SECTION II - FLIGHT CHARACTERISTICS

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INTRODUCTION

The C-295M aircraft is capable of performing the following missions:

– Personnel Transport.
– Paratroops Transport and Airdropping.
– Cargo Transport and Airdropping.
– Short-Field Takeoff and Landing from both paved and unpaved runways.
– Ambulance (with appropriate equipment).

For the above-mentioned types of operations, including instrumental flight and formation flight, aircraft flight characteristics are satisfactory. Most notable features include excellent stability and smooth-landing operations.

STALL

The aircraft has a warning system for imminent stall: Stick-Shaker. The aircraft has also an identification stall system: Stick-Pusher. The warning system (Stick-Shaker) activates control column vibration and provides acoustic warning. The stall identification system (Stick-Pusher) acts by pushing the control column forward to low the aircraft nose. Both systems are activated when specific angles of attack are reached.

As the aircraft comes closer to stall, and when the angle of attack at which the Stick-Shaker activates, the control column starts vibrating to warn the pilot the aircraft is close to stalling. If airspeed continues to decrease and the angle of attack-that activates the Stick-Pusher, is reached, the pilot will notice that control column tends to move forward. At this point, the pilot should relax his pull on the control column and follow the movement of the column until the aircraft recovers. While manoeuvring, all flight controls remain effective, and aircraft recovery is achieved by smoothly allowing the nose to low a few degrees and correcting aircraft bank as required.

If the pilot follows control column forward movement when Stick-Pusher is activated, the aircraft will not attain stall. However, the pilot may proceed against the action of the Stick-Pusher by pulling harder on the control column. Thus, the pilot may overcome the force of the system and the aircraft reaches stall, that may be accompanied by a wing drop. If this happens, the aircraft is recovered by gently lowering the nose a few degrees and correcting the aircraft bank as required.

Each pilot AOA is a reliable reference of how close the aircraft is to stall. Both acoustic warnings and control column vibration, by means of the Stick-Shaker, starts at the end of the yellow zone. Activation of the Stick-Pusher takes place at the end of the red zone.

Figure 2-1 shows power-off stalling airspeeds for diverse flap configurations.

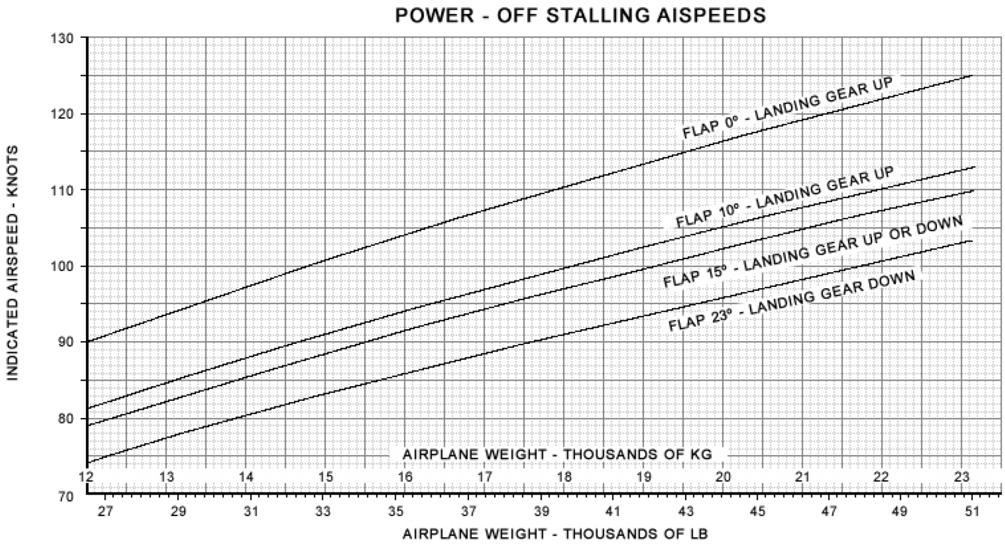

Figure 2-1 Stall Speeds

PRACTICING STALLS

Practicing stalls should be performed with the aircraft unloaded.

Minimum altitude should be 6000 feet AGL, and aircraft recovery margin shall be guaranteed above the clouds.

Loss of altitude will normally be limited to 300 feet.

Once the Stick-Pusher activation is achieved, do not delay recovery. Do low aircraft nose and level wings.

SPINS

Spins are a prohibited manoeuvre.

If a spin is accidentally initiated, reduce power to idle, attain a clear configuration and operate foot pedals in the opposite direction to spin, until it halts. Hold the control column forward.

When spin stops, return foot pedals to neutral position and gently recover levelled flight.

Avoid sudden recovery manoeuvres that could exceed the aircraft load factor limit.

FLIGHT CONTROLS

Flight controls require proper trimming in order to reduce the amount of force required to move them, especially at high airspeeds. Once trimmed, aircraft three-axis stability is very satisfactory.

Remember that for aileron and elevator normal trimming it is mandatory to push and move the required selector simultaneously.

An autotrim system is fitted to reduce pilots workload and make the aircraft easier to fly. This system leaves the aircraft almost fully trimmed when power is applied or configuration is changed, leaving small final adjustments to pilots.

Bank control is rapid and yaw damping, when a rudder command is applied, is immediate.

Turns with bank angle above 30º produces a slight nose down attitude that is easily corrected.

Rudder pedals displacements are asymmetrical, with a longer displacement for right pedal. Efforts are also asymmetrical so more effort is required to be operated on left pedal.

The aircraft is fitted with a rudder booster that, in case of engine failure, helps to maintain directional control. This system ensures no effect on aircraft heading while under engine-failure condition at cruise flight.

LEVELLED FLIGHT CHARACTERISTICS

When controls have been correctly trimmed, aircraft control and stability within its flight envelope is excellent.

During in-flight ramp opening, aircraft nose tends to rise, and this must be trimmed. When the ramp is closed, the opposite effect also requires trimming. Flight Characteristics, with open ramp, are similar to those of a clean configuration.

FLIGHT MANOEUVRES

Aerobatic manoeuvres are forbidden.

Normal manoeuvres are performed with a moderate effort input on flight controls.

During combat manoeuvres, remember that maximum bank angle is 66.7º for flaps up, and 60º for flaps extended.

Minimum turning radius is achieved with 15º flaps and airspeed (IAS) between 125 kts (aircraft weight below 17000 kg) and 130 kts (high aircraft weights). For 10º flaps, recommended airspeed (IAS) is 130 kts. For clean aircraft configurations, minimum turning radius is achieved at 150 kts at sea level and 145 kts at 5000 feet.

OPERATION IN STRONG CROSSWINDS

Takeoff and landing under crosswind conditions above 15 kt is possible without requiring special flying skills from the pilots if recommendations and operational techniques, as specified below, are strictly observed. Crews should understand and be familiar with these recommendations and techniques.

TAKEOFF

The main difficulty on takeoff with strong crosswind is the tendency of the upwind wing to lift during the takeoff run.

Lateral control is not effective at low speeds. Therefore, in order to inhibit lift at takeoff run, it is recommended:

– Flaps angle = 10º.

– Power progressive increase.

– $V_1=V_R$

– Runway length is not limiting. Runway length available has to exceed required distance by a margin of at least 400 ft.

Applicable procedure consists of:

Before the brakes are released, 50% power should be attained. The brakes are then released and power is gradually increased up to MAX-AUTO when aircraft reaches within 45 and 60 kt speed.

During this phase the C/M-2 should compensate the wing up tendency, acting the control wheel into the wind to maintain wings level as required.

Because of the heavy forces required to maintain lateral control, it is recommended that the C/M-2 keeps his hands on the control column to help the C/M-1 if necessary.

Rudder directional control starts to be effective at around 40 kt. Nevertheless, C/M-1 will keep his left hand on the steering wheel until C/M-2 has announced "SEVENTY KNOTS" in case it is necessary to use it due to a wheel failure or power asymmetry. When the C/M-2 announces "SEVENTY KNOTS", the C/M-1 takes his hand off the steering wheel and puts it on the control column.

The C/M-1 must not operate the Nose Wheel Steering above 70 kt. It would delay the nose wheel auto-centred and may lead the wheel to hit the NLG housing during the retraction, being this condition susceptible for a wheel jamming or an abnormal indication of the NLG status.

Climb with level wings and nose heading into the wind.

APPROACH AND LANDING

Proceed to approach with a maximum flap deflection of 15º. Therefore, tactical landing is not possible under such conditions. Turbulence and wind speed/direction sudden changes, do not ease a precision touchdown, consequently it is recommended runway length not to be a limiting factor.

Approach speed (V_{APP}) and Threshold speed (V_{TH}) are defined under "TRAFFIC PATTERNS" heading in this section. Landing reference speed (V_{REF}) is defined in Part 8 "Approach and Landing" of Performance Data Manual.

While at final approach, to keep runway alignment, use "crabbing" technique to keep wings levelled and nose into the wind. Just before main landing gear touches down, gradually deflect rudder to align the aircraft with the runway and simultaneously operate roll control for lateral correction.

It is recommended to hold firmly the control wheel during the entire operation.

After main landing gear touches down, immediately low the nose wheel onto the runway and transfer to C/M-2 the control column. C/M-2 must maintain pressure to keep aircraft nose wheel on the runway, and turn control wheel windward to counteract roll tendency caused by crosswinds during this phase.

As the aircraft decelerates, to counteract windward wing tendency to lift:

– C/M-2 has to keep the control wheel turned into the wind.

– C/M-1 has to apply reverse thrust on windward side engine, leaving the other engine set at Flight Idle until speed drops below 70 kts.

Apply brakes gradually.

OPERATIONS ON UNPAVED RUNWAYS

Unpaved runways definition and limitations are described in Section I - Operating Limitations.

TAKEOFF

NOTE

Prior to airplane operation on a "soft" unpaved runway, ensure the airplane is not bogged down. Use of forward thrust with the airplane bogged down may aggravate the condition. Very low taxi speeds should also be avoided and, in order to minimize excessive runway rutting, tight turns during taxiing are not recommended.

Takeoff from an unpaved runway is executed as on a paved one except for the following.

Do not perform a static takeoff on gravelly or slippery runways.

NOTE

Performing a static takeoff on a slippery surface may cause locked wheels to skid. Performing a static takeoff on a gravelly surface may cause structural damage to the airplane. Use of high engine power (including reverse) on "soft" unpaved runways with brakes applied on, may cause the airplane to bog down.

Advance power levers to read 50%TQ, maximum, prior to brake release and maintain to 50 knots; thereafter, the normal takeoff power setting procedure will apply. During the takeoff run, adjust back elevator control pressure to counteract any existing pitch oscillations caused by surface undulations. If nose wheel lift-off occurs, keep the attitude and do not attempt regaining nose wheel contact to ground.

In the event of an engine failure prior to rotation, apply forward elevator control pressure to ensure positive nose wheel contact to ground in order to recover effective directional control.

On a rejected takeoff conducted on a runway surface with smooth undulations, full unrestricted braking may be applied; however, if undulations are not smooth, judiciously apply wheel brakes so as not to aggravate any existing pitch oscillations caused by surface undulations.

LANDING

TWO ENGINE LANDING

Landing must be conducted at a minimum rate of descent (below 360 fpm), whenever local runway slope of the intended touchdown zone exceeds 1.0 percent uphill.

Full reverse should be gradually applied after touchdown. After nose wheel has been lowered to the surface, adjust back elevator control pressure to ensure no significant pitch oscillation or nose wheel bouncing will develop. On airfields with smooth undulations, normal braking technique may be used; however, if undulations are not smooth, judiciously apply brakes so as not to aggravate any existing pitch oscillation caused by surface undulations. On long/wet grass surfaces, airplane skidding and reduced nose wheel steering effectiveness may occur, especially at low speeds. Cancel reverse power application prior to slowing down to 30 knots, in order to avoid dust cloud ingestion and possible engine FOD.

On "soft" unpaved runways, judiciously apply brakes during the landing roll so as to minimize runway rutting. The use of reverse with brakes applied on may cause the airplane to bog down. In order to prevent the airplane from bogging down, do not use reverse power when brakes are being applied, and release the brakes immediately prior to full stop.

SINGLE ENGINE LANDING

Unless available landing field length is a factor, the use of reverse power on a slippery surface is not recommended.

NOTE

Use of asymmetric reverse power on a slippery surface significantly increases pilots workload.

TAXIING

To preclude damage to the landing gear, avoid fast and/or tight turns on unpaved runways. On a "soft" unpaved runway, very low taxi speeds should be avoided.

OPERATION ON SHORT FIELDS

TAKE-OFF

Short-field take-off operations require a high degree of pilot familiarization with both the techniques described herein and the airplane handling qualities. Operational approval must be obtained from the competent Authority prior to conducting this special-type operation.

The user is cautioned to exercise the utmost care in selecting the applicable take-off performance charts appropriate to the desired type of take-off. In order to assist the user in avoiding chart mis-selection, a prominently displayed caption stating the type of take-off for which the graph applies, has been incorporated into each graph.

WARNING

Failure to select the appropriate charts may lead to a hazardous condition during the take-off.

Take-off in a short field is conducted as in a normal field, except for the following comments and variations to the normal procedure.

Selection of the 15º flap position requires the muting of the Unsafe Take-off (UNSAFE TO) Warning during the take-off power setting procedure.

The nose wheel should not be raised from the ground until rotation speed is reached. The control column must be sharply pulled back to effect rotation (as well as lift-off) and, once airborne (as confirmed by reference to the radio-altimeter), the control column must be relaxed to achieve the initial climb attitude (10º-12º), while the landing gear is simultaneously retracted.

When the user has opted to schedule the short field take-off using performance protection against engine failure, the technique allows an adequate engine margin for obstacle clearance in the event of engine failure during initial climb.

LANDING

The user is cautioned to exercise the utmost care in selecting the applicable landing performance charts appropriate to the desired type of landing. In order to assist the user in avoiding chart mis-selection, a prominently displayed caption stating the type of landing for which the graph applies, has been incorporated into each graph.

WARNING

Failure to select the appropriate charts may lead to a hazardous condition during the landing.

Procedures and scheduled performance shown throughout this Sub-section are based on the use of high-set flight idle power during the approach to landing. The use of low-set flight idle during such phase of flight, unless the flare is executed at the proper height and with the appropriate technique, may be hazardous.

Threshold speed and touchdown speed are $1.13V_S$ and $1.10V_S$, respectively, however, if a one-engine-out go-around is anticipated, the air minimum control airspeed during approach and landing, V_{MCL}, on Performance Data Manual page 8-12 should be observed.

The power levers must be gradually retarded in the flare, in order to prevent an excessive rate of sink, resulting in a hard drop-in landing.

TRAFFIC PATTERNS

In order to be certain while reading and understanding C-295M characteristic flight patterns shown in Figures 2-2, 2-3, 2-4, 2-5, 2-6, 2-7, 2-8, 2-9, 2-10, 2-11 and 2-12, following definitions for takeoff and approach should be acknowledged.

Minimum operating speeds have been defined in order to provide a safe range above aircraft stall speed and at the same time, above the minimum speed at which the aircraft is controllable with one engine inoperative (V_{MCA}).

These speeds will vary according to aircraft configuration, weight and type of manoeuvre.

TAKEOFF SPEEDS

TAKEOFF DECISION SPEED (V_1)

Decision speed (V_1) is the speed calculated by the pilot prior to takeoff, so if an engine failure occurs before this speed is reached, takeoff should be aborted. If an engine failure occurs at a speed higher than decision speed, takeoff should be continued.

ROTATION SPEED (V_R)

Rotation speed (V_R) is the speed at which rotation to takeoff attitude is initiates.

CLIMBOUT SPEED (V_2)

Climbing speed (V_2) is recommended speed to clear from obstacles in a continued takeoff after an engine failure. This speed must be reached and maintained before the aircraft reaches 50 feet above the runway.

In Normal Takeoff, V_2 corresponds to 1.13 V_{SR} or 1.23 V_{SR} with flaps 10º, except for low gross weights, for which V_2 is limited by V_{MCA}.

CLIMB, CRUISE AND DESCENT SPEEDS

Refer to Performance Data Manual.

APPROACH AND LANDING SPEEDS

Reference speed (V_{REF})

Reference speed (V_{REF}) is the minimum threshold speed recommended for landing with flaps 23º.

For Normal Landings, V_{REF} is 1.23 V_{SR}.

For Tactical Landings, V_{REF} is 1.13 V_{SR}.

At both approach and landing, some speeds are specified as a function of V_{REF}, in order to assist remembering and adapting them to existing conditions.

Approach Speed (V_{APP})

Approach speed (V_{APP}) is defined in terms of indicated airspeed as:

V_{APP} = V_{REF} + Additive (flap) + Additive (ice) + Operational Additives

1. Additive (flap), due to a flap setting other than 23º.
   - Increase the speed by 1 kt for each flap degree setting below 25º.
2. Additive (ice), due to ice accretion on aircraft surfaces.
   - Increase speed by 15 kt.
3. Operational Additives (maximum 15 kt):
   - One engine inoperative: + 5 kt
   - Headwind: Headwind (½ Steady wind + Gust)

NOTE

In all cases V_{APP} must not exceed 175 kt (limitation for landing gear extension).

Threshold Speed (V_{TH})

Threshold speed (V_{TH}) is the actual landing speed to reach and maintain until 50 ft above the runway.

V_{TH} is defined in terms of indicated airspeed as:

V_{TH} = V_{REF} + Additive (flap) + Additive (ice) + Operational Additives

When landing with both engines operative (23º flaps), no ice accretion, and zero wind, both reference and threshold speeds are the same.

Touchdown Speed (V_{TD})

Touchdown speed (V_{TD}) is the result of flight tests and depends on pilot skills while at final approach phase.

Go-Around Speed

Out of icing conditions:

– Go-Around Speed with two operative engines is V_{REF}+12 kt with 15° flaps.
– Go-Around Speed with one inoperative engine is V_{REF}+12 kt with 10° flaps.

In icing conditions:

- Go-Around Speed with two operative engines is V_{REF}+15 kt with 15° flaps.
- Go-Around Speed with one inoperative engine is V_{REF}+15 kt with 10° flaps.

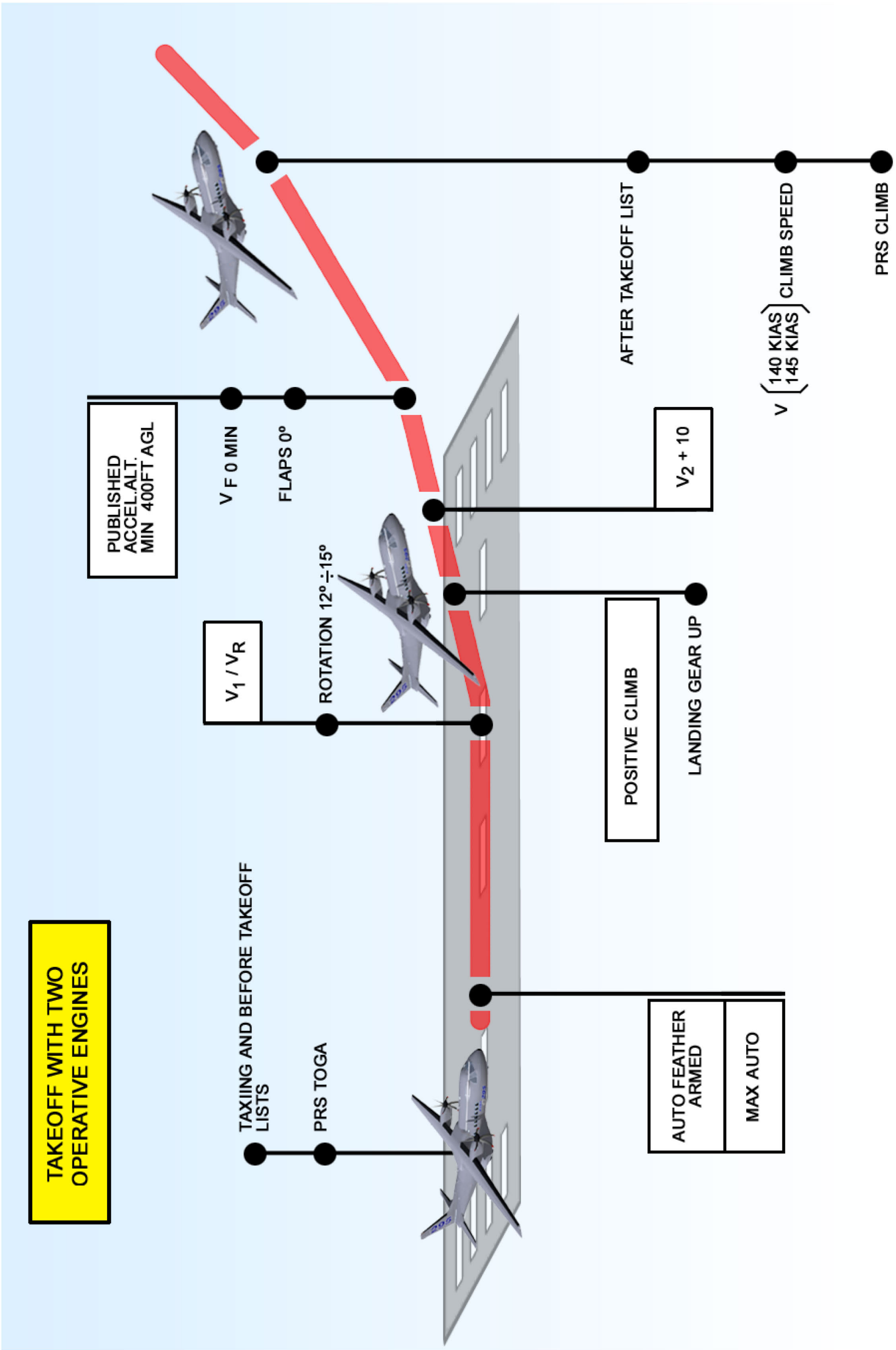

Figure 2-2 Takeoff

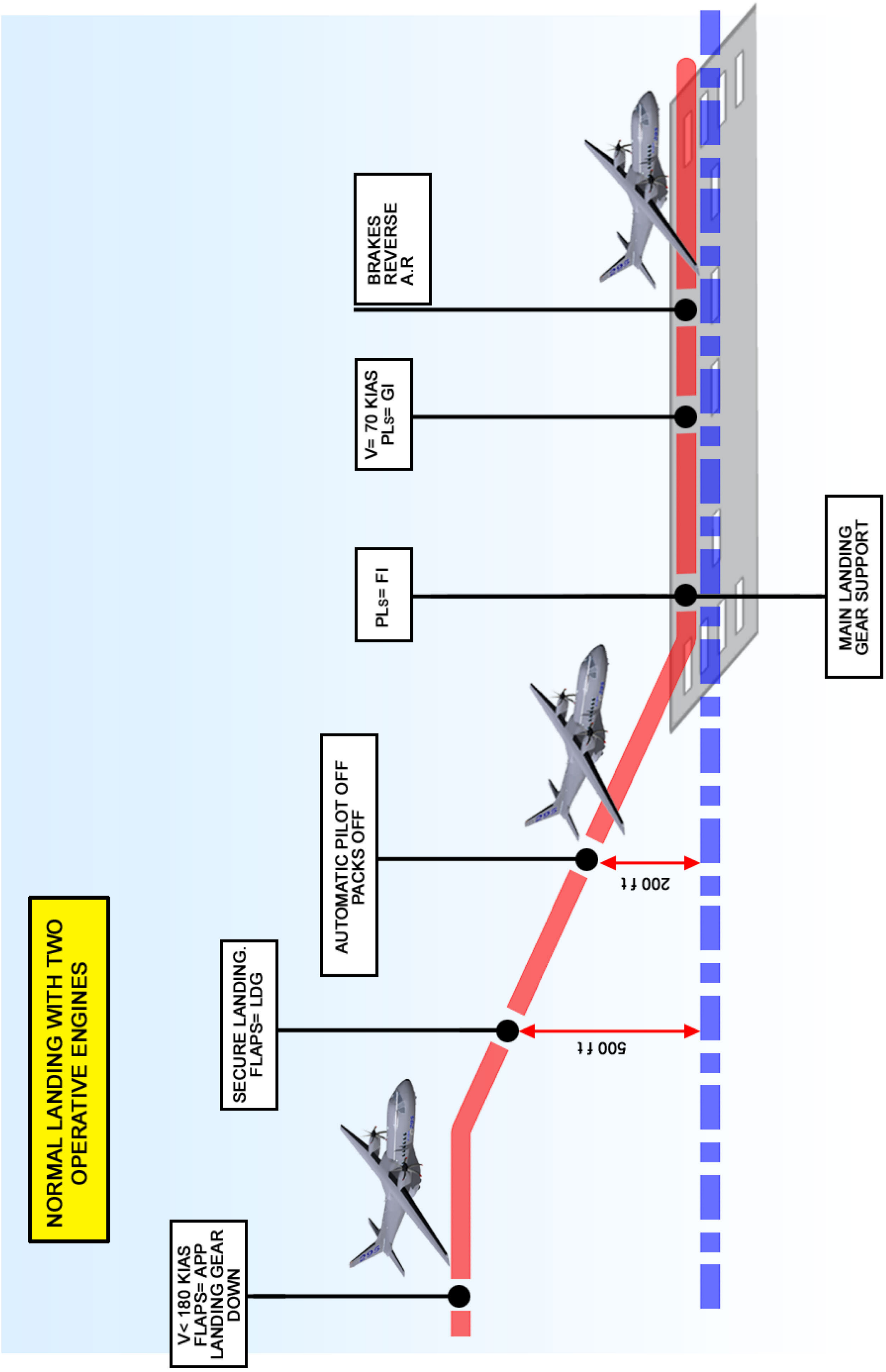

Figure 2-3 Normal Landing

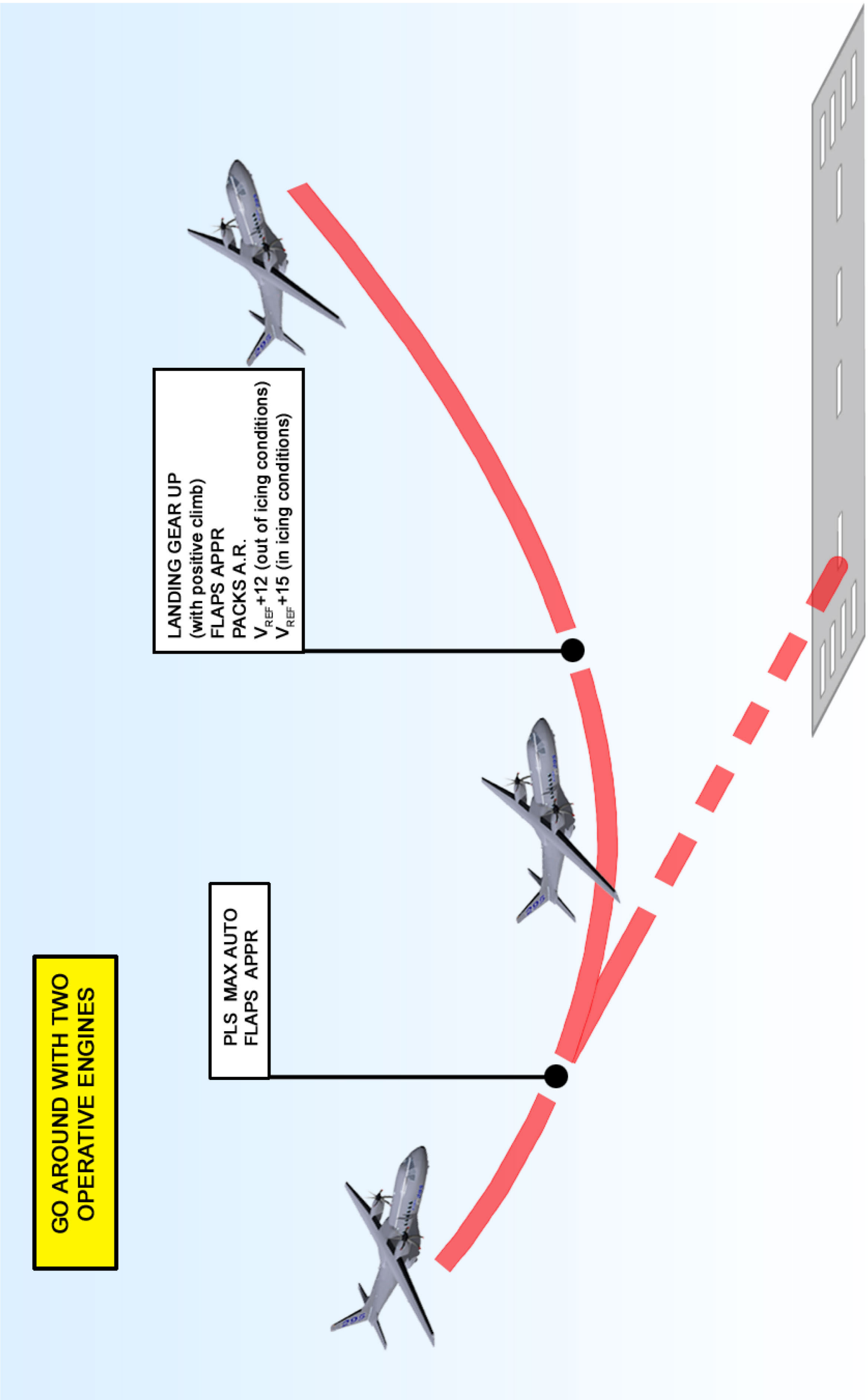

Figure 2-4 Go-Around - Two Engines Operative

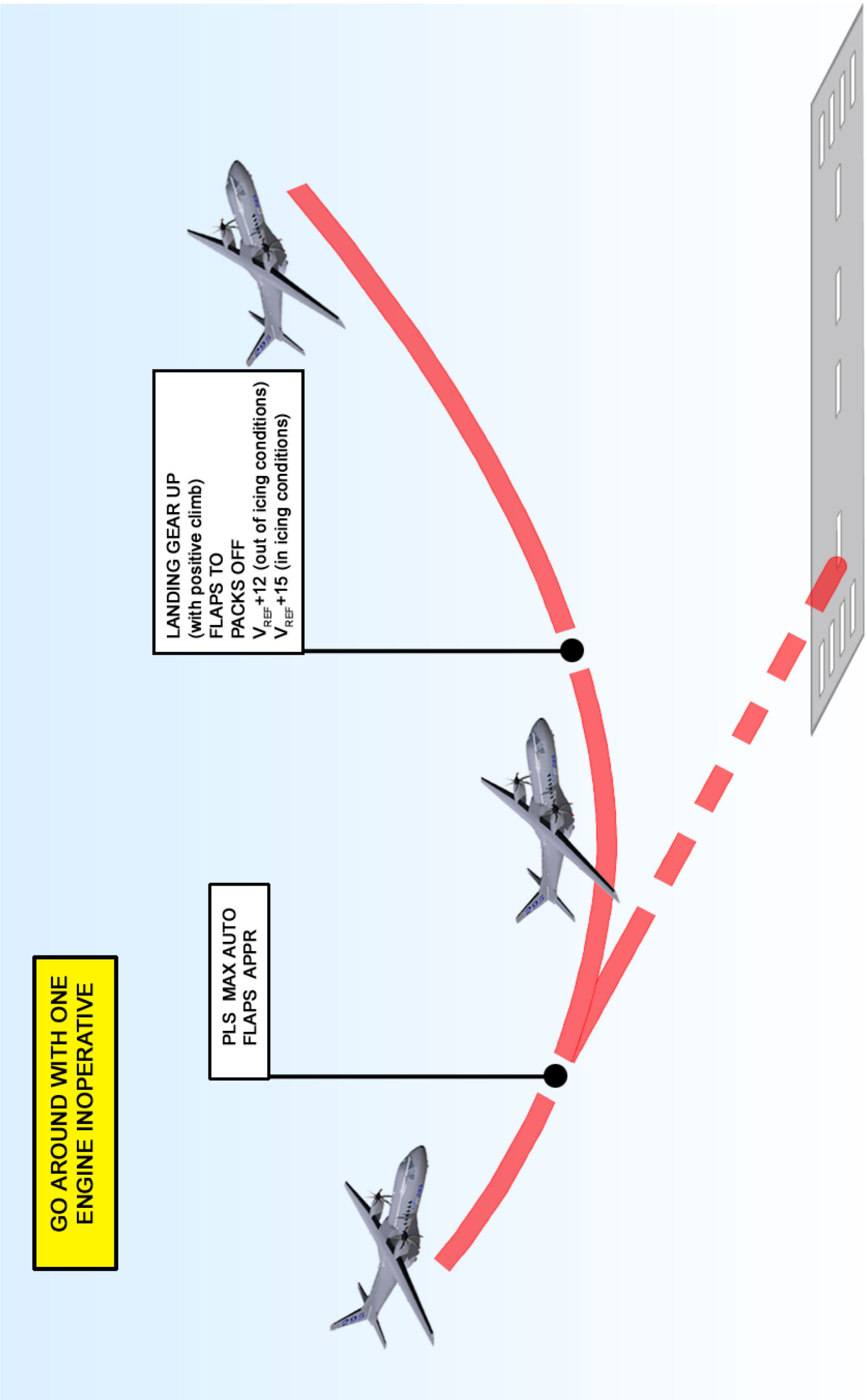

Figure 2-5 Go-Around - One Engine Inoperative

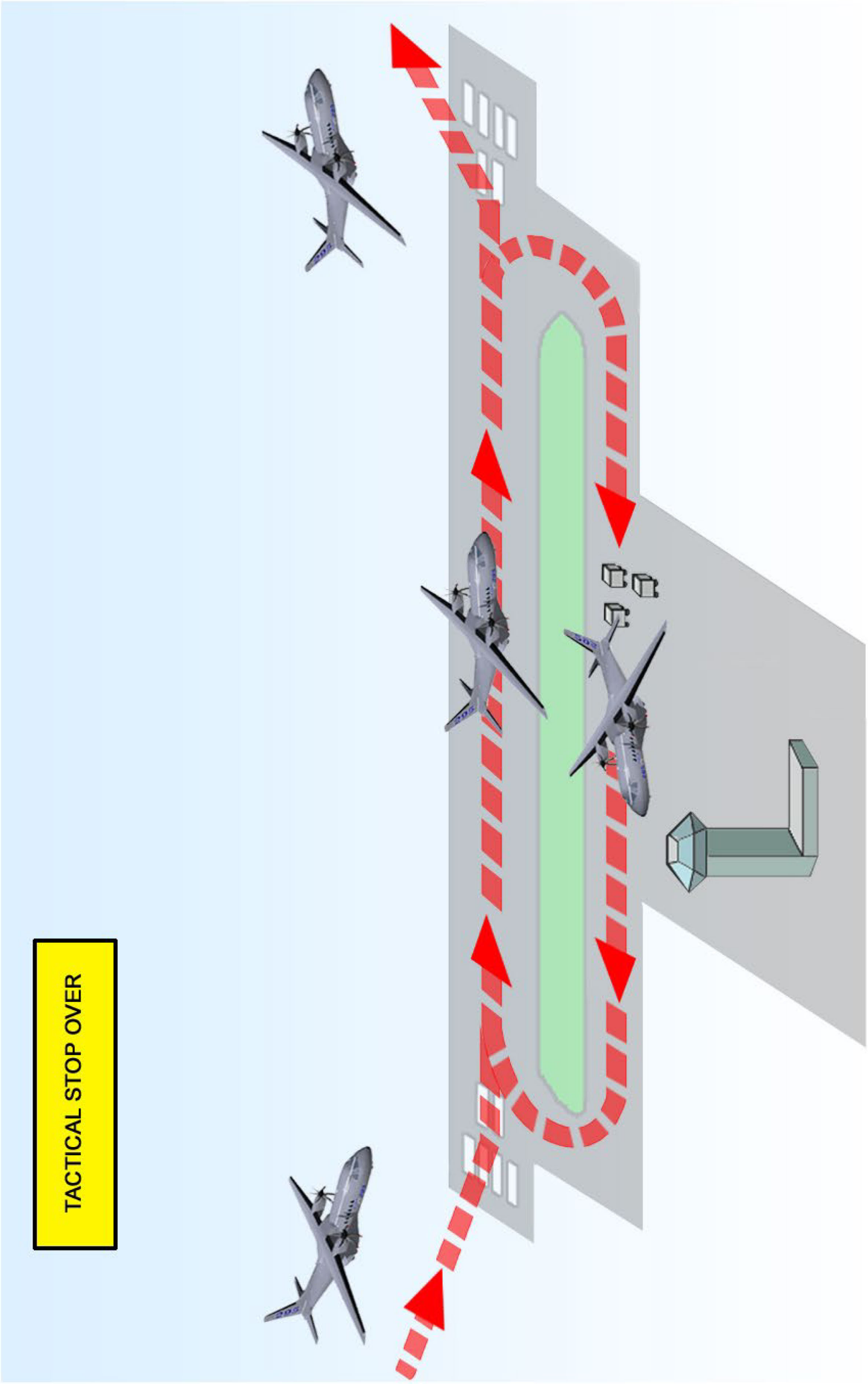

Figure 2-6 Tactical Stop-over

INSTRUMENTAL APPROACH

The aircraft is fitted to perform all types of normal instrumental approaches. Instrumental approaches may be carried-out during manual flight with data sources information, manually with Flight Director data, or automatically with automatic pilot engaged.

ILS APPROACH

Aircraft manoeuvres towards final approach pattern may be performed using radar vectors or pilot navigation, depending on established procedures. Interception of final approach pattern must be done not closer to 3 NM from outer marker in order to allow enough time margin to stabilize the aircraft prior to overfly localizer location.

Primary Data

HSI is the primary navigation instrument provided that displays all primary ILS data. Tendency to rely solely on this instrument must to be avoided. Its readings should be constantly checked with those from other instruments. Each localizer point represents approximately 1.25° of deviation, and each glide slope point 0.35°. Pilots must be constantly alert of any aircraft actual deviation from both localizer and glide slope.

Localizer Holding

Zero-delay detection and correction of any small deviations will result on a smooth and precise approach. It will be necessary to consider drift and adjust heading for localizer holding purposes. For small heading corrections up to 5º, slight pressure on the control wheel is recommended to adjust heading. For larger corrections, a certain amount of bank will be required. Bank angles above 10º are not recommended as larger angles may cause overcontrol.

Glide slope Holding

When first positive movement of the needle occurs, C/M-2 will inform C/M-1 that glide slope is HSI-screen displayed. C/M-1 will acknowledge and check correspondence between altimeter indication and glide slope interception altitude. Then C/M-1 shall require to complete "Before Landing Checklist".

Pitch down the aircraft nose at the interception point until required rate of descent is obtained. This rate of descent depends on both glide slope angle and groundspeed. After permitting the aircraft to stabilize, trim as required and adjust power if necessary. Hold the path with the elevators and ground speed with power.

C/M-1 should fly the final approach phase with one hand on the power levers. Airspeed may fluctuate by ± 5 kt while glide slope is held, without any power-setting change. All corrections must be smooth and precise for glide slope becomes more sensitive while reaching the runway. An overcontrol action may alter other aspects of the approach pattern to the extent that situation may become irreversible.

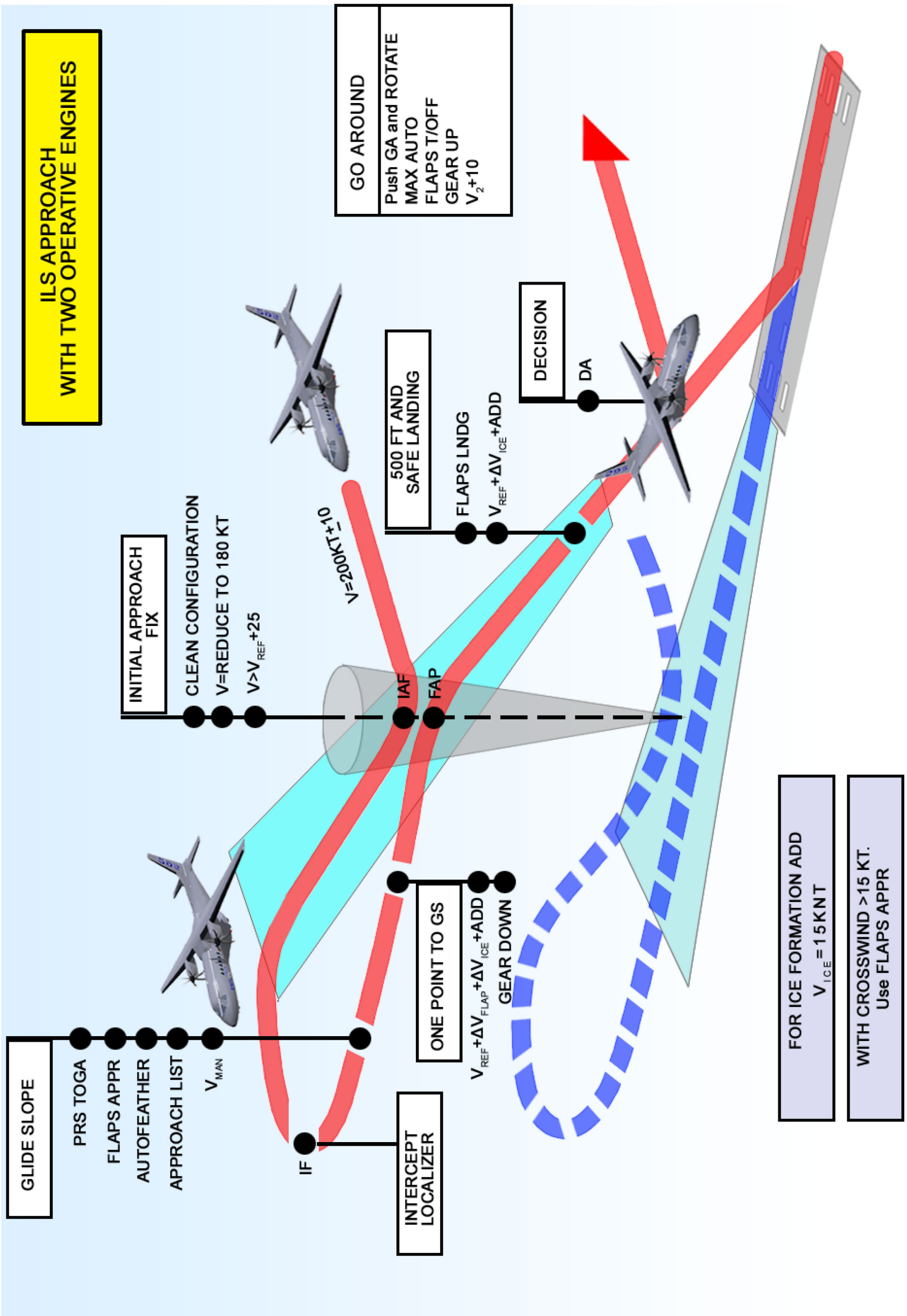

Figure 2-7 Normal ILS Approach Profile - Two Engines Operative.

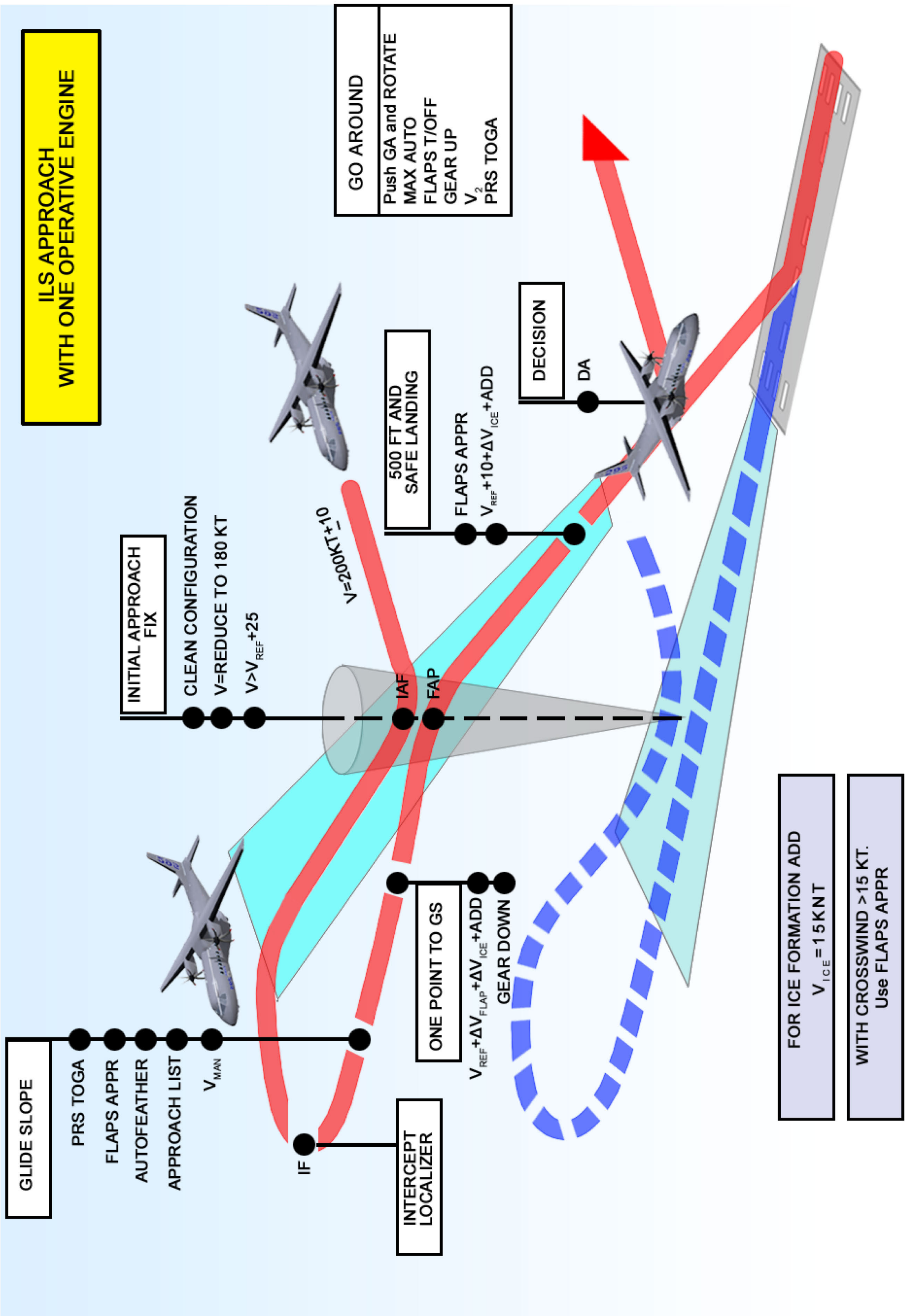

Figure 2-8 Normal ILS Approach Profile - One Engine Inoperative

VOR/ADF APPROACH

Normally, non-precision approaches require some descending manoeuvre during holding phase-or a turn, depending on the approach, so a minimum altitude must be observed. While entry start, stabilize the aircraft at V_{REF} + 5 KIAS with 15º flaps. Descend at this speed with this configuration as shown in the graph.

Hold Minimum Decision Altitude (MDA) until runway is in sight and it is possible to perform a normal approach for landing, or until it is necessary to perform a go-around procedure. When contact has been made and landing is secured, decrease speed to V_{REF} + Additives.

Procedure for a missed approach is the same as an ILS procedure.

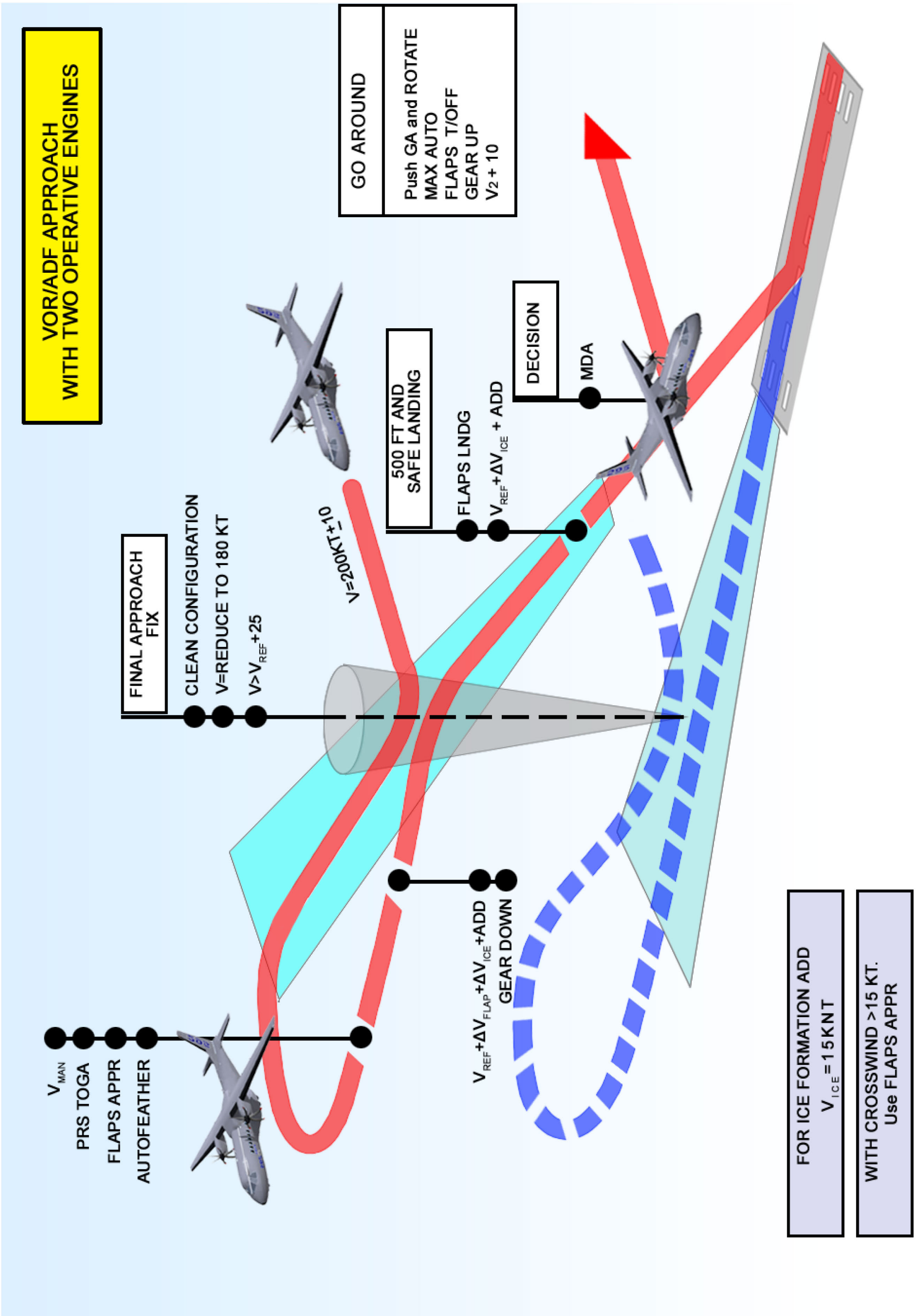

Figure 2-9 VOR/ADF Approach - Two Engines Operative

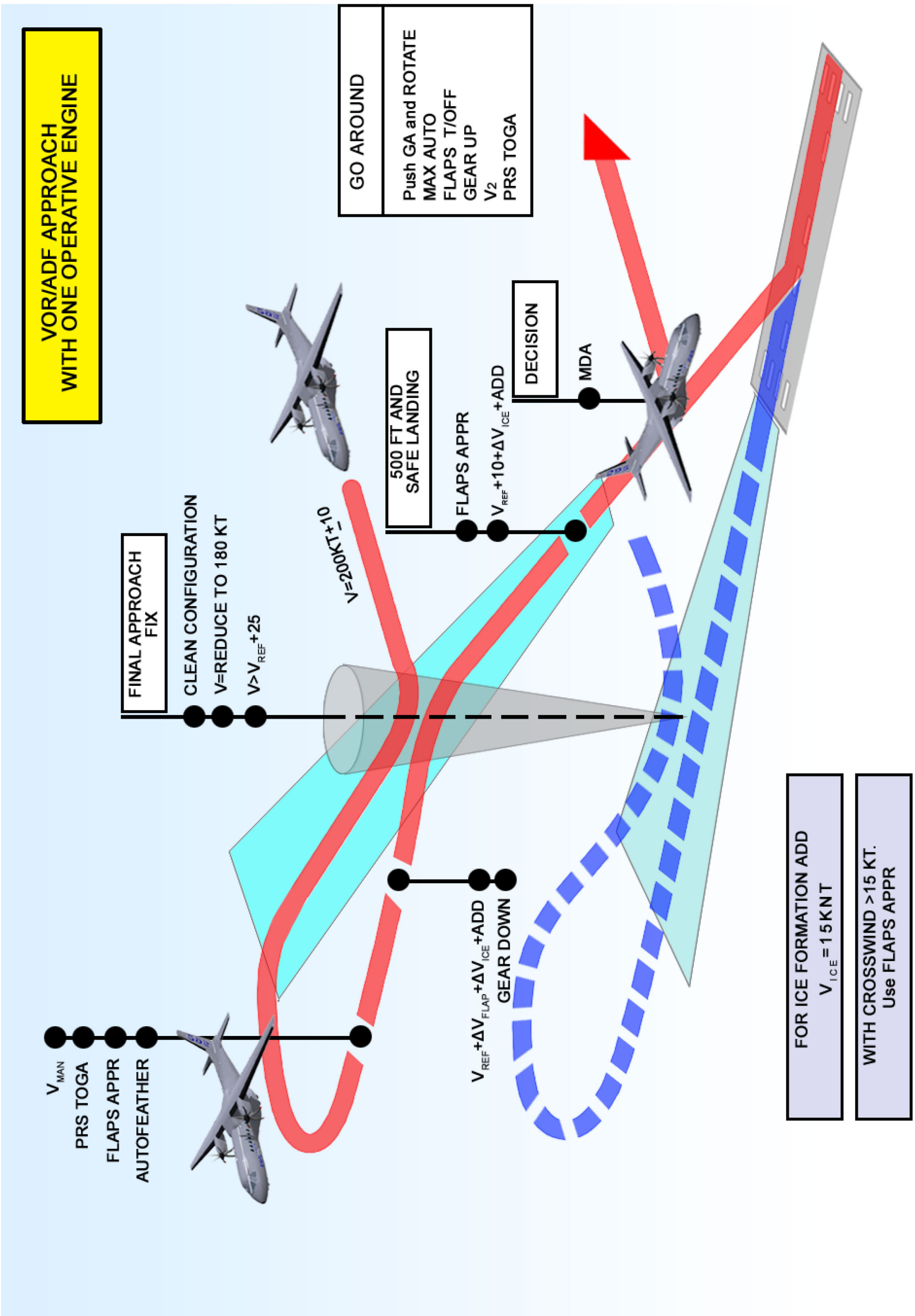

Figure 2-10 VOR/ADF Approach - One Engine Operative

CIRCLING APPROACH

This is a visual manoeuvre to align the aircraft with the runway after making an instrumental approach guided by a ground station which does not provide immediate instrumental landing. It is frequently used when tailwind component for landing exceeds the aircraft limit when aligned by 10 knots and in final instrumental approach pattern.

Radio station approach is normally performed following the corresponding procedure until reaching a circled Minimum Decision Altitude (MDA). Maintain final approach pattern and minimum decision altitude until the runway is in sight or until a go-around is performed. When runway is in sight, fly the aircraft to establish a basis for the trajectory either to the left or to the right, depending on the margin indicated by Air Traffic Control, terrain, or crew member flying the aircraft. If pilot is at the controls, left guidelines are those permitting the airport zone to be kept in sight. If the pilot is outside, the co-pilot will give him instructions to maintain visual contact. It is essential that visual contact is maintained throughout the procedure.

Do not descend under any circumstances below Minimum Decision Altitude (MDA) in order to maintain visual contact. Minimum Decision Altitude (MDA) is a minimum value and if it is possible to maintain visual contact above MDA it is permitted to circle above this altitude. In this case, fly circular portion of the approach at normal trajectory altitude in order to maintain both perspective and reference points.

Do not climb back up into the clouds. Start the turn to the base within 10 to 15 seconds after abeam threshold. Do not exceed the normal limits of visibility, usually established at 1.5 miles from runway. Start descending from Minimum Decision Altitude when turning to base if position is such to perform a normal landing. If base is close to the runway, turn towards the corner closest to the runway threshold to avoid nose-up pitching and/or excessive roll when close to the ground.

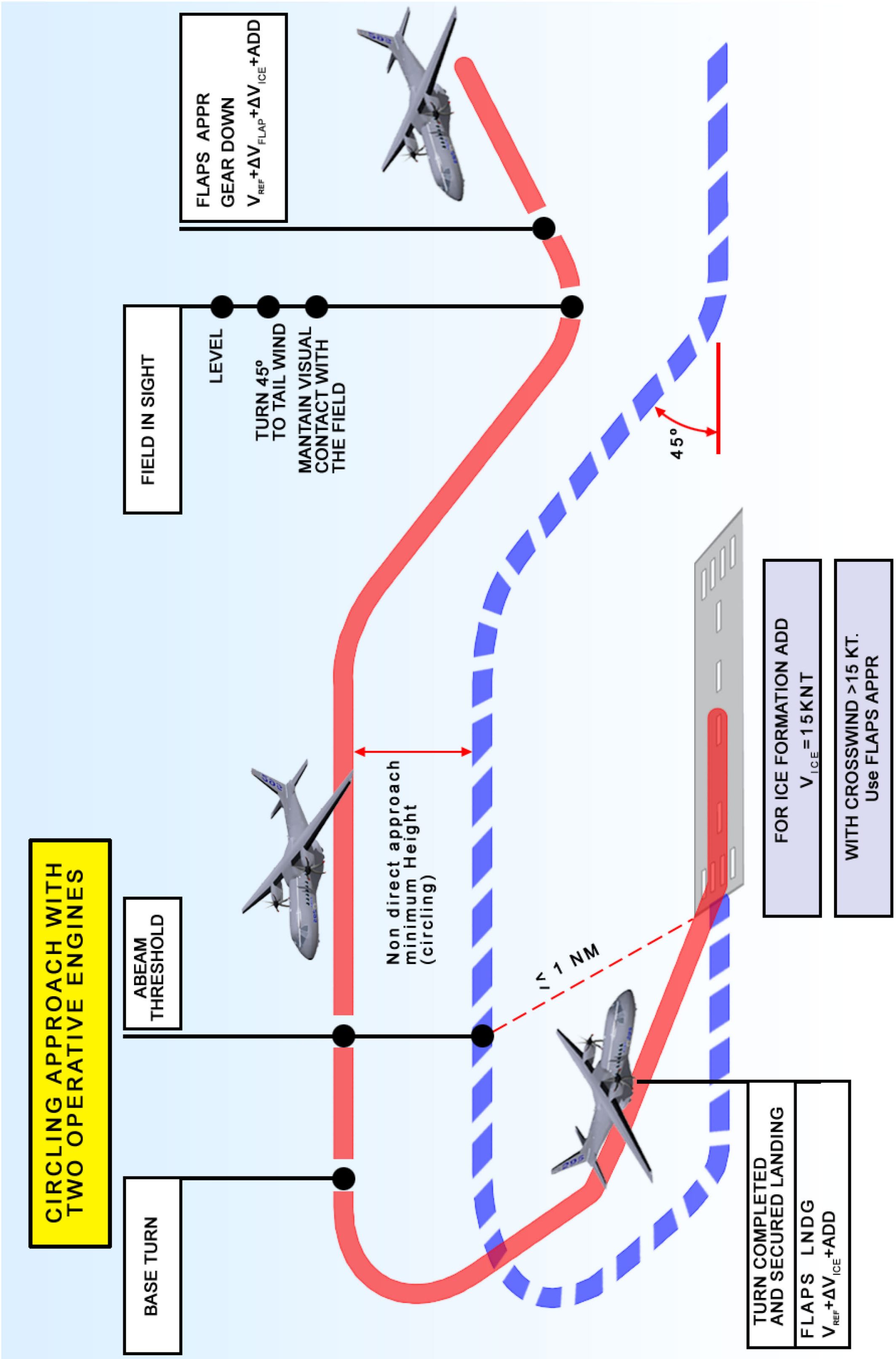

Figure 2-11 Circling Approach - Two Engines Operative

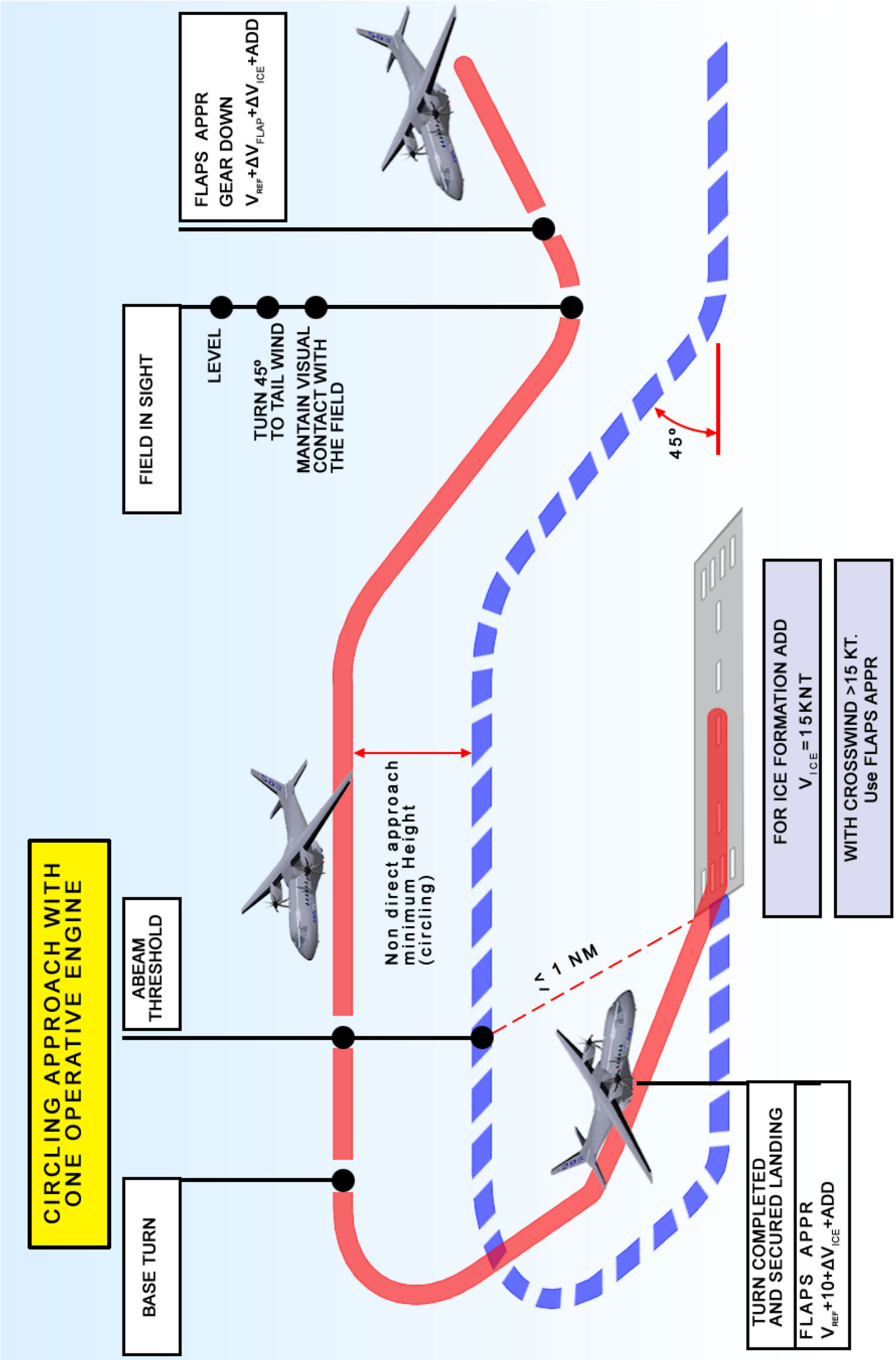

Figure 2-12 Circling Approach - One Engine Operative

WIND CORRECTIONS

In addition to airspeed corrections by reported wind, outbound distance also requires to be wind-corrected both in visual and circling approaches.

Add/subtract to outbound distance time: 1 second for each kt of headwind/tailwind component.