMAL TEMPERATURE

If the Q-BAY temperature indication is abnormal, proceed as follows:

1. Q-bay auto temp control - Rotate toward COLD or WARM as necessary.

NOTE

The above step should be accomplished in increments as there will be a lag in the temperature indication.

If auto temp control is not effective and Q-bay temperature remains abnormal:

2. Q-bay and cockpit EMERGENCY AIR switch - HOLD in COLD or WARM position as necessary.

NOTE

The temperature control valve will take from 7 to 13 seconds to travel from full hot to full cold or the reverse.

If Q-bay temperature control system should fail in the cold position and heavy cockpit fog occurs:

3. Q-bay system - OFF.

4. Normal cockpit air control - Rotate towards WARM as necessary to dissipate cockpit fog.

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OXYGEN SYSTEM AND PERSONAL EQUIPMENT FAILURES

PRESSURE GAGE INDICATIONS

Rise of Pressure 100 to 120 psi range

1. System indicating normal pressure range - OFF.
2. Visor opening control - Depress 3-5 seconds. This allows increased oxygen flow between visor and seal.
3. System indicating normal pressure range - ON.
4. Repeat above steps if necessary.

If no correction noted:

5. It is safe to continue flight if pressure does not exceed 120 psi.

If pressure rises above 120 psi:

6. Malfunctioning system - OFF.
7. Land when practicable.

Drop of Pressure Below 50 psi

1. Accomplish steps 1 thru 4 above.

If no correction noted:

2. Land when practicable.

No Pressure on System

1. Both systems - ON.
2. Accomplish steps 1 thru 4 above.

If no correction:

3. Inoperative system - OFF.
4. Land when practicable.

PERSONAL EQUIPMENT INDICATIONS

No suit pressure when TEST IND button pressed

1. Descend below suit inflation altitude.
2. Land when practicable.

Reduced oxygen flow in helmet - (Both systems)

1. Green apple - Pull.
2. Descend to safe altitude.
3. Land when practicable.

Constant oxygen flow in helmet

1. Both systems - OFF then ON.
2. One system - OFF.
3. Visor control - Depress 3-5 seconds.
4. Both systems - ON
5. Repeat on other system if necessary.

If no correction:

6. Both systems - OFF.
7. Green apple - Pull.
8. Descend to safe altitude.
9. Land when practicable.

Green apple loose from snap (possible active system)

1. Observe pressure gage on green apple.

If indicator shows full:

2. Replace green apple and continue flight at pilot's discretion.

Poor or no communications

1. Check communications lead for accidental disconnect.

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LANDING EMERGENCIES

SINGLE ENGINE LANDING

A single engine landing is basically the same as a normal landing, except that the pattern may be entered at any point and is expanded to avoid steep turns. Airspeed is maintained above the normal value on final approach. The outstanding difference from normal landings is the noticeable change in directional trim with power changes. The most marked trim change will occur as the throttle is retarded during flare. This may be anticipated and rudder trim set to neutral on the trim indicator after final approach is established. Directional heading is maintained by rudder pressure until thrust is smoothly reduced during the flare. The landing gear may be lowered after lining up on final approach with the left hydraulic system operating; however, at least 90 seconds must be allowed for emergency gear extension if the left system is inoperative.

1. Fuel - DUMP and TRANSFER as required.
2. Hydraulic system - Review services available.
3. If left engine is inoperative, brake switch - ALT STEER & BRAKE.
4. Inoperative engine SAS pitch and yaw switches - OFF.
5. SAS roll switches - Both OFF.
6. Operative engine SAS roll switch - ON.
7. Landing gear lever - DOWN.
8. Establish steeper than normal final approach.
9. Maintain 200 KIAS minimum until landing is assured.

NOTE

If it is necessary to land with more than 35,000 pounds of fuel remaining increase minimum approach speed 1 knot for each additional 1000 pounds.

10. Rudder trim - Neutral.
11. When landing assured - Retard throttle.
12. Make normal landing.

SIMULATED SINGLE-ENGINE LANDING

Directional trim changes will be more pronounced during an actual single engine situation with one engine windmilling.

1. Retard one throttle to IDLE.
2. Follow Single Engine Landing procedure.

SINGLE ENGINE GO-AROUND

Make decision to go around as soon as possible and definitely prior to flare.

1. Throttle - As required.
2. Continue approach until go-around is assured.
3. Landing gear lever - UP, as appropriate.

   Delay gear retraction until there is no possibility of contacting the runway.
4. Trim - As necessary.
5. Accelerate to 250 KIAS.

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LANDING GEAR SYSTEM EMERGENCIES

GEAR UNSAFE INDICATION

An unsafe indication could be caused by low L hydraulic system pressure or malfunction within the landing gear extension or indicating system. Upon detecting an unsafe gear indication, proceed as follows:

1. Land gear control and indicator circuit breakers - Check IN.
2. L hydraulic pressure - Check.
3. Recycle landing gear lever to down position, repeat as desired and pull emergency gear release handle if necessary.

If landing gear still indicates unsafe:

4. Landing gear position - Request visual confirmation.
5. If all landing gear appear fully extended, make a normal landing on side of runway away from suspected unsafe gear. Observe the following precautions:
   a. Shoulder harness - Manually lock.
   b. Hold weight off unsafe gear as long as possible then allow gear to contact runway as smoothly as possible. If nose gear is held off, lower nose at approximately 110 KIAS.
   c. Allow aircraft to roll to a stop straight ahead, have downlocks installed prior to further taxiing or engine shutdown.
6. If any gear remains fully retracted, use Emergency Extension procedure.
7. If all gear are not fully extended, refer to Partial Gear Landing procedure, this section.

NOTE

- Increasing airspeed may assist in locking a partially extended nose gear.
- Yawing aircraft may assist in locking a partially extended main landing gear.

GEAR EMERGENCY EXTENSION

The emergency landing gear extension system unlocks the landing gear uplocks and allows the landing gear to free fall to the down and locked position. If R hydraulic system pressure is available, the landing gear handle must be placed in the DOWN position or the landing gear control circuit breaker must be pulled to permit emergency extension. The time required for emergency gear extension is 60 to 90 seconds. The emergency landing gear handle must be pulled approximately 9 inches for full actuation. If it is not fully actuated, one or more gear may fail to extend.

If the L hydraulic system has decreased below 2000-2200 psi or normal gear extension is unsuccessful, proceed as follows:

1. Landing gear handle - DOWN.
2. Emergency landing gear release handle-PULL.
3. Verify gear down and locked.

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If L hydraulic system pressure low:

4. Brake switch - ALT STEER & BRAKE.

NOTE

Alternate nosewheel steering is available when L system pressure decreases below 2200 psi.

If landing gear remains retracted or landing gear handle sticks in the UP position:

5. Landing gear control circuit breaker - PULL.

6. Repeat steps 2 and 3 of this procedure.

Note

When the landing gear control circuit breaker is pulled nosewheel steering will be inoperative.

CAUTION

The landing gear must not be retracted if the manual release handle is being held in the free fall (full out) position as damage to the system can result. The GEAR RELEASE handle should be permitted to return to the stowed position before attempting to retract the gear with the landing gear lever.

PARTIAL GEAR LANDING

A landing with the nose gear retracted or with all gear up should not be attempted. Under ideal circumstances, a landing with the nose gear extended and both main wheels retracted may be possible. If this configuration can be accomplished, base a decision to land or eject on whether other factors are favorable or not. Wind velocity and direction are important in selection of the landing heading.

If a decision is made to land, conventional final approach and landing speeds and attitudes are recommended. This will result in the tail touching while the nose is at less than normal height. An attempt to hold the aircraft off by using a higher pitch angle is not recommended because of the greater possibility of high impact loads as the nose gear slaps down. An empty tank 1 condition is desired.

1. Accomplish nose gear only configuration if necessary as follows:

    a. Landing gear CONT circuit breaker-Push in.

    b. Landing gear lever - Up.

    c. Landing gear CONT circuit breaker-Pull.

    d. Manual landing gear release handle-Pull to release nose gear only (first lock releases nose gear). Check nose gear down light - ON.

2. Do not transfer fuel forward.

3. Fuel dump switch - DUMP, if necessary to reduce weight.

4. Igniter purge switch - Dump during approach.

5. Battery switch - OFF.

6. Inertia reel lock lever - LOCK.

7. Canopy jettison handle - Pull, if desired.

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NOTE

If the canopy is not jettisoned prior to landing, it should not be unlocked until the aircraft has stopped.

8. Make normal approach and landing.
9. Drag chute handle - Pull.
10. Use rudders for directional control.
11. Throttles - OFF, when directional control is no longer possible.
12. Abandon aircraft as quickly as possible.

MAIN GEAR FLAT TIRE LANDING

Plan the landing for minimum gross weight with touchdown to be made on the side of the runway away from the flat tire. It is possible that only one or two of the three tires has failed. If only one tire has failed, little danger exists when landing at low weight because two tires have sufficient strength to support the aircraft.

1. Touch down on good tires.
2. Drag chute handle - Pull, as soon as possible.
3. Nosewheel - Lower.
4. Nosewheel steering - Engage.
5. Hold weight off bad side as long as possible using full aileron.

WARNING

Maintain IDLE rpm until fire-fighting equipment arrives. Engine shutdown allows fuel to vent in the vicinity of the wheel brake area, thus creating a fire hazard.

NOSE GEAR FLAT TIRE LANDING

If it is necessary to land with a flat nose-wheel tire or tires, avoid a forward c. g. if possible and proceed as follows after making a normal touchdown.

1. Drag chute handle - Pull.
2. Nose gear - Hold off.

   Hold the nosewheel off as long as practicable (approximately 110 KIAS) and then lower gently to runway.

3. Use nosewheel steering and differential braking to maintain directional control.

After stop, before shutdown:

4. Fuel - FWD TRANS.

HEAVY WEIGHT LANDING

Use normal procedure, observing operating limits of Section V.

ABBREVIATED CHECKLIST

The emergency abbreviated checklist is furnished separately.

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