Chapter 1 General

1.1 General Description:

This manual introduces normal and abnormal procedures; meanwhile it also introduces and recommends concepts, thinking modes, and techniques of airplane operation and flight management.

This manual is compiled by strictly conforming to *Operation specification, Flight operation manual, Flight crew operation manual, Airplane flight manual, Quick reference handbook, Flight crew training manual and* related manuals promulgated by the company. During flight, the flight crew should operate in accordance with the recommended procedures in the manuals. In case conditions that are beyond the crew's control arise, causing the crew unable to comply with the recommended procedures, the captain should handle properly according to real situation and judgment.

In general, manuals can not fully take place of good judgment and logical reasoning.

1.2 Usage Principle_

Operation procedure, guidance and skills are recommended to the flight crew in this manual. The flight crew must proficiently master all the contents of *Operations Standards* ,*Flight operation manual*, *Airplane flight manual, Flight crew operation manual*, *Quick reference handbook (QRH), Flight crew training manual* prior to the usage of this manual.

The normal procedures are used by the trained flight crew. Each flight crew member should complete a flow scan according to respective area of responsibility by memory. The checklist is used to confirm that critical actions are definitely correct and associated normal procedures are completed.

The supplementary procedures are completed when a special requirement exists. The captain could complete the procedures by memory or after reviewing the procedures, or by referring to them. The checklist does not include these contents.

The non-normal procedures are used to handle and solve the abnormal conditions on the ground and in the air. If there is abnormal indication, the first step is to confirm if the system control devices are in the proper position. Then check relevant circuit breakers and test corresponding system lights, as necessary. Before engine start, respective system lights are used to verify system conditions. After engine start, master caution system, signal lights and alerts are used as primary methods to remind the crew of a certain abnormal system condition. If a master caution or system signal light is illuminated, corresponding abnormal procedures must be completed. In case of abnormal conditions during flight, the flight crew should ensure that flight path is controlled, the aircraft is not in a critical flight phase (such as takeoff or landing), and non-normal checklist is conducted after all memory items have been completed.

For procedures or training courses not compiled into this manual, refer to the latest *flight crew operation manual (FCOM)*, *flight crew training manual (FCTM)*, and *quick reference handbook (QRH).*

1.3 Flight Crew Responsibility

1.3.1 Basic Principles:

The responsibilities prior to or after flight are divided as these for the captain (left seat) and for the first officer (right seat). The responsibilities in each flight phase are divided as these for pilot flying (PF) and for pilot monitoring (PM).

Each flight crew member is responsible for his respective control devices and switches in his area of responsibility. The responsibility panel diagram displays his respective responsibility area under normal and abnormal situations.

The captain could guide the flight crew members to execute actions out of the area of responsibility.

General responsibilities of PF in the flight phases are:

- taxiing
- controlling flight path and airspeed
- aircraft configuration
- navigation

General responsibilities of PM in the flight phases are_

- reading checklist
- communication
- tasks allocated by PF

In case of emergencies or abnormal conditions, conduct non-normal procedures in the following sequences:

- cancel sounds and visual indications: chime_warning_alert
- if applicable, apply auto-page searching function
- after pilot flying (PF) issues the order, PM performs memory items.
- after pilot flying (PF) issues the order, PM performs the procedures
- tasks allocated by PF

During flight, responsibilities of PF and PM can be changed. For example, the captain can be PF during taxiing, and PM during the phase from takeoff to landing.

Mode Control Panel (MCP) is the area of responsibility of PF. During manual flight, PF will advise PM to make changes in the MCP as required.

The captain makes the final decision to the execution and correct completion of all the responsibilities.

1.3.2 Responsibility Area Division

Area of responsibility in preflight and postflight, and Scan flow

Area of responsibility——the captain is the pilot who controls or taxis the airplane

Responsibility area——first officer is the pilot who controls or taxis the airplane

1.3.3 Control Display Unit (CDU) procedure:

Before taxi, the captain or first officer could perform the CDU inputs, while the other pilot must confirm the inputs.

Perform the CDU inputs before taxi or when the airplane parking brake is set as possible as applicable. If the CDU input must be performed during taxi, it should be carried out by PM. PF must confirm the input before executing.

CDU inputs are generally performed by PM during flight. If workload permits, PF can make some easy CDU inputs. The input, made by one pilot, should be confirmed by the other pilot before being executed.

In case of heavy workload, such as during departure or approach, diminish CDU inputs as much as possible. Control the aircraft by using MCP heading, altitude and speed control mode. Using MCP is more simple than inputting complex flight routes into CDU.

1.3.4 Automatic Flight Director System (AFDS) procedure

Flight crew should always monitor:

- airplane course
- vertical path
- speed

When an MCP selection is made, verify relevant values in flight instruments according to real conditions.

The flight crew must verify manual selection or the automatic change of AFDS. Use FMA (Flight Mode Annunciator) to verify the following mode change:

- Autopilot
- Flight director
- Autothrottle

During LNAV and VNAV operation, check all changes of the airplane

- Flight course
- Vertical path
- Thrust
- Speed

Good CRM practice requires that callouts should be made when FMA and thrust mode display are changed.

1.3.5 Configuration Check

The flight crew is responsible for verify the system is reacting normally. Before engine start, verify the system condition or configuration with lights or indications.
If configuration or reaction is not correct:

- Check setting of system control is correct
- Check corresponding circuit breakers as required. When reset tripped circuit breakers on ground, the maintenance must confirm safety beforehand.
- Test corresponding system lighting as required.

Before engine start, check EICAS alert information and system indication. If unexpected information occurs:

- Check DDG (Dispatch deviation guidance) or operator document to determine if the condition influences dispatch.
- Confirm if maintenance is needed.

If alert information occurs during startup or after startup:

- Perform corresponding NNC
- On ground, check DDG or operator document

After engine startup, EICAS alert information is the main method of alerting crew of non-normal conditions or non-normal configuration. After engine startup, it's not necessary to check status information. Any information that may severely affect continuous flight safety is displayed in EICAS alert information.

1.3.6 Normal procedure logic and assumption

The normal procedure is to verify at every flight phase:

- Flight conditions are satisfied
- Cockpit configuration is correct

Normal procedure should be completed in every flight. Refer to chapter SP for the needed procedures, e.g, operation procedures under adverse weather conditions.
Normal procedures are used by trained pilots and assumes:

- All systems operate normally
- All auto functions (LNAV, VNAV, autoland, autopilot and autothrottle)

Normal procedures also assume coordination with ground crew ahead of time:

- Hydraulic system pressurization, or
- Flight control surface activities, or
- Airplane activities

Normal procedures don’t include cockpit lighting system procedures and crew entertainment items.
Normal procedures proceed through recall and scan flow. Panel diagram displays scan flow. The sequence of scan flow can be changed as required.

1.4 Checklist

1.4.1 Operation of the Normal Checklist

Normal checklist is used when all corresponding procedural items have been completed by the flight crew.
The table below shows task sharing of pilots doing checklist callouts and reading the checklist. Both pilots should visually check to confirm that each item has been completed in the required configuration and step. The rightmost column refers to the pilot who responds the checklist.
This is different from that in normal procedures, in which the rightmost column shows the pilot doing these procedures.

Checklist	Callout by	Read by	Confirm by	Response
Pre-flight	Captain	F/O	Both pilots	Responsibility area
Before start	Captain	F/O	Both pilots	Responsibility area
Before taxi	Captain	F/O	Both pilots	Responsibility area
Before takeoff	PF	PM	Both pilots	PF
After takeoff	PF	PM	Both pilots	PM
Descend	PF	PM	Both pilots	Responsibility area
Approach	PF	PM	Both pilots	Responsibility area
Landing	PF	PM	Both pilots	PF
Engine shutdown	Captain	F/O	Both pilots	Responsibility area
Secure	Captain	F/O	Both pilots	Responsibility area

In case the airplane configuration is different from that being required:

- stop the checklist
- complete the associated procedural steps
- continue to perform the checklist

If the whole procedure is not completed:

- stop performing the checklist
- complete the whole procedure
- do the checklist from the beginning

Try to do checklists before or after high work load times. The crew may need to stop a checklist for a short time to do other tasks. If the interruption is short, continue the checklist with the next step. If a pilot is not sure where the checklist was stopped, do the checklist from the start. If the checklist is stopped for a long time, also do the checklist from the start.
After completion of each checklist, the pilot reading the checklist calls, "________ Checklist completed."

Checklist Content

The checklist has the minimum items needed to operate the airplane safely.
Normal checklists have items that meet any of the following criteria:

- items essential to safety of flight that are not monitored by an alerting system, or
- items essential to safety of flight that are monitored by an alerting system but if not done, would likely result in a catastrophic event if the alerting system fails, or
- items needed to meet regulatory requirements, or
- items needed to maintain fleet commonality between the 737_747-400_757_767 and 777, or
- items that enhance safety of flight and are not monitored by an alerting system (for example autobrakes), or
- during shutdown and secure, items that could result in injury to personnel or damage to equipment if not done

Checklist Construction

When a checklist challenge does not end with "switch or lever", then the challenge refers to system status. For example, "Landing Gear...Down", refers to the status of the landing gear, not just the position of the lever. When a checklist challenge ends with "switch or lever", then the challenge refers to the position of the switch or lever. For example, "FUEL CONTROL switches...CUTOFF" refers to the position of the switches.

1.4.2 Non-normal checklist

Introduction

The non-normal checklists chapter contains checklists used by the flight crew to cope with non–normal situations. The checklists are grouped in sections which match the system description chapters in Volume 2.
Most checklists correspond to an EICAS alert message. The EICAS alert message indicates a non-normal condition and is the cue to select and do the associated checklist.
Checklists without an EICAS alert message (such as Ditching Preparation) are called unannunciated checklists. Most unannunciated checklists are in the associated system section. For example, Engine Fuel Leak is in section 12, Fuel.
Unannunciated checklists with no associated system are in section 0, Miscellaneous.
All checklists have condition statements. The condition statement briefly describes the situation that caused the EICAS alert message.
Unannunciated checklists also have condition statements to help in understanding the reason for the checklist.
Some checklists have objective statements. The objective statement briefly describes the expected result of doing the checklist or briefly describes the reason for steps in the checklist.
Checklists can have both memory and reference items. Memory items are critical steps that must be done before reading the checklist. The last memory item is followed by a dashed horizontal line. Reference items are actions to be done while reading the checklist.
Some checklists have additional information at the end of the checklist. The additional information provides data the crew may wish to consider. The additional information does not need to be read.
Checklists that need a quick response are listed in the Quick Action Index. In each system section, Quick Action Index checklists are listed first, followed by checklists that are not in the Quick Action Index. The titles of Quick Action Index checklists are printed in **bold** type. Checklist titles in upper case (such as AUTOBRAKES) are annunciated by an EICAS alert message or other indication.
Checklist titles in upper and lower case (such as Window Damage) are not annunciated.

Non–Normal Checklist Operation

Non–normal checklists start with steps to correct the situation. If needed, information for planning the rest of the flight is included. When special items are needed to configure the airplane for landing, the items are included in the Deferred Items section of the checklist. Flight patterns for some non–normal situations are located in the Maneuvers chapter and show the sequence of configuration changes.

While every attempt is made to supply needed non–normal checklists, it is not possible to develop checklists for all conceivable situations. In some smoke, fire or fumes situations, the flight crew may need to move between the Smoke, Fire or Fumes checklist and the Smoke or Fumes Removal checklist. In some multiple failure situations, the flight crew may need to combine the elements of more than one checklist. In all situations, the captain must assess the situation and use good judgment to determine the safest course of action.

There are some situations where the flight crew must land at the nearest suitable airport. These situations include, but are not limited to, conditions where:

- the non–normal checklist includes the item "Plan to land at the nearest suitable airport."
- fire or smoke continues
- only one AC power source remains (engine or APU generator)
- any other situation determined by the flight crew to have a significant adverse effect on safety if the flight is continued.

It must be stressed that for smoke that continues or a fire that cannot be positively confirmed to be completely extinguished, the earliest possible descent, landing, and evacuation must be done.

If a smoke, fire or fumes situation becomes uncontrollable, the flight crew should consider an immediate landing. Immediate landing implies immediate diversion to a runway. However, in a severe situation, the flight crew should consider an overweight landing, a tailwind landing, an off-airport landing, or a ditching.

Checklists directing an engine shutdown must be evaluated by the captain to determine whether an actual shutdown or operation at reduced thrust is the safest course of action. Consideration must be given to the probable effects of running the engine at reduced thrust.

There are no non–normal checklists for the loss of an engine indication or automatic display of the secondary engine indications. Continue normal engine operation unless an EICAS alert message shows or a limit is exceeded.

Non–normal checklists also assume:

- During engine start and before takeoff, the associated non–normal checklist is done if an EICAS alert message is shown or a non-normal situation is identified. After completion of the checklist, the Dispatch Deviations Guide or operator equivalent is consulted to determine if Minimum Equipment List dispatch relief is available.
- System controls are in the normal configuration for the phase of flight before the start of the non–normal checklist.
- Aural alerts are silenced and the system is reset by the flight crew as soon as the cause of the alert is recognized.
- The EICAS message list is cancelled after all checklists are complete or on hold so that future messages are more noticeable.
- The EMERGENCY position of the oxygen regulator is used when needed to supply positive pressure in the masks and goggles to remove contaminants. The 100% position of the oxygen regulator is used when positive pressure is not needed but contamination of the flight deck air exists. The Normal position of the oxygen regulator is used if prolonged use is needed and the situation allows. Normal boom microphone operation is restored when oxygen is no longer in use.
- Indicator lights are tested to verify suspected faults.
- Flight crew reset of a tripped fuel pump or fuel pump control circuit breaker is prohibited. In flight, flight crew reset of any other tripped circuit breaker is not recommended. However, these other tripped circuit breakers may be reset once, after a short cooling period (approximately 2 minutes), if in the judgment of the captain, the situation resulting from the circuit breaker trip has a significant adverse effect on safety. On the ground, flight crew reset of any other tripped circuit breaker should only be done after maintenance has determined that it is safe to reset the circuit breaker.
- Flight crew cycling (pulling and resetting) of circuit breakers to clear a non-normal situation is not recommended, unless directed by a non-normal checklist.

Non–Normal Checklist Use

If a checklist or a step in a checklist is not applicable to all airplanes, airplane effectivity information is included in the checklist. Airplane effectivity can be listed by airplane number, registry number, serial number or tabulation number. If a checklist is applicable to some but not all airplanes, airplane effectivity is centered below the checklist title. If a step in a checklist is applicable to some but not all airplanes, airplane effectivity is included above the step. If a checklist or a step in a checklist is applicable to all airplanes, airplane effectivity information is not included.

Non–normal checklist use starts when the airplane flight path and configuration are correctly established. Only a few situations need an immediate response (such as CABIN ALTITUDE or Rapid Depressurization). Usually, time is available to assess the situation before corrective action is started. All actions must then be coordinated under the captain's supervision and done in a deliberate, systematic manner. Flight path control must never be compromised.

When a non–normal situation occurs, at the direction of the pilot flying, both crewmembers do all memory items in their areas of responsibility without delay.

The pilot flying calls for the checklist when:

- the flight path is under control
- the airplane is not in a critical phase of flight (such as takeoff or landing)
- all memory items are complete.

The pilot monitoring reads aloud:

- the checklist title
- messages (if applicable)
- as much of the condition statement as needed to verify that the correct checklist has been selected
- as much of the objective statement (if applicable) as needed to understand the expected result of doing the checklist.

The pilot flying does not need to repeat this information but must acknowledge that the information was heard and understood.

For checklists with memory items, the pilot monitoring first verifies that each memory item has been done. The checklist is normally read aloud during this verification. The pilot flying does not need to respond except for items that are not in agreement with the checklist. The item numbers do not need to be read.

Non-memory items are called reference items. The pilot monitoring reads aloud the reference items, including:

- the precaution (if any)
- the response or action
- any amplifying information.

The pilot flying does not need to repeat this information but must acknowledge that the information was heard and understood. The item numbers do not need to be read.

The word "Confirm" is added to checklist items when both crewmembers must verbally agree before action is taken. During an inflight non-normal situation, verbal confirmation is required for:

- an engine thrust lever
- a fuel control switch
- an engine or APU fire switch, or a cargo fire arm switch
- a generator drive disconnect switch.

This does not apply to the Dual Engine Failure checklist.

With the airplane stationary on the ground:

- the captain and the first officer take action based on preflight and postflight areas of responsibility.

With the airplane in flight or in motion on the ground:

- the pilot flying and the pilot monitoring take action based on each crewmember’s Areas of Responsibility.

The pilot flying may also direct reference procedures to be done by memory if no hazard is created by such action, or if the situation does not allow reference to the checklist.

Checklists include an Inoperative Items table only when the condition of the items is needed for planning the rest of the flight and the condition is not shown on EICAS. The inoperative items, including the consequences (if any), are read aloud by the pilot monitoring. The pilot flying does not need to repeat this information but must acknowledge that the information was heard and understood.

Consequential EICAS alert messages can show as a result of a primary failure condition (such as RUDDER RATIO as a result of HYDRAULIC SYSTEM PRESSURE (L Only)) or as a result of doing a non–normal checklist (such as L PACK OFF or R PACK OFF as a result of doing the Smoke, Fire or Fumes checklist). The flight crew should do the checklists for consequential EICAS alert messages, unless the statement "Do not accomplish the following checklists:" is included. All consequential EICAS alert messages may not show while doing the primary checklist, depending on operational circumstances.

After completion of the non–normal checklist, normal procedures are used to configure the airplane for each phase of flight.

When there are no deferred items, the DESCENT, APPROACH and LANDING normal checklists are used to verify that the configuration is correct for each phase of flight.

When there are deferred items, the non-normal checklist will include the item "**Checklist Complete Except Deferred Items.**" The pilot flying is to be made aware when there are deferred items. These items are included in the Deferred Items section of the checklist and may be delayed until the usual point during descent, approach or landing.

The deferred items are read aloud by the pilot monitoring. The pilot flying or the pilot monitoring takes action based on each crewmember's area of responsibility.

After moving the control, the crewmember taking the action also states the response.

When there are deferred items, the Deferred Items section of the non-normal checklist will include the Descent, Approach and Landing normal checklists.

These checklists should be used instead of the usual DESCENT, APPROACH and LANDING normal checklists. If a normal checklist item is changed as a result of the non-normal situation, the changed response is printed in **bold** type. The pilot flying or the pilot monitoring responds to the deferred normal checklist items based on each crewmember's area of responsibility. However, during the deferred Landing normal checklist, the pilot flying responds to all deferred normal checklist items.

Each checklist has a checklist complete symbol at the end. The following symbol indicates that the checklist is complete:

■ ■ ■ ■

The checklist complete symbol can also be in the body of the checklist. This only occurs when a checklist divides into two or more paths. Each path can have a checklist complete symbol at the end. The flight crew does not need to continue reading the checklist after the checklist complete symbol.

After completion of each non–normal checklist, the pilot monitoring states "___Checklist completed"

Additional information at the end of the checklist is not required to be read.

The flight crew must be aware that checklists cannot be created for all conceivable situations and are not intended to replace good judgment. In some situations, at the captain’s discretion, deviation from a checklist may be needed.

1.5 MEL/CDL Usage:

Each time before departure, the flight crew has the responsibility to verify that the airplane has been equipped with an MEL manual.

1. The flight crew must get an understanding of the reserved malfunctions and make pre-flight preparations according MEL/CDL regulations.
2. Before the airplane moves with its own power but after malfunction arises, the crew can handle the situation by complying with the airworthiness dispatching suggestions released in the Technical Logbook by the mechanic dispatchers in accordance with MEL regulations.
3. If the malfunction influences the airplane's ability to operate under dispatched flight plan operation, the captain should report to the dispatcher to revise dispatch or redispatch. This new dispatch plan must include limitations of the inoperative items.
4. Once the airplane moves with its own power, the flight crew must handle the equipment failure according to the approved quick reference handbook and then refer to MEL before takeoff. If it is clearly stated in the MEL that the airplane can not be dispatched or can be dispatched but a system test or some necessary work is required to be carried out by the ground maintenance personnel, the airplane should be taxied back to parking gate and be shutdown for trouble-shooting.

1.6 Airplane record

The flight logbook and technical logbook must be onboard in the process of flight operation for the use of recording flight parameters, malfunction maintenance and other items. During operation, the crew members should review records for malfunctions, malfunctioned equipment and the adopted maintenance measurements and fill in all the newly-emerging information and malfunctions.

It is prohibited to fill in the flight logbook during critical flight phases.

Flight operation is not allowed without logbook on board.

An ink pen must be used to fill in the flight logbook and technical book to ensure clear and easily-identified writings.

For any malfunction entered into the flight logbook by the flight crew, the maintenance personnel should fill the detailed trouble-shooting and handling actions into the malfunction maintenance record.

The malfunction record should be written in English during international operation as required.

1.6.1 Flight logbook

Including: aircraft model number, registration number, aircraft type, flight number, block time, takeoff/landing dates and hours, flight time, route segments, payload data, fuel quantity information, takeoff/landing information during training, information about the flight crew members, etc.

1.6.2 Technical logbook

Including: detailed description on malfunctions affecting aircraft airworthiness and operational safety detected during flight operation, signatures and signing dates of the flight crew, maintenance and airworthiness personnel after the preflight check; clearance evidence (license number, date, signature code, etc); oil quantity information; ground de-icing time; the deferred defect records should contain the details of any malfunctions that may affect normal operation and provide the flight crew with maintenance or guidance for reference. It should include any maintenance information that should be known by the flight crew. It should include the linked data and instructions about how to conduct technical analysis and handling when problems arise en route.

1.6.3 Filling in a logbook

(1) The flight crew member should ensure that the previous page has been correctly filled in with corresponding airworthiness dispatch records before using a new page in a logbook.
(2) The date and time filled in the logbook should be the international standard time or Beijing time.
(3) No page in the logbook shall be damaged or torn away and all entries should be complete;
(4) If a page is to become obsolete due to wrong entry, an indication in capital letter OBSOLETE shall be written on the page while the flight number and date shall be retained in the logbook;
(5) It is not allowed to remove or strike out a record or signature in the logbook in whatsoever manner and it is not permitted to use corrective liquid;
(6) The flight crew members shall sign their names after completion of all entries in the logbook;
(7) One malfunction record column can only be filled in by one malfunction.

1.7 Airborne Document

1. Airworthiness Certificate
2. Nationality Certificate
3. Radio License
4. Airplane Flight Manual
5. Operations Manual
6. Quick Reference Handbook
7. Minimum Equipment List
8. Takeoff Analysis Manual
9. Manual of Flight Operations
10. Operations Specification
11. Aviation Security Manual(Chinese version, one volume)
12. Normal Checklist
13. Papers on Board List/Meters to Feet Conversion)
14. Standby Balance Chart)(for international flight)

1.8 Flight Document:

1. Flight assignment paper
2. Flight plan
3. Weather information data
4. NOTAM
5. Dispatch sheet
6. Special telex or special loading notification sheet(if any) for the captain
7. Cabin sheet and weight and balance table:

The airplane can takeoff only if the airplane loading is within the scope of C/G limitation and maximum allowable weight, while airplane structure and performance limitation weight are also be considered. After receiving the weight and balance sheet, the flight crew member should check and confirm the following data are within the limitation data for this specified flight.

1) Zero fuel weight of this flight;
2) Takeoff weight and estimated landing weight of this flight;
3) Takeoff C/G and estimated landing C/G of this flight;
4) Actual gross fuel weight of this flight;
5) When the actual data differs from cabin sheet, the weight and balance sheet should be revised;

Ensure that aircraft loading is in accordance with regulations. The captain should check the computed result of the weight and balance sheet, confirm that the aircraft’s actual takeoff weight and CG is within allowable limit and approved by the captain with his signature.

8. Passenger cabin sheet, cargo sheet and detailed declaration sheet;
9. General declaration sheet (for international or regional airline flight); Customs seal (for domestic segment of international and regional flight); sanitation quarantine certificate.

1.9 Flight Crew Cooperation

Flight crew cooperation is the important guarantee of flight safety; each member of the flight crew should be the supplementary or backup of another member. Favorable flight crew cooperation can reduce the workload for each crew member.

The flight crew members could be divided into pilot flying (PF), pilot monitoring (PM) and observer. When the airplane is operated by F/O, F/O takes the responsibility of pilot flying (PF) and the captain (instructor) takes the responsibility of pilot monitoring (PM).

During auto flight, for ATC cleared altitude, speed and heading clearance, PF will set MCP panel and callouts which should be confirmed by PM. During manual flight, PF commands and PM sets MCP panel which should be checked by PF.

After PF has completed the actions, report this to PM. Actions beyond the responsibility area shall require commands from PF, even if PM is an instructor and PF is a student pilot (except for special and emergency conditions).

The pilot should verify any change in FMA in a timely manner and call out.

The captain (instructor) reserves the final right to command and execute all the actions.

1.10 Standard Callouts:

One basic principle of crew resources management（CRM） is that each flight crew member should be able to assist or act as a backup for the other member. Implementing correct and standard callouts is an important means to guarantee flight safety and improve cockpit resource management.

Each flight crew member should be aware of the altitude, position and status of the airplane. The content of the standard callout contains: critical data, ATC clearance, change of flight mode, indications and cautionary callouts, etc.

Standard callout must be simple, generalized, standard, clear, understandable, and be responded as required.

Standard callouts provide the pilots with the required information for the airplane system status and for another flight crew to take part. PM conducts callouts according to instrument indications or corresponding conditions observed. The command speed or obvious deviation from flight path should be reported. PF should confirm the condition and position on the instruments and make responses. If the PM hasn't made the required callouts, PF should make them.

Any pilot should report any abnormal display of the flight instrument (malfunction information, deviation, pointer loss, etc).

PF should be aware of the aural callout of all GPWS during approach. If the automatic electronic aural callout is not heard by the flight crew, PM should report it.

Note: 1) If there is no automatic callout, PM should assist to establish the touchdown point at radio altitudes of "100 FT, 50FT, 30FT, 20FT, 10FT (other data as required)".

2) If there is no standard callout during the associated flight phase, it may indicate a fault has occurred in airplane system or an indication of the other pilot's incapacitation.

3) During critical flight phases especially taxiing, takeoff, approach and landing, avoid unnecessary talk. Unnecessary talk does reduce the flight crew work efficiency and awareness. Therefore talking not related to flight is inhibited under 10,000FT (MSL)/FL 100.

B767 standard callouts

Phase, condition, position	PF standard callout	PM standard callout
Align the runway/takeoff		
Advance throttle: 1.10 EPR After takeoff thrust (reduced thrust) has been set.	"Set Takeoff Power"	"1.1, Stabilized" "Takeoff Power Set"
Speed is 80 knots.	"Check"	"80,throttle hold"
5 knots before V1 VR		"V1" "Rotate"
After lift off, establish positive climb rate	"Gear Up"	"Positive" "Gear Up"
Radio altitude 400 feet	"LNAV/Heading Select"	"400"
1000 feet or obstacle clearance altitude	"VNAV"	"1000"or obstacle clearance altitude "XXXX"
Confirm climbing and accelerate. Announce retracting flaps as planned	"Flaps 1" "Flaps Up"	(Vref30)"+40" "+60"
Transition Height (Altitude)	"1013" "After Takeoff Checklist"	"Transition Height(Altitude)" "After Takeoff Checklist completed"
10000 feet	"Check, lights off"	"10,000"
Approach and landing		

Transition level	"QNH XXXX" "Approach Checklist"	"Transition level" "Approach Checklist completed"
10000 feet	"Check, lights on"	"10,000"
Call "Flaps__" according to the flap extension schedule	"Flaps__"	
Localizer alive		"Localizer alive"
Localizer captured		"Localizer captured"
When glide slope moving, announce:	"Gear down" "Flaps 20"	"Glide slope alive"
Glide slope one dot	"Flaps 25"	"Glide slope one dot"
Glide slope captured Set missed approach altitude	"Flaps 30"	"Glide slope captured"
Announce	"Landing Checklist"	"Landing Checklist completed"
1000 feet(AGL)	"Check"	"1000"
500 feet	"Check"	"500"

DA(H)+100 feet	"Continue approach"	"Approaching minimum"
DA(H) Establish applicable visual reference	"Landing" or "go around"	"Minimum" "Runway in sight"
Landing		"Speedbrakes up, reversers unlocked"
Start to move reverse thrust levers		"60" "Autobrake disarmed"
Go around		
DA(H)+100 feet	"Continue approach"	"Approaching minimum"
DA(H) Unable to establish suitable visual reference	"Go Around , flaps 20, set go around power"	"Negative Contact" "Go around power set"
Establish positive climb rate	"Gear up"	"Positive" "Gear up"
Radio altitude 400 feet	"Heading select/LNAV"	"400"
Above 1000 feet(AGL)or obstacle clearance altitude, confirm climbing and accelerate, announce flaps up as planned	"VNAV" "Flaps 5" "Flaps 1" "Flaps up	"1000"or obstacle clearance altitude "XXXX" "+20" "+40" "+60
Stabilized flight	"After Takeoff Checklist"	"After Takeoff Checklist completed"

Note: 1. CATII callout is not included in the approach standard callout.
2. Insight: includes visual approach light/ strobe light/ runway centerline light/runway threshold/touchdown zone.
3. The callout table does not include the following content, but the following situations must be clearly called out:

- During control handover: ”you have control” “I have control” must be clearly called out;
- When FMA mode changes;
- When the autopilot/auto-throttle has been disconnected or engaged;
- When critical equipment has been changed;
- When non-normal conditions arise;
- 1000 feet to level off;
- When configuration has been changed.

Deviation Calls during the final approach phase:

During the final approach phase, PM or other flight crew members should report the deviation beyond the normal range. It includes:

1. VOR indication: 1 Dot;
2. ADF indication pointer deviation: 5 degrees deviation from planned heading
3. DME arc: 2NM;
4. Speed: 500 feet or lower, lower than command speed or more than Vref30+20 knots;
5. Vertical speed: more than 1000 feet/minute when the altitude is lower than 1000 feet AGL;
6. VASI: large deviation from the prescribed reference glide slope.

- Localizer:
  a Before descending to DA/DH+300 feet, deviation more than one dot;
  b After descending to DA/DH+300 feet, deviation more than half dot;
- Glide slope: deviation more than one dot(including one dot)

Note: When this kind of alerting callouts are made by PM, PF should answer and respond to show his situational awareness and control capability. No response or no actions within a long period of time should be considered as incapacitation of the pilot.

1.11 Communication:

1) The flight crew must keep effective communication during flight. The flight crew members should keep radio monitoring (flight interphone when using boom). Earphone must be used before taxi-out, takeoff, climb and cruise, descent from the cruise altitude until parked in the apron: If the cruise altitude is below 3000 meters (10000 feet), use the earphone for the whole flight process. The pilot responsible for communication must use earphone for radiotelephony communication, do not use loudspeaker for replacement. Other members must monitor the communication content and check in time to ensure the flight crew can correctly implement ATC controllers' commands. The pilot who is serving as an observer must wear earphone during climb and descent to assist in monitoring and checking radiotelephony communication.
2) During flight, one communication frequency should always be set to the frequency used by ATC. The other one should be set to 121.5 when not used, on which frequency the pilot should always monitor.
3) Communication with ATC: under normal situations, PM (F/O when the airplane doesn't move by its own power) is responsible for the communication. Important ATC commands (altitude, heading) must be repeated. When the clearance is not clear or part of the clearance is lost, ask until it is perfectly right. When the ATIS is received for listening, make sure another flight crew member is monitoring ATC frequency. Under any circumstance, it is not allowed for two flight crew members to monitor ATIS at the same time.
4) When the handy microphone is used, open the loudspeaker and use the suitable volume and ensure normal communication between crew members; when the oxygen mask is used, the flight crew should select flight interphone, open the loudspeaker and use the suitable volume to communicate. Ensure normal communication between the flight crew and with ATC. When the oxygen mask is removed to resume crew communication, there is no need to put the oxygen mask back into the mask well, but the cover of the

mask well should be closed and the reset test lever should be pulled to retract OXY ON indication.

5） Communication with ground maintenance: when pushback for start and taxi back for shutdown, the cockpit should keep communication with the ground personnel. When failure occurs in the interphone, it should be replaced by standard gestures.
When the flight crew members monitor ATC and ground maintenance at the same time, task sharing should be made to avoid mutual interference.

6） Communicate with flight attendant: the flight crew communicates with purser (flight attendant) by service interphone during flight. If time doesn't permit, turn off the safety belt lights and turn on them again for replacement (when ready for takeoff or landing). Under emergency situation, use the passenger PA to issue command to the flight attendant, or use the following signal communication modes.

① Cockpit calls cabin: one sound, if the flight attendant does not respond in time, the flight attendant should quickly enter the cockpit as the procedure requires.

② When the emergency situation happens in the cabin, the director purser/purser/flight attendant use the interval two times three sound (ring 2 times,, 3 sounds each time, 2 seconds interval) and report to the cockpit quickly.

③ Under emergency situations, if the cockpit needs to report to the cabin crew quickly, two times three sounds should be used (ring 2 times, 3 sounds each time, 2 seconds interval) to notify the cabin crew, the flight attendant should quickly enter into the cockpit.

④ When the cabin sends continuous 5 sounds "cockpit interphone ring", this indicates hijacking happens in the cabin. It is not convenient to talk with the cockpit.
Note: For the above deviation of the communication signal, the purser, safe guard and captain should coordinate and convey to the flight crew member and the crew coordination mode shall supersede.

⑤ For confidentiality, the flight crew and cabin crew could discuss to determine the temporary cipher or argot prior to flight.

1.12 The requirement to the flight crew member in critical flight phases:

Flight critical phase refers to taxi, takeoff, climb, landing and the flight less than 10000 feet other than cruise. In these phases:

(1) The flight crew member in the cockpit should stick to their positions except for fulfilling the flight operation-related responsibility or physical need; the flight crew must use earphone and transmitter for communication.

(2) The flight crew members must fasten the safety belts including the shoulder harness and waist belt except when not installed in their seats, or this will defect the fulfillment of their responsibilities and tasks.

(3) Any member of the flight crew shouldn't do the activities that influence or distract the concentration of other flight crew members, and shouldn't do activities not related to safe operation of flight. The captain is responsible for monitoring and ensuring good cockpit order; the flight crew member should not do other work except the safety operation work, which include dining, not important talking in the cockpit or between the flight crew and the cabin crew., read the publications not directly related to the normal flight, reserve the galley supply, confirm the passengers has connected flight, advertise to the passengers, irrelevant communication, introduction to the passengers of the places and interest, filling in the report table, logbook and related document.

1.13 The requirement to the captain for airplane takeoff and landing

The captain should complete all takeoff and landing under the following situations:

(1) The special airport regulated by CAAC or company;

(2) The effective visibility in the latest weather report equals to or less than 1200 meters (3/4 miles), or RVR equals to or less than 1200 meters (4000 feet);

(3) Water, snow, slush or situations severely influencing the airplane performance on runway in use ;

(4) Braking action of runway in use is reported as lower than “good”;

(5) Crosswind component for runway in use is more than 7m/s（15 kts）；

(6) Windshear is reported in the vicinity of the airport;

(7) Any other situations under which the captain considers that he should execute captain’s right with caution.

1.14 Crew Resources Management (CRM) and training ：

(1) The purpose of CRM is to effectively use and manage the available resources including information, equipment and personnel to fulfill the purpose of safe and efficient flight;

(2) Company CRM courses provide practical skill training to the trainees with the purpose of improving crew communication and cooperation and consolidating teamwork awareness. CRM is helpful for the flight crew to correctly recognize and understand the task and responsibility of the cooperator. Its ultimate purpose is to obtain safe, efficient and comfortable flight;

(3) Emphasizing CRM is not intended to reduce the authority of the captain in crew work. Its purpose is to increase the ability of the flight crew members to give appropriate support to the leader in different aspects and then enhance the whole level of the flight crew;

(4) CRM does not encourage or allow deviation from the company SOP. Instead, it strengthens the ability of the flight crew adhering to these procedures in various aspects;

(5) Each flight crew member, in the training courses, is obliged to complete their responsibility at the highest standard according to requirement of CRM principles. Each flight crew member also has the right to require his cooperator to perform at the highest standard.

1.15 LOFT Training

LOFT（line oriented flight training）,is a kind of line flight training conducted in the simulator. Its purpose is to improve the flight crew's situation awareness and handling ability, enhance their ability of comprehensive judgment and reasonable decision, raise the level of CRM management by means of simulating special situations happened in line flight to ensure flight safety.

1. LOFT refers to the flight crew training of a typical and entire flight task simulation related to line operation conditions. It puts special emphasis on communication, management and art of leadership. LOFT is a real, timely and entire flight task training.
2. LOFT has an important impact on the aviation safety through improving the effectivity of training and operation procedures. LOFT could provide typical daily flight situations and also reasonable and practical troubles and emergency situations so that the training is provided to evaluate if the cockpit management techniques are proper. This helps the airlines to have a correct understanding of the operation shortages of this airline flight crew and also get an evaluation about if cockpit procedures and instruments are used properly and the overall training effect.
3. The situation of LOFT can be started from different sources, whereas the various incident reports can provide a real and proper starting point. Correct execution of the LOFT plan could provide extensive insights into the airlines operation and training plans to a certain airlines for the following reasons:
   a） if similar mistakes repetitively appear among pilots, they are probably due to the underlying problems caused by the following reasons:
      - Procedure errors
      - The conflict or error between manuals
      - Shortages of other operation aspects

   b） It can expose weak points or other sections worthy of being noticed in crew training plan.

   c） It can expose problems of instrument-installing positions or other troubles brought about by a special and typical cockpit layout.

d) It is used by the airlines to test and confirm cockpit operation procedures.

4. LOFT can not be used to check the individual ability. On the contrary, it is the confirmation of the training plan and operation procedure. If additional training is needed for the individual or flight crew after LOFT training, opportunity should be provided for them while prejudice and accusation should not be shown.
5. Except the extreme or abnormal situation happens, LOFT course should not be interrupted. Resetting the simulator or repeatedly setting the problems disagrees with LOFT principles. Partial advantage of LOFT is that: the individual or flight crew could know the operation decision result very soon whatsoever good or bad it is. After completing the course, comments should be made in details in all aspects. Self briefing of the flight crew and comment can be made first, then by the inspector or instructor. This briefing method should also be accompanied by some auxiliary equipment such as tape or video recorders ,notes, etc.

1.16 Fuel Monitoring:

1. Fuel consumption monitoring
   After takeoff, the captain should monitor fuel consumption and fuel balance on board to ensure that there is enough fuel to complete a safe flight. When conditions change and planned fuel consumption is surpassed, extra fuel would be used. The captain is responsible for avoiding using extra fuel.
2. Fuel temperature monitoring
   Fuel temperature changes relative to total air temperature. For example, extended operation at high cruise altitudes tends to reduce fuel temperature. In some cases the fuel temperature may approach the minimum fuel temperature limit.
   Fuel freezing point should not be confused with fuel ice formation caused by frozen water particles. The fuel freezing point is the temperature at which the formation of wax crystals appears in the fuel. The Jet A fuel specification limits the freezing point to -40°C maximum, while the Jet A-1 limit is -47°C maximum.
   In the Commonwealth of Independent States (CIS), the fuel is TS-1 or RT, which has a maximum freezing point of -50°C, which can be lower in some geographical regions. The actual uplifted freezing point for jet fuels varies by the geographical region in which the fuel is refined.
   Unless the operator measures the actual freezing point of the loaded fuel at the dispatch station, the maximum specification freezing point must be used. At most airports, the measured fuel freezing point can yield a lower freezing point than the specification maximum freezing point. The actual delivered freezing temperature can be used if it is known. **Pilots should keep in mind that some airports store fuel above ground and, in extremely low temperature conditions, the fuel may already be close to the minimum allowable temperature before being loaded.**
   For blends of fuels, use the most conservative freezing point of the fuel on board as the freezing point of the fuel mixture. This procedure should be used until 3 consecutive refuelings with a lower freezing point fuel have been completed. Then the lower freezing point may be used. If fuel freezing point is projected to be critical for the next flight segment, wing tank fuel should be transferred to the center wing tank before refueling. The freezing point of the fuel being loaded can then be used for that flight segment.

Fuel temperature should be maintained within AFM limitations as specified in the Limitations chapter of the FCOM.
Maintaining a minimum fuel temperature should not be a concern unless the fuel temperature approaches the minimum temperature limit. The rate of cooling of the fuel is approximately 3° C per hour, with a maximum of 12° C per hour possible under the most extreme conditions.
Total air temperature can be raised in the following three ways, used individually or in combination:

- climb or descend to a warmer air mass
- deviate to a warmer air mass
- increase Mach number.

Note: In most situations, warmer air can be reached by descending but there have been reports of warmer air at higher flight levels. Air temperature forecasts should be carefully evaluated when colder than normal temperatures are anticipated.

It takes from 15 minutes to one hour to stabilize the fuel temperature. In most cases, the required descent would be 3,000 to 5,000 feet below optimum altitude.
In more severe cases, descent to altitudes of 25,000 feet to 30,000 feet might be required. An increase of 0.01 Mach results in an increase of 0.5° to 0.7° C total air temperature.

1.17. The Lowest Fuel Quantity Announcement

The lowest fuel quantity refers to a specific fuel quantity minimum at which pilots should report ATC to take emergent action. With the regulated fuel quantity indication system error taken into account, this fuel quantity is used to supply the airplane for at most 30 minutes at the holding airspeed at an altitude 450m(1500 feet) higher than airport elevation after the airplane has arrived in the landing airport.

The captain should adopt proper procedures to complete the flight as soon as possible when lowest fuel quantity conditions exist.

(1) Advise ATC “the lowest fuel quantity”

(2) Count the remaining fuel available with minutes

(3) Continue the flight route approved by ATC

(4) Advise flight dispatcher that the lowest fuel quantity has been announced

(5) Report current position and ETA if the airplane is operated according to VFR or in non-radar areas.

1.18 Fuel Balancing

The primary purpose of fuel balance limitations on Boeing airplanes is for the structural life of the airframe and landing gear and not for controllability. A reduction in structural life of the airframe or landing gear can be caused by frequently operating with out-of-limit fuel balance conditions. Lateral control is not significantly affected when operating with fuel beyond normal balance limits.

The primary purpose for fuel balance alerts are to inform the crew that imbalances beyond the current state may result in increased trim drag and higher fuel consumption. The FUEL CONFIGURATION NNC should be accomplished when the fuel balance alert is received.

There is a common misconception among flight crews that the fuel crossfeed valve should be opened immediately after an in-flight engine shutdown to prevent fuel imbalance. This practice is contrary to Boeing recommended procedures and could aggravate a fuel imbalance. This practice is especially significant if an engine failure occurs and a fuel leak is present. Arbitrarily opening the crossfeed valve and starting fuel balancing procedures, without following the checklist, can result in pumping usable fuel overboard.

1.19 CDU Usage:

1) On the ground, CDU inputs are generally done by the first officer while the captain checks and verifies.
2) When airborne, CDU inputs are generally commanded by PF and done by PM. Before execution, PF should approve and verify it.
3) CDU inputs should be done before heavy workload (for example, before arrival, departure or holding). When you are busy, for example during arrival or departure, it is much more simple to use the direct commands on MCP than to input complicated flight routes into CDU. If time permits (above 10,000 feet), command PM for inputs.
4) CDU page selection:
   ① Before takeoff: PF: takeoff page. PM: flight leg page
   ② During flight: PF: select the page suited to flight situation ,PM: progress page ,flight leg page or PF-commanded pages。
   ③ After ILS established, PF selects approach reference page. PM selects flight leg page or PF- commanded pages.

1.20 Exterior Lighting Usage

Exterior lighting is generally operated by PM.

1) Taxi light usage: When taxiing on the ground, turn on taxi light. When taxi stops, turn off taxi light.
2) Logo light usage: turn on logo light during the flight operation time from sunset to sunrise..
3) Strobe light usage: strobe light should be used from lining up runway and takeoff to landing and vacating runway. The strobe light may be turned off if the flashing of it influences flight in cloud.
4) Anti-collision light usage: anti-collision light should be turned on during the flight process from the time flight crew receives pushback and startup command to that the airplane taxis to gate and shutdown the engine completely. The anti-collision light should also be turned on at the gate during motoring, run-up and flaps retracting/extending.
5) Landing light usage: The function of landing light is for illumination, anti-collision and airplane position display. From lining up runway and takeoff to FL100 or descending to a height below FL100, inboard landing light should be turned on. Turn off landing light as needed when the reflection of the light causes dizziness in cloud. During night flight approach, turn on all landing lights at specified height. Turn off landing light as needed after vacating runway. Turn on all landing lights during emergency descent.
6) Navigation light usage: During flight operation (including airplane towing), turn on navigation light.
7) Wing lights usage: During night flight, wing lights may help pilots observe ice accumulation conditions on wings. Wing lights should be turned on when exterior check is carried out at night.
8) During RVSM flight, turn on all exterior lights when deviation from planned flight route is needed.

1.21 Airborne Weather Radar Usage

1.21.1 Dispatching requirements

The function of the airborne weather radar must be normal for dispatching in IFR condition as long as weather report indicates or system detects that adverse weather condition exists. Minimum equipment list (MEL) for this type of airplane must be met when dispatching in case that weather radar is inoperative.

1.21.2 Weather radar usage limit on ground:

Observe the following operation rules when you use weather radar on ground（including the test and maintenance of weather radar equipment）.

(1) Radar sector beam must keep at least 37 meters (120 feet) from the following equipments and personnel; otherwise the radar cannot be turned on at normal mode (radar antenna rotates) for operation.

① the airplanes which are fueling on the ground;
② Fuel truck and fuel truck driver, fuel tank and fuel storage area;
③ Ground staff and cargo;
④ Any airplane or hangar.

(2) Maintain at least 60 meters (200 feet) from item (1) above, otherwise radar cannot operate at shallow sector beam mode and facing item (1).

(3) The distance in item (1) and (2) above may be reduced by 70% if approved radar beam weakening device is used between weather radar and Item (1).

(4) The use of airborne weather radar is prohibited when airplane is fueling on the ground.

(5) The airplanes parking in hanger or other closed parking area are prohibited to use weather radar unless there is a suitable microwave energy-absorbing cover which can block at the weather radar antenna position effectively.

1.21.3 En route

Airborne weather radar is used to avoid thunderstorm area rather than to go through it. It may be used to observe and select a weaker thunderstorm area to go through only when the airplane has run into the area, cannot return and are forced to go through it.

Once the weather radar fails in thunderstorm area, the flight crew should deviate from planned track (return), divert and change flight level to avoid thunderstorm. Speed regulations and other operation limits in adverse weather areas should also be observed.

1.22 Radio Altimeter Usage

A Radio Altimeter (RA) is normally used to determine DH when a DA(H) is specified for Category II or Category III approaches, or to determine alert height (AH) for Category III approaches. Procedures at airports with irregular terrain may use a marker beacon instead of a DH to determine the missed approach point.

The radio altimeter may also be used to cross check the primary altimeter over known terrain in the terminal area. However, unless specifically authorized, the radio altimeter is not used for determining MDA(H) on instrument approaches. It should also not be used for approaches where use of the radio altimeter is not authorized (RA NOT AUTHORIZED). However, if the radio altimeter is used as a safety backup, it should be discussed in the approach briefing.

1.23 Altimeter Setting Procedure

1.23.1 Takeoff, climb:

During climb, when crossing transition altitude published by the departing airport, both pilots set the altimeter to 1013Hpa, and do crosscheck.

1.23.2 Descent:

During descent, when crossing the transition level, both pilots set the altimeter to published QNH or QFE, and do crosscheck.

Note: Set the altimeter according to ATC clearance if there is no published transition level for the airport.

1.24 Safety Belt Usage:

1. During flight the pilots should sit in the designated duty position and fasten the safety belt.
2. For two pilots' flight crew when one pilot leaves seat, the other pilot must fasten safety belt and shoulder harness above flight level 7600 meters (25,000 feet).
3. Shoulder harnesses may be loosened when there is no turbulence of a moderate or higher level in cruise or above 10,000 feet.
4. During critical flight phases, the flight crew members who are on duty in the cockpit should sit in the designated duty positions and fasten safety belts and shoulder harnesses. For the flight crew members other than pilots, they may loosen their shoulder harnesses when performing normal responsibilities.

1.25 Oxygen usage

1) If flight altitude exceeds 7600 meters (25,000feet), the flight crew must make sure the oxygen masks can be used anytime.
2) After the cabin pressure altitude exceeds 3000 meters (10,000 feet), the flight crew must use oxygen.
3) If the oxygen mask used due to only altitude requirement, this system should be used according to normal regulations, and oxygen cannot be overused. If there is smoke in the cockpit, you must set the system to 100%. You also must set it to 100% after using the oxygen mask.
4) When operating above flight altitude 7600 meters (25,000feet), if there is only one pilot in the control seat for any reason or at any time, this pilot should don and use oxygen mask.

1.26 Time and Clock:

1. The left seat clock on the airplane must be correctly set to UTC time during flight operation, while the right seat clock to Beijing (or local) time.
2. Use UTC or Beijing local time to report time in the air.
3. The error of reporting time should not exceed 3 minutes.

1.27 ATC Clearance:

1) Comply with ATC clearance anytime in the flight.
2) When ATC clearance cannot be met due to airplane performance and weather, the flight crew should notify ATC in time and require clearance change.
3) The flight crew should verify in time if there is any doubt about ATC clearance.
4) ATC clearances should be recorded in the form that can be understood by both pilots and kept in the place easy to be found so that there is a clarified record to be referred to when needed.
5) Before departure, ATC clearance should be consistent with not only the planned departure and initial track, but also all the flight legs in the plan. This is shown in takeoff briefing, and also can be taken as an important means to check takeoff data. Refer to related maps and manuals if there is any serious problem about terrain clearance.
6) After receiving ATC clearance, you need to take further steps to verify that navigation data is consistent with actual clearance and check the overflied navigation facilities and waypoints to make sure that the planned route is consistent with ATC clearance.
7) All flight crew members should make sure that they can receive and understand ATC departure and landing clearance. Crosscheck the clearance before takeoff and landing.

1.28 Autoflight

Autoflight system can reduce workload of the flight crew so that they can have more time and energy to monitor flight track. Both pilots must monitor AFDS mode annunciator and current FMC flight plan at anytime. PF is responsible for selecting AFDS mode and PM verifies it when autopilot is used in flight.

Pilots must fly by manual immediately when autoflight system cannot operate in the anticipated way. Measures can be taken to solve the problem of autopilot only when the airplane is flied manually and you are sure that the airplane is under control.

1.29 Autopilot:

1) The minimum altitude regulated by the company for autopilot engagement after takeoff is 500 feet. If autoland is not used, autopilot should be disengaged at a minimum altitude of 50 feet (AGL).
2) Autopilot should be disengaged and the airplane should be flied manually anytime when the situation is out of the range of autopilot control performance, or during instrument approach the autopilot can not maintain the airplane in the anticipated track.

Under the following conditions, it is recommended to use autopilot:

□ It is recommended that the fight crew should try their best to use autopilot during climbing/cruising/descending.

② Use autopilot during non-precision approach/precision approach.

③ Use autopilot during approach in marginal weather.

Use autopilot in the following cases when pilots are under heavy workload. (Strictly observe limits of operation manual for each type of airplane):

□Pilot incapacitation

□ Emergency descent

□Non-normal situations arise on the airplane.

1.30 Autoland System Usage

Generally, sensitive areas will not be protected when the airplane makes CAT I ILS approach. Most ILS equipments are enslaved to the ground vehicle or interference of airplane signals, and the scheduled flight check of ILS approach given by CAT I ILS airport doesn't include the performance analysis within the threshold. Based on this, the ILS beam quality in these positions is unknown. Unexpected flight control actions may occur at very low altitude or during landing when autopilot tries to track the incorrect beam.

1) Autoland is not recommended for CAT I ILS approach.
2) Before autoland with autopilot, confirm that the control system of the airplane has completed the regulated maintenance, and the operation condition of the airport meets the regulated requirements.
3) In case autoland can not be completed, the cause should be written on the airplane logbook. The captain should make overall consideration about the operation conditions of the landing runway.
4) During autoland with autopilot, the pilot must maintain and control the airplane at any time. The flight crew must keep high alert all the time, and their hands and feet can not leave control wheels, pedals and thrust levers during the whole automatic approach and landing. They should be prepared to disengage autopilot (A/P) and do manual landing or go-around at any moment.
5) Autoland crosswind capability:

	Headwind	Crosswind	Tailwind
767-300	25kts (12.5m/s)	25kts (12.5m/s)	10kts (5 m/s)

1.31 The Engagement and Disengagement of Autopilot/Autothrottle

1.31.1 Autopilot Engagement Method:

Follow F/D closely, maintain aircraft state and trim it properly. Make sure that there is no force on the control wheel and then engage the needed AP. Observe CMD is displayed on FMA. PF calls out autopilot middle, left or right engaged and PM verified it. (Note: If there is a force on the control wheel, AP can not be engaged. There will be a significant attitude change if the airplane is not trimmed properly.)

1.31.2 Autopilot and Autothrottle Disengagement Method:

PF informs PM: “disengage autopilot”. Hold the control wheel by two hands and push the A/P button on the control wheel twice. (The interval is 1 second. For the first time disengage A/P and for the second time silence the warning)。 Then one hand leaves the control wheel and holds the thrust lever and the callout is “disengage autothrottle”. Push the A/T disengagement button twice (Note: A/T may be used during takeoff, climb and manual flight cruise. A/T should be disengaged during approach and landing phases when the airplane is flied manually or with engine inoperative).

1.32 Manual Control

1. During manual control, the heading, altitude, speed change, speed selection related to flaps and AFDS mode selection cleared by ATC are commanded by PF, and PM takes actions,then verify together. For example, PF commands "set heading 170". PM reports "heading 170 set", and PF "check".
2. Manual control mode may be selected by PF according to weather conditions. In marginal weather approach, manual control approach is not recommended. Autopilot cannot be disengaged until pilots have established enough visual reference for landing.
3. The pilots are prohibited to control the airplanes in a careless and reckless way.
4. Do not give the commands or take the actions which will endanger flight safety.
5. Bank angle should not exceed 30 degrees (25 degrees for normal situations) when airplanes are in normal flights.

1.33 Control Transferring

During control transferring, the first control pilot must call “you control” and the pilot who takes the control must call “I have control”. If it is manual flight, the pilot who will take control must put hands and feet on the control wheel, pedal separately during control transferring. He can not respond until getting the actual control of the airplane.

1.34 Flight Director

Flight director should be turned on in all flight phases as long as it is available. Flight crew should turn off flight director first and then turn it on in order that there is an indication on flight director when go around during non-precision approach unless an accepted approach profile and visual reference have been established. Flight director may not be used during training flight.

1.35 Flap Setting

Use flap setting 5 for normal takeoff. Using larger takeoff flap setting can help reduce takeoff distance. Refer to Airport Analysis Manual to determine different takeoff flap setting.

Tail clearance during takeoff:

Airplane type	Flap setting	Liftoff attitude (degree)	Tail clearance (inch)	Tailstrike pitch attitude (degree)
B767-300	5,15,20	7.5	24(61cm)	9.6

Use flap 30 for normal landing.

When using flaps, flight crew must comply with flap placard speed limitation. The maximum altitude for flap extension is 20000 feet.

Flap retraction plan during takeoff

Takeoff flap setting	Speed (knots)	Flap selection
20 or 15	Vref 30+20	5
	"F" Vref 30+40	1
	"F" Vref 30+60	UP
5	"F" Vref 30+40	1
	"F" Vref 30+60	UP

"F"=Minimum flap retraction speed for next flap setting on speed tape display (if installed)

Flap extension schedule

Current flap position	at "F" or speed (knots)	Flap selection	Command speed according to selected flaps
UP	"F" Vref30+80	1	Vref30+60
1	"F" Vref30+60	5	"F" Vref30+40
5	"F" Vref30+40	20	Vref30+20
20	Vref30+20	25 or 30	(Vref25/Vref30)+wind adjustment

The flight crew should select flaps position used for landing and set landing reference speed according to landing airport conditions, meteorological conditions and airplane conditions.

Table of flaps maneuvering speed

The flap extension speed schedule is based upon Vref 30 and provides full maneuver capability or at least 40 of bank to stick shaker at all weights.

Flap position	Gross weight
Flap 0	Vref30+80
Flap 1	Vref30+60
Flap 5	Vref30+40
Flap 15	Vref30+20
Flap 20	Vref30+20
Flap 25	Vref25
Flap 30	Vref30

During flap retraction and extending, when the maneuvering speed for the current flap position is reached, the next flap setting value should be set. When flaps are retracted to the next position, the airplane should be accelerating. Under bank angle 30 degrees or less, when the airplane operates at a lower speed than the recommended speed 20NM/h, enough maneuvering margin can still be maintained. During flap extending, select the next flap of the flaps before the airplane decelerates to the flap recommended speed for the current flap setting.

For EFIS/MAP airplanes with ADI speed tapes, start to retract flaps to the next position when "F" symbol appears on the speed tape.

1.36 Speedbrake Usage

Speedbrake system is controlled by speedbrake lever (moving upward and downward). This system is comprised of independent spoilers. So these spoilers may be extended and retracted by moving speedbrake levers.
When using speedbrake in the air, PF should put hands on the speed brake lever all the time, which can prevent the speedbrake to be left in flight detent.
The airplane may roll rapidly if speedbrake is put between down detent and flight detent. This should be avoided under normal conditions. During descent when speedbrake is used, the airplane should have sufficient altitude and speed margin to level off smoothly. Retract speedbrake before increasing thrust.
To avoid buffeting, use of speedbrakes with flaps greater than 5 should be avoided. If circumstances dictate the use of speedbrakes with flaps extended, high sink rates during the approach should be avoided. Speedbrakes should be retracted before reaching 1,000 feet AGL.
The flaps are normally not used for increasing the descent rate. Descend to flight pattern or instrument approach altitude in clean configuration.
The rapid retraction of speedbrake will increase the airspeed to above VMO/MMO when airplane is descending with autopilot on and speedbrake extending at a speed close to VMO/MMO. In order to avoid this situation, retract speed brake smoothly and slowly, which allows the autopilot to have enough time to adjust pitch attitude and keep the airspeed within the limit.
When retracting speedbrake during approaching VMO/MMO at captured altitude, momentary overspeed may happen. That is because the autopilot has smoothly captured the selected altitude by maintaining fixed flight track when thrust is maintained or approaching to idle. To avoid this, it is probably needed to reduce selected speed, descent rate or selected speed and delay retracting speedbrake before altitude is captured until leveling off is completed.
After touchdown when nose gear touches ground, speedbrake can be fully extended without unfavorable pitch effect. Speedbrake will destroy the wing lift, and press the main gears with airplane weight in order to provide good braking action.

If the speed brake is not up at touchdown, the braking action will probably be reduced by 60%. This is because the weight on the gears is very light, and the application of the brake will make the anti-skid system adjust quickly.
In normal situations, speedbrake should be armed and extended automatically. After touchdown, both pilots should monitor speedbrake extension. Speedbrake should be extended manually and immediately if automatic extension fails.
During landing, pilots should be conscious of the speedbrake lever position, which is very important to avoid rolling out of runway. PM should call out speedbrake position during landing. This can improve the awareness of the flight crew on speed brake position, help them form a good habit and prevent that the flight crew may not observe malfunctions or unarmed spoiler system.

1.37 Required Navigation Performance (RNP) Operation

RNP specifies the navigation accuracy of the special routes or airport area procedure requirements. The unit of this accuracy is nautical miles (for example, RNP0.3 means that the required accuracy is within 0.3 nm). Normally, RNP value in airport area procedure (SID, STARS, approach transition and approach) is less than that in route procedure. Small RNP can require that the navigation accuracy is more accurate than the current VOR/ADF navigation, so during arrival and/or approach the lower minimum weather standard may be used.

If there is a RNP related to the current procedure or route, or the RNP comes from the current flight phase, the RNP will be set automatically in the navigation data in CDU. Flight crew may input a RNP manually if the automatically set RNP is incorrect for current route or airport area procedure. Incorrect flight crew alert may be aroused if the RNP is set below the one regulated by procedure, airspace or route. Flight crew may refer to the published area procedure, route or airspace in order to determine the appropriate RNP. If there is no published RNP, there will be no need to use it.

FMC calculates the actual RNP and this performance is displayed as ACTUAL. ACTUAL display and confirm the accuracy related to FMC position by the unit of nm. This accuracy is based on the FMC position which is within the 95% possibility of ANP value. This calculation is based on updating source (GPS,DME—DME,VOR—DME, LOC—GPS,LOC—DME—DME,LOC / VOR—DME or LOC) and the final time updated to FMC position by one of these sources. When FMC is not updated by one of these sources, the indication mode is IRS NAV ONLY. When there is a more accurate updating source, ANP value will be lower. GPS provides the lowest ANP and the highest position accuracy. At the same time, INERTIAL updating provides the highest ANP value and the lowest position accuracy.

When ANP exceeds RNP, the alert information will be provided to the flight crew. When this case occurs in the published RNP route or airport area procedure, the flight crew should verify the position and consider requesting diversion clearance. This means possible transition to non-RNP procedure or route, or a procedure or route for which RNP value is larger than the displayed ANP value.

The flight crew should know that the ANP is only related to FMC position accuracy. XTK ERROR on FMC will indicate the horizontal deviation from route or procedure track. Use LNAV to reduce XTK ERROR when the autopilot is engaged. Excess XTK ERROR will not arouse flight crew alert information.

Approach Requirements Relating to RNP

With appropriate operational approval, approaches requiring RNP alerting may be conducted in accordance with the following provisions:

- AFM indicates that the airplane has been demonstrated for selected RNP
- at least one GPS or one DME is operational
- any additional GPS or DME requirements specified by Operations Specification or by the selected terminal area procedure must be satisfied
- when operating with the following RNP values, or smaller:

Approach type	RNP
NDB,NDB/DME	0.6NM
VOR,VOR/DME	0.5NM
RNAV	0.5NM
GPS	0.3NM

- no UNABLE RNP alert is displayed during the approach.

1.38 Takeoff and Landing Speed Bug Setting:

Bug setting (MASI)
B767-300

Bug setting (EFIS/speed tape)
B767-300

1.39 Noise Abatement Procedure:

The flight path may be strictly required in a certain phase of approach or departure. Generally the departure design has already taken the noise factor into account, and the pilots just need to execute the standard departure requirements strictly. The approaching aircraft should not be below the visual or electric glide slope guidance, and they should follow the noise abatement flight track strictly. Of course, this flight track regulated may also be designed due to requirements of ATC according to operation, weather or traffic. Some airports require that during approach, reduce flap setting or delay flap extending, and the captain should consider if the airplane performance and runway surface conditions can meet the requirements.
The normal takeoff procedure of Boeing 767 conforms to the noise abatement requirements. Maintain maneuver speed with flap up before the noise abatement profile is met until the aircraft reach terrain clearance or above minimum obstacle clearance height.

Note: Observe specific procedures of the local airport.

1. Pilots should observe the regulated noise abatement procedures when doing takeoff and landing in the noise limit airports except if anyone of the following conditions exists.
   (1) Low clouds, thunderstorm and/or low visibility exists.
   (2) The following conditions exist on the dry runway surface:
      ① If crosswind (including gusting) exceeds 20knots;
      ② If tailwind (including gusting) exceeds 5knots.
   (3) The following conditions exist on the wet runway surface:
      ① If crosswind (including gusting) exceeds 20 knots;
      ② If tailwind exists.
   (4) If possibility of windshear exists.
   (5) When the captain considers safety problem due to runway condition and other factors.
2. For takeoff on the designated runway, the normal noise abatement procedure is:
   (1) Climb at a speed between V2+10KT and V2+20KT, or the speed for the maximum climb angle, and
   (2) Maintain takeoff thrust and climb to 1500 feet AGL.

(3) Then, adjust thrust to not lower than climb thrust. Climb at a speed between V2+10KT and V2+20KT, and climb to 3000 ft AGL.

(4) Accelerate to enroute climb speed, retract flaps as planned, and

(5) Maintain runway direction unless there is a standard departure procedure and definite ATC clearance.

3. If the airplane's high bypass ratio is higher than 3.5, you can execute the following alternate procedure except the above procedure.

(1) Climb at a speed between V2+10KT and V2+20KT, or the speed for the maximum climb angle, and

(2) Maintain takeoff thrust till climbing to 1000FT AGL.

(3) Then accelerate to Vzf (the minimum safety maneuver speed when flap up and retract flap as planned.

(4) Adjust thrust to normal climb thrust, and

(5) Climb to the height 3000 AGL at a speed not more than Vzf+10KT.

(6) Accelerate to enroute climb speed. Retract flap as planned, and

(7) Maintain runway direction unless there is a standard departure procedure and definite ATC clearance.

Execute strictly the noise abasement procedure published by airport.

1.40 Avoid Wake Turbulence

Each airplane in flight generates wake turbulence caused primarily by a pair of counter rotating vortices trailing from the wing tips.

Wake turbulence generated from heavy aircraft, even from those fitted with wing tip fences, can create potentially serious hazards to following aircraft. Vortices generated in the wake of large aircraft can impose rolling movements exceeding the counter-roll capability of small aircraft. Therefore, these turbulences can pose potential threat to following aircraft.

Division:

Wake turbulence separation minima shall be decided by aircraft type classification, and aircraft type classification is divided into three types according to maximum takeoff weight:

(H) Heavy:: maximum takeoff weight equal to or above 136000 kilograms;

(M) Medium: maximum takeoff weight is above 7000 kilograms and less than 136000 kilograms;

(L) Light: maximum takeoff weight is equal to or less than 7000 kilograms.

Note: When the medium or light aircraft flies following B757, B757 wake turbulence is heavy; when the heavy flies following B757, B757 wake turbulence is medium.

Criteria:

(1) To avoid wake turbulence during takeoff and landing, the following table shows relationship of minimum separation and minimum separation time between various types of aircraft.

Aircraft type		Minimum separation				
Leading aircraft	Following aircraft	Arrival separation	Distance from following aircraft to threshold	Opposite direction	Departure	
					Full runway	Runway of middle section (refer to note)
		NM-minute	minute	minute	NM-minute	minute
Heavy	Heavy	4-2	2		4-2	2
	Medium	5-2	2	2	5-2	3
	Light	6-3	2	2	6-2	3
Medium	Heavy					
	Medium					
	Light	5-2.5	2	2	5-2	3

Note: (1) When the same runway is in use, the following aircraft uses the location 150 meters or more from taking off point for rolling and takeoff;

(2) When maximum takeoff weight of the leading aircraft exceeds 200,000kg, the following aircraft should keep a minimum spacing of 3 NM or 1.5 minutes;

(3) There is no specific regulation for the vortex for one airplane landing after another airplane takes off. In general, the vortex doesn't influence much;

(4) When one airplane takes off after another heavy airplane lands, sufficient spacing should be kept if the estimated lifting off point is before the touching down point of the heavy airplane.

(5) When aircraft spacing can be directed by radar or distance, ATC will not direct aircraft by designated time intervals.

(6) If two parallel runways are 760 meters(2,500 feet) or more distance apart and the intersection altitude spacing of the takeoff tracks of the second and first aircraft is not less than 300 meters(1,000 feet), they will not influence each other.

(7) For two airplanes facing oppositely and taking off and landing towards the same direction : the minimum time interval is 2 minutes.

1.41 Liquid Protection

(1) The beverage that handed to the pilots should avoid any electronic equipment over the central control stand to keep the liquid away from the electronic equipment.

(2) The cup that pilots use should be put in the fixed place. The cup with water in it which has no cover should not be put in the cockpit during takeoff and landing.

1.42 Cockpit Sunshading

If there is sunvisor or sunshade in the cockpit, flight crew can use it when in need, but it should not affect the sight of crew to look outside. The sunvisor or sunshade cannot be used during critical phases of flight.

Nothing except sunvisor and sunshade can be used to shade the sunlight at anytime.

1.43 Takeoff Briefing:

The Takeoff briefing should be accomplished as soon as practical, otherwise it will interfere with the final takeoff preparations.

The takeoff briefing is a description of the departure flight path with emphasis on anticipated track and altitude restrictions. It assumes normal operating procedures are used. Therefore, it is not necessary to brief normal or standard takeoff procedures. Additional briefing items may be required when any elements of takeoff and/or departure are different from those routinely used. These may include:

- Adverse weather
- Adverse runway conditions
- Unique noise abatement requirements
- Dispatch using the minimum equipment list
- Methods of special departure conditions with engine failure (if applicable)
- Any other situation where it is necessary to review or define crew responsibilities.

Takeoff briefing（example）:

Plan to take off at runway____, turn left(right) to heading ____to join the route after takeoff, ____procedure departure, initial height (altitude) ____meters, transition height (altitude) ____meters, airway altitude ____meters, full（derated）thrust, flap 5.V1____、VR____、V2____。

Engine failure /severe damage before V1, rejected takeoff: retard the throttle、disengage A/T、pull speedbrake、pull reverse thrust、use brake according to the speed（RTO）.

Engine failure /severe damage after V1, continue to takeoff:. Climb at a speed higher than V2, report to the tower to return for landing / or receive commands and complete the appropriate checklist.

The takeoff briefing is completed.

1.44 Approach Briefing

Before the start of an instrument approach, the PF should brief the PM of his intentions in conducting the approach. Both pilots should review the approach procedure. All pertinent approach information, including minimums and missed approach procedures, should be reviewed and alternate courses of action considered.

As a guide, the approach briefing should include at least the following:

- Weather and NOTAMS of destination and alternate
- Approach type and the validity of the charts to be used
- Navigation and communication frequencies to be used
- Minimum safe sector altitudes for that airport
- Approach procedure including courses and heading
- Vertical profile including all minimum altitudes, crossing altitudes and approach minimums
- Determination of the Missed Approach Point (MAP) and the missed approach procedure
- Other related crew actions such as tuning of radios, setting of course information, or other special requirements
- Taxi route to parking
- Any appropriate information related to a non-normal procedure
- Management of AFDS

Approach Category

An aircraft approach category is used for straight-in approaches. The designated approach category for an aircraft is defined using the maximum certified landing weight as listed in the AFM. Under FAA criteria, the speed used to determine the approach category is the landing reference speed (Vref). ICAO and other regulatory agencies may use different criteria.

Airplanes are classified in one of two categories depending upon the operator's maximum certified landing weight. The category used is determined by the operator in coordination with the applicable regulatory authority.

Category	IAS
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots

Under FAA criteria:

• the 767 series airplanes are classified as Category “C” or “D” airplanes, depending upon the maximum landing weight

1.45 Holding

Note: This procedure is selected from ICAO Doc 8168-OPS/611 Aircraft Operation flight procedure the first volume.

Holding pattern joining must be in accordance with the relationship between heading and three joining sectors, taking into account 5°maneuvering at both sides of the sector boundary. Holding at VOR cross fixed, joining the track is limited to the radial that forms the cross fixed; holding at VOR/DME cross fixed, joining the track is limited to VOR radial, DME arc or VOR/DME fix joining radial published to the end of flight leg.

1.45.1 The First Sector Procedure (parallel joining):

(a)After arriving at the fix, the aircraft turn left to the outbound until the appropriate time;
(b) The aircraft turn left to one side of the holding, and intercept the inbound track or return to the fix; and then
(c)The aircraft turn right and fly along the holding pattern when flying across the fixed point for the second time.

1.45.2 The Second Sector Procedure(offset joining):

(a)After the aircraft reaches the fixed point, it turns to one side of the holding pattern to fly along the opposite track which is at a 30°angle with the inbound track, and then

(b)Aircraft outbound flying:

(1) Fly for proper time if timing is regulated, or

(2) Fly to the limited DME distance if the distance is regulated, or

(3) Fly to the limited DME distance or meet the limited radial (the earlier is preferable) if a limited radial is also regulated. And then

(c)The aircraft turn right to intercept the holding inbound track; then

(d)The aircraft turn right to fly along the holding pattern when flying across the fixed holding point for the second time.

1.45.3 The Third Sector Procedure (direct joining)

The aircraft turn right and fly along the holding pattern when flying across the fixed point.

Note: 3 minutes before the aircraft is estimated to arrive at the fixed, the arrival airspeed should be decelerated in order that the aircraft can initially fly across the fixed when the airspeed is equal to or below the maximum arrival airspeed.

1.45.4 Non-standard Holding Pattern (turn left after passing the fix) (see the picture below)

Joining the holding pattern should be in accordance with the relationship with the three joining sectors and take into account 5°flexing zone at both sides of the boundary ：

1 sector procedure, (parallel joining)
2 sector procedure, (offset joining)
3 sector procedure, (direct joining)

1.45.5 ICAO holding airspeed (maximum)

Altitude	Speed
To 14,000 feet	230KTs
Above 14,000 feet-20,000feet(MSL)	240KTs
Above 20,000 feet-34,000feet(MSL)	265KTs
Above 34,000feet(MSL)	.83Mach

FAA holding airspeed (maximum)

Altitude	Speed
Below 6,000 feet(MSL)	200KTs
6,000-14,000feet(MSL)	230KTs(For Washington and New York,210 KTs)
Above14,000 feet(MSL)	265KTs/.83Mach

During holding under icing conditions, clean configuration should be maintained.

If holding pattern is not compiled into FMC, according to altitude requirements, fly initial outbound flight segment for one or one and a half minutes. Adjust following timing in outbound segment as required so that correct inbound timing can be required.

Under conditions when heavy wind exists or holding speed is too high, the airplane may fly beyond the prescribed regulated airspace of holding pattern. But the holding pattern indicated on MAP display will not exceed limits. ATC should be informed in case there is a need to increase airspeed due to turbulence, or any part of the holding procedures can not be completed, or flight can not be completed at the listed speed in the above table.

1.46 Deviation and Diverting to the alternate:

Diversion means that the airplane doesn't fly to the destination airport or the designated alternate airport appointed by dispatch list (not including the pre-planned redispatch), and the diverted airport is called diverted alternate airport. When the airplane, airborne equipment, ground navigation equipment failed, or the airway and destination airport weather influence flight safety, passengers' life or some emergencies happen, the captain should divert to the alternate.

1.46.1 Alternate Airport Selection

The choice of alternate airport should refer to the remained fuel, airport facilities, weather conditions and passengers servicing ability. If the airplane needs divert to the alternate airport due to airplane problems or accidents, the safety factor should be taken into consideration. If the systems fail or performance deteriorates during flight, the pilot can operate in accordance with the procedures in the flight crew operational manual (FCOM).

When one of the procedures requires immediate landing, the pilot should choose an appropriate landing airport according to the situation severity. In general, the captain should not choose the airport other than the nearest appropriate airport unless he thinks the chosen airport is as safe as the nearest appropriate airport and takes all factors influencing flight safety into account.

1.46.2 The Minimum Fuel Consumption for Diversion

The minimum fuel consumption for diversion includes the fuel consumption and the final remained fuel from diversion to the alternate landing (the fuel needed for holding airspeed flying for 30 minutes at 450 meters/1,500 feet over the airport at standard air temperature)

1.46.3 Flight Plan and ATC Clearance

Aircraft diversion must get ATC clearance, and before diversion the captain offer the aircraft state, captain purpose and:

(1) The alternate airport;
(2) Flight route;
(3) Flight altitude;

(4) Estimated flight time;

(5) The endurance capability（hours and minutes）;

(6) Inform the flight dispatcher as soon as possible.
After the flight dispatcher receives the captain purpose, he should offer the alternate airport weather, correct the dispatch list, and inform the alternate airport to get prepared.

1.46.4 Advice Flight Attendants and Passengers

After the captain makes a decision to divert, he should immediately inform purser about the decision so that the purser can have enough time to arrange cabin service and safety matters, and as necessary inform the passengers about the conditions of diversion.

1.46.5 Flight Crew's Duty after Landing

The captain should shoulder main responsibility for the safety of airplane, passengers, airborne luggage, cargo, dangerous goods and mail to avoid any danger and accidents. The captain should help the local agency, airport management department, and the maintenance department to set the passengers and airplane check and maintenance. The captain should get in touch with company dispatchers as soon as possible, discuss the flight plan, clearance, fuel quantity and weather, and prepare to take off again. The purser should ensure the good service offered to the onboard passengers.

1.47 Landing at the Nearest Suitable Airport

"Plan to land at the nearest suitable airport" is a phrase used in QRH. The following explains foundation for this action and procedures for implementing it.
In a non-normal situation, the captain, having the authority and responsibility for operation and safety of the flight, must make the decision to continue the flight as planned or divert. In an emergency situation, this authority may include necessary deviations from any regulation to meet the emergency. In all cases, the captain is expected to take a safe course of action.
The QRH assists flight crews in the decision making process by indicating those situations where "landing at the nearest suitable airport" is required. These situations include but are not limited to the following:

- Non-normal checklist containing "landing at the nearest suitable airport"
- The continual smoke or fire in the cabin
- Only one remaining main AC power (such as engine or APU)
- Only one remained hydraulic system (consider using standby system as hydraulic system), or
- Other situations to be decided by the crew, and in these situations the continuing flying will have bad effects on safety.

It should be emphasized that for persistent smoke or a fire which cannot definitely be confirmed to be completely extinguished, perform the earliest possible descent, landing and passenger evacuation.

The regulations regarding an engine failure are specific. FARs specify that the captain of a twin engine airplane that has an engine failure or engine shutdown shall land at the nearest suitable airport at which a safe landing can be made.

A suitable airport is defined by the operating authority for the operator based on guidance material, but in general must have adequate facilities and meet certain minimum weather and field conditions. If required to divert to the nearest suitable airport (two engines failure), the guidance material also typically specifies that the pilot should select the nearest suitable airport "in point of time” or “in terms of time”. In selecting the nearest suitable airport the captain should consider the suitability of nearby airports in terms of facilities and weather and their proximity to the airplane position. The captain may determine, based on the nature of the situation and an examination of the relevant factors that the safest course of action is to divert to a more distant airport than the nearest airport. For example, there is not necessarily a requirement to spiral down to the airport nearest the airplane’s present position if, in the judgment of the captain, it would require equal or less time to continue to another nearby airport.

For persistent smoke or a fire which cannot positively be confirmed to be completely extinguished, the safest course of action typically requires the earliest possible descent, landing and passenger evacuation. This may dictate landing at the nearest airport appropriate for the airplane type, rather than at the nearest suitable airport normally used for the route segment where the incident occurs.

1.48 Stabilized Approach

Maintaining a stable speed, descent rate, and vertical/lateral flight path in landing configuration is commonly referred to as the stabilized approach concept.
Any significant deviation from planned flight path, airspeed, or descent rate should be announced. The decision to execute a go-around is no indication of poor performance.

Note: Do not attempt to land from an unstable approach.

Recommended Elements of a Stabilized Approach

The following recommendations are consistent with criteria developed by the Flight Safety Foundation.
All approaches should be stabilized by 1,000 feet AFE in instrument meteorological conditions (IMC) and by 500 feet AFE in visual meteorological conditions (VMC). An approach is considered stabilized when all of the following criteria are met:

- the airplane is on the correct flight path
- only small changes in heading and pitch are required to maintain the correct flight path
- the airplane speed is not more than Vref30 + 20 knots indicated airspeed and not less than Vref30
- the airplane is in the correct landing configuration
- sink rate is no greater than 1,000 fpm; if an approach requires a sink rate greater than 1,000 fpm, a special briefing should be conducted
- thrust setting is appropriate for the airplane configuration
- all briefings and checklists have been conducted.

Specific types of approaches are stabilized if they also fulfill the following:

- ILS approaches should be flown within one dot of the glide slope and localizer, or within the expanded localizer scale
- during a circling approach, wings should be level on final when the airplane reaches 300 feet AFE.

Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing.

Note: An approach that becomes unstabilized below 1,000 feet AFE in IMC or below 500 feet AFE in VMC requires an immediate go-around.

These conditions should be maintained throughout the rest of the approach for it to be considered a stabilized approach. If the above criteria cannot be established and maintained at and below 500 feet AFE, initiate a go-around.

At 100 feet HAT for all visual approaches, the airplane should be positioned so the flight deck is within, and tracking to remain within, the lateral confines of the runway edges extended.

As the airplane crosses the runway threshold it should be:

- stabilized on target airspeed to within + 10 knots until arresting descent rate at flare
- on a stabilized flight path using normal maneuvering
- positioned to make a normal landing in the touchdown zone (the first 3,000 feet or first third of the runway, whichever is less).

Initiate a go-around if the above criteria cannot be maintained.

Maneuvering (including runway changes and circling)

When maneuvering below 500 feet, be cautious of the following:

- descent rate change to acquire glide path
- lateral displacement from the runway centerline
- tailwind or crosswind components
- runway length available.

1.49 Reject Approach:

The captain should reject approach when the airborne equipment, ground navigation equipment have failures and cannot continue the approach and landing safely.

The captain cannot continue the approach if the received weather condition is below landing minimum standard before the airplane flies over the final approach fix (FAF) or final approach point (FAP).

The captain can continue the approach to DA/DH or MDA/MDH if the received weather condition is below landing minimum standard after the airplane flies over the final approach fix (FAF) or final approach point (FAP).

If there is no regulated FAF, and the received weather condition is below the regulated landing minimum standard, the captain cannot begin flight of the last phase.

1.50 Landing Conditions

Before landing the captain should judge whether the landing distance meets the following conditions according to the airplane conditions and surface conditions:

(1) Acquire landing clearance;
(2) Verify the landing weight is not more than critical landing maximum weight;
(3) Confirm runway in use;
(4) Autobrake is selected according to airplane weight, surface conditions, weather conditions. Autobrake should be selected before touchdown unless it doesn't work;
(5) Landing flaps are selected according to flying conditions and airplane conditions;
(6) Take into full account of the affects of the wind to landing;
(7) Take into account of the affects of the forward airplane tail turbulence;
(8) Take into account of the affects of birds and other threats to landing.

1.51 Landing Minima

There are limits on how far an airplane can descend without visual contact with the runway environment when making an approach. Descent limits are based on a decision altitude (DA) (ILS OR PAR) for approaches using a glide slope or certain approaches using a VNAV path, or a MDA for non-precision approaches without a glide slope.

Note: Approach charts use the abbreviation DA (H) or MDA (H). The decision altitude (DA) or minimum descent altitude (MDA) is referenced to MSL, and the parenthetical height (H) is referenced to Touchdown Zone Elevation (TDZE) or runway threshold elevation. For example, A DA (H) of 1,440 feet (200 feet) is a DA of 1,440 feet with a corresponding decision height of 200 feet.

When RVR is reported for the landing runway, it typically is used in lieu of the reported meteorological visibility.

When the pilot find the ceiling, horizontal visibility or RVR is below what the company regulated in the operational regulation or the airport published minimum weather standard when descending to the minimum descent altitude or decision height according to the instrument approach procedures, the pilot must climb to the safety altitude according to the regulated go-around procedures, report to ATC, and then fly according to its instructions.

1.52 Visual Reference of the Landing Runway:

(1) Use approach lighting system. However, if the pilot uses approach lighting for reference, he should not descend to below an altitude 30 meters (100 feet) above elevation of touchdown zone unless he can see and identify transverse lights at the red runway ends or red side lights;

(2) Runway threshold;

(3) Runway threshold signs;

(4) Runway threshold lights;

(5) Runway end identified lights;

(6) Glide slope indicators in visual approach;

(7) Touchdown zone or signs of touchdown zone;

(8) Touchdown zone lights;

(9) Runway or runway signs;

(10)Runway lights.

1.53 Reject Landing:

The captain should consider reject landing under following conditions:

(1) ATC clearance;

(2) The runway visual range cannot meet the landing requirements during landing such as effects of advection fog;

(3) Surface conditions will induce insecurity occurrence after landing such as staff, traffic, animals, obstacles, surface damage and so on;

(4) Landing gear warning appears;

(5) The leading airplane hasn't completely vacated the runway or there is danger to collide with other airplanes;

(6) Wrong control and no in-time correction;

(7) When the captain thinks it is necessary.

The reject landing procedure is the same as the go-around procedure. Press GA switch down, ensure setting go-around thrust or manually used go-around thrust, select go-around flaps, and nose up to the missed approach attitude simultaneously. Retract the landing gear after positive climb rate is established. Set the command speed as the flaps retraction operation speed or other required speed at safe altitudes, and retract flaps as planned. If landing is rejected in the initial period after touchdown, advance thrust levers to retract auto spoilers and disarm autobrakes.

Warning: Once reverse thrust is initiated, a full stop landing must be made.

Factors dictating this are:

- Five seconds are required for a reverser to transit to the forward position.
- A possibility exists that a reverser can not return to be stowed in the forward thrust position.

A go-around in flare or after touchdown can easily induce tailstrike. When a missed approach mode is initiated, flight guidance immediately indicates the pitch attitude of missed approach. If the pilots suddenly nose up to hitch the pitch command lever, tailstrike will happen before the airplane reacts and starts climbing. A go-around requires both pitch attitude and thrust. If the pitch attitude increases but the thrust doesn't increase enough, it will cause airspeed decrease and tailstrike. When a later go-around is initiated and the airplane is still over the runway, the intense desire of the flight crew in trying to avoid the landing gear touchdown might be another reason for tailstrike. In a word, it is not necessary to worry about this because it is acceptable for the landing gear to touchdown for a short time period during a later go-around process. This case has been verified in the autolanding and go-around certified procedures.

1.54 Overweight Landing

The actual landing weight should not exceed the maximum landing weight limit unless in emergency.

1.54.1 Situations Needing Overweight Landing:

1.54.1.1 The airplane cannot continue flying safely and needs immediate landing:

(1) There is uncontrollable fire warning or smog in the airplane;
(2) The body and parts of the airplane are severely damaged;
(3) Airplane control, hydraulic, electricity and fuel systems have severe problems;
(4) The damage of communication, navigation equipment might affect the approach and landing procedures;
(5) The bomb, terror threat, unclear dangerous goods or dangerous goods leakage might severely affect the passengers, crew and flight safety;
(6) Passengers or flight crew have severe illnesses that will affect life and needs immediate hospitalizing;
(7) Quick checklist requires other emergency situations for the near suitable airport landing;
(8) ATC requires immediate landing;
(9) Immediate landing helps ease other situations that might influence or threat flight safety.
(10) One engine out.

1.54.1.2 The following factors should be considered for assessing whether it is overweight landing:

1) QRH requires landing at the nearby airport;
2) The low circling consuming fuel may get the situation worse;
3) Long time circling consuming fuel might get the media to give more negative report about airlines;
4) The low circling consuming fuel will cause unnecessary economy loss.

Flight dispatcher and the captains are responsible to ensure that the aircraft weight is less than the maximum landing weight when the aircraft lands at the airport. Under emergency conditions, when it needs to return for landing in emergency the captain should consider consuming the fuel (if possible) and some related factors such as the pavement classification NO （PCN）, surface condition, landing roll distance. The captain should control the airplane smoothly to avoid hard landing after completing the checklist (if any). The captain should immediately report to the maintenance and the company dispatcher and record the landing weight in the flight log after landing.

1.55 Go-around Requirement:

Go-around is the final action to correct or avoid insecure state and the important strategy to ensure flight safety. 767 has the ability to go around at any altitude. So long as the crew do not use the reverse thrust, they can initiate go-around according to the procedures.

(1) Go around must be initiated in the below situations:

① The airplane cannot satisfy the normal navigation precision according to airborne or ground navigation equipment during instrument approach to final;

② Airborne or ground radio navigation equipment is not reliable or fully fail when the instrument approach is below MSA;

③ The visual reference cannot be established when reaching MAP (non-precision approach) or DA/DH (precision approach);

④ The stable approach procedure requirements cannot be satisfied;

⑤ The normal landing cannot be completed;

⑥ Visual reference is lost during circling maneuver landing of instrument approach.

Note: **visual reference:** the pilot can totally see the runway or runway markings, runway threshold, runway threshold markings, touchdown zone or touchdown zone markings, approach lights, runway threshold lights, runway end lights, runway lights, touchdown zone lights, and other markings for identifying runway that conforms to the following conditions: for circling approach airplanes, there is no low cloud, the ground is visible and the visibility is not below the procedures requirement; or for direct approach airplanes, the visibility is not below the procedure requirement.

(2) When the go-around procedure is executed, the pilots must comply to the go-around procedure regulated in the instrument approach map. If the missed approach is needed before reaching the missed approach point (MAP), the pilots must first fly to MAP. The MAP in the procedure may be:

(3) In precision approach, fly along the glide slope to the DA position;

Over one navigation station;

One appointed position point;
One appointed position point to FAF.

(4) When it requires go-around during circling approach, pilots should turn to the landing runway during climbing and join the go-around procedure track after flying across the above area.

1.56 Mandatory Missed Approach

On all instrument approaches, where suitable visual reference has not been established and maintained, execute an immediate missed approach when:

- a navigation radio or flight instrument failure occurs which affects the ability to safely complete the approach
- the navigation instruments show significant disagreement
- on ILS final approach and either the localizer or the glide slope indicator shows full deflection
- on an RNP based approach and an alert message indicates that ANP exceeds RNP
- on a radar approach and radio communication is lost

Rejection system of approach landing:

During approach and landing,due to weather standard and A/C unstable condition etc,under the condition that not against emergency situation disposition requirements of related manual,when anyone of the nessary crew member advance the go around command definitely,the whole crew should excute go around procedure.(go around command equals captain decision.)

Note: the flight crew must abide go around condition requirements strictly,and be responsible for the command issued by himself.

1.57 Pilot Report of Non-normal Situation

The captain is responsible for reporting the non-normalities to the associated departments in flight in a proper way. Especially when this situation might threaten the flight safety, the pilots must report it immediately to ATC. These non-normalities include ground navigation, communication equipment failure, traffic conflict, adverse weather, severe mechanical malfunctions, distress and rescue signs, volcano activities, forest fire, standing water on the runway, braking action and so on.

1.58 Limitations

1.58.1 Airplane General， Operational Limitations

Runway Slope	± 2%
Maximum Operating Altitude	43,100 feet pressure altitude
Maximum Takeoff and Landing Altitude	8,400 feet pressure altitude
Maximum Takeoff and Landing Tailwind Component	10 knots

1.58.1.1 Non–AFM Operational Information

Note: The following items are not AFM limitations, but are provided for flight crew information.

Turbulent air penetration speed is: 290 KIAS/.78 Mach, whichever is lower.

The navigation and display system does not support operations at latitudes greater than 87° North or South.

Do not operate HF radios during refueling operations.

1.58.1.2 RVSM Altimeter Cross Check Limits

Standby altimeters do not meet altimeter accuracy requirements of RVSM. The maximum allowable in-flight difference between Captain and First Officer altitude displays for RVSM operation is 200 feet.

The maximum allowable on-the-ground differences between Captain and First Officer altitude displays for RVSM operation are:

Field Elevation	Max Difference Between Captain & F/O	Max Difference Between Captain or F/O & Field Elevation
SEA LEVEL	40 feet	75 feet
5,000 feet	45 feet	75 feet
10,000 feet	50 feet	75 feet

1.58.1.3 Weather Radar

Do not operate the weather radar in a hanger or within 50 feet of any personnel or fuel spill.

Note: The hanger and personnel restrictions do not apply to the weather radar test mode.

1.58.1.4 Weight Limitations

Maximum Weight Limitations

Weights	Kilograms
Maximum Taxi Weight (MTW)	187,333
Maximum Take Off Weight (MTOW)	186,880
Maximum Landing Weight (MLW)	145,149
Maximum Zero Fuel Weight (MZFW)	133,809

Other Weight Restrictions

Note: These weights may be further restricted by field length limits, climb limits,tire speed limits, brake energy limits, obstacle clearance, or enroute and landing requirements.

1.58.1.5 Flight Deck Security Door

Verify that an operational check of the Flight Deck Access System has been accomplished according to approved procedures once each flight day.

Door Mounted Escape Slides

Entry door evacuation slide systems must be armed and engagement of the girt bar with door sill verified prior to taxi, takeoff, or landing whenever passengers are carried.

1.58.1.6 Auto Flight

After takeoff, the autopilot must not be engaged below 200 feet AGL.

Use of aileron trim with the autopilot engaged is prohibited.

Maximum allowable wind speeds when landing weather minima are predicated on autoland operations:

Headwind	25 knots
Crosswind	25 knots
Tailwind	10 knots

1.58.1.7 Aircraft Communications Addressing and Reporting System(ACARS)

The ACARS is limited to the transmission and receipt of messages which will not create an unsafe condition if the message is improperly received, such as the following conditions:

• the message or parts of the message are delayed or not received,
• the message is delivered to the wrong recipient, or
• the message content may be frequently interrupted.

However, Pre-Departure, Digital Automatic Terminal Information Service, Oceanic Clearances, Weight and Balance and Takeoff Data messages can be transmitted and received over ACARS if they are verified per approved operational procedures.

1.58.1.8 Engine

Continuous ignition must be on (engine start selector in the CONT position) while operating in severe turbulence.

Note: Continuous ignition is automatically provided in icing conditions when engine anti–ice is on.

Flight crew shall not blank engine vibration display during takeoff.

1.58.1.9 Engine Fuel System

The minimum inflight fuel tank temperature is 3°C (5°F) above the freeze point of the fuel being used.

The maximum fuel temperature is 49°C (120°F) {Jet B/ JP-4: 43°C (109°F)}The center tank may contain up to 10,000 kilograms of fuel with less than full main tanks provided center tank fuel weight plus actual zero fuel weight does not exceed the maximum zero fuel weight, and center of gravity limits are observed.

1.58.1.10 Reverse Thrust

Reverse thrust is for ground use only.

Backing the airplane with use of reverse thrust is prohibited.

1.58.1.11 Flight Controls

The maximum altitude for flap extension is 20,000 ft.
Avoid rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw (e.g. large side slip angles) as they may result in structural failure at any speed, including below VA.

1.58.1.12 Ground Proximity Warning System (GPWS)

Look–Ahead Alerting

Do not use the terrain display for navigation.
The use of look-ahead terrain alerting and terrain display functions is prohibited within 15 NM of takeoff, approach or landing at an airport not contained in the GPWS terrain database. Refer to Honeywell Document 060-4267-000 for airports and runways contained in the installed GPWS terrain database.

Chapter 2 Normal Procedures

2.1 Preliminary Preflight Procedure – Captain or First Officer

The Preliminary Preflight Procedure assumes that the Electrical Power Up supplementary procedure is complete.

IRS mode selectors ....OFF, then NAV

Verify that the ON DC lights illuminate then extinguish.

Verify that the ALIGN lights are illuminated.

STATUS display ....Check

Verify that only expected messages are shown.

Verify that the following are sufficient for flight:

- oxygen pressure
- hydraulic quantity
- engine oil quantity

Do the remaining actions after a crew change or maintenance action.

Maintenance documents ....Check

FLIGHT DECK ACCESS SYSTEM switch .... Guard closed

BULK CARGO HEAT selector .... NORM or VENT

FLIGHT RECORDER switch ....NORM

SERVICE INTERPHONE switch ....OFF

RESERVE BRAKES and STEERING
RESET/DISABLE switch .... Guard closed

Verify that the ISLN light is extinguished.

Circuit breakers ....Check

Emergency equipment ....Check

Fire extinguisher – Checked and stowed

Crash axe – Stowed

Escape ropes – Stowed

Other needed equipment – Checked and stowed

Parking brake ....As needed

Set the parking brake if brake wear indicators will be checked during the exterior inspection.

2.1.1 CDU Preflight Procedure - Captain and First Officer

Start the CDU Preflight Procedure anytime after the Preliminary Preflight Procedure. The Initial Data and Navigation Data entries must be complete before the flight instrument check during the Preflight Procedure. The Performance Data entries must be complete before the Before Start Checklist.

The captain or first officer can do CDU inputs and another pilot must verify the entries.

Enter data in all the boxed items on the following CDU pages.

Enter data in the dashed items or modify small font items that are listed in this procedure. Enter or modify other items at pilot's discretion.

Failure to enter enroute winds can result in flight plan time and fuel burn errors.

Initial Data ....Set

IDENT page:

Verify that the MODEL is correct.

Verify that the navigation data base ACTIVE date range is current.

POS INIT page:

Verify that the time is correct.

Enter the present position on the SET IRS POS line. Use the most accurate latitude and longitude.

Navigation Data ....Set

RTE page:

Enter the route.

Enter the FLIGHT NUMBER.

Activate and execute the route.

DEPARTURES page:

Select the runway and departure routing.

Execute the runway and departure routing.

Verify RTE and LEG page are correct.

Performance Data ....Set

PERF INIT page:

CAUTION: Do not enter the ZFW into the GR WT boxes. The FMC will calculate performance data with significant errors.

Enter the ZFW.

Verify that the FUEL on the CDU, the dispatch papers, and the fuel quantity indicator agree.

Verify that the fuel is sufficient for flight.

Verify that the GR WT on the CDU and the dispatch papers agree.

TAKEOFF REF page:

Enter the CG.

Verify that a trim value is shown.

Enter the takeoff speeds.

2.1.2 Exterior Inspection

Before each flight the captain, first officer, or maintenance crew must verify that the airplane is satisfactory for flight.

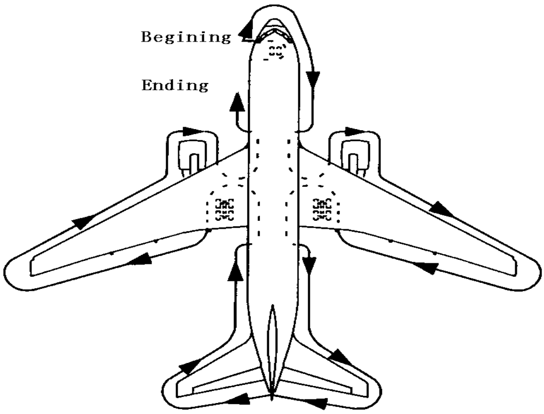
Items at each location may be checked in any sequence.

Use the detailed inspection route below to check that:

- the surfaces and structures are clear, not damaged, not missing parts and there are no fluid leaks
- the tires are not too worn, not damaged, and there is no tread separation
- the gear struts are not fully compressed
- the engine inlets and tailpipes are clear, the access panels are secured, the exterior is not damaged, and the reversers are stowed
- the doors and access panels that are not in use are latched,
- the probes, vents, and static ports are clear and not damaged
- the skin area adjacent to the pitot probes and static ports is not wrinkled
- the antennas are not damaged
- the light lenses are clean and not damaged

For cold weather operations see the Supplementary Procedures.

Check Route



Left Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) ....Check

Doors and access panels (not in use) ....Latched

Nose

Radome ....Check

Diverter strips - Secure

Forward access door ....Secure

E/E access door ....Secure

Nose Wheel Well

Tires and wheels ....Check

Gear strut and doors ....Check

Nose wheel steering assembly ....Check

Nose gear steering lockout pin ....As needed

Gear pin ....As needed

Exterior lights ....Check

Nose wheel spin brake (snubbers) ....In place
Wheel well light switches ....As needed

Right Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) ....Check
Doors and access panels (not in use) ....Latched
Oxygen pressure relief green disc ....In place
Negative pressure relief doors ....Closed

Right Wing Root, Pack, and Lower Fuselage

Probes, sensors, ports, vents, and drains (as applicable) ....Check
Exterior lights ....Check
Pack inlet and pneumatic access doors ....Secure
Leading edge slats ....Check
Fuel sticks ....Flush and secure

Right Engine

Access panels ....Latched
Probes, sensors, ports, vents, and drains (as applicable) ....Check
Fan blades, probes, and spinner ....Check
Thrust reverser ....Stowed
Exhaust area and tailcone ....Check

Right Wing and Leading Edge

Access panels ....Latched
Leading edge slats ....Check
Fuel sticks ....Flush and secure
Wing Surfaces ....Check
Fuel tank vent ....Check

Right Wing Tip and Trailing Edge

Position and anti-collision lights ....Check
Static discharge wicks ....Check
Fuel jettison nozzle ....Check
Ailerons and trailing edge flaps ....Check

Right Main Gear

Tires, brakes and wheels ....Check
Verify that the wheel chocks are in place as needed.
If the parking brake is set, the brake wear indicator pins must extend out of the guides.

Gear strut, actuators, and doors ....Check

Hydraulic lines ....Secure

Gear pins ....As needed

Right Main Wheel Well

Wheel well ....Check

Right Aft Fuselage

Ram air turbine door ....Check

Doors and access panels (not in use) ....Latched

Probes, sensors, ports, vents, and drains (as applicable) ....Check

Negative pressure relief doors ....Closed

Tail

Vertical stabilizer and rudder ....Check

Tail skid ....Check
Verify that the tail skid is not damaged.

Horizontal stabilizer and elevator ....Check

Static discharge wicks ....Check

APU exhaust outlet ....Check

Left Aft Fuselage

Outflow valve ....Check

Doors and access panels (not in use) ....Latched

Probes, sensors, ports, vents, and drains (as applicable) ....Check

Left Main Wheel Well

Wheel well ....Check

Left Main Gear

Tires, brakes and wheels ....Check

Verify that the wheel chocks are in place as needed.
If the parking brake is set, the brake wear indicator pins must extend out of the guides.

Gear strut, actuators and doors ....Check
Hydraulic lines ....Secure
Gear pins ....As needed

Left Wing Tip and Trailing Edge

Position and anti-collision lights ....Check
Static discharge wicks ....Check
Ailerons and trailing edge flaps ....Check
Fuel jettison nozzle ....Check

Left Wing and Leading Edge

Wing Surfaces ....Check
Fuel sticks ....Flush and secure
Fuel tank vent ....Check
Leading edge slats ....Check
Access panels ....Latched

Left Engine

Exhaust area and tailcone .... Check
Thrust reverser .... Stowed
Fan blades, probes, and spinner .... Check
Probes, sensors, ports, vents, and drains (as applicable) .... Check
Access panels .... Latched

Left Wing Root, Pack, and Lower Fuselage

Fuel sticks .... Flush and secure
Probes, sensors, ports, vents, and drains (as applicable) .... Check
Exterior lights .... Check
Pack inlet and pneumatic access doors .... Secure
Negative and positive pressure relief doors .... Closed
Leading edge slats .... Check

2.2 Preflight Procedure – First Officer

The first officer normally does this procedure. The captain may do this procedure as needed.

YAW DAMPER switches ....ON

The INOP lights stay illuminated until IRS alignment is complete.

ELECTRONIC ENGINE CONTROL switches .... NORM

Note: Don't press passenger oxygen switch, which can cause extension of passenger oxygen mask.

HYDRAULIC panel .... Set

Verify that the SYS PRESS lights are illuminated.

Verify that the QTY lights are extinguished.

Left and Right ENGINE PRIMARY pump switches –ON

Verify that the PRESS lights are illuminated.

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – Off

Verify that the PRESS lights are illuminated.

DEMAND pump selector–OFF

Verify that the PRESS lights are illuminated.

BATTERY/STANDBY POWER CONTROL panel .... Set

BATTERY switch – ON

Verify that the DISCH light is extinguished.

STANDBY POWER selector – AUTO

Verify that the standby power bus OFF light is extinguished.

Electrical panel .... Set

APU GENERATOR switch – ON

BUS TIE switches – AUTO

Verify that the AC BUS OFF lights are extinguished.

UTILITY BUS Switches – ON

Verify that the OFF lights are extinguished.

GENERATOR CONTROL switches – ON

Verify that the OFF lights are illuminated.

Verify that the DRIVE lights are illuminated.

APU selector (as needed) ....START, then ON

Do not allow the APU selector to spring back to the ON position.

Verify that the RUN light is illuminated.

Lighting Panel .... Set

TAXI light switch – OFF

RUNWAY TURNOFF light switches – OFF

EMERGENCY LIGHTS Switch .... Guard closed

Verify that the UNARMED light is extinguished.

Note: Do not push PASSENGER OXYGEN switch. The switch causes deployment of the passenger oxygen masks.

PASSENGER OXYGEN ON light ....Verify extinguished

WARNING: Do not push the RAM AIR TURBINE switch. The switch causes deployment of the ram air turbine.

Ram air turbine UNLKD light ....Verify extinguished

Engine control panel .... Set

Engine ignition selector – 1 or 2

Engine start selectors – AUTO

FUEL JETTISON panel ....Set

Fuel jettison NOZZLE switches – Off

Fuel jettison selector – OFF

FUEL panel ....Set

CROSSFEED switches – Off

Verify that the VALVE lights are extinguished.

FUEL PUMP switches – Off

Verify that the left forward pump PRESS light is extinguished if the APU is on or is illuminated if the APU is off.

Verify that the other left and right pump PRESS lights are illuminated.

Verify that both center pump PRESS lights are extinguished.

ANTI–ICE panel ....Set

WING anti–ice selector – OFF

ENGINE anti–ice selectors – OFF

WIPER selector ....OFF

Lighting panel ....Set

POSITION light switch – As needed

ANTI–COLLISION light switches – OFF

WING light switch – OFF

LANDING light switches – OFF

WINDOW HEAT switches .... ON

Verify that the INOP lights are extinguished.

PASSENGER SIGNS panel ....Set

NO SMOKING selector---AUTO or ON

SEATBELTS selector – AUTO or ON

CABIN ALTITUDE CONTROL panel .... Set

AUTO RATE control – Index

LANDING ALTITUDE selector – Destination airport elevation

MODE SELECTOR – AUTO 1 or AUTO 2

EQUIPMENT COOLING mode selector .... AUTO

CARGO HEAT switches .... ON

Air Conditioning panel .... Set

CABIN compartment temperature controls – AUTO

Set as needed.

The INOP lights stay illuminated until the trim air switch is ON.

TRIM AIR switch – ON
RECIRCULATION FAN switches – ON
Verify that the INOP lights are extinguished.
FLIGHT DECK compartment temperature control – AUTO
Set As needed.
Verify that the INOP light is extinguished.
PACK CONTROL selectors – AUTO
The PACK OFF lights stay illuminated until bleed air or external air is supplied.

BLEED AIR panel... Set
LEFT, CENTER and RIGHT ISOLATION switches – On
Verify that the VALVE lights are extinguished.
ENGINE bleed air switches – ON
Verify that the OFF lights are illuminated.

APU bleed air switch – ON
Verify that the VALVE light is extinguished.

FLIGHT DIRECTOR switch .... ON

VOR/DME switch ....AUTO

Oxygen mask ....Test and set
Select the status display.
Oxygen mask – Stowed and doors closed
RESET/TEST switch – Push and hold
Verify that the yellow cross shows momentarily in the flow indicator.
EMERGENCY/TEST selector – Push and hold
Continue to hold the RESET/TEST switch and push the EMERGENCY/TEST selector for 10 seconds. Verify that the yellow cross shows continuously in the flow indicator.
Release the RESET/TEST switch and the EMERGENCY/TEST selector.
Verify that the yellow cross does not show in the flow indicator.
Verify that the crew oxygen pressure does not decrease more than 100 psig.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 100 psig, or
- increase slowly back to normal

Release the RESET/TEST switch and the EMERGENCY/TEST selector. Verify that the yellow cross does not show in the flow indicator.

Normal/100% selector – 100%

Crew oxygen pressure – Check EICAS

Verify that the pressure is sufficient for dispatch.

INSTRUMENT SOURCE SELECT panel .... Set

FLIGHT DIRECTOR source selector – R

NAVIGATION instrument source selector – FMC R

ELECTRONIC FLIGHT INSTRUMENT switch – Off

INERTIAL REFERENCE SYSTEM switch – Off

AIR DATA source switch – Off

Do the Initial Data and Navigation Data steps from the CDU Preflight Procedure and verify that the IRS alignment is complete before checking the flight instruments.

Flight instruments .... Check

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:

- TCAS OFF
- V1 INOP until takeoff V–speeds are selected
- expected RDMI flags

Verify that the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is TO
- pitch mode is TO
- AFDS status is FD

Select the map mode.

AUTOLAND STATUS annunciator .... Check

Verify that the indications are blank.

Landing gear panel .... Set

Landing gear lever – DN

ALTERNATE GEAR EXTEND switch – Guard closed

Ground proximity FLAP OVERRIDE switch ....Off

Ground proximity GEAR OVERRIDE switch ....Off

Ground proximity TERRAIN OVERRIDE switch ....Off

HEADING REFERENCE switch ....NORM

Alternate flaps panel ....Set

ALTERNATE FLAPS selector – NORM

Alternate flaps switches – Off

EICAS display .... Check

Upper EICAS display – Check

Verify that the primary engine indications show existing conditions.

Verify that no exceedance is shown.

Lower EICAS display – Check

Secondary ENGINE indications – Check

Verify that the secondary engine indications show existing conditions.

Verify that no exceedance is shown.

Select the status display.

Status messages – Check

COMPUTER selector – AUTO

THRUST REFE RENCE SET selector – BOTH and in

Verify that the TO mode is shown.

EFIS control panel .... Set

Decision height selector – As needed

TERRAIN switch – As needed

HSI RANGE selector – As needed

HSI TRAFFIC switch – As needed

HSI mode selector – MAP

HSI CENTER switch – As needed

WEATHER RADAR switch – Off

Verify that weather radar indications are not shown on the HSI.

MAP switches – As needed

Weather radar panel .... Set

Left radio tuning panel .... Set

Verify that the OFF light is extinguished.

Transponder panel .... Set

Center radio tuning panel .... Set

Verify that the OFF light is extinguished.

Engine fire panel .... Set

Verify that the ENG BTL 1 DISCH and ENG BTL 2 DISCH lights are extinguished.

Engine fire switches – In

Verify that the LEFT and RIGHT lights are extinguished.

ADF panel .... Set

ILS panel ....As needed

CARGO FIRE panel .... Set

CARGO FIRE ARM switches – Off

Verify that the FWD and AFT lights are extinguished.

Verify that the DISCH light is extinguished.

APU fire panel ....Set

Verify that the APU BTL DISCH light is extinguished.

APU fire switch – In

Verify that the APU light is extinguished.

Right radio tuning panel ....Set

Verify that the OFF light is extinguished.

First officer's audio control panel .... As needed

Flight deck printer ....Set

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seat .... Adjust

Adjust the seat for optimum eye reference.

Verify a positive horizontal (fore and aft) seat lock.

Rudder pedals .... Adjust

Adjust the rudder pedals to allow full rudder pedal and brake pedal movement.

Seat belt and shoulder harness .... Adjust

Do the Preflight Checklist on the captain's command.

2.3 Preflight Procedure – Captain

The captain normally does this procedure. The first officer may do this procedure if needed.

VOR/DME switch .... AUTO

Mode control panel .... Set

FLIGHT DIRECTOR switch – ON

AUTOTHROTTLE ARM switch – ARM

BANK LIMIT selector – As needed

Autopilot DISENGAGE bar – UP

Oxygen .... Test and set

Select the status display.

Oxygen mask – Stowed and doors closed

RESET/TEST switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

EMERGENCY/TEST selector – Push and hold

Continue to hold the RESET/TEST switch and push the EMERGENCY/TEST selector for 10 seconds.

Verify that the yellow cross shows continuously in the flow indicator.

Release EMERGENCY/TEST selector and RESET/TEST switch. Verify that the yellow cross doesn't show in the flow indicator.

Verify that the crew oxygen pressure does not decrease more than 100 psig.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 100 psig, or
- increase slowly back to normal

Release the RESET/TEST switch and the EMERGENCY/TEST selector. Verify that the yellow cross does not show in the flow indicator.

Normal/100% selector – 100%

Crew oxygen pressure – Check EICAS

Verify that the pressure is sufficient for dispatch.

INSTRUMENT SOURCE SELECT panel .... Set

FLIGHT DIRECTOR source selector – L

NAVIGATION instrument source selector – FMC L

ELECTRONIC FLIGHT INSTRUMENT switch – Off

INERTIAL REFERENCE SYSTEM switch – Off

AIR DATA source switch – Off

Do the Initial Data and Navigation Data steps from the CDU Preflight Procedure and verify that the IRS alignment is complete before checking the flight instruments.

Flight instruments .... Check

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:

- TCAS OFF
- V1 INOP until takeoff V–speeds are selected
- expected RDMI flags

Verify that the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is TO
- pitch mode is TO
- AFDS status is FD

Select the map mode.

AUTOLAND STATUS annunciator .... Check

Verify that the indications are blank.

RESERVE BRAKES AND STEERING switch .... Off

Verify that the VALVE light is extinguished.

Integrated standby flight display .... Set

Verify that the approach mode display is blank.

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that no flags or messages are shown.

Standby engine indicator selector .... AUTO

AUTOBRAKES selector .... RTO

EFIS control panel .... Set

Decision height selector – As needed

TERRAIN switch – As needed

HSI RANGE selector – As needed

HSI TRAFFIC switch – As needed

HSI mode selector – MAP

HSI CENTER switch – As needed

WEATHER RADAR switch – Off

Verify that weather radar indications are not shown on the HSI.

MAP switches – As needed

ALTERNATE STABILIZER TRIM switches .... Neutral

SPEEDBRAKE lever ....DOWN

Reverse thrust levers .... Down

Forward thrust levers .... Closed

Flap lever .... Set

Set the flap lever to agree with the flap position.

Parking brake .... Set

Verify that the PARK BRAKE light is illuminated.

Note: Do not assume that the parking brake will prevent airplane movement. Accumulator pressure can be insufficient.

STABILIZER TRIM cutout switches .... Guards closed

FUEL CONTROL switches .... CUTOFF

FUEL CONTROL switch fire warning lights ..... Verify extinguished

Captain’s audio control panel .... As needed

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seat .... Adjust

Adjust the seat for optimum eye reference.

Verify a positive horizontal (fore and aft) seat lock.

Rudder pedals .... Adjust

Adjust the rudder pedals to allow full rudder pedal and brake pedal movement.

Seat belt and shoulder harness .... Adjust

Call “Preflight Checklist.”

2.4 Before Start Procedure

Start the Before Start Procedure after papers are on board.

Flight deck door .... Closed and locked F/O

Verify that the LOCK FAIL light is extinguished.

Do the CDU Preflight Procedure – Performance Data steps before completing this procedure.

CDU display .... Set C, F/O

Normally the PF selects the TAKEOFF REF page.

Normally the PM selects the LEGS page.

Takeoff thrust reference .... Set C, F/O

Verify that the thrust reference mode is correct.

IAS bugs .... Set C, F/O

Set the bugs at V1, VR, Vref 30 + 40, and Vref 30 + 80.

MCP .... Set C

IAS/MACH selector – Set V2

Arm LNAV as needed.

Initial heading – Set

Initial altitude – Set

Taxi and Takeoff briefings .... Complete C, F/O

The pilot who will do the takeoff does the taxi and takeoff briefings.

Exterior doors ....Verify closed F/O

Flight deck windows .... Closed and locked C, F/O

Verify that the lock lever is in the forward, locked position.

Verify that the WINDOW NOT CLOSED decal does not show.

Start clearance .... Obtain C, F/O

Obtain a clearance to pressurize the hydraulic systems.

Obtain a clearance to start the engines.

If pushback is needed:

Verify that the nose gear steering is locked out. C, F/O

HYDRAULIC panel .... Set F/O

WARNING: If the tow bar is connected, do not pressurize the

hydraulic systems until the nose gear steering is locked out. Unwanted tow bar movement can occur.

Note: Pressurize the right system first to prevent fluid transfer between systems.

Right ELECTRIC DEMAND pump selector – AUTO

Verify that the PRESS light is extinguished.

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – ON

Verify that the center 1 PRESS light is extinguished.
The center 2 PRESS light stays illuminated until after the engine start due to load shedding.

Left ELECTRIC DEMAND pump selector – AUTO

Verify that the PRESS light is extinguished.

Center AIR DEMAND pump selector – AUTO

Verify that the PRESS light is extinguished.

Fuel panel .... Set F/O

LEFT and RIGHT FUEL PUMP switches – ON

Verify that the PRESS lights are extinguished.

If there is fuel in the center tank:

CENTER FUEL PUMP switches – ON

Both PRESS lights stay illuminated until after the engine start because of load shedding.

RED ANTI–COLLIS ION light switch ....ON F/O

RECALL switch ....Push F/O

Verify that only the expected alert messages are shown.

CANCEL switch……………………………………….Push F/O

Verify the information is cancelled.

Trim ....Set C

Stabilizer trim – ___ UNITS

Set the trim for takeoff.

Verify that the trim is in the greenband.

Aileron trim – 0 units

Rudder trim – 0 units

PACK CONTROL selector………………………….…….OFF F/O

Verify PACK OFF light is illuminated

Call "Before Start Checklist."	C
Do the Before Start Checklist	F/O

2.5 Pushback or Towing Procedure

The Engine Start procedure may be done during pushback or towing.

Establish communications with ground handling personnel. C

CAUTION: Do not hold or turn the nose wheel tiller during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Transponder ....As needed F/O

At airports where ground tracking is not available, select STANDBY.

At airports equipped to track airplanes on the ground, select an active transponder setting, but not a TCAS mode.

Set or release the parking brake as directed by ground handling personnel. C

When pushback or towing is complete:

Verify that the tow bar is disconnected. C

Verify that the nose gear steering is not locked out. C

2.6 Engine Start Procedure

Select the secondary engine indications. F/O

CANCEL switch. …………………………………………..Push F/O

Verify that the messages are cancelled.

Start sequence ....Announce C

Call "START ___ ENGINE" C

Engine start selector .... GND F/O

Start up in cold weathers, oil pressure increase may be higher than normal.

Verify that the oil pressure increases. C, F/O

Verify N2 rotation. C, F/O

At maximum motoring and a minimum of 15% N2:

FUEL CONTROL switch ....RUN C

Verify that the EGT increases and stays below the EGT limit. C, F/O

Do not increase thrust above that needed to taxi until the oil temperature o the Aborted Engine Start Checklist for one or more of the is a minimum of 50° C.

After the engine is stabilized at idle, start the other engine.

Do the Aborted Engine Start Checklist for one or more of the following abort start conditions:

- the EGT does not increase by 20 seconds after the fuel control switch is moved to RUN
- there is no N1 rotation when the EGT increases
- the EGT quickly nears or exceeds the start limit
- the N2 is not at idle by 2 minutes after the fuel control switch is moved to RUN
- the oil pressure indication is not normal by the time that the engine is stabilized at idle

2.7 Before Taxi Procedure

APU selector .... OFF F/O
ENGINE ANTI–ICE selectors ....As needed F/O
PACK selectors ....…AUTO F/O
LEFT and RIGHT ISOLATION switches .... ….Off F/O
Select the status display. F/O
Verify that the ground equipment is clear. C, F/O
Call “FLAPS___” as needed for takeoff. C
Flap lever .... .Set takeoff flaps F/O
Flight controls .... .Check C

Move the control wheel and the control column to full travel in both directions and verify:

- freedom of movement
- that the controls return to center
- correct flight control movement on the EICAS display

Hold the nose wheel tiller during the rudder check to prevent nose wheel movement.

Move the rudder pedals to full travel in both directions and verify:

- freedom of movement
- that the rudder pedals return to center
- correct flight control movement on the EICAS display.

Select the secondary engine indications. F/O
Transponder ....As needed F/O

At airports where ground tracking is not available, select STANDBY.
At airports equipped to track airplanes on the ground, select an active transponder setting, but not a TCAS mode.

Recall ....Check C,F/O

Verify that only expected alert messages are shown.

Update changes to the taxi briefing, as needed…………… C or PF
Call “Before Taxi Checklist.”……………………………. C
Do the Before Taxi Checklist……………………………… F/O

2.8 Before Takeoff Procedure

Pilot Flying	Pilot Monitoring
	Notify the cabin crew to prepare for takeoff. Verify that the cabin is secure.
Updates changes to the takeoff briefing as needed.	
Set the weather radar display as needed Set the terrain display as needed	Set the WHITE ANTI COLLISION light switch to ON. Set the left and right WING LANDING light switches to ON. Set the transponder mode selector to TA/RA.
Call "Before Takeoff Checklist."	Do the Before Takeoff Checklist.

2.9 Takeoff Procedure

Pilot	Pilot Monitoring
Verify that the brakes are released. Align the airplane with the runway.	
Advance the thrust levers to approximately 1.10 EPR. Allow the engines to stabilize	
Push the THR switch.	
Verify that the correct takeoff thrust is set.	
	Monitor the engine instruments during the takeoff. Call out any abnormal indications. Adjust takeoff thrust before 80 knots as needed. During strong headwinds, if the thrust levers do not advance to the planned takeoff thrust by 80 knots, manually advance the thrust levers.
After takeoff thrust is set, the captain's hand must be on the thrust levers until V1.	
Monitor airspeed. Maintain light forward pressure on the control column.	Monitor airspeed and call out any abnormal indications.
Verify 80 Kts and call "check"	Call "80"
Verify V1 speed.	Call "V1."
At VR, rotate toward 15° pitch attitude. After liftoff, follow F/D commands. Establish a positive rate of climb.	At VR, call "rotate" Monitor airspeed and vertical speed.

Pilot Flying	Pilot Monitoring
Verify a positive rate of climb on the altimeter and call "gear up"	Verify a positive rate of climb on the altimeter and call "positive" Set the landing gear lever to UP.
Above 400 feet radio altitude, call for a roll mode as needed.	Select or verify the roll mode.
At thrust reduction height, call "VNAV."	Push the VNAV switch.
Verify that climb thrust is set.	
Verify acceleration. Verify acceleration at accelerated altitude. Call "FLAPS__" according to the flap retraction schedule.	Set the flap lever as directed.
Engage the autopilot after a roll mode and VNAV are engaged.	
	After flap retraction is complete: Set the landing gear lever to OFF after landing gear retraction is complete

Takeoff Flap Retraction Speed Schedule

Takeoff Flaps	At Speed (knots)	Select Flaps
20 or 15	Vref 30 + 20	5
	"F" Vref 30 + 40	1
	"F" Vref 30 + 60	UP
5	"F" Vref 30 + 40	1
	"F" Vref 30 + 60	UP

"F" = Minimum flap retraction speed for next flap setting on speed tape display (as installed)

2.10 Climb and Cruise Procedure

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

Pilot Flying	Pilot Monitoring
	At or above 10,000 feet MSL, set the landing light switches to OFF.
	Set the passenger signs as needed.
At transition altitude, set and crosscheck the altimeters to standard.	
Call "After Takeoff Checklist."	Do the After Takeoff Checklist.
	When the CTR L and CTR R FUEL PUMP messages are shown, set both CENTER FUEL PUMP switches to Off.
	Check fuel crossfeed valves at one Hour before the ETOPS entry point.
	Before T/D, change active route as needed to do arrival and approach.

2.11 Descent Procedure

Prepare for approach and perform descent procedure at 40 NM from T/D.

Passenger signs should be set to ON before descent.

Pilot Flying	Pilot Monitoring
	Verify that pressurization is set to landing altitude.
Review all alert messages.	Recall and review all alert messages.
Verify Vref on the APPROACH REF page.	Enter Vref on the APPROACH REF page
Set the bugs at Vref 30, Vref 30 + 40, and Vref 30 + 80.	
Set the RADIO/BARO minimums as needed for the approach.	
Set or verify the navigation radios and course for the approach.	
	Set the AUTO BRAKE selector to the needed brake setting.
Do the approach briefing.	
Call "Descent Checklist"	Do the Descent Checklist

2.12 Approach Procedure

The Approach Procedure is normally started at transition level.

Complete the Approach Procedure before:

- the initial approach fix, or
- the start of radar vectors to the final approach course, or
- the start of a visual approach

Pilot Flying	Pilot Monitoring
	Set the passenger signs as needed.
	At or above 10,000 feet MSL, set the LEFT and RIGHT WING LANDING light switches to ON.
At transition level, set and crosscheck the altimeters.	
Update the arrival and approach, as needed.	
Update the approach briefing as needed.	
Call "Approach Checklist."	Do the Approach Checklist.

Flap Extension Schedule

Current Flap Position	At "Display" or Speed (knots)	Select Flaps	Command Speed for Selected Flaps
UP	"Ref Bug" Vref30 + 80	1	Vref30 + 60
1	Vref30 + 60	5	"Ref Bug" Vref30 + 40
5	"Ref Bug" Vref30 + 40	20	Vref30 + 20
20	Vref30 + 20	25 or 30	(Vref25 or Vref30) + wind additives

2.13 Landing Procedure

Pilot Flying	Pilot Monitoring
	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Call "FLAPS___" according to the flap extension schedule.	Set the flap lever as directed.
When on localizer intercept heading: • verify that the ILS is tuned and identified • verify that the LOC and G/S pointers are shown .Arm the APP mode.	
Arm the APP mode.	
Use HDG SEL or HDG HOLD to intercept the final approach course, as needed.	
Verify that the localizer is captured.	
	Call "GLIDE SLOPE ALIVE."
At glide slope alive, call: • "GEAR DOWN" • "FLAPS 20"	Set landing gear lever to DN. Set flap lever to 20.
Set the missed approach altitude on the MCP.	
Call "Landing Checklist"	Do the Landing Checklist.
At the final approach fix or OM, verify the crossing altitude.	
Monitor the approach. Verify the autoland status at 500 feet radio altitude.	

2.14 Go–Around and Missed Approach Procedure

Pilot Flying	Pilot Monitoring
At the same time: • push the GA switch • call "FLAPS 20"	Set the flap lever to 20.
Verify: • the rotation to go–around attitude • that the thrust increases	
	Verify that the thrust is sufficient for the go-around or adjust as needed.
Verify a positive rate of climb on the altimeter and call "GEAR UP."	Verify a positive rate of climb on the altimeter and call "POSITIVE RATE." Set the landing gear lever to UP.
Above 400 feet radio altitude, select a roll mode.	Verify that the missed approach altitude is set.
Verify that the missed approach route is tracked.	
At acceleration height, set speed to the maneuver speed for the planned flap setting. Call "CLIMB THRUST."	Select CLB thrust.
Call "FLAPS___" according to the flap retraction schedule.	Set the flap lever as directed.
After flap retraction to the planned flap setting, select FLCH or VNAV as needed.	
Verify that climb thrust is set.	
Verify that the missed approach altitude is captured.	
	Set the landing gear lever to OFF after landing gear retraction is complete.
Call "After Takeoff Checklist"	Do the After Takeoff Checklist.

2.15 Landing Roll Procedure

Pilot Flying	Pilot Monitoring
Verify that the thrust levers are closed. Verify that the SPEEDBRAKE lever is UP.	Verify that the SPEEDBRAKE lever is UP. Call "SPEEDBRAKES UP." If the SPEEDBRAKE lever is not UP, call "SPEEDBRAKES NOT UP."
Monitor the rollout progress.	
Verify correct autobrake operation.	
WARNING: After the reverse thrust levers are moved, a full stop landing must be made. If an engine stays in reverse, safe flight is not possible.	
Without delay, move the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. Then apply reverse thrust as needed.	
By 60 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed.	Call "60"
After the engines are at reverse idle, move the reverse thrust levers full down.	
Before taxi speed, disarm the autobrakes. Use manual braking as needed.	
Before turing off the runway, disconnect the autopilot.	

2.16 After Landing Procedure

Start the After Landing Procedure when clear of the active runway.

Captain(left seat)	First Officer (right seat)
The captain moves or verifies that the SPEEDBRAKE lever is DOWN.	
	Set the APU selector to START, then ON, as needed. Do not allow the APU selector to spring back to the ON position.
	Set the WHITE ANTI–COLLISION light switch to OFF. Set the LANDING and TAXI light switches as needed.
Set the weather radar to off.	
	Set the AUTOBRAKE selector to OFF.
	Set the flap lever to UP.
	Set the transponder mode selector as needed. At airports where ground tracking is not available, select STANDBY. At airports equipped to track airplanes on the ground, select an active transponder setting, but not a TCAS mode.

Approaching to the gate:

	Taxi to the gate and set the taxi light switch to OFF.

2.17 Shutdown Procedure

Start the Shutdown Procedure after taxi is complete.

Parking brake .... Set C

Verify that the PARK BRAKE light is illuminated.

Electrical power .... Set F/O

If APU power is needed:

Verify that the APU RUN light is illuminated.

If external power is needed:

Verify that the EXTERNAL POWER AVAIL light is illuminated.

EXTERNAL POWER switch---- Push

Verify that the ON light is illuminated.

WING ANTI–ICE selector ....OFF F/O

ENGINE ANTI–ICE selectors ....OFF F/O

FUEL CONTROL switches ....CUTOFF C

If towing is needed:

Establish communications with ground handling personnel C

WARNING: If the nose gear steering is not locked out, any change to hydraulic power with the tow bar connected may cause unwanted tow bar movement.

Verify that the nose gear steering is locked out C

CAUTION: Do not hold or turn the nose wheel tiller during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Set or release the parking brake as directed by ground handling personnel C

SEATBELTS selector .... OFF F/O

HYDRAULIC panel .... Set F/O

Note: Depressurize the right system last to prevent fluid transfer between systems.

Center AIR DEMAND pump selector – OFF

Left ELECTRIC DEMAND pump selector – OFF

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – Off

Right ELECTRIC DEMAND pump selector – OFF

FUEL PUMP switches .... Off F/O

RED ANTI–COLLISION light switch .... Off F/O

LEFT and RIGHT ISOLATION switches ....On F/O

FLIGHT DIRECTOR switches ....OFF C, F/O

Status messages ....Check F/O

Record shown status messages in maintenance log.

After wheel chocks are in place:

Parking brake – Release

C

APU selector ....As needed F/O

Call "Shutdown Checklist" C

Do the Shutdown Checklist. F/O

2.18 Secure Procedure

IRS mode selectors ....OFF	F/O
EMERGENCY LIGHTS switch ....OFF	F/O
WINDOW HEAT switches .... Off	F/O
CARGO HEAT switches .... Off	F/O
PACK CONTROL selectors ....OFF	F/O
Call “Secure Checklist”	C
Do the Secure Checklist.	F/O

Chapter 3 Supplementary Procedures

3.1 General

This chapter contains procedures (adverse weather operation, engine crossbleed start, and so on) that are accomplished as required rather than routinely performed on each flight. System tests which the flight crew are likely to perform are also included.

Procedures accomplished in flight, or those that are an alternate means of accomplishing normal procedures (such as selecting reduced T.O. thrust), are usually accomplished by memory. Infrequently used procedures, not normally accomplished (such as engine crossbleed start) are usually accomplished by reference.

Supplementary procedures are provided by section. Section titles correspond to the respective chapter title for the system being addressed except for the Adverse Weather section.

3.2 Airplane General, Emergency Equipment, Doors, Windows

Doors

Entry Door Closing

Door .... Lower

Raise door slightly, push and hold uplatch release button, then lower door approximately 2 inches (5 centimeters). Then, release button and continue to lower door until closed.

Doors with electrical operating systems may be lowered electrically using the control switch.

Door handle .... Down

Rotate to the down (flush) position.

Arming lever (interior only) ....SLIDE ARMED

While pushing arming lever release, position arming lever to SLIDE ARMED. Observe armed indicator in view and Direct Visual Indication of girt bar lockdown is completely yellow.

Entry Door Opening

Arming Lever (interior only) ....SLIDE DISARMED

Position arming lever to SLIDE DISARMED. Observe armed indicator out of view, arming lever release button extended and girt bar lockdown indications show blank.

Note: Slide disarms automatically when the door is opened from outside.

Door handle ....Up

Rotate aft to the up position.

Door .... Raise

Raise the door until the uplatch is engaged.

Doors with electrical operating systems may be raised electrically using the control switch.

Flight Deck Door Access System Test

Flight Deck Access System switch .... Norm
Flight Deck Door ....Open
Flight Deck Door Lock selector .... AUTO
Emergency access code ....Enter
ENT key .... Push

Verify alert sounds.

Verify AUTO UNLK light illuminates.

Flight Deck Door Lock selector .... DENY

Verify AUTO UNLK light extinguishes.

Flight Deck Door Lock selector .... UNLKD
Flight Deck Access System switch .... OFF

Verify LOCK FAIL light illuminates.

Flight Deck Access System switch ....NORM (guard down)

Verify LOCK FAIL light extinguishes.

Windows

Flight Deck Window Closing

Window crank ....Rotate

Crank the window to the full closed position (the WINDOW NOT CLOSED placard not visible).

Window lock lever ....Rotate

Rotate the window lock lever forward to the locked position.

Flight Deck Window Opening

Window lock lever ....Rotate

Rotate the window lock lever aft to the open position.

Window crank ....Rotate

Crank the window to the full open position (the WINDOW NOT CLOSED placard is visible).

Lights

Indicator Lights Test

INDICATOR LIGHTS TEST switch ....Push and hold

Verify all indicator lights in the flight deck, except lights in the fuel control and APU/engine fire switches illuminated.

INDICATOR LIGHTS TEST switch ....Release

Emergency Equipment

Oxygen Mask Microphone Test

BOOM/OXYGEN switch ....OXY

RESET/TEST switch ....Push and hold

EMERGENCY/TEST selector ....Push and hold

MICROPHONE/INTERPHONE switch ....INT

Verify oxygen flow sound is heard through the flight deck loudspeaker.

Push-to- talk switch...Push

Push push-to-talk switch, EMERGENCY/TEST switch and RESET/test switch at the same time.

Verify oxygen flow sound is heard through the flight deck loudspeaker.

Push-to- talk switch..Release

MICROPHONE/INTERPHONEswitch..Release

EMERGENCY/TEST selector..Release

RESET/TEST switch...Release

3.3 Air Systems

Air Conditioning Packs

Ground Conditioned Air Use

Before connecting ground conditioned air:

Pack Control selectors .... OFF

After disconnecting conditioned air:

Pack Control selectors .... AUTO

Packs Off Takeoff

Before takeoff:

Pack Control selectors (both) .... OFF

After takeoff:

Note: If engine failure occurs, pack control selectors should remain OFF until reaching 1,500 feet or until obstacle clearance height has been attained, whichever is higher.

Pack Control selector (one only) ....AUTO

After engine thrust is reduced from takeoff, position one pack control selector to AUTO.

Pack Control selector (remaining pack) .... AUTO

When cabin pressurization stabilizes, position remaining pack control selector to AUTO.

3.4 Anti-Ice, Rain

Ice Protection

Ice protection is provided by the airplane anti–ice systems.

Anti–Ice Use

Requirements for use of anti-ice and operational procedures for engine and wing anti-ice are moved from Supplementary Procedures，Chapter.3 to Adverse Weather Section， Chapter 8.

Windshield Wiper Use

CAUTION: Do not use windshield wipers on a dry window.

Windshield Wiper selector (as required) .... LOW/HIGH

3.5 Automatic Flight

AFDS Operation

If Flight Director (F/D) operation is desired:

FLIGHT DIRECTOR switches .... ON

On ground, observe flight director command wings level and 8°pitch up and flight mode annunciations display TO, TO, FD.

In–flight, observe flight director command and flight mode annunciations display vertical speed (V/S) and heading hold(HDG HOLD) if no autopilot in command (CMD), or display existing autopilot modes if any autopilot in command (CMD).

AFDS Mode(s) ....Engage as desired

Observe flight director command and selected AFDS mode(s).

If the autopilot is desired:

Command switch ....Engage

Observe flight mode annunciations display V/S and HDG HOLD, or existing AFDS modes if flight director on and not in takeoff or go–around mode.

Heading Hold

Maintain airplane heading accomplished with the selected HDG

Heading Hold switch .... Engage

Observe HDG HOLD displayed in the roll mode annunciator.

Heading Select

Heading selector .... Set as desired

Heading selector switch .... Push

Observe HDG SEL is displayed in the roll mode annunciator.

Bank Limit selector .... Set as desired

Altitude Hold

Altitude Hold switch ....Engage

Verify ALT HOLD is displayed in the pitch mode annunciator.

Flight Level Change, Climb or Descent

Altitude selector .... Set

Set level off altitude in the altitude window.

Flight Level Change switch .... Engage

Observe SPD in the pitch mode annunciator and FLCH displayed in the autothrottle mode annunciator.

IAS/MACH selector .... Set

Set the desired speed in the speed window.

Climb Thrust Reference Mode Select switch (if required) .... Select

If climb initiated, select climb reference EPR.

Vertical Speed, Climb or Descent

Altitude selector .... Set

Set level off altitude in the altitude window.

Vertical Speed switch .... Engage

Observe V/S displayed in the pitch mode annunciator.

Note: The vertical speed mode does not provide automatic low speed protection and permits flight away from selected altitude. For level–off protection, always select new level–off altitude prior to engaging vertical speed mode.

Vertical Speed selector .... Set

Set desired rate in vertical speed window.

Climb Thrust Reference Mode Select switch (if required) .... Select

If climb initiated, select climb reference EPR.

Intermediate Level Off

Altitude selector ....Set desired altitude

At MCP altitude:

Verify pitch mode annunciation is ALT HOLD.

To resume climb/descent:

If using VNAV:

VNAV switch .... Engage

Verify pitch mode annunciation is VNAV SPD or VNAV PTH as appropriate.

If using Flight Level Change:

Flight Level Change switch .... Engage

Verify pitch mode annunciation is SPD and autothrottle annunciation is FLCH.

IAS/MACH selector .... Rotate

Set the desired speed in the IAS/MACH window.

Speed Intervention

IAS/MACH selector .... Push

Verify IAS/MACH window opens.

IAS/MACH selector .... Rotate

Set the desired speed in the IAS/MACH window.

To resume FMC speed schedule:

IAS/MACH selector ....Push

Verify IAS/MACH window blanks.

Autothrottle Operation

Autothrottle switch .... A/T ARM

If EPR mode desired:

Thrust Reference Mode Select switch (As desired) .... Select

Select desired reference EPR.

THR switch .... Engage

Observe EPR displayed in the autothrottle mode annunciator.

If Speed mode desired:

Thrust Reference Mode Select switch (As desired) .... Select

Select desired reference EPR.

Speed switch .... Engage

Observe SPD displayed in the autothrottle mode annunciator.

IAS/MACH selector .... Set

Set the desired speed in the IAS/MACH window.

Instrument Approach Using (VNAV)

Note: QFE operation is not authorized for VNAV use.

Note: If MDA(H) will be used as DA(H), specific operation approval shall be obtained. If required to remain at or above the MDA(H) during the missed approach, missed approach must be initiated at least 50 feet above MDA(H).

Recommended roll modes for final approach:

- RNAV or GPS approach: LNAV
- LOC-BC, VOR or NDB approach: LNAV or HDG SEL
- LOC, SDF, or LDA approach: LOC or LNAV

For LOC, LOC-BC, SDF or LDA approach, ensure appropriate navaids (VOR, LOC or NDB) are tuned and identified prior to commencing the approach and raw data is monitored during the whole process. For VOR or NDB approach, raw data should be monitored if needed.

FMC approach procedure…………………………………………..Select

Select approach procedure on ARRIVAL page. Don't manually create approach procedure or add waypoints in the selected FMC procedure. Add colder temperature adjustment value in waypoint altitude limits as needed.

RNP appropriate for approach (if required) .... Verify/Enter

Allows appropriate alerting to occur if ANP exceeds RNP.

Within the scope of 2NM prior to FAF, and after ALT HOLD or VNAV PTH appears:

MCP altitude selector ....……................Set MDA(H)/DA(H)

VNAV can be commanded for descent in VNAV PTH mode. If constraints or MDA(H) do not end in zero zero (00; for example, 1820), set MCP ALTITUDE window to the closest 100 foot increment below the constraint or MDA(H).

Note: Before intercepting descent path, there may be a level off leg within FAF scope.

Before reaching FAF:

AFDS roll mode………………………………………Verify/Select

Verify displaying appropriate roll mode.

VNAV switch (if needed)……………………………………..Push

If ALT HOLD mode is held in altitude, select VNAV. Verify displaying VNAV PTH.

Speed intervation……………………………………………Select

Autopilot…………………………………………………Verify ON

Autopilot should be kept ON until appropriate visual reference is established.

Prior to MDA(H)/DA(H) and when the airplane is at an altitude at least 300 feet lower than missed approach altitude:

MCP altitude selector……………..……Set missed approach altitude

At MDA(H)/Missed Approach Point:

If suitable visual reference is not established, execute missed approach.

After suitable visual reference is established:

A/P Disengage Switch .... Push

Disengage autopilot before descending below MDA(H)/DA(H)

A/T Disconnect Switch .... Push

Disconnect autothrottle before descending below MDA(H)/DA(H)

Instrument Approach Using (V/S)

Note: Autopilot use is recommended until suitable visual reference is established.

Note: If required to remain at or above the MDA(H) during the missed approach, missed approach must be initiated at least 50 feet above MDA(H).

Recommended roll modes for final approach:

- LOC-BC, VOR or NDB approach: LNAV or HDG SEL (B/CRS for LOC-BC approaches)
- LOC, SDF, or LDA approach: LOC or LNAV

Ensure appropriate navaids (VOR, LOC or NDB) are tuned and identified prior to commencing the approach.

RNP appropriate for approach (if required) .... Verify/Enter

Allows appropriate alerting to occur if ANP exceeds RNP.

Before descent to MDA(H):

MCP altitude selector .... Set

Set the first intermediate altitude constraint or MDA(H). When the current constraint is assured, the next constraint may be set prior to ALT HOLD engaged to achieve continuous descent path.
If constraints or MDA(H) do not end in zero zero (00; for example, 1820), set MCP ALTITUDE window to the closest 100 foot increment below the constraint or MDA(H).

At descent point:

V/S switch ....Push

Verify V/S Mode annunciates.

Desired V/S ....Set

Set desired V/S to descend to MDA (H). Use a V/S that results in no level flight segment at MDA(H).

Approximately 300 feet above MDA(H):

MCP altitude selector .... Set Missed Approach Altitude

At MDA(H)/Missed Approach Point:

If suitable visual reference is not established, execute missed approach.

After suitable visual reference is established:

A/P Disengage Switch .... Push

Disengage autopilot before descending below MDA(H)/DA(H)

A/T Disconnect Switch .... Push

Disconnect autothrottle before descending below MDA(H)/DA(H)

Circling Approach

Note: Autopilot use is recommended until intercepting the landing profile.

MCP Altitude Selector ....Set

If the MDA(H) does not end in zero zero (00; for example, 1820), set MCP ALTITUDE window to the closest 100 foot increment below the MDA(H)

Accomplish an instrument approach and establish suitable visual reference.

At MDA(H):

ALT HOLD switch (if required) ....Push

Enables level off at MDA(H). Verify ALT HOLD mode annunciates.

MCP altitude selector ....Set Missed Approach Altitude

HDG SEL Switch ....Push

Verify HDG SEL mode annunciates.

Intercepting the landing profile:

Autopilot disengage switch ....Push

Autothrottle disconnect switch ....Push

Autoland Status Annunciator Test

AUTOLAND STATUS ANNUNCIATOR TEST switch 1 ....Push

Observe LAND 3 and NO LAND 3 in view.

AUTOLAND STATUS ANNUNCIATOR TEST switch 2 .... Push

Observe LAND 2 and NO AUTOLND in view.

Autoland Status Annunciator Reset

AUTOLAND STATUS ANNUNCIATOR
PUSH/RESET switch.. Push

3.6 Communications

Cockpit Voice Recorder Test

Voice Recorder Test switch ....Push

Observe Status light flash once. A tone may be heard with a headset plugged into the headset jack on the voice recorder panel.

Aircraft Communications Addressing and Reporting System (ACARS)

The following procedures are applicable to the noted ACARS functions from the company pages.

Pre-Departure Clearance

The flight crew shall manually verify (compare) the filed flight plan versus the digital pre-departure clearance and shall initiate voice contact with Air Traffic Control if any question/confusion exists between the filed flight plan and the digital pre-departure clearance.

Digital-Automatic Information Service (D-ATIS)

The flight crew shall verify that the D-ATIS altimeter setting numeric value and alpha value are identical. If the D-ATIS altimeter setting numeric and alpha values are different, the flight crew must not accept the D-ATIS altimeter setting.

Oceanic Clearances

The flight crew shall manually verify (compare) the filed flight plan versus the digital oceanic clearance and shall initiate voice contact with AirTraffic Control if any question/confusion exists between the filed flight plan and the digital oceanic clearance.

Weight and Balance

The flight crew shall verify the Weight and Balance numeric and alphabetical values are identical. If the Weight and Balance numeric and alphabetical values are different, the flight crew must not accept the Weight and Balance data.

Takeoff Data

The flight crew shall verify the Takeoff Data numeric and alphabetic values are identical. If the Takeoff Data numeric and alphabetic values are different, the flight crew must not accept the Takeoff Data message.

3.7 Electrical

Electrical Power Up

The following procedure is accomplished to permit safe application of electrical power.

Battery switch .... ON

Standby Power selector .... AUTO

Verify battery DISCH light illuminated and standby bus OFF light extinguishes.

Hydraulic Electric Primary Pump switches .... Off

Hydraulic Demand Pump switches .... Off

Landing Gear Lever .... DN

Alternate Flaps selector .... NORM

Electrical Power .... Establish

Bus Tie switches...AUTO

If external power is desired:

If External Power AVAIL light is illuminated:

External Power switch .... Push

If APU power is desired:

APU Generator switch .... ON

APU selector .... START, then ON

Position the APU selector back to the ON position. Do not allow the APU selector to spring back to the ON position.

Electrical Power Down

The following flight deck procedures are accomplished to permit removal of electrical power from the airplane.

APU selector/External Power switch .... Off

When APU RUN light extinguishes:

Standby Power selector .... OFF

Battery switch .... OFF

Operation With Less Than 90 KVA External Power Source

When external power source is less than required (90 KVA), airplane electrical loads must be minimized by supplementing normal procedures as follows:

Before Start Procedure

Accomplish normal exterior Inspection, Preflight Procedure – First Officer, Preflight Procedure – Captain and Before Start Procedure through "Start Clearance......Obtain".

Confirm cargo loading complete.

Utility Bus switches .... OFF

Hydraulic System .... Set

Demand Pump selector (right) .... AUTO

Observe PRESS light extinguished.

Fuel Pump switches (one left and one right main wing) .... ON

Observe PRESS lights extinguished.

Note: Delay activation of the remaining hydraulic and fuel pumps, setting trim and checking flight controls until after engines are started.

Complete the normal Before Start and Engine Start procedures.

After start up Procedure

Hydraulic System .... Set

Electric Primary Pump switches (both) ....ON

Demand Pump selectors (remaining pumps) .... AUTO

Utility Bus switches .... ON

Fuel Pump switches (remaining pumps) .... ON

Position switches ON for all tanks containing fuel.

Trim ....Set

Flight controls .... Check

Displace control wheel and control column to full travel in both directions and verify:

- freedom of movement

- controls return to center
- proper flight control movement on EICAS status display.

Hold the nose wheel steering tiller during rudder check to prevent undesired nose wheel movement.

Displace rudder pedals to full travel in both directions and verify:

- freedom of movement
- rudder pedals return to center
- proper flight control movement on EICAS status display.

Complete normal Before Taxi procedure.

Shutdown Procedure

After park brake is set and prior to establishing external power:

Hydraulic System .... Set

Electric Primary Pump switches (both) .... OFF

Demand Pump selectors (All) .... OFF

Fuel Pump switches ....OFF

Accomplish normal Shutdown procedure.

Standby Power Test

Airplane must be on ground with all busses powered.

Standby Power Selector .... BAT

Observe battery DISCH light illuminates and standby power OFF light remains extinguished.

Standby Power Selector .... AUTO

Observe battery DISCH light extinguishes and standby power OFF light remains extinguished.

Transfer From External Power To APU Power

Prior to disconnecting external power:

External Power switch ....Push

Observe ON light extinguish.

Hydraulic Generator Test

Electrical and pneumatic power must be established on the airplane.

Center 1/2 Electric Primary Pump Switches .... OFF

Center Air Demand Pump Selector .... AUTO

EICAS Status Display .... ON

Hydraulic Generator Test Switch ....HYD GEN

While holding the test switch in the HYD GEN position, verify the HYD GEN ON and HYD GEN VAL Status messages appear on EICAS, and Captain ADI and HSI are powered with no flags displayed. The HYD GEN ON and HYD GEN VAL messages should no longer be displayed when the test switch is released.

3.8 Engines, APU

Engines

Engine Crossbleed Start

The APU must be shut down or the APU bleed air switch must be OFF.

Check that the area behind the airplane is clear.

Engine Bleed Air switch (operating engine) ....ON

Advance thrust on operating engine to approximately 70% N2 and accomplish normal Engine Start procedure

Engine Ground Pneumatic Start

Check duct pressure 30 psi or greater.

Start engine using normal Engine Start procedure.

Reduced Thrust Selection Prior To Takeoff

If only reduced takeoff thrust desired:

Assumed Temperature ....Set

Rotate assumed temperature selector clockwise and set desired temperature value or enter temperature on Takeoff Reference page

Observe D–TO displayed .

If both reduced takeoff thrust and reduced climb thrust desired:

Thrust Reference Mode Select switch ....1 or 2

Select desired thrust reference： 1 or 2

CLB 1 or CLB 2 is preselected

Observe TO 1 or TO 2 displayed

If additional takeoff thrust reduction desired:

Assumed Temperature ....Set

Rotate assumed temperature selector clockwise and set desired temperature value or enter temperature on Takeoff Reference page.

Observe D–TO 1 or D–TO 2 displayed.

Reduced Takeoff Thrust Change or Cancellation

If change desired:

Accomplish "Reduced Thrust Selection Prior To Takeoff" procedural steps.

If cancellation desired:

Thrust Reference Mode Select switch .... As desired

Select desired thrust reference mode; TO/GA, CLB, CON or CRZ.

Observe associated mode displayed

Note: If full takeoff thrust desired during takeoff following 80 knots (autothrottle in THR HOLD mode) thrust levers must be adjusted manually.

Reduced Climb Thrust Selection In–flight

Thrust Reference Mode Select switch .... CLB

Observe CLB displayed.

Thrust Reference Mode Select switch .... 1 or 2

Select desired thrust reference: 1 or 2

Observe CLB 1or CLB 2 displayed.

If cancellation is needed:

Thrust Reference Mode Select switch ....1 or 2

Press switch related to current thrust reduction.

Observe displaying CLB or TO(only on ground)

Note: If preselcted reduced thrust is changed or cancelled and reduced thrust is needed for takeoff, reduced takeoff thrust must selected again.

Reduced Climb Thrust Change or Cancellation

If change desired:

Thrust Reference Mode Select switch .... 1 or 2

Select desired thrust reference; 1 or 2

Observe displaying CLB1 or CLB 2(TO 1, TO 2 ,only on ground)

If cancellation is needed:

Thrust Reference Mode Select switch ....1 or 2

Press switch related to current thrust reduction.

Observe displaying CLB or TO (only on ground)

3.9 Fire Protection

Engine, APU and Cargo Fire/Overheat Test

Engine/APU/Cargo Fire/Overheat Test switch .... Push

Observe the fire bell ring intermittently

Observe the following lights illuminate:

- Discrete FIRE warning
- Fuel control switches
- L and R ENG OVHT
- LEFT, RIGHT and APU fire switches
- FWD and AFT cargo fire
- Master Warning

Observe the following EICAS messages:

- APU FIRE warning
- FWD and AFT CARGO FIRE warning
- L and R ENGINE FIRE warning
- L and R ENG OVHT caution

Wheel Well Fire Detection Test

Wheel Well Fire Test switch ....Push

Observe the fire bell ring intermittently

Observe the following lights illuminate:

- Discrete FIRE warning
- WHL WELL FIRE
- Master Warning

Observe the following EICAS message:

- WHEEL WELL FIRE warning

3.10 Flight Instruments

Flight Recorder Test

Flight Recorder switch .... Test

Observe OFF light extinguish

Heading Reference Switch Operation

Use TRUE when flying in regions where true referencing is required.

Use NORM at other times.

Heading Reference switch ....NORM or TRUE

Note: The following information applies when using the Heading Reference switch:

- If the AFDS is in the HDG SEL mode and the Heading Reference switch position is changed, the AFDS mode changes to HDG HOLD; HDG SEL may be reselected.
- If making an ILS approach using true referencing, the localizer course referenced to true north must be set on the ILS control panel.
- VOR bearings are not available when the Heading Reference switch is in TRUE.

QFE Operation

Use this procedure when ATC altitude assignments are referenced to QFE altimeter settings, and QNH settings are not available.

Note: Do not use LNAV or VNAV below transition altitude/level.

Altitudes in the navigation data base are not referenced to QFE.

Use only raw data for navigation.

Altimeters .... Set

Set primary and standby altimeters to QFE below transition altitude/level.

Note: If the QFE altimeter setting is beyond the range of the altimeters, QNH procedures must be used with QNH set in the altimeters.

Landing Altitude Indicator ....Set at Zero

3.11 Flight Management, Navigation

Transponder Test (TCAS equipped airplanes)

This procedure requires the IRSs to be aligned and in NAV mode.

TCAS Test switch .... Push

Verify "TCAS SYSTEM TEST OK" aural sounds.

Weather Radar Test

Weather Radar Mode .... TEST

HSI Mode selector ....MAP

Weather Radar switch ....ON

Observe radar test pattern on HSI.

Note: If the airplane is on the ground and the thrust levers are not advanced for takeoff, the WXR tests the predictive windshear system (PWS) indications. These include the WINDSHEAR SYS EICAS advisory, the PWS caution, and PWS warning. Deactivating WXR on the EFIS control panel will discontinue the test. The PWS test lasts approximately 15 seconds.

Weather Radar switch.. OFF

Select captain’s and first officer’s weather radar displays off.

Weather Radar Mode ....As desired

IRS

Align Lights Flashing

Do not move IRS Mode selector to OFF except where called for in procedure.

POS INIT page .... Select

Set IRS Position ....Enter Present Position

Enter present position using most accurate latitude and longitude available. If a position is already displayed on the SET IRS POS line, enter new position over displayed position.

If ALIGN light continues to flash:

Set IRS Position ....Enter Present Position

Re–enter same present position.

If ALIGN light continues to flash after re–entry:

IRS ....OFF

Rotate IRS Mode selector to OFF and verify ALIGN light extinguished.

Note: Light must be extinguished before continuing with procedure (approximately 30 seconds).

IRS ....NAV

Rotate IRS Mode selector to NAV and verify ALIGN light illuminated.

Set IRS Position ....Enter

Enter present position in boxes. If ALIGN light flashes, re–enter same present position over displayed position.

Note: Approximately ten minutes is required for realignment.

If ALIGN light continues to flash, maintenance action is required.

Fast Realignment

If the combined operating time from the last full IRS alignment to the expected next destination arrival time does not exceed 18 hours, a fast realignment may be accomplished.

IRS Mode selectors ....ALIGN

CDU ....Set

Enter present position on SET IRS POSITION line of Position Initialization page.

IRS Mode selectors .... NAV

High Latitude Alignment

This procedure applies to alignment at latitudes greater than 70°12.0' and less than 78°15.0'.

IRS Mode selectors .... OFF, then ALIGN

POS INIT page .... Set

Enter present position on SET IRS POS line using the most accurate latitude and longitude available.

IRS Mode selectors .... NAV

Select NAV after remaining in ALIGN for 17 minutes minimum.Verify ALIGN lights extinguished.

Position Entry Using IRS Mode Selector Panel

Latitude .... Enter

Begin with N or S, followed by latitude including trailing zeros, i.e., N003°30.0' entered as N3300.

Longitude .... Enter

Begin with E or W, followed by longitude including trailing zeros, i.e., E001°11.0' entered as E1110.

Lateral Navigation

Alternate Route Entry/Activation

Desired RTE page 1 .... Select

If desired route (1 or 2) not displayed, select desired route.

Route (if required) ....Enter

Enter route using preflight procedure.

ACTIVATE .... Select

If in–flight, use DIRECT TO or INTC LEG TO boxes to enter desired course from present position to new route.

EXEC key .... Push

Direct To A Waypoint Using Overwrite

RTE LEGS page .... Select

Desired Waypoint ....Enter

Enter the desired waypoint over the active waypoint.

Waypoint Sequence .... Check

Enter waypoints in desired sequence.

EXEC key ....Push

Estimate For Alternate

PROGRESS page 1 ....Select

Desired Destination...Enter

Note: Estimates displayed are for present position direct.

Holding Pattern Entry

Holding fix must be a route waypoint or present position before accomplishing following steps.

HOLD key ....Push

NEXT HOLD (if displayed) ....Select

Holding Fix ....Enter

To hold at present position, select PPOS. To hold at waypoint, enter waypoint identifier in HOLD AT boxes.

HOLD page ....Check

EXEC key...Push

Holding Pattern Exit

To exit holding accomplish the following procedure or refer to one of the"Direct to a Waypoint" procedures.

EXIT HOLD ....Select

EXEC key ....Push

Intercept A Leg Or Course To A Waypoint Using Overwrite

RTE LEGS page ....Select

Desired Waypoint ....Enter

Enter the desired waypoint over the active waypoint.

Note: If waypoint not previously in route, a discontinuity occurs. If waypoint was previously in route, the inbound course is set to same inbound great circle course. For airways, displayed course may not be identical to charted value.

If inbound course not correct:

Intercept Course ....Enter
Enter course desired at waypoint in INTC CRS TO boxes (or over existing intercept course to value if waypoint was already in route).

EXEC key ....Push

Waypoint Sequence ....Check

Enter waypoints in desired sequence.

EXEC key ....Push

If necessary, use Heading Select mode to change intercept heading. Then, arm LNAV mode.

Lateral Offset

RTE page .... Select

Offset ....Enter

Enter desired offset direction and distance over OFFSET dashes.

EXEC key .... Push

To remove offset, accomplish Direct To procedure or enter "0" in OFFSET line.

Leg Modification

To modify active waypoint or leg, accomplish one of the Direct To or Intercept A Leg Or Course procedures except when entering along track waypoints.

RTE LEGS page .... Select

To change waypoint sequence:

Desired Waypoint Sequence .... Enter

Note: If waypoint not previously in route a discontinuity occurs except when entering along track waypoints.

EXEC key .... Push

To delete a waypoint at end of route:

DEL key..Push

Waypoint..Select

EXEC key ....Push

To enter along track waypoints:

Along Track Displacement ....Enter

Select reference waypoint to scratch pad and modify for desired displacement.

Reference Waypoint .... Select

The FMC will automatically position the created waypoint to the appropriate position.

EXEC key ....Push

Route Removal

RTE page 1 .... Select

Origin .... Enter

If EXEC key illuminates:

EXEC key ....Push

SID Change Or Runway Change

This entire procedure must be accomplished when a SID is used and the runway or SID is changed. This will prevent the possibility of incorrect routing or inadequate obstacle clearance.

DEPARTURES page .... Select

Runway .... Reselect

SID ....Reselect

Transition (if required) ....Reselect

RTE LEGS page .... Select

Waypoint Sequence and Altitude ....Check

Modify as necessary to agree with clearance.

EXEC key .... Push

STAR, Profile Descent Or Approach Change

Associated airport must be entered as route origin or destination.

ARRIVALS page .... Select

STAR or Profile Descent (if required) .... Select
Transition (if required) .... Select
Approach .... Select
Approach Transition (if required) .... Select
RTE LEGS page .... Select
Waypoint Sequence and Altitude .... Check
Modify as necessary to agree with clearance.
EXEC key .... Push

Vertical Navigation

Climb, Cruise Or Descent Speed Schedule Change

CLB or CRZ or DES page .... Select
To change schedule:
Desired Schedule .... Select
To enter fixed speed schedule:
Desired Speed .... Enter
Enter speed on ECON/SEL SPD line (line 2L).
EXEC key .... Push

Climb Or Descent Direct To MCP Altitude

This procedure deletes all waypoint altitude constraints between current airplane altitude and altitude set in MCP.

Altitude Window.. Set
CLB or DES page .... Select
CLB DIR or DES DIR ....Select
EXEC key ....Push

Cruise Altitude Change

Altitude Window..Set

CRZ page .... Select

Cruise Altitude .... Enter

EXEC key ....Push

Speed/Altitude Constraint At Waypoint

RTE LEGS page .... Select

To enter or modify constraint:

Speed/Altitude .... Enter

Note: Speed entry requires "/" mark and altitude.

EXEC key .... Push

To delete constraint:

DEL key .... Push

Speed/Altitude .... Select

Select undesired constraint and observe estimated values appear.

EXEC key .... Push

Speed/Altitude Transition And Restriction

CLB or DES page .... Select

To enter speed/altitude restriction:

Speed/Altitude .... Enter

EXEC key .... Push

To delete speed/altitude restriction or transition:

DEL key ....Push

Speed/Altitude .... Select

EXEC key .... Push

Temporary Altitude Restriction

Altitude Window .... Set

To resume climb or descent:

Altitude Window ....Set

VNAV ....Engage

Temporary Speed Restriction

IAS/MACH selector .... Push

Speed Window .... Set

To resume FMC speed schedule:

IAS/MACH selector .... Push

Performance Data Entries

Descent Forecast

DES page .... Select

DESCENT FORECAST page .... Select

Transition Level ....Check

Thermal Anti–ice On Altitude (if required) ....Enter

Wind Altitude ....Enter

Enter altitude over dashes on left.

Wind Direction/Speed .... Enter

Step Climb Evaluation

CRZ page ....Select

Step to Altitude ....Enter

Savings..Check

Waypoint Winds

RTE LEGS page .... Select

RTE DATA page .... Select

WINDS page .... Select

Altitude and Wind .... Enter

EXEC key .... Push

Additional CDU Functions

Data Link Request

For Pegasus FMC

FMC COMM page .... Select

Desired page .... Select

Request send .... Select

Fix Page Entries

FIX page .... Select

Fix Identifier ....Enter

Bearing or Distance From Fix ....Enter

Enter desired bearing or distance or select ABEAM.

Note: Bearing/distance from fix may be used as route waypoint.

HSI Plan Mode Control

HSI Mode ....PLAN

RTE LEGS page ....Select

Map Center Step ....Select

Navaid Inhibit

To inhibit use of radio navigation aids from position updating:

INIT REF page .... Select

INDEX page .... Select

NAV DATA page .... Select

Navaid Identifier .... Enter

To inhibit use of a VOR and DME:

NAVAID line .... Enter

To inhibit use of a VOR only:

VOR ONLY line .... Enter

To inhibit use of all VORs:

VOR/DME NAV OFF/ON prompt ....Select

ALL is displayed in the VOR ONLY inhibit line and OFF is displayed in large font.

Update Active Navigation Database

The navigation database can be changed only on the ground.

Changing the database removes all previously entered route data.

INIT REF .... Select

IDENT page .... Enter

Inactive Date line .... Enter

Transfers inactive date range to scratchpad

Active Date line .... Enter

Transfers inactive database line to active database line.

Transfers active database line to the inactive database line.

3.12 Fuel

Fuel Balancing

If an engine fuel leak is suspected:

Accomplish the Engine Fuel Leak checklist

Note: Fuel pump pressure should be supplied to the engines at all times. At high altitude, without fuel pump pressure, thrust deterioration or engine flameout may occur.

When the fuel quantities in left main and right main tanks differ by an appreciable amount:

Crossfeed switches (both) .... ON

Fuel pump switches (low quantity tank) .... OFF

When fuel load balanced:

Fuel pump switches .... ON

Crossfeed switches (both) .... OFF

Fuel Quantity Test

Fuel Quantity Test switch ....FUEL QTY

Observe FUEL CONFIG light illuminate and LOW FUEL message display.

Observe fuel quantity indicators display all eights (8) except initial digit in total fuel quantity indicator which displays one (1). Observe fuel temperature indicator display -188 degrees Centigrade.

3.13 Warning Systems

EICAS Test

This procedure requires the airplane to be on the ground and parking brake set.

EICAS Test switch .... Push

Wait 5 seconds and switch to L then R.

Observe TEST OK message displayed on CRTs in both positions.

Note: Standby engine indications will be displayed during test and siren aural will sound.

EICAS Test switch .... Push

Event Record

Event Record switch .... Push

Use as directed by Flight Operations for maintenance analysis or at the discretion of the captain to manually record parameters for a suspect condition.

Landing Configuration Warning Test

Configuration Test switch .... LDG

Observe CONFIG light illuminate and GEAR NOT DOWN message display.

Stall Warning Test

L Stall Warning Test switch .... STALL

Observe control columns vibrate.

R Stall Warning Test switch .... STALL

Observe control columns vibrate.

L and R Stall Warning Test switches .... STALL

Observe both stall warning systems vibrate control columns and also move control columns forward.

Note: A minimum of one hydraulic system must be pressurized for proper verification of the control column nudger.

Takeoff Configuration Warning Test

Establish one or more of the following conditions:

Flaps not in takeoff position.

Speedbrakes not down.

Stabilizer units set greater than green band.

Park brake set.

Configuration Test switch .... T/O

Observe CONFIG light illuminate, and appropriate configuration warning message(s) display.

Establish appropriate configuration.

3.14 Special Operations: RVSM, ETOPS and re-clearance

3.14.1 RVSM

At dispatch office and pilots preperation area:

1. Verify the airplane is approved for RVSM operation. Refer to HNA Operations Specification.
2. Verify that flight crew has RVSM ground shool training and simulator training, or established RVSM operation experience.
3. Verify （ICAO column 10 marked with “W”） RVSM has been approved in the flight plan.
4. Thoroughly review RVSM operation special regulations such as Emergency Procedures, Cruise Level and Transponder TCAS Requirement of related countries or regions in flight planned route and alternate route in AIP or JEPPESEN manual. Estimate and verify the affect of these special rules to the flight.
5. If the airplane has deferred items, check that deferred items are in compliance with MEL and RVSM operation requirement. Check items which should be observed with MEL relative items.
6. For specific aircraft, if any operational limits to RVSM airworthiness approval exsit, the flight crew should evaluate and verify the affect to the flight. Observe these limitations.
7. Cooperate with dispatcher to verify emergency procedures in RVSM operational area in case of emergency occurs or weather condition deminites aircraft’s performance for maintaining flight levels. Making decisions with dispatchers to dispatch or not.
8. Obtain computer flight plan（RVSM operation record included）.

3.14.2 ETOPS

Pre-flight preperation:

At dispatch office:

• Check NOTAMS……………………………………………Completed

• Get CFP……………………………………………………Completed

• Get Aviation weather information……………………………Completed

 Destination, alternate, METAR and TAF
 Meteorologic chart of high altitude wind
 En route waypoints high altitude wind and temperature
 SIGMET

• Get two ETOPS plotting charts, draw or check the track drawn in the first chart……………………………………………………Completed

• **For ETOPS flights………………………………..………Completed**

 Check the aircraft and crew qualifications are ETOPS approved for this flight.
 Check MEL if the aircraft has deffered items.
 Check and mark the ETP, EEP, CP and EXP of ETOPS operation.
 Check the VALIDITY, WEATHER and NOTAMS for suitable airports
 Remember the increased weather minima and the runway crosswind limits for pre-flight dispatch
 Aware the performance factor applicable to the aircraft.
 Verify ,confirm and cross check the added fuel
 •Trip fuel and chock fuel VS flight plan fuel
 •Different flight/fuel scenarios
 •Critical fuel scenario, eventual additional ETOPS fuel
 Check the cost index, Mach number and flight speed schedule adopted for the flight

3.14.3 Re-clearance

At dispatch office and pilots preperation area:

Airplane deferred items……………..……compliance with re-clearance dispatch requirement.

Note: the flight crew must ensure the Airborne communication equipment（eg. SATCOM、ACARS、VHF、HF） can be used effectively entoute with the company.

Re-clearance flight plan…………………………..…obtain; all on board

Contain: Primary flight plan

Primary alternate flight plan

Re-clearance decision point（RDP）

Enroute flight plan from RDP to initial destination airport

Initial destination airport to other alternates

Initial destination airport to primary destination airport

Alternate of initial destination airport to primary destination airport

Destination and alternate………………….…weather at or above standard

Contain: Primary destination airport and its alternate

Initial destination airport

Alternate of initial destination airport

（if initial destination or its alternate is enroute alternate or ETOPS alternate of the route, enroute alternate or ETOPS alternate requirement must be satisfied）.

Fuel quantity of each flight plan………………………list individually

RDP minimum fuel and total fuel…………..determine and reasonable

Related NOTAMs..…………………………………………….review

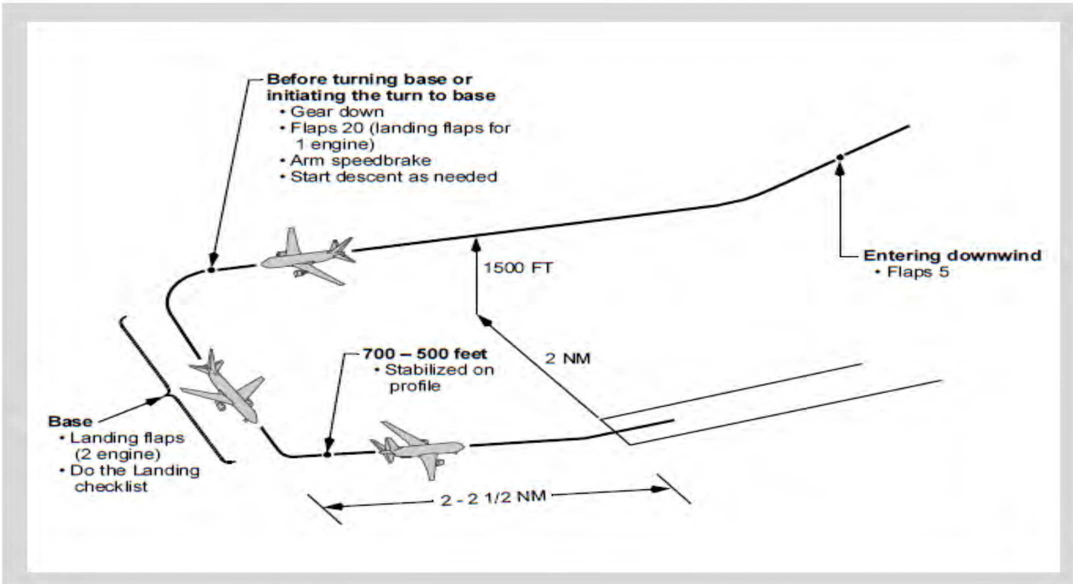
Other special operation performed simultaneously （such as ETOPS）preparation…………….……………….complete

Chapter 4 Normal Maneuvers

4. Normal Maneuvers

4.1 Visual traffic pattern procedure

Condition: takeoff with flaps 5, pattern height 450 meters (1500ft), pattern width 1.5-2nm. **Without F/D, A/P, A/T.**



4.1.1 Visual traffic pattern: without A/P、A/T、F/D

Position	PF	PM
Takeoff clearance is acquired	1) Manually advance thrust levers to 1.10 EPR 3) Manually advance thrust levers to takeoff position 4) "Set takeoff power"	2) "1.1,stabilized" 5) Set takeoff thrust "takeoff power set"
Airspeed at 80KTs	2) "Check"	1) "80"
5KTs before V1	2) Verify airspeed	1) "V1"
VR	2) Smoothly rotate toward about 15° pitch attitude.	1) "Rotate"
Positive climb rate	2) Verify positive climb rate and call "gear up"	1) "Positive" 3) Retract gear
400 ft AGL		"400"
1,000ft AGL	2) "Set speed Vref 30+40, turn left(right) heading XXX" 4) Call "After Takeoff Checklist"	1) "1,000" 3) Set Vref 30+40 in MCP and callout, set heading and call out 5) Do the After Takeoff Checklist
Abeaming runway threshold	1) "Timing" 4) "Gear down, flaps 20, set speed Vref 30+20"	2) Timing 3)"20 seconds" 5) Extend gear, set flap lever to 20 and monitor flap position indicator, set speed Vref 30+20

Position	PF	PM
40seconds, turn base Runway insight	2) "Flaps 25, set Vref 25" 4) Maintain approximately 500 ft \m descend rate during turn in 5)"Flaps 30, set speed Vref 30+5" 7) Call "Landing Checklist"	1) Set base heading 3) Set flap lever to 25 and monitor flap position indicator, set Vref 25 6) Set flap lever to 30 and monitor flap position indicator, set Vref 30+5 8) Do the Landing Checklist
Before turning final	1) Judge the good time to turn to final with runway in sight, stabilize the aircraft on profile to establish a stabilized approach 2) "set missed approach altitude and heading"	3)Set missed approach altitude and heading
On final, aircraft is aligned with the runway	Approach and landing	Call out any deviations of speed, track and instrument indication

B767-300 Flap Extension Schedule

Present flap position	At display or speed(knot)	Select flaps	Command speed according to selected flaps
UP	"Reference bug" Vref 30+80	1	Vref 30+60
1	Vref 30+60	5	"ref bug" Vref 30+40
5	"ref bug" Vref 30+40	20	Vref 30+20
20	Vref 30+20	25 or 30	(Vref 25 or Vref 30)+ wind additives

4.1.2 Touch and go in traffic pattern:

After aircraft touch down, retard thrust levers to idle position, lower nosewheel and maintain rolling direction. Do not use speedbrake, auto brake or reverse. Consider if the runway length is enough.

POSITION	PF	PM
Nose wheel is lowered on the runway	1) Maintain runway direction "flaps 20, trim in green band" 3) Advance thrust levers to vertical position	2) Set flap lever to 20 detent and trim the stabilizer to green band and call out
When engines are stabilized	1) Advance thrust levers to go around thrust "set takeoff power"	2) Set takeoff thrust "takeoff power set" 3) Monitor and check engine instruments
At Vref	2) Smoothly rotate toward 15° pitch attitude.	1) "Rotate"

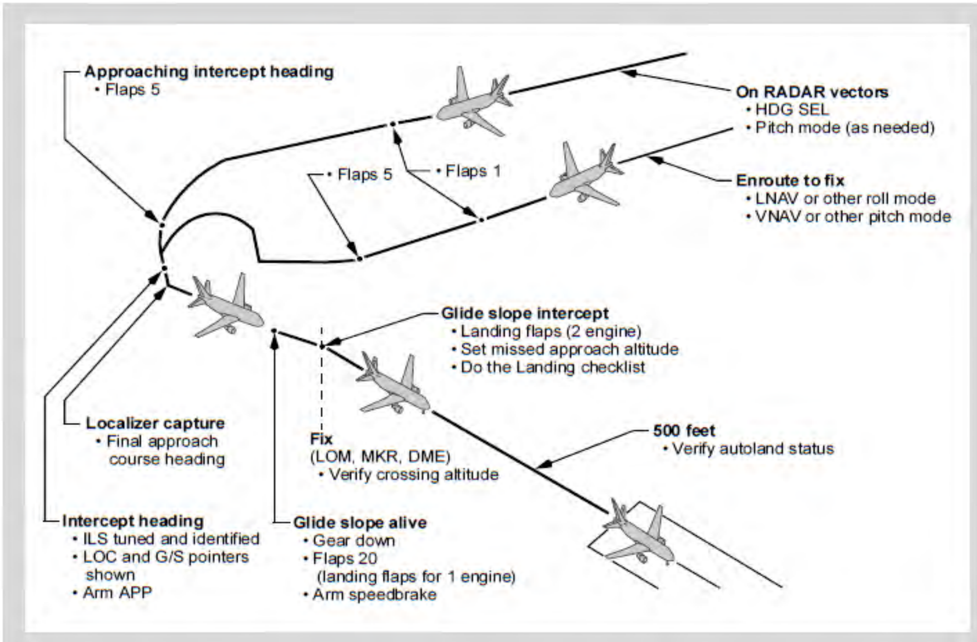
POSITION	PF	PM
Positive climb rate	2）Verify positive climb rate, “gear up”	1) “Positive” 3）Retract gear
Speed is greater than Vref 30+40	2)“Flaps 5, set speed Vref 30+40”	1)“ Vref 30+20” 3) Set flap lever to 5 and monitor flap position indicator, set speed Vref 30+40
Altitude to turn	1)“Turn to downwind heading, After Takeoff Checklist”	2)Set downwind heading and callout, do the After Takeoff Checklist

NOTES:

1. When taking off after a touch and go with F/Ds on, reset F\Ds after landing.
2. When reversers are used, full stop landing must be made. When doing landing checklist, it should be verified that the speedbrake is in down detent and auto brake is off.
3. Landing gear can be maintained at down position to cool brakes when commencing touch and go.
4. For the use of thrust lever on takeoff phase, when PF is right seat pilot, PF controls the thrust levers after the airplane is aligned with the runway; After takeoff thrust is set, hand over thrust levers to left seat; at V1, remove hand from thrust levers.

4.2 ILS LOCAL TRAINING PROCEDURE（FLAPS UP）

Conditions: takeoff with flaps 5, pattern altitude 900 meters(3000ft), pattern width 3nm. **Use F/D and use A/P, A/T as needed.**



4.2.1 **ILS approach procedure:** （A/P、A/T、F/D）

POSITION	PF	PM
Takeoff clearance is acquired	1）Manually advance thrust levers to 1.1EPR 3）Push THR switch, "set takeoff power"	2） "1.1, stabilized" 4）Set takeoff thrust , "takeoff power set"
At 80KTs	2) "check"	1)"80, throttle hold"
5KTs before V1	2)Verify airspeed, remove hand from thrust levers to control wheel	1) "V1"
VR	2) Rotate smoothly toward 15° pitch attitude.	1)"Rotate"
Positive climb rate	2)"Gear up"	1)"Positive" 3) Retract gear
400ft AGL	2)"heading select" 4) Verify FMA indications	1)"400" 3) Press HDG SEL switch, verify FMA indications
1,000ft AGL	2)"Climb power,level change " 4) Verify FMA indications	1)"1,000" 3) Press FL CH, verify FMA indications
At speed Vref30+40	2) "Flaps 1"	1)"Vref 30+40" 3) Move flap lever to position 1, monitor flap position indicator

POSITION	PF	PM
At Vref 30+60 speed	2) "Flaps up" 4)"Engage A/P"	1)"Vref 30+60" 3) Move flap lever to UP position, monitor flap position indication 5) Verify A/P is engaged
During the turn	1)"Left(right) turn heading XXX" 3) Call "After Takeoff Checklist"	2) Set heading 4) Do the After Takeoff Checklist
On downwind	Transfer control to do approach briefing	Request landing conditions
Vref 30+80 Vref 30+60	1) "Flaps 1,set speed Vref 30+ 60" 3)"Flaps 5,set speed Vref 30+40" 5) Call"Descend and Approach Checklist "	2) Set flap lever to position 1 and monitor flap position indicator 4) Set flap lever to position 5 and monitor flap position indicator 6)Do the Descend and Approach Checklist
Abeaming outer marker	1) "Timing" 3) Set altitude and descend rate according to the published approach procedure	2) Timing 4) Confirm MCP altitude and descend rate
At base turn point (time for 1.5 minutes or refer to DME)	1) "Left(right) turn heading XXX"	2) Set heading

POSITION	PF	PM
Establish intercept heading	1)Set abeaming angle of 30° ,"Arm LOC" 4) "Arm APP"	2) Verify FMA, "localizer alive" 3)"localizer captured" 5) Verify FMA
Glide slope alive Glide slope one dot	2) "Gear down, flaps 20,set speed Vref 30+20" 4) "Flaps 25, set speed Vref 25"	1) "Glide slope alive" 3) Extend gear, set flap lever to position 20 and monitor flap position indicator 5) Set flap lever to position 25 and monitor flap position indicator
Glide slope captured	2)Verify FMA. "flaps 30、set Vref 30+5、set missed approach altitude,Landing Checklist"	1)"Glide slope captured" 3) Set flap lever to position 30 and monitor flap position indicator 4) Do the Landing Checklist Confirm missed approach altitude and heading are set
1000ft AGL	2)"Check"	1)"1000" (call out abnormal deviations as necessary)
500ft AGL	2)"Check"	1)"500" （call out abnormal deviations as necessary)
When runway is in sight	2)"Land" control the airplane to land	1)"Runway in sight"

POSITION	PF	PM
Landing Roll	1) Maintain directional control, retard thrust levers and deploy reversers 4) Retract reversers, brake manually	2) Call out: "speedbrakes up, reversers unlocked" 3) "60" 5)Call out: "autobrake disarmed"
At 20KTs taxiing speed	Taxi with tiller	

4.2.2 ILS approach missed approach procedure:

POSITION	PF	PM
500ft AGL	2)"Check"	1)"500"（call out abnormal deviations as necessary）
100 to DA（H）	2)"Continue approach"	1)"Approaching minimum"
DA（H）	2)"Go around, flaps 20, set go around power" advance thrust levers and press GA	1)"Negative Contact" 3) Retract flap levers to position 20 and monitor flap position indicator
Positive climb rate	2)"Gear up"	1)"Positive" 3) Retract gear
400ftAGL	2)"Heading select" 4) Verify FMA indications	1)"400" 3) Press HDG SEL switch, verify FMA indications
when speed is greater than Vref30+40	1) Retract flaps to 5, then retract flaps to UP on speed schedule 2) Complete After Takeoff Checklist	

4.3 VOR APPROACH TRAINING PROCEDULE

Conditions: takeoff with flaps 5, pattern altitude 900 meters (3000ft)**. Use F/D and use A/P, A/T as needed.**

4.3.1 VOR/DME APPROACH PROCEDURE:

POSITION	PF	PM
Before abeaming outermarker, the procedure is the same as that of ILS approach		
Abeaming outermaker	1)"Timing" 3) Set MCP altitude per published procedures and adjust descent rate	2) Timing 4) Confirm MCP altitude and descend rate
Base turn (time for 1.5minutes or refer to DME)	1) "Left(right) turn heading XXX"	2) Set heading
Approaching intercept heading	1) Set abeaming angle of 30° 3) Intercept VOR course using HDG SEL 4) FMA: after ALT HOLD, set next altitude, arm V/S	2) Verify FMA 4) Verify MCP
3nms before initial descend point	1)"Gear down, flaps 20,set Vref 30+20 "	2)Extend gear, set flap ever to position 20 and monitor flap position indicator
2nms before initial descend point	1) "Flaps 25,set Vref 25"	2) Set flap lever to position 25 and monitor flap position indicator
1nm before initial descend point	1) "Flaps30, set Vref30+5" 3) Call "Landing Checklist"	2)Set landing flaps 4) Do Landing Checklist
Descent	Step descend as necessary and make standard callouts	

Runway insight /approach lights in sight	2) "Disengage A\P and A\T, FD off, set missed approach heading and altitude," control airplane to land visually	1)"Runway insight,X ahead" 3)Turn PF's FD off, set missed approach heading and altitude
Missed approach		
MDA	1) Maintain MDA to missed approach point	2) Verify missed approach altitude setting
At MAP, runway not insight	1) "Go-around", carry out missed approach procedure	2) Carry out missed approach procedure

4.4 NDB local training procedure

Conditions: takeoff with flaps 5, pattern altitude 900 meters (3000ft), pattern width 3nms**. Use F/D, use A/P and A/T as required**

4.4.1 NDB/DME approach:

Procedure before final turn is the same as that of VOR/DME approach, turn to final directly when the angle between landing course and outer marker is 10-12 degree, correct final track using ADF indication and HDG SEL, descend and other procedure are the same as that of VOR/DME approach

4.5 CIRCLING APPROACH:

POSITION	PF	PM
Localizer captured	2）Verify FMA,set MDA(H) 4）“Gear down, flaps 20,set Vref 30+20	1）Verify FMA, “localizer captured” 3）“Glide slope alive” 5）Gear down, set flap lever to position 20 and monitor flap position indicator
Glide slope intercept	2）Descend to MDA（H） on glide slope using V/S	1）“ON glide slope ”
Runway insight	Engage HDG SEL Left(right) turn 45°	
Level the wings	1) “Timing”	2) Timing
Fly 20 seconds Abeaming runway threshold	2) Set heading for downwind 4)“Timing”	1)“20seconds” 3)“Abeaming runway threshold ” 5）Timing
20 seconds After abeaming runway threshold (for training)	2) Turn base , “flaps 25, set Vref 25 ” 4)“Flaps 30,set Vref 30+5, Landing Checklist”	1)“20 seconds” 3) Set flaps 25 5) Set flaps 30, do Landing Checklist
Runway insight	1) “Disengage A\P and A\T, F/D off, set missed approach heading and altitude”, control airplane to land visually	2)Turn PF’s F/D off, set missed approach heading and altitude

Notes on circling approach:

1. Maneuvers must be commenced within the protected areas. When the airplane is not in the protected areas, descent to circling MDA is prohibited.
2. Do not descend below MDA/MDH before visual profile interception.
3. Use APP mode for descent is not allowed.
4. 45° turn for 20 seconds and then abeam runway end for other 20 seconds are recommendations only. In real flight, wind effect should be considered and airplane must within obstruction areas all the time.
5. Visual contact should be maintained at all times when doing circling approach. Go around must be initiated in case of losing visual reference.
6. If a missed approach is required at any time while circling, turn in the shortest way toward the landing runway, this may result in a turn greater than 180° to intercept missed approach course. Continue the turn until established on an intercept heading to the missed approach course corresponding to the just flown instrument approach. Maintain the missed approach flap setting until close-in maneuvering is completed.
7. MDH and visibility requirement for circling approach are 300 meters (1000ft) and 5,000meters（3miles）.
8. The minimum altitude to establish stabilized approach is 300ft during circling approach.
9. If the MDA (H) does not end in “00”, set the MCP altitude to the nearest 100ft above the MDA (H), start the circling approach at MCP altitude.
10. When initiating the turn to base leg, select landing flaps and begin decelerating to the approach speed plus wind correction. To avoid overshooting final approach course, adjust the turn to final to initially aim at the inside edge of the runway threshold. Timely speed reduction also reduces turning radius to the runway. Do the landing checklist.

11. Leaving MDA (H), disengage the autopilot and autothrottle. After interception the visual profile, cycle F/Ds to OFF then to ON. This eliminates unwanted commands for both pilots and allows F/D guidance in the event of a go-around.
12. The following figure illustrates the maneuvering that may be required to become established on the prescribed missed approach course. This ensures the airplane remains within the circling and missed approach obstruction clearance areas. In the event that a missed approach must be accomplished from below the MDA(H), consideration should be given to selecting a flight path which assures safe obstacle clearance until reaching an appropriate altitude on the specified missed approach path.

13. Obstruction clearance areas during the circling approach are depicted in the following figure. Distances are determined by aircraft approach category. Adjust airplane heading and timing so that the airplane ground track does not exceed the obstruction clearance distance.

Aircraft Category	**FAA** Obstruction Clearance Radius（r）	**ICAO** Obstruction Clearance Radius(r）
C	1.7NM	4.2NM
D	2.3NM	5.28NM

4.6 Approach Category

FAA **Category**	Speed
C	121knots or more but less than 141knots
D	141knots or more but less than 166knots
Speed-based upon a speed of Vref in the landing configuration at maximum certificated landing weight.	

ICAO Cate-gory	VAT	Speed range for Initial Approach	Speed range for Final Approach	Max Speeds for Visual Maneuvering (Circling)	Max Speeds For Missed Approach	
					Inter Me-diate	Final
C	121/140	160/240	115/160	180	160	240
D	141/165	185/250	130/185	205	185	265
VAT -- Speeds at threshold, based upon a speed of 1.3 or 1.23 times stall speed in the landing configuration at maximum certified landing weight.						

NOTE: The coefficient is based on the airplane type certification.

The designated approach category for an aircraft type is defined by the landing reference speed(Vref) at the maximum certified landing weight under both USA TERPS and ICAO PANS OPS.

□During direct approach, B767 aircraft is categorized into D. For example:

The categorization in left side of the above table is FAA category;

The categorization of runway threshold speed in the right side of the above table is ICAO category.

Chapter 5 Abnormal Maneuvers

Chapter 5 Abnormal Maneuvers

The abnormal maneuvers contained in this chapter are only training flight items. Flight crew should observe recommended procedure when abnormal situations occurred in flight.

5.1 Overspeed

5.1.1 Training Purpose:

Vmo/Mmo is the maximum operating speed of the airplane that should not be exceeded in flight. The speed may be exceeded the limit when there are adverse weather, equipment malfunction or some other unexpected conditions occurred. The training purpose of this chapter is to make pilots correctly trained of the overspeed recovery technique.

5.1.2 Indications and Conditions

The Mach aural warning in the cockpit will alert pilot the overspeed condition of the airplane when indicated airspeed exceeds Vmo/Mmo during climb, cruise or descent.

5.1.3 Control Techniques:

Pilot should reduce thrust smoothly and adjust flight attitude as required to slow down speed below Vmo/Mmo while an overspeed condition occurred. Disconnect A/P as required during recovery and manually fly the airplane, avoid abrupt control of airplane. Flight crew should write in the Flight Log Book for maintenance to check and repair the airplane if overspeed occurred in flight.

5.2 Approach to Stall Recovery

5.2.1 Training Purpose

The training purpose of approach to stall recovery is to make pilots familiarized with the condition and indications when stall warning occurred and correctly trained of recovery techniques. Therefore pilots can correctly handle the stall warning in flight.

5.2.2 Indications and Conditions

Before the airplane enters stall in clean configuration, BUFFET ALERT warning message is displayed on CDU (there is no CDU message when flaps are extended), SPEED box flashes, ADI displays pitch limit indicator. When speed is slowed to minimum operating speed, stick shaker warning will be activated.

Command Speed

As the airplane is decelerated to the desired initial condition for the approach to stall, set command speed to the maneuver speed for each selected flap setting. For the approach to stall condition in landing configuration, set command speed to Vref 30+5 knots.

Initial Buffet—Stall Warning—Stall Buffet

The approach to stall recovery maneuver is entered with thrust that achieves an airspeed decrease of approximately 1 knot per second. During the initial stages of a stall, local airflow separation results in initial buffet giving natural warning of an approach to stall. A stall warning is considered to be warning readily identifiable by the pilot. Recovery from an approach to stall is initialed at the earliest recognizable stall warning, initial buffet or stick shaker.

Lateral and Directional Control

Lateral control is maintained with ailerons. Rudder control should not be used because it causes yaw and the resultant roll is undesirable.

Effect of Flaps

Flaps are used to increase low speed performance capability. The LE devices ensure the inboard wing stalls before the outboard wing. This causes the nose of the airplane to pitch down at the onset of the stall.

Effect of Speedbrakes

For any airspeed, the angle of attack is higher with speedbrakes up. This increases initial buffet speed and stick shaker speed but has a lesser effect on actual stall speed.

Entry

To save time, thrust levers may be closed to allow a more rapid deceleration. Target thrust for the configuration should be set approaching selected speed.

Some thrust is used during entry to provide positive engine acceleration for the recovery. The airplane is maintained in trim while decelerating. Level flight or a slight rate of climb is desired.

Landing Gear

If the entry has been made with the landing gear extended, do not retract it until after the recovery.

Flaps

Do not retract flaps during recovery. Retracting the flaps from the landing position, especially when near the ground, causes an altitude loss during the recovery.

Recovery

Recover from approach to stall with one of the following recommended recovery techniques.

◆ **Ground Contact Not a Factor**

At the first indication of stall (buffet or stick shaker), smoothly apply maximum thrust, smoothly decrease the pitch attitude to approximately 5 degrees above the horizon and level the wings. As engines accelerate, counteract the nose up pitch tendency with positive forward control column pressure and nose down trim. (At altitude above 20,000 feet, pitch attitude of less than 5 degrees may be necessary to achieve acceptable acceleration.)

Accelerate to maneuvering speed and stop the rate of descent. Correct back to the target altitude.

◆ **Ground Contact a Factor**

At the first indication of stall (buffet or stick-shaker) smoothly advance the thrust levers to maximum thrust and adjust the pitch attitude as needed to avoid the ground. Simultaneously level the wings. Control pitch as smoothly as possible. As the engines accelerate, the airplane nose pitches up. To assist in pitch control, add more nose down trim as the thrust increases. Avoid abrupt control inputs that may induce a secondary stall. Use intermittent stick shaker as the upper limit for pitch attitude for recovery when ground contact is a factor.

When ground contact is no longer a factor, continue to adjust pitch as required to maintain level flight or a slight climb while accelerating to maneuvering speed for the existing flap position.

A/P Engaged

If an approach to stall is encountered with the autopilot engaged, apply limit thrust and allow the airplane to return to the normal speed. At high altitude, it may be necessary to initiate a descent to regain maneuvering speed. If autopilot response is not acceptable, it should be disengaged.

5.2.3 Approach to stall Recovery (Operation Procedure)

Once stall shake or stick shake happens, perform the following immediately:

Pilot flying	Pilot monitoring
●Advance thrust levers to maximum thrust* ●Smoothly adjust pitch attitude **to avoid ground contact or obstacles ● Level the wings(do not change flaps or landing gear configuration) ● Retract the speedbrakes	● Verify maximum thrust ● Monitor altitude and airspeed ● Call out any trend toward terrain contact ● Verify all required actions have been completed and call out any omissions

When ground contact is no longer a factor ●Adjust pitch attitude to accelerate while minimizing altitude loss ● Return to a speed appropriate for the configuration	

Note: * If an approach to stall is encountered with the autopilot engaged, apply maximum thrust and allow the airplane to return to the normal airspeed.

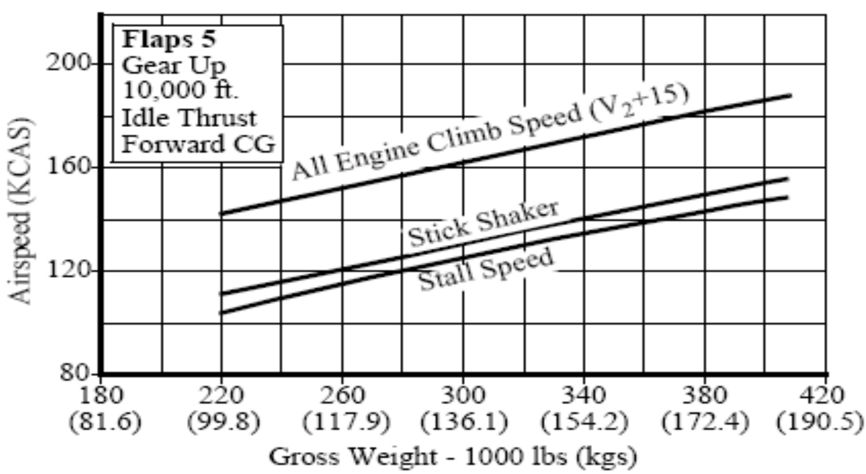
Note: ** At high altitude, it may be necessary to descend to accelerate.

Note: If autopilot response is not acceptable, it should be disengaged.

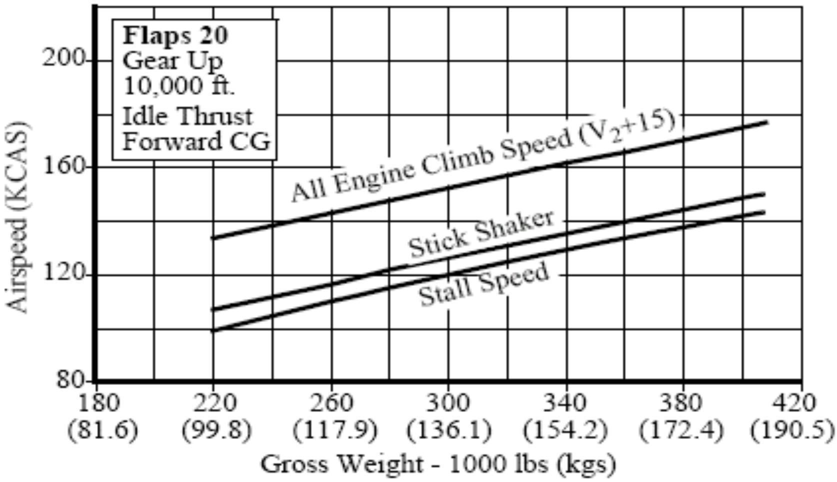
5.2.4 Stick shaker and stall speed

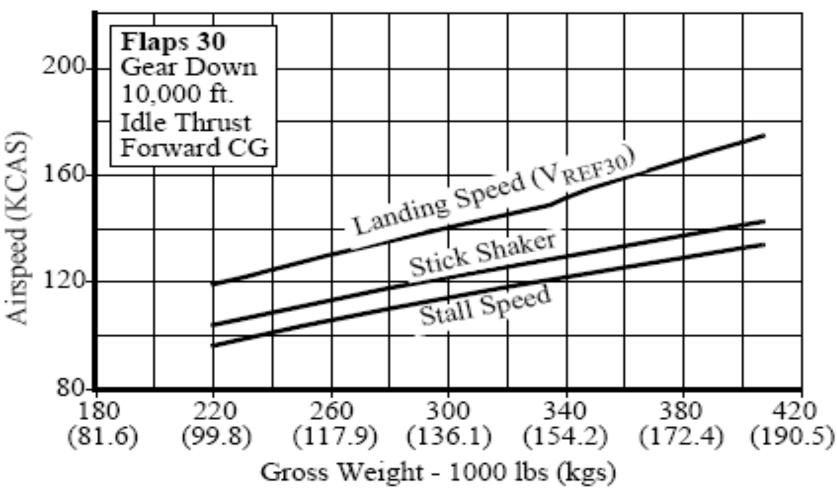
The following figures depict stick shaker and stall speeds at various gross weights and flap settings. This data is presented for training purposes only.

767-300


Flaps 5
Gear Up
10,000 ft.
Idle Thrust
Forward CG
All Engine Climb Speed (V2+15)
Stick Shaker
Stall Speed
Airspeed (KCAS)
200
160
120
80
180 (81.6)
220 (99.8)
260 (117.9)
300 (136.1)
340 (154.2)
380 (172.4)
420 (190.5)
Gross Weight - 1000 lbs (kgs)

767-300


Flaps 20
Gear Up
10,000 ft.
Idle Thrust
Forward CG
All Engine Climb Speed (V2+15)
Stick Shaker
Stall Speed
Airspeed (KCAS)
200
160
120
80
180 (81.6)
220 (99.8)
260 (117.9)
300 (136.1)
340 (154.2)
380 (172.4)
420 (190.5)
Gross Weight - 1000 lbs (kgs)


Flaps 30
Gear Down
10,000 ft.
Idle Thrust
Forward CG
Landing Speed (VREF30)
Stick Shaker
Stall Speed
Airspeed (KCAS)
200
160
120
80
180 (81.6)
220 (99.8)
260 (117.9)
300 (136.1)
340 (154.2)
380 (172.4)
420 (190.5)
Gross Weight - 1000 lbs (kgs)

5.2.5 Three types of approach to stall recovery in flight training (operational procedures)

Condition	PF	PM
The 1st Approach to stall (Clean Configuration, bank angle 0°)		
Altitude 10000 FT	1)"START switches CONT, select TO/GA thrust reference" 3)Close thrust levers, "set Vref 30+80"	2)START switches to CONT, select TO/GA thrust reference in TMSP 4)Set speed Vref 30+80
Approach Vref 30+80	2)"Set N1 45-50%" 4)Well trim the airplane	1)"Approaching Vref 30+80" 3)Set N1 45-50%
Approach to stall		"Approaching to stall"
Stick shaker and recovery	Apply full thrust to accelerate, "set GA power", smoothly adjust pitch attitude until reaching designed airspeed ,set thrust as required	Adjust GA thrust and call out "GA power set"
The 2nd Approach to Stall (Flaps 20， landing gear up and Bank Angle 25°)		
Altitude 10000 FT	1) Retard thrust levers "set N1 45-50%" 4)"Flaps 1, set Vref 30+60" 6)"Flaps 5, set Vref 30+40" 8) "Flaps 20, set Vref20 " 10)Well trim the airplane 11)Bank angle 25°, start turn	2) Set N1 45-50% 3)"Approaching Vref 30+80" 5)Move flap lever to 1, set Vref 30+60, "flaps 1 set" 7)Move flap lever to 5, set Vref 30+40 , "flaps 5 set" 9)Move flap lever to 20, set Vref 20 , "flaps 20 set"

Approach to stall		"Approaching to stall"
Stick shaker and recovery	Apply full thrust to accelerate, "set GA or CON thrust", level off bank angle, smoothly adjust pitch attitude until reaching designed airspeed ,set thrust as required	Set GA thrust and call out "GA power set"
The 3rd Approach to stall (Flaps 30 , landing gear down, bank angle 0°)		
Altitude 10000 FT	1） Retard thrust lever "Set N1 50-55%" 4） "Gear down" 6)"Flaps 30, set Vref30+5" 8)Well trim the airplane	2） Set N1 50-55% 3） "Approaching flaps 20 maneuver speed" 5) Gear down 7)Move flap lever to 30 and set Vref30+5, and call out "Flaps 30 set"
Approach to stall		"Approaching to stall"
Stick shaker and recovery	Apply full thrust to accelerate, "set GA power" , smoothly adjust pitch attitude until reaching designed airspeed ,set thrust as required	Set GA/CON thrust and call out "XX thrust set"
Speed above Vref20	1)"Flaps 20" 3)"Gear up, set speed Vref 30+80"	2)Retract flap levers to 20 4)Retract gear levers to UP. Set Vref 30+80 and call out.
Speed Vref 30+40	2)"Flaps 5"	1)"Vref 30+40" 3)Move flap lever to 5

Speed Vref 30+60	2)"Flaps 1"	1)"Vref 30+60" 3)Move flap lever to 1
Speed Vref 30+80	2)"Flaps up"	1)"Vref 30+80" 3)Move flap lever to UP
Speed above Vref 30+80	1)Retract thrust " F/D ON, heading select, engage A/T, set speed 250" 3)Well trim the airplane	2)F/D ON, heading select, engage A/T , set speed 250.
Do After Takeoff Checklist when airplane is clean up		

5.3 Recovery from a Fully Developed Stall

5.3.1 Training Purpose

To make pilots well trained of the difference of approach to stall recovery and complete stall recovery techniques, to convince pilots that the airplane can be recovered from complete stall.

5.3.2 Indications and Conditions

An airplane may be stalled in any attitude (nose high, nose low, high angle of bank) or any airspeed (turning, accelerated stall). It is not always intuitively obvious that the airplane is stalled.

An airplane stall is characterized by any one (or a combination) of the following conditions:

- Buffeting, which could be heavy
- Lack of pitch authority
- Lack of roll authority
- Inability to arrest descent rate.

These conditions are usually accompanied by a continuous stall warning. A stall must not be confused with the stall warning that alerts the pilot to an approaching stall. Recovery from an approach to stall is not the same as recovery from an actual stall. An approach to a stall is a controlled flight maneuver; a stall is an out-of-control, but recoverable, condition.

Note: Anytime the airplane enters a fully developed stall, the autopilot and autothrottle should be disconnected.

5.3.3 Control Techniques

To recover from a stall, angle of attack must be reduced to below the stalling angle. Nose down pitch control must be applied and maintained until the wings are unstalled. Application of forward control column (as much as full forward may be required) and the use of some nose-down stabilizer trim should provide sufficient elevator control to produce a nose-down pitch rate. The application of stabilizer trim depends on the current flight condition; excessive stabilizer trim also has no benefit to the control of airplane. Stop trimming nose down when pilots feel the g force on the airplane or the required elevator force lessen.

In some cases, it may be necessary to reduce thrust in order to prevent the angle of attack from continuing to increase. Once the wings are unstalled, upset recovery actions should be taken and thrust reapplied as required.
If normal pitch control inputs do not stop an increasing pitch rate in a nose high situation, rolling the airplane to a bank angle that starts the nose down may be effective. Bank angles of about 45 degrees, up to 60 degrees, could be needed. Unloading the wing by maintaining continuous nose-down elevator pressure keeps the wing angle of attack as low as possible, making the normal roll controls as effective as possible.
Finally, if normal pitch control then roll control in ineffective, careful rudder input in the direction of the desired roll may be required to initiate a rolling maneuver recovery.

Warning: Only a small amount of rudder is required. Too much rudder applied too quickly or held too long may result in loss of lateral and direction control.

5.4 Upset Recovery

5.4.1 Training Purpose

Though flight crews in line operation rarely, if ever, encounter an upset situation, understanding how to apply aerodynamic fundamentals in such a situation helps them control the airplane. Several techniques are available for recovering from an upset. In most cases, if a technique is effective, it is not recommended that pilots use additional techniques. For detailed information regarding the nature of upsets, aerodynamic principles, recommended training and other related information, refer to the Airplane Upset Recovery Training Guide.

Several of these techniques are discussed in the example scenarios below,

- Stall recovery
- Nose high, wings level
- Nose low, wings level
- High bank angles
- Nose high, high bank angles

5.4.2 Indications and Conditions

An upset can generally be defined as unintentionally exceeding the following conditions:

- Pitch attitude greater than 25 degrees nose up, or
- Pitch attitude greater than 10 degrees nose down, or
- Bank angle greater than 45 degrees, or
- Within above parameters but flying at airspeeds inappropriate for the conditions.

5.4.3 Control Techniques

1. Stall Recovery

In all upset situations, it is necessary to recover from a stall before applying any other recovery actions. A stall may exist at any attitude and may be recognized by continuous stick shaker activation accompanied by one or more of the following:

- Buffeting which could be heavy at times

- Lack of pitch authority and/or roll control
- Inability to arrest descent rate.

If the airplane is stalled, recovery from the stall must be accomplished first by applying and maintaining nose down elevator until stall recovery is complete and stick shaker activation ceases. Under certain conditions, it may be necessary to reduce some thrust in order to prevent the angle of attack from continuing to increase. Once stall recovery is complete, upset recovery actions may be taken and thrust reapplied as needed.

2. Nose High, Wings Level

In a situation where the airplane pitch attitude is unintentionally more than 25 degrees nose high and increasing, the airspeed is decreasing rapidly. As airspeed decreases, the pilot's ability to maneuver the airplane also decreases. If the stabilizer trim setting is nose up, as for low-speed flight, it partially reduces the nose-down authority of the elevator. Further complicating this situation, as the airspeed decreases, the pilot could intuitively make a large thrust increase. This causes an additional pitch up. As full thrust settings and very low airspeeds, the elevator, working in opposition to the stabilizer, has limited control to reduce the pitch attitude. In this situation the pilot should trade altitude for airspeed, and maneuver the airplane's flight path back toward the horizon. This is accomplished by the input of up to full nose-down elevator and the use of some nose-down stabilizer trim. These actions should provide sufficient elevator control power to produce a nose-down pitch rate. It may be difficult to know how much stabilizer trim to use, and care must be taken to avoid using too much trim. Pilots should stop trimming nose down when they feel the g force on the airplane lessen or the required elevator force lessen. This use of stabilizer trim may correct an out-of-trim airplane and solve a less-critical problem before the pilot must apply further recovery measures. Because a large nose-down pitch rate results in a condition of less than 1 g, at this point the pitch rate should be controlled by modifying control inputs to maintain between 0 to 1 g. If altitude permits, flight tests have determined that an effective way to achieve a nose-down pitch rate is to reduce some thrust.

If normal pitch control inputs do not stop an increasing pitch rate, rolling the airplane to a bank angle that starts the nose down should work. Bank angles of about 40 degrees, up to a maximum of 60 degrees, could be needed. Unloading the wing by maintaining continuous nose-down elevator pressure keeps the wing angle of attack as low as possible, making the normal roll controls as effective as possible. With airspeed as low as stick shaker onset, normal roll controls – up to full deflection of ailerons and spoilers – may be used. The rolling maneuver changes the pitch rate into a turning maneuver, allowing the pitch to decrease. Finally, if normal pitch control then roll control is ineffective, careful rudder input in the direction of the desired roll may be required to induce a rolling maneuver for recovery. Only a small amount of rudder is needed. Too much rudder applied too quickly or held too long may result in loss of lateral and directional control. Because of the low energy condition, pilots should exercise caution when applying rudder.

The reduced pitch attitude allows airspeed to increase, thereby improving elevator and aileron control effectiveness. After the pitch attitude and airspeed return to a desired range the pilot can reduce angle of bank with normal lateral flight controls and return the airplane to normal flight.

3. Nose Low, Wings Level

In a situation where the airplane pitch attitude is unintentionally more than 10 degrees nose down and going lower, the airspeed is increasing rapidly. A pilot would likely reduce thrust and extend the speedbrakes. Thrust reduction causes an additional nose-down pitching moment. Speedbrake extension causes a nose-up pitching moment, an increasing in drag, and a decrease in lift for the same angle of attack. At airspeeds well above VMO/MMO, the ability to command a nose-up pitch rate with elevator may be reduced because of the extreme aerodynamic loads on the elevator. Again, it is necessary to maneuver the airplane's flight path back toward the horizon. At moderate pitch attitudes, applying nose-up elevator, reducing thrust, and extending speedbrakes, if necessary, changes the pitch attitude to a desired range. At extremely low pitch attitudes and high airspeeds (well above VMO/MMO), nose-up elevator and nose-up trim may be required to establish a nose-up pitch rate.

4. High Bank Angles

A high bank angle is one beyond that necessary for normal flight. Though the bank angle for an upset has been defined as unintentionally more than 45 degrees, it is possible to experience bank angles greater than 90 degrees.

Any time the airplane is not in “zero-angle-of-bank” flight, lift created by the wings is not being fully applied against gravity, and more than 1 g is required for level flight. At bank angles greater than 67 degrees, level flight cannot be maintained with a load factor limit of 2.5 g. In high bank angle increasing airspeed situations, the primary objective is to maneuver the lift of the airplane to directly oppose the force of gravity by rolling (in the shortest direction) to wings level. Applying nose-up elevator at bank angles above 60 degrees causes no appreciable change in pitch attitude and may exceed normal structure load limits as well as the wing angle of attack for stall. The closer the lift vector is to vertical (wings level), the more effective the applied g is in recovering the airplane.

A smooth application of up to full lateral control should provide enough roll control power to establish a very positive recovery roll rate. If full roll control application is not satisfactory, it may even be necessary to apply some rudder in the direction of the desired roll. Only a small amount of rudder is needed. Too much rudder applied too quickly or held too long may result in loss of lateral and directional control or structure failure.

5. Nose High, High Bank Angles

A nose high, high angle of bank upset requires deliberate flight control inputs. A large bank angles is helpful in reducing excessively high pitch attitudes. The pilot must apply nose-down elevator and adjust the bank angle to achieve the desired rate of pitch reduction while considering energy management. Once the pitch attitude has been reduced to the desired level, it is necessary only to reduce the bank angle, ensure that sufficient airspeed has been achieved, and return the airplane to level flight.

6. Nose Low, High Bank Angles

The nose low, high angle of bank upset requires prompt action by the pilot as altitude is rapidly being exchanged for airspeed. Even if the airplane is at a high enough altitude that ground impact is not an immediate concern, airspeed can rapidly increase beyond airplane design limits. Simultaneous application of roll and adjustment of thrust may be necessary. It may be necessary to apply nose-down elevator to limit the amount of lift, which will be acting toward the ground if the bank angle exceeds 90 degrees. This also reduces wing angle of attack to improve roll capability. Full aileron and spoiler input should be used if necessary to smoothly establish a recovery roll rate toward the nearest horizon. It is important to not increase g force or use nose-up elevator or stabilizer until approaching wings level.

5.4.4 Recommended Upset Recovery Techniques

Nose high and nose low are focused in scenarios described above.
Other crew actions such as recognizing the upset, reducing automation, and completing the recovery are included in these techniques. The recommended techniques provide a logical progression for recovering an airplane. If an upset situation is recognized, immediately accomplish the Upset Recovery maneuver found in the non-normal maneuvers section in the QRH.
The following recovery techniques introduce logic sequence of recovery airplanes. Sequence of recovery actions only guide and stand for a series of options requiring consideration, which should be determined according to situations. Once in recovery, it may not need all actions. If needed, use pitch trim with caution. Only when roll control fails and the airplane doesn't stall, use of rudder with caution to control roll can be considered. These techniques assume the airplane doesn't stall. Stall situations may exist at any attitude and can be continuously actuated by stick shaker and be identified by one or more following situations:

- Buffeting which could be heavy at times
- Lack of pitch authority and/or roll control
- Inability to arrest descent rate.

If the airplane is stalled, recovery from the stall must be accomplished first by applying and maintaining nose down elevator until stall recovery is complete and stick shaker activation ceases.

Nose High Recovery

Pilot Flying	Pilot Monitoring
● Recognize and confirm the situation	
● Disconnect A/P and A/T ● Apply as much as full nose-down elevator ● Apply appropriate nose down stabilizer trim ● Reduce thrust ● Adjust bank angle to obtain a nose down pitch rate	● Call out attitude, airspeed and altitude throughout the recovery
Complete the recovery: ● When approaching the horizon roll to wings level ● Check airspeed and adjust thrust ● Establish pitch attitude	● Verify all required actions have been completed and call out any omissions.

Nose Low Recovery

Pilot Flying	Pilot Monitoring
● Recognize and confirm the situation	
● Disconnect A/P and A/T ● Recover from stall, if required ● Roll in shortest direction to wings level (unload and roll if bank angle is more than 90 degrees) ● Apply nose up elevator ● Apply nose up trim, if required ● Adjust thrust and drag as required.	● Call out attitude, airspeed and altitude throughout the recovery ● Verify all required actions have been completed and call out any omissions.

WARNING: Excessive use of pitch trim or rudder may aggravate an upset situation or may result in loss of control and/or high structural loads.

5.5 Steep Turns

5.5.1 Training Purpose

The objective of the steep turn maneuver is to familiarize the pilot with airplane handling characteristics and improve the instrument cross check. During training, 45 degrees of bank is used for this maneuver. It is not intended that the pilot should ever be required to bank greater than 25 to 30 degrees in any normal or non-normal condition.

5.5.2 Indications and Conditions

When the bank angle of an airplane exceeds 35º, 40º, 45º, GPWS equipped airplane produces an audio warning BANK ANGLE, airspeed and flight attitude of the airplane decrease. During the entry and rollout of a steep turn, the attitude indicator and vertical speed indications of the airplane are reliable.

Note: Stabilizer trim is not recommended during the steep turn maneuver because of increased workload during roll out.

5.5.3 Control Techniques

Entry

Stabilize airspeed at 250 knots on heading and altitude. Use a normal turn entry. An increase in pitch is required as the bank angle is increased to maintain constant altitude. An increase in thrust is required to maintain constant airspeed.

During Turn

Pitch and thrust control are the same as for a normal turn; however, large pitch adjustments are required for a given altitude deviation. Trimming during the maneuver is not recommended. Varying the angle of bank while turning makes pitch controls more difficult. If altitude loss becomes excessive, reduce the angle of bank as needed to regain positive pitch control. Smooth and positive control is required. A rapid instrument scan is required to detect deviations early enough to be corrected by small adjustments.

Attitude Indicator

The attitude indicator is reliable for accurate pitch and bank information throughout the turn. Precession error does not exist because the IRS is the source of attitude information.

Vertical Speed Indicator

IRS vertical speed indications are reliable during the turn.

Altimeter

Crosscheck the direction and rate of change, and make smooth minor adjustments to the pitch attitude for corrections.

Airspeed

Airspeed changes very slowly because of small changes in thrust and drag. Anticipate thrust changes and apply them at the first indication of change on the airspeed indicator or speed tape. An increase in thrust is required as bank angle increases.

Rollout

The pitch attitude and thrust applied during the turn are greater than a normal turn. Roll out at the same rate as used during normal turns. Normally rollout should begin 15º to 20º prior to the desired heading.

Operation Procedure (Steep Turns)

Conditions	Pilot Flying	Pilot Monitoring
Airspeed 250 knots, altitude 10000 feet, prepare to enter the steep turn	◆ "F/D OFF, disconnect A/P and A/T" ◆ "Left (Right) turn 180º" Roll the airplane to a bank angle of 45º to enter the turn ◆ Bank angle of 30º, advance thrust to about 72%N1 ◆ Do not trim	◆ FD off ◆ Left (Right) turn heading 180º and call out ◆ "30º to rollout" ◆ "20º to rollout" ◆ "10º to rollout"
Rollout	◆ Level the wings ◆ Thrust 67%N1	

5.6 Traffic Avoidance

5.6.1 Training Purpose

Traffic Alert and Collision Avoidance System (TCAS) is designed to enhance crew awareness of nearby traffic and issue advisories for timely maneuvers to avoid potential collisions. TCAS operation should be required to initiate before takeoff and continue until after landing. The system should be operated in the TA/RA mode to maximize system benefits. Except the ability to accomplish traffic avoidance according to the message provided by TCAS, the responsibility for avoiding collisions still remains with the flight crew and ATC. Pilots should not ignore the basic airplane control, normal visual lookout and other crew duties.

5.6.2 Indications and Conditions

Use of TA/RA, TA Only, and Transponder Only Modes

TCAS operation should be initiated just before takeoff and continued until just after landing. Whenever practical, the system should be operated in the TA/RA mode to maximize system benefits. Operations in the Traffic Advisory (TA) Only or TCAS Off (Transponder Only) modes, to prevent nuisance advisories and display clutter, should be in accordance with operator policy.

Traffic Advisory（TA）

A Traffic Advisory (TA) occurs when nearby traffic meets system minimum separation criteria, and is indicated aurally and visually on the TCAS traffic display. A goal of the TA is to alert the pilot of the possibility of an RA. If a TA is received, immediately accomplish the Traffic Avoidance Maneuver in the QRH.

Maneuvers based solely on a TA may result in reduced separation and are not recommended.

The TA ONLY mode may be appropriate under the following circumstances:

- during takeoff toward known nearby traffic (in visual contact) which would cause an unwanted RA during initial climb
- during closely spaced parallel runway approaches
- when flying in known close proximity to other airplanes
- in circumstances identified by the operator as having a verified and significant potential for unwanted or undesirable RAs
- engine out operation

Resolution Advisory（RA）

When TCAS determines that separation from approaching traffic may not be sufficient, TCAS issues a Resolution Advisory (RA) aural warning and a pitch command. Maneuvering is required if any portion of the airplane symbol is within the red region on the attitude indicator. Flight crews should follow RA commands using established procedures unless doing so would jeopardize the safe operation of the airplane or positive visual contact confirms that there is a safer course of action. If a RA is received, immediately accomplish the Traffic Avoidance maneuver in the QRH.
Resolution advisories are known to occur more frequently at locations where traffic frequently converges (e.g. waypoints). This is especially true in RVSM airspace. Climb or descent profiles should not be modified in anticipation of avoiding an RA unless specifically requested by ATC.
RA maneuvers require only small pitch attitude changes which should be accomplished smoothly and without delay. Properly executed, the RA maneuver is mild and does not require large or abrupt control movements. Remember that the passengers and flight attendants may not all be seated during this maneuver. The flight director is not affected by TCAS guidance. Therefore, when complying with an RA, flight director commands may be followed only if they result in a vertical speed that satisfies the RA command.
There have been reports of some flight crews responding incorrectly to the RA “Adjust Vertical Speed Adjust” (AVSA) by increasing rather than decreasing vertical speed. Flight crews should be aware that an AVSA always requires a reduction in vertical speed. Follow QRH procedures and comply with the RA commanded vertical speed.
During the RA maneuver, the aircrew attempts to establish visual contact with the target. However, visual perception of the encounter can be misleading, particularly at night. The traffic acquired visually may not be the same traffic causing the RA.

Note: Pilots should always observe the displayed RA orders, unless visual traffic can be determined as the airplane causing RA.

Pilots should maintain situational awareness since TCAS may issue RAs in conflict with terrain considerations, such as during approaches into rising terrain or during an obstacle limited climb. Continue to follow the planned lateral flight path unless visual contact with the conflicting traffic requires other action. Windshear, GPWS, and stall warnings take precedence over TCAS advisories. Stick shaker must be respected at all times. Complying with RAs may result in brief exceedance of altitude and/or placard limits. However, even at the limits of the operating envelope, in most cases sufficient performance is available to safely maneuver the airplane. Smoothly and expeditiously return to appropriate altitudes and speeds when clear of conflict. Maneuvering opposite to an RA command is not recommended since TCAS may be coordinating maneuvers with other airplanes.

5.6.3 Control Techniques

Traffic avoidance:

Anytime when TCAS TA or RA appear, completed the following contents by memory.

WARNING: Comply with the RA if there is a conflict between the RA and air traffic control.

WARNING: Once an RA has been issued, safe separation could be compromised if current vertical speed is changed, except as necessary to comply with the RA. This is because TCAS II–to–TCAS II coordination may be in progress with the intruder aircraft, and any change in vertical speed that does not comply with the RA may negate the effectiveness of the aircraft's compliance with the RA.

Note: If stick shaker or initial buffet occurs during the maneuver, immediately accomplish the APPROACH TO STALL RECOVERY procedure.

Note: If high speed buffet occurs during the maneuver, relax pitch force as necessary to reduce buffet, but continue the maneuver.

Note: Do not use flight director pitch commands until clear of conflict.

For TA:

Pilot Flying	Pilot Monitoring
Look for traffic using traffic display as a guide. Call out any conflicting traffic.	
If traffic in sight, maneuver as required.	

For RA (Resolution Advisory), except climb in landing configuration

WARNING: A DESCEND (fly down) RA issued below 1000 feet AGL should not be followed.

Pilot Flying	Pilot Monitoring
If maneuvering is required, disengage the autopilot and autothrottle. Smoothly adjust pitch and thrust to satisfy the RA command. Follow the planned lateral flight path unless visual contact with the conflicting traffic requires other action.	
Attempt to establish visual contact. Call out any conflicting traffic.	

For a climb RA in landing configuration:

Pilot Flying	Pilot Monitoring
Disengage the autopilot and autothrottle. Advance thrust levers forward to ensure maximum thrust is attained and call for FLAPS 20. Smoothly adjust pitch to satisfy the RA command. Follow the planned lateral flight patch unless visual contact with the conflicting traffic requires other action.	Verify maximum thrust set. Position flap lever to 20 detent.
Command to retract gear after positive climb rate established.	Landing gear levers UP.
Try to establish visual reference. Call out immediately in case of any flight conflict.	

5.7 Terrain Avoidance

5.7.1 Training Purpose

Pilots should be able to distinguish the difference between ground proximity caution and ground proximity warning. When the GPWS of the airplane produces a ground proximity caution or ground proximity warning aurally, pilots may advance thrust levers to forward limit immediately, do not use overpressure thrust unless ground contact is a factor, simultaneously pull the control column to control the airplane to avoid obstacles and terrain effectively.

5.7.2 Indications and Conditions

The Ground Proximity Warning System (GPWS) PULL UP Warning occurs when an unsafe distance or closure rate is detected with terrain below the airplane. The Look-ahead terrain alerting (as installed) also provides an aural warning when an unsafe distance is detected from terrain ahead of the airplane. Immediately accomplish the Terrain Avoidance maneuver found in the non-normal maneuvers section in the QRH.
Do not attempt to engage the autopilot and/or autothrottle until terrain clearance is assured.

5.7.3 Control techniques

Ground Proximity Caution

Accomplish the following maneuver for any of these aural alerts*:

- CAUTION TERRAIN
- TERRAIN
- DON'T SINK
- GLIDESLOPE
- SINK RATE
- TOO LOW FLAPS
- TOO LOW GEAR
- TOO LOW TERRAIN
- BANK ANGLE

Pilot Flying	Pilot Monitoring
Correct the flight path or the airplane configuration.	

The below glideslope deviation alert may be cancelled or inhibited for:

- localizer or backcourse approach
- circling approach from an ILS
- when conditions require a deliberate approach below glideslope
- unreliable glideslope signal.

Note: If a terrain caution occurs when flying under daylight VMC, and positive visual verification is made that no terrain hazard exists, the alert may be regarded as cautionary and the approach may be continued.

Note: *As installed, some repeat.

Ground Proximity Warning

Accomplish the following maneuver for any of these conditions:

- activation of the "PULL UP" warning
- activation of the "TERRAIN TERRAIN PULL UP" warning
- other situations resulting in unacceptable flight toward terrain.

Pilot Flying	Pilot Monitoring
• Disengage autopilot. • Disconnect autothrottle. • Aggressively apply maximum* thrust.	• Verify maximum* thrust.
• Simultaneously roll wings level and rotate to an initial pitch attitude of 20°. • Retract speedbrakes. • If terrain remains a threat, continue rotation up to the pitch limit indicator or stick shaker or initial buffet.	• Verify all required actions have been completed and call out any omissions.

• Do not change gear or flap configuration until terrain separation is assured. • Monitor radio altimeter for sustained or increasing terrain separation. • When clear of the terrain, slowly decrease pitch attitude and accelerate.	• Monitor vertical speed and altitude(radio altitude for terrain clearance and barometric altitude for a minimum safe altitude). • Call out any trend toward terrain contact.

Note: Aft control column force increases as the airspeed decreases. In all cases, the pitch attitude that results in intermittent stick shaker or initial buffet is the upper pitch attitude limit. Flight at intermittent stick shaker may be required to obtain positive terrain separation. Smooth, steady control will avoid a pitch attitude overshoot and stall.

Note: Do not use flight director commands.

Note: * Maximum thrust can be obtained by advancing the thrust levers to the takeoff or go-around limit. On airplanes with EEC's operating normally, the pilot may advance the thrust levers full forward. If terrain contact is imminent, advance thrust levers full forward.

Note: If positive visual verification is made that no terrain hazard exists when flying under daylight VMC conditions prior to a terrain warning, the alert may be regarded as cautionary and the approach may be continued.

Chapter 6 Non-normal Operations

6.1 Preface

Preface

This chapter describes pilot techniques associated with accomplishing selected Non-Normal Checklists (NNCs) and provides guidance for situations beyond the scope of NNCs. Aircrews are expected to accomplish NNCs listed in the QRH. These checklists ensure maximum safety until appropriate actions are completed and a safe landing is accomplished. Techniques discussed in this chapter minimize workload, improve crew coordination, enhance safety, and provide a basis for standardization. A thorough review of the QRH section CI.2, (Checklist Introduction, Non-Normal Checklists), is an important prerequisite to understanding this chapter.

Non-Normal Situation Guidelines_

When a non-normal situation occurs, the following guidelines apply:

- **NON-NORMAL RECOGNITION**: The crewmember recognizing the malfunction calls it out clearly and precisely
- **MAINTAIN AIRPLANE CONTROL**: It is mandatory that the Pilot Flying (PF) fly the airplane while the Pilot Monitoring (PM) accomplishes the NNC. Maximum use of the autoflight system is recommended to reduce crew workload
- **ANALYZE THE SITUATION**: NNCs should be accomplished only after the malfunctioning system has been positively identified. Review all caution lights, warning lights, and EICAS messages to positively identify the malfunctioning system(s)

  Note: Pilots should don oxygen masks and establish crew communications anytime oxygen deprivation or air contamination is suspected, even though an associated warning has not occurred.
- **TAKE THE PROPER ACTION**: Although some in-flight non-normal situations require immediate corrective action, difficulties can be compounded by the rate the PF issues commands and the speed of execution by the PM. Commands must be clear and concise, allowing time for acknowledgment of each command prior to issuing further commands. The PF must exercise positive control by allowing time for acknowledgment and execution. The other crewmembers must be certain their reports to the PF are clear and concise, neither exaggerating nor understating the nature of the non-normal situation. This eliminates confusion and ensures efficient, effective, and expeditious handling of the non-normal situation

- **EVALUATE THE NEED TO LAND**: If the NNC directs the crew to plan to land at the nearest suitable airport, or if the situation is so identified in the QRH section CI.2, (Checklist Instructions, Non-Normal Checklists), diversion to the nearest airport where a safe landing can be accomplished is required. If the NNC or the Checklist Instructions do not direct landing at the nearest suitable airport, the pilot must determine if continued flight to destination may compromise safety.

Approach and Landing

When a non-normal situation occurs, a rushed approach can often complicate the situation. Unless circumstances require an immediate landing, complete all corrective actions before beginning the final approach.

For some non-normal situations, the possibility of higher airspeed on approach, longer landing distance, a different flare profile or a different landing technique should be considered.

Plan an extended straight-in approach with time allocated for the completion of any lengthy NNC steps such as the use of alternate flap or landing gear extension systems. Arm autobrakes and speedbrakes unless precluded by the NNC.

Note: The use of autobrakes is recommended because maximum autobraking may be more effective than maximum manual braking due to timely application upon touchdown and symmetrical braking. However, the Advisory Information in the PI chapter of the QRH provides Non-Normal Configuration Landing Distance data based on the use of maximum manual braking. When used properly, maximum manual braking provides the shortest stopping distance.

Fly a normal glide path and attempt to land in the normal touchdown zone. After landing, use available deceleration measures to bring the airplane to a complete stop on the runway. The captain must determine if an immediate evacuation should be accomplished or if the airplane can be safely taxied off the runway.

6.2 Reject Takeoff

Principle:

The captain has the sole responsibility for the decision to reject the takeoff. The decision must be made in time to start the reject takeoff maneuver by V1. If the decision is to reject the takeoff, the captain must clearly announce "Reject," immediately start the reject takeoff maneuver, and resume control of the airplane. If the first officer is making the takeoff, the first officer must maintain control of the airplane until the captain makes a positive input to the controls.

Prior to 80 knots the takeoff should be rejected for any of the following:

- activation of the master caution
- system failure(s)
- unusual noise or vibration
- tire failure
- abnormally slow acceleration
- takeoff configuration warning
- fire or fire warning
- engine failure
- if a side window opens
- predictive windshear warning
- if the airplane is unsafe or unable to fly.

Above 80 knots and prior to V1, the takeoff should be rejected for any of the following:

- fire or fire warning
- engine failure
- predictive windshear warning
- if the airplane is unsafe or unable to fly.

During the takeoff, the crew member observing the non-normal situation will immediately call it out as clearly as possible.

Operation procedures:

Condition	(Left seat, Captain_	(Right seat, First Officer_
Prior to 80 kts, during takeoff if system failure(s), unsafe warning or any failure indication occurs; Between 80 KTs to V1 if engine failure, fire warning, predictive windshear warning or if the captain thinks the airplane is unsafe or unable to fly.	♦ Judge it and make decision ♦ Reject takeoff and simultaneously_ ♦ Close both thrust levers. ♦ Disengage the autothrottle. ♦ Raise speedbrake lever manually. ♦ Apply maximum manual wheel brake,or verify RTO autobrake operative ♦ If RTO autobrakes is engaged, monitor system performance and apply manual braking if the AUTO BRAKE DISARM light illuminates or deceleration is not adequate ♦ Apply the maximum amount of reverse thrust consistent with conditions ♦ Continue maximum braking until ensure the airplane will stop on the runway.	♦ Call out the failure or non-normal indication. Verify actions as follows: ♦ Thrust levers closed. ♦ Autothrottle disengaged. ♦ Verify Speed Brake lever UP and call "Speed Brake UP." ♦ If Speed Brake lever is not UP, call "Speed Brakes NOT UP." ♦ Use maximum brake ♦ Verify use of thrust reversers ♦ Call out any omitted action items.
	Field length permitting: ♦ Initiate movement of the reverse thrust levers to reach the reverse idle detent by taxi speed.	♦ Call out "60 knots" ♦ Notifiy control tower and cabincrew as soon as practical

Notes:

Consider the following:

- The possibility of wheel fuse plugs melting
- The need to clear the runway
- The requirement for remote parking
- Wind direction in case of fire
- Alerting fire equipment
- Not setting the parking brake unless passenger evacuation is necessary
- Advising the ground crew of the hot brake hazard
- Advising passengers of the need to remain seated or evacuate
- Completion of Non–Normal checklist (if appropriate) for conditions which caused the RTO

6.3 Tail Strike

Phenomenon:

Tail strike occurs when an airplane tail section or lower aft fuselage contacts the runway. Anytime fuselage contact is suspected or known to have occurred, accomplish the Tailstrike Checklist.

Cause

Takeoff

- Improper stabilizer trim
- Incorrect rotation speed
- Trim when rotating
- Too high the rotation rate
- Improper use of F/D

Landing

- Unstabilized approach
- Leveling off during flare
- Mishandling of crosswind
- Too large attitude when pitch up during go around

Operation procedure (Tailstrike on takeoff):

<table>
<tr><th>condition</th><th>PF</th><th>PM</th></tr>
<tr><td rowspan="2">Tail strike on takeoff with EICAS message “TAIL STRIKE”</td><td>1)Control the airplane to avoid excess maneuvering load.
3)Return for landing.
4)“Tailstrike Checklist”</td><td>2)Notify ATC the decision of return to land.

5)Do the Tailstrike Checklist</td></tr>
<tr><td colspan="2">Notify cabin crew and passengers the decision to return to land.</td></tr>
<tr><td>After landing</td><td colspan="2">Determine taxi route and park according to the situation.</td></tr>
</table>

Operation procedure (Tailstrike on landing):

condition	PF	PM
Tail strike on landing with EICAS message of "TAIL STRIKE"	2)Taxi normally and decelerate to vacate runway. 4)Taxi to bay according to ATC command.	1)Do standard callouts according to normal procedures. 3)Readback ATC taxi clearance.

6.4 Pneumatic System

6.4.1 Cabin Auto Pressurization inoperative

Judgement and decision:

When the flight crew detects an auto pressurization failure light/s or abnormal differential pressure with pressurization change, execute Auto Fail/Unscheduled Pressurization Change checklist (does not exclude selection of MAN on the pressurization mode selctor to control the outflow valve and cabin altitude as a RECALL ITEM if required). If the pressurization system **cannot control** the cabin altitude, descend to lower altitude, check the route for obstacle clearance and available fuel, select the suitable airport to land.

Operation procedure:

condition	PF	PM
CABIN AUTO INOP information appears on EICAS	Control the airplane status Announce “Cabin Automatic Inoperative Checklist”	Do the Cabin Automatic Inoperative Checklist
The pressurization can be controlled	Monitor pressurization, continue the flight	
The pressurization cannot be controlled	Notify ATC descend to lowest safe altitude or 10,000 feet, whichever is higher. Select the suitable airport for landing.	

Note: Recommended cabin rate is approximately 500 ft/m for climb and descent.

Recommended cabin altitude in cruise is:

FLIGHT LEVEL	CABIN ALTITUDE
Up to 230	Landing Field Elevation
260	2000
300	4000
350	6000
400 and above	8000

6.4.2 Cabin Rapid Depressurization and Emergency Decent

Judgement and decision:

The following situations can be considered as cabin pressurization system malfunction:

1. When the plane altitude is more than 14,000 feet MSL, the cabin pressure will decrease quickly. Ear equalization discomfort and difficulty in breathing will occur, cabin altitude will increase and differential pressure will decrease rapidly, cabin climb rate may indicate maximum. When the cabin altitude has passed 10,000 feet, the cabin warning horn sounds; the red waring information of "CABIN ALTITUDE "on EICAS appears.
2. In case of system malfunction, first the red information of "CABIN AUTO INOP" appears on EICAS. If the cabin pressure cannot be controlled, or if the red warning information of "CABIN ALTITUDE" appears on EICAS, it is considered as cabin depressurization.

If cabin altitude increases rapidly and the cabin pressure cannot be controlled, when the cabin altitude is above 14000 feet, the passenger oxygen masks fall off automatically, the flight crew should complete **Cabin Altitude or Rapid Depressurization Checklist** and Notify ATC.

Oxygen lack reactions:

Cabin Altitude	Symptoms
10000 feet	Headache, fatigue
14000 feet	Sleepiness, headache, syncope, eyesight weakness, musle incoordination, nails turning purple
18000 feet	The memory declines, the similar symptoms worsen.
22000 feet	Convulsion,prostration,obfuscation,shock
28000 feet	Prostration and loss of consciousness occurs in 5 minutes

Effective awareness time

Altitude	Awareness time:
22000 feet	5-10 minutes
25000 feet	3-5 minutes
30000 feet	1-2 minutes
35000 feet	30 seconds
40000 feet	15 seconds

For persons who are unfit, smoke, stressed,etc., the reaction may be more severe and the effetive time of awareness (time of useful consciousness) will be less.

The Rapid Depressurization Phenomenon

The rapid depressurization phenomenon refers to a rapid cabin pressure loss. It maybe because of airframe damage, duct leaks or breaks, any door/window failure, explosion or weapon discharge,damaging the pressurized fuselage and signs as follows:

1_ Cabin climb rate increases rapidly.
2_ Cabin altitude increases rapidly.
3_ The body feels expanded with ear drum equalization problems.
4_ If the airframe is visibly damage and cabin air turbulence occurs.
5_ Cold air enters into the cabin, the temperature decreases rapidly.
6_ Strong airflow, fog/misting of the cabin air may be produced.
7_ When the cabin altitude passes 10,000 feet, the cabin altitude aural warning sounds and red warning information"CABIN ALTITUDE" appears on EICAS.
8_ When the cabin altitude is 14,000 feet, the passenger oxygen mask deploys automatically.

Operation proceudure:

condition	PF	PM
Cabin rapid deressurization	♦The captain, first officer should immediately remove the headset/boom mic and place on and breathe through the quick doning mask and establish flight crew communication.	
Handling	♦Hold and monitor the airplane status	♦Cut off the cabin altitude aural warning ♦Check outflow valve is OFF. If not in OFF, manually turn if off.
The cabin pressure **can be controlled** (the cabin rate changes to descend and the cabin altitude does not increase)	♦Manually pressurize and continue flight.	
The cabin rapidly depressurizes, or the cabin pressure can not be controlled, red waring information "CABIN ATTITUDE" appears on EICAS	♦Announce "Emergency Descent " ♦Notify the cabin with PA to carry out the emergency descent " I am the captain, the airplane will descend rapidly, please fasten your seat belt and put on your oxygen mask"	♦Passenger Signs -- ON. ♦Engine Start switches --CONT. ♦Passenger Oxygen Switch --ON ♦Transponder 7700 ♦Notify ATC and acquire altimeter settings

Emergency descent:

	♦Select HDG SEL, deviate route according to area operation requirements ♦Set lower altitude in the altimeter window. ♦Select FL CH ♦Thrust levers – idle ♦Speed brake lever – UP. ♦Reset the speed to about MMO/VMO −10 kts (if the structural damage is suspected, limit speed and avoid excessive maneuvering loads) ♦Set the minimum safety altitude or 10000 feet, whichever is higher.	♦Check the route safety altitude and report to captain ♦Check the deviation distance in Progress Page 2 or select deviation distance in ROUTE page and execute ♦Confirm that Recall Items completed ♦Use the current frequency and 121.5 to transmit the emergency situation (MAYDAY MAYDAY MAYDAY). ♦Monitor airplane status ♦Observe other aircraft. ♦Report the deviation distance
	♦When the situation permits, call "Cabin Altitude or Rapid Depressurization Checklist" ♦Monitor the airplane status	♦Do the Cabin Altitude or Rapid Depressurization Checklist
♦2000 feet to level off	♦Reduce speed to required cruising speed	♦"2000 feet to level off".

♦Transition level	♦Set the altimeter as required	
♦1000 feet to level off	♦Retract the speed brake lever smoothly	♦"1000 feet to level off".
♦Level off altitude	♦Maitain the level off altitude and confirm that ALT HOLD is displayed on the FMA. Remove the oxygen mask and resume the normal flight crew communication. Oxygen must be used when the altitude is above 10,000 feet. Put the Normal/100% selector to Normal position to save oxygen.	
	♦If the checklist is not completed, announce "Continue the Cabin Altitude or Rapid Depressurization Checklist ". ♦Review fuel status. ♦Search for the nearest suitable airport. ♦Decide and announce the flight intentions.	♦Continue to complete the Cabin Altitude or Rapid Depressurization Checklist. ♦Level off altitude and flight speed should be input into the CDU as required. ♦Confirm with Cabin Crew on damage or injuries. ♦Notify the Captains intention to ATC.
♦Fly to the nearest suitable airport to land according to the airplane status.		

Notes:

1. When the right seat pilot is PF, in case of rapid depressurization, hand over the control to left seat and the left seat pilot performs the responsibility of PF.
2. Emergency descent aims to descent the airplane to safe altitude in the shortest time and reduce passengers' discomfort as much as possible. Don't be in a hurry and descend in an orderly way.

3. In case of cabin rapid depressurization, the flight crew should don oxygen mask immediately and establish communication, turn on louderspeaker and adjust suitable volume.
4. During emergency descent, crew members should communicate with each other constantly in order to detect incapacitation happened due to lack of oxygen in time.
5. Don't deviate from airway safe width, use parallel airline for flight. If there is need for deviation exceeding 25 km, notify ATC and refer to Grid MORA in high airspace diagram.
6. In case of icing conditions, use engine anti-ice and adjust thrust as required.
7. In case of dangerous weather, turn on radar and make circling plan.
8. Use autopilot and autothrottle, and maintain landing gear up.
9. During flight after speedbrake extended, the flight crew should notice lateral control of the airplane should be gentle and PF should put his hand on the speedbrake lever.
10. Roughly set heading and altitude window at intial descent.
11. In case of doubt about structural integrity, limit airspeed and avoid abrupt maneuver load.
12. During level off with autopilot and airspeed approaching to VMO, reduce speed to lower than VMO and then retract speedbrake to prevent overspeed.
13. Make arrival plan and prevent larger descent rate which can induce large pressure difference resulting in passenger discomfort
14. Red warining information "CABIN ALTITUDE" appears on EICAS. The flight crew should confirm the automatic procedures of the outflow valve.
15. During autoflight with all recall items completed, both pilots should confirm all recall items completed and callout any omited items.

6.4.3 Smoke, Fire or Fumes

Judgement and decision making:

When the cockpit or cabin is found or reported to have smoke,fire or fumes, the flight crew should immediately don oxygen masks and smoke goggles (if necessary) and establish flight crew communication. If the cabin reports smoke, fire or fumes, the cockpit door should be kept closed. Use the interphone to communicate with the Cabin Crew and advise ATC. Make a decision to execute the Smoke, Fire or Fumes checklist or Equipment Smoke Checklist according to nature and types of smoke,fire or fumes, and complete related checklist; in case of uncertainty about complete removal of smoke,fire or fumes, land at the nearest suitable airport.

Operational procedure

condition	PF	PM
Smoke/ fire/fumes	♦ "Smoke or Fire or Fumes Checklist"	♦ Do the Smoke or Fire or Fumes Checklist
Equipment smoke	♦ "Equipment Smoke Checklist"	♦ Do the Equipment Smoke Checklist
Unable to identify completed eradicate smoke or fumes	♦ "Smoke or Fumes Removal Checklist"	♦ Do the Smoke or Fumes Removal Checklist
	♦ land at the nearest suitable airport, and complete the passenger evacuation as required after landing.	

Note:

1. When the flight crew suspects hypoxia, they should don oxygen masks and establish flight crew communication. Put on the oxygen mask and smoke goggle (if necessary). If there is smoke in the mask or goggles, press the emergency button to purge the smoke.
2. After depressurization, decelerate to holding airspeed if needed, open the PM's cockpit window to remove smoke (proably unable to open the window in case of high speed).Due to heavy noise, ATC should be informed and cockpit normal communication should be ensured.
3. When the cabin has on fire or there is smoke in the cabin, it is forbidden to select the Passenger Oxygen switch to ON.

6.5 Electrical

Approach and Landing on Standby Power

The probability of a total and unrecoverable AC power failure is remote. Because of system design, a NNC for accomplishing an approach and landing on standby power is not required. However, some regulatory agencies require pilots to train for this condition. During training, or in the unlikely event that a landing must be made on standby power, the following guidelines should be considered.

Fly the approach on speed. Antiskid is not available, and with the higher approach speed, any excess speed is undesirable. Auto speedbrakes are not available. Thrust reversers are available on many, but not all airplanes. Verify thrust reverser availability with the appropriate FCOM.

6.6 Engine
6.6.1 Abort Engine Start:
Judgement and decision making:

Do the Aborted Engine Start Checklist for one or more of the following abort start conditions:

- EGT does not increase by 20 seconds after the fuel control switch is moved to RUN
- No N1 rotation when the EGT increases
- If EGT is rapidly approaching or exceeding the start limit
- N2 is not stabilized at idle by 2 minutes after the fuel control switch is moved to RUN
- Oil pressure indication is not normal by the time that the engine is stabilized at idle

Operation procedrue

Captain(left seat_	F/O (right seat_
	♦ Call out failure or abnormal indication
♦ "Abort Engine Start" Fuel control switch cut off," Timing"	♦ Timing
♦ "Aborted Engine Start Checklist"	♦ Do the Aborted Engine Start Checklist ♦ Advise ground maintenance engineer ♦ Advice ATC and dispatch

Considerations:

1. During engine start, the captain and F/O should monitor the engine indications closely, and call out any abonormal indications.
2. Starter duty cycles shall be strictly followed before any further start attempts.
3. In case the cause for aborted engine cannot be identified, it is prohibited to try to restart before troubleshooting.
4. In case of rapidly increasing EGT, the Captain should select the Fuel Control switch to CUTOFF without delay to avoid EGT start limit exceedances.
5. Two-way communitation should be held with ground maintenance engineer during engine start.

6.6.2 Engine Failure

During takeoff

Judgement and decision

Engine failure during takeoff roll and possibly accompanied with direction yaw, noise changes and/or vibrations of the aircraft.

Engine failure before V1_Perform reject takeoff procedure

Engine failure after V1_Continue to takeoff

ILS approach operation procedure with engine faiure after V1:

Condition	PF	PM
	Takeoff phase	
Flaps 5 takeoff. Engine failure after V1	♦ "Continue" ♦ Control centerline tracking using rudder inputs.	♦ Verify failure, call out "X engine failure" ♦ Monitor aircraft status
VR	♦ Rotate smoothly to 12_13° pitch to maintain airspeed V2_V2+15_ and use rudder as required to control the track and make the control wheel neutral	♦ "Rotate"
Positive rate.	♦ Verify positive rate of climb and Call "Gear up".	♦ "Positive rate" ♦ Gear up ♦ Monitor aircraft status and engine parameters and call out any abnormal indications

400feet AGL.	♦ "Heading Select, Advise ATC"	♦ "400" ♦ Push HDG SEL, adjust as required to correct track. ♦ Inform ATC of associated malfunction and crew's intention
Climb phase		
1,000feet AGL or obstacle clearance altitude, whichever is higher.	♦ "V/S+200"	♦ "1,000" ♦ Set climb rate to +200 ft/m
Speed above Vref 30+40	♦ "Flaps 1"	♦ "Vref 30+40" ♦ Move Flap lever to 1 and monitor flap movement
Speed above Vref 30+60	♦ "Flaps UP"	♦ "Vref 30+60" ♦ Move Flap lever to UP and monitor flap movement
Speed above Vref 30+80	♦ "Flight Level Change, select CON" ♦ Verify FMA ♦ When aircraft is trimmed properly_ ♦ "Engage A/P"as reqired.	♦ "Vref 30+80" ♦ Press FL CH ♦ Verify FMA ♦ Select CON ♦ Adjust EPR to maximum continuous thrust. ♦ Verify A/P engaged

Initial turning Safety altutude		♦ Inform ATC of crew's definite intention
When A/C is stable	♦ "Engine Failure or Shutdown Checklist" ♦ Continue to climb to ATC assigned altitude.	♦ Complete Engine Failure or Shutdown Checklist.
After Engine Failure or Shutdown_checklist	♦ "After Takeoff Checklist".	♦ Do the After Takeoff Checklist ♦ Request landing information and advise Cabin Crew
Approach preparation phrase		
Proceed to approach point.	♦ "Flaps 1_Set speed Vref 30+60" ♦ "Flaps 5_Set speed Vref 30+40"	♦ Put flap lever to 1 detent, verify flaps 1, and call "Flaps 1 set" ♦ Put flap lever to 5 detent, verify flaps 5, and call "Flaps 5 set"
When ATC approach clearance is received	♦ "You control" ♦ Complete approach preparation and briefing	♦ "I control"
	♦ "I control" ♦ "Descent and Approach Checklist" ♦ Verify landing conditions	♦"You control" ♦ Do the"Descent and Approach Checklist" in Deferred Items
ILS approach landing		
intercept course	♦ "Arm LOC"	♦ Verify ILS callsign correct ♦ Check FMA "LOC armed"

Capture LOC	♦ Check LOC established	♦ "Localizer Alive" ♦ "Localizer Captured"
	♦ "APP armed	♦ Check "APP armed" displayed in FMA
Glide slope one dot	♦ "Gear Down, Flaps 20, Set Vref 20+(wind adjustment) ♦ Arm speedbrake	♦ "Glide Slope One Dot" ♦ Gear Down_Flaps 20 ♦ Verify three green lights illuminated ♦ Reset fuel balance
Glideslope is captured	♦ " Set Go Around Altitude" ♦ Check FMA display correct ♦ "Landing Checklist"	♦ "Glideslope Captured" ♦ Check missed approach altitude ♦ Check FMA display correct ♦ Complete Landing Checklist in Deferred Items
Final approach	♦ Monitor aircraft and make standard callouts, A/P off when runway is in sight.	
Landing rollout	♦ Use operating engine's reverser only. ♦ Check speedbrake fully extended. ♦ Control aircraft direction.	♦ Report "Speedbrake Up, "Reverser Thrust Unlocked" and Autobrake operation
Parking	♦ Vacate runway as appropriate, complete Engine Shut Down Checklist as appropriate after engine shut down.	♦ Shut down engines and complete Engine Shutdown Checklist as appropriate.

767-300 flap extension schedule

Present flap position	At"F" or speed(knots)	Selected flaps	Command speed according to selected flaps
UP	"F" Vref 30+80	1	Vref 30+60
1	"F" Vref 30+60	5	"F" Vref 30+40
5	"F" Vref 30+40	20	Vref 30+20
20	"F" Vref 30+20	25 or 30	Vref 25 or Vref 30+ wind adjustment

B767-300 one engine lift off attitude

Type	Flaps	Lift off attitude (degrees)	Minimum tail clearance inch_cm_
300	5,15,20	8	12(30)

Considerations:

1. Shadowed part_when the A/P is engaged, PF orders and sets; when manual flight, PF orders and PM does action.
2. During takeoff roll, PM should callout "X Engine Failure.
3. Take caution incase of engine failure on takeoff, the range of travel the column control wheel is higher than normal.
4. During flaps retraction, if no F/D selected ON, the airspeed and attitude are the main reference for maintaining pitch attitude; reduce pitch to 7-8° and maintain 0—200FT/min climb rate.
5. Adjust rudder trim to center the control wheel based on the speed, thrust and configuration changes.

6. Limit bank angle to 15 degrees using takeoff flaps and until reaching V2+15 kts. Limit bank angle to maximum 30 degrees when maintaining V2+15 kts or greater.
7. Noise abatement takeoff is not followed in case of an engine failure.
8. In case of engine failure when using reduced thrust takeoff, full thrust may be used based on aircraft performance. If it is required, set to full thrust manually.
9. Rudder trim should be used above 400ft AGL and aircraft is under control. A/P engagement is recommended after clean up.
10. During engine shutdown using non-recall items found in the QRH, **PF guards the operating Engine Thrust Lever and Fuel Control Valve**, PM will shutdown the thrust lever of the affected engine and cutoff the fuel control valve under the confirmation of the PF.
11. Fuel Crossfeed Valve should be closed during approach and landing
12. Set rudder trim to 0 before landing to provide full rudder authority when thrust lever is retarded. However, this can be performed by the PM above 500 ft (above landing elevation) under PF's order. When rudder trim is not selected to 0 before landing, it requires high force to maintain runway centerline by using rudder during landing roll (recommended set back to 0 on slippery and wet runway)
13. After landing with single engine, it is recommended to vacate the runway and stop the airplane except in case that engine fire, severe damage or landing gear problems and so on require immediate passenger evacuation.
14. During single engine operation, flaps may be retracted according to actual conditions.

6.6.3 SINGLE ENGINE MISSED APPROACH

Judgement and decision:

The missed approach requirement is the same as with all engines, the Captain should go around immediately when visual reference is not sufficient when reaching minimums, deviation exceeds limit or not within standlized approach criteria.

Operation procedure:

Condition	PF	PM
Captain must go around immediately when approach lights can not be contacted or a stable approach is not established.	♦ "Go Around, Flap5, Set Go Around Thrust" ♦ Press GA switches, and at the same time manually advance thrust levers and adjust go around attitude follow F/D, maintain target speed Vref20+5, use rudder pedals to control A/C track and keep control wheel as neutral as possible ♦ Check FMA	♦ "DA , Negative contact (runway not in sight)" ♦ Retract flap to 5, check indication ♦ Set go around EPR ♦ Check FMA ♦ Monitor A/C status and engine parameters
Positive rate of climb	♦ Verify positive rate "Gear Up"	♦ "Positive Rate " ♦ "Gear Up"
400feet AGL	♦ "HDG Select(L NAV is recommended if FMC has missed approach route), modify track, inform ATC" ♦ Check FMA	♦ "400" ♦ Press HDG SEL or LNAV set heading ♦ Verify FMA ♦ Report ATC
Stabilized status	♦ After takeoff checklist	♦ Put landing gear lever to OFF, speedbrake to Down detent ♦ Perform After takeoff checklist
Re-approach	♦ Suplemetary briefing content ♦ Descent and approach checklist	♦ Perform Descent and approach checklist

Considerations:

1. Good teamwork/CRM and effective A/C control is required for single engine go around.
2. During missed approach, PM MUST monitor engine parameters and set N1 to missed approach limit promptly.
3. When missed approached thrust is applied, the direction of A/C shall be controlled by proper and smooth rudder inputs and the Control Wheel kept as neutral as possible.

6.6.4 ENGINE FAILURE ON FINAL

Judgement and decision

Engine failure on final is a rare occurance, the flight crew must monitor engines' parameter during each approach. In case of engine failure, unexpected yaw happens , speed decreases and the airplane tends to sink below the glide slope and at the same time EICAS information appears. **The captain must** control the airplane status immediately. The decision for continuing approach or performing a Missed Approach is very important. HNA recommends two phrases: above 1000 feet and below 1000 feet. In case of engine failure during these two phases, the captain should make decision and announce according to airplane status at that time. In all ,controlling the airplane status is always the first thing to do.

Operation procedure above 1000 feet:

Conditions	PF (CM1)	PM (CM2)
When A/C is in landing flap configuration and engine fails on final or thrust reduces, Captain decides to continue the Approach.	♦ Controls the A/C, verify failure ♦ "Continue Approach" ♦ "Flaps 20_set VREF20+5_Ground Proximaty Flap Inhibit"	♦ Verify failure_"X engine failure". ♦ Set flaps 20_set MCP VREF20+5_Ground Proximaty Flap Inhibit.
Continue Approach.	♦ Land the aircraft smoothly	♦ Related call outs.

Landing rollout and stop.	♦ Vacate runway and stop when clear, "Engine Failure or Shutdown Checklist"	♦ Perform Engine Failure or Shutdown Checklist ♦ Advice ATC and HNA Dispatch Office, arrange towing truck.
When runway is vacated	♦ Perform engine shutdown procedure, "Engine Failure or Shutdown checklist"	♦ Once runway vacated ♦ Complete "Shutdown checklist"

Operation procedure below 1000 feet:

Conditions	PF	PM
When A/C is in landing flap configuration and engine fails on final or thrust reduces, Captain decides to continue the Approach.	♦ verify failure ♦ "Continue Approach"_control A/C immediately, apply thrust, use rudder, adjust pitch attitude.	♦ Verify failure_"X Engine Failure" ♦ Monitor A/C status and engine parameters ♦ Advise ATC
Continue approach.	♦ Land the aircraft smoothly.	♦ Related call outs
Landing rollout and stop	♦ Vacate runway and stop when clear, "Engine Failure or Shutdown Checklist"	♦ Perform Engine Failure or Shutdown Checklist ♦ Advice ATC and HNA Dispatch Office arranging towing truck.

After runway vacated	♦ Perform shutdown procedure, "Engine Shutdown Checklist"	♦ Complete runway vacated procedure ♦ Complete "Engine Shutdown Checklist"

Considerations:

1. In case of engine failure on final approach, Flight Crew should judge properly and correctly, make decision of continuing or performing a go around promptly.
2. When an engine failure occurs, the most important is control of the aircraft and to land safely as soon as possible.
3. If time permits, complete Engine Failure or Shutdown Checklist.
4. Incase of an engine failure on Final, crew should decide to go around at any phase when unable to maintain approach conditions.
5. At low altitude, when landing with flaps 30, missed approach flaps is 20; when landing with flaps 20, Missed Approach flaps is 5.

6.6.5 ENGINE FAILURE DURING MISSED APPROACH

Judgement and decision

In case of an engine failure during the missed approach, normal Missed Approach Procedure shall be followed (if no performance issues exist) to control aircraft and standard callouts made. PF Also monitor lateral deviation and pitch changes to control missed approach track by using rudder. Rely on and follow F/D commands and monitor and check FMA indications at the same time until above initial maneuvering and safety altitude. PM should call out "X Engine Failure" promptly and correctly and at the same time confirm maximum go around EPR is set, airplane status and engine parameters are monitored.

Operation procedure:

Conditoins	PF	PM
Engine failure during missed approach or unexpected thrust reduction	♦ Engine failure during Missed Approach or unexpected thrust reduction, perform normal missed approach procedure and standard call outs.	
	♦ Verify failure. ♦ "Set Go Around Thrust" ♦ Use rudder, control A/C and missed approach track. Follow F/D, adjust pitch attitude, maintain the required airspeed.	♦ Verify failure_"X Engine Failure" ♦ Set go around thrust, and call:"Go Around Thrust Set" ♦ Monitor aircraft and flight track, call out any deviation timely and correctly and any abnormal indication.
	♦ "HDG select_LNAV is recommended if missed approach procedure stored in FMC_,Correct Track, notify ATC" ♦ Check FMA	♦ "400" ♦ Press HDG SEL or LNAV ♦ Adjust HDG ♦ Check FMA ♦ Report ATC and dispatch
	♦ "Complete Engine Failure or Shut down Checklist" ♦ "After Takeoff Checklist"	♦ Perform Engine Failure or Shut down Checklist. ♦ Move landing gear lever to OFF, speedbrake to Detent. ♦ Perform After Takeoff Checklist

Make a new approach	♦ Briefing again. ♦ "One Engine Inoperative Landing Checklist"	♦ Perform One Engine Inoperative Landing Checklist.
♦ Complete single engine landing and parking procedure.		

Notes:

1. During approach, besides that the flight crew should complete normal missed approach procedures, PF should immediately apply rundder to control airplane status in case of engine failure, maintain control column in middle position, keep missed approach path and ensure missed approach climb step requirement is satisfied. PM should enhance monitoring airplance status besides normal crew coordination.
2. During approach, the flight crw should rely on guidance, monitor airspeed and verify FMA indications.
3. Do go-around according to ATC or publicized missed approach procedures. Due to thrust variation induced by engine failure, immediately adjust pitch attitude after engine failure, prevent nose up largely and airspeed from decreasing too rapidly.
4. Maintain flaps 20 and observe pitch command. Limit bank angle to 15 degrees before flaps 20 manuver speed is reached and until intial maneuver flight is completed and safe altitude is reached.
5.

6.6.6 ENGINE FAILURE IN FLIGHT (climb, cruising, descent)

In flight, it is important for the Flight Crew to maintain aircraft control and monitor flight instrument indications. The aircraft control in climb, cruise and descent with an engine failure is different from engine failure during takeoff. The aircrafts single engine altitude capability is very important to consider. The Pilot should try to use rudder trim and autopilot, and all the available resourses to manage the flight path. Determine the engine failure altitude by using FMC CDU Engine Failure advisory page, execute Engine Failure Drift Down procedure as required, select the nearest suitable alternate (airport weather conditon at the alternate airport, check NOTAMS), check the en-route safety altitude, remaining fuel, report to ATC your intentions, report the ETA, **do not use** FMC fuel predictions (confirm with fuel-flow and groundspeed). In all_ maintaining flight track and airspeed is the most important thing in case of an engine failure. Good teamwork and effective CRM is is one of the keys to guarantee flight safety.

Operation procedure:

Condit-ions	PF	PM
Engine failure.	♦ Verify failure, ♦ Control A/C and trim the aircraft. ♦ Check and confirm AP , disengage A/T.	♦ Verify failure_"X Engine Failure" ♦ Monitor A/C status ♦ Squak 7700
	♦ **Duing climb and descent**_"Select MCT", set MCT manually as required ♦ Select LVL CHG or ALT HOLD on MCP ♦ Select Engine Out climb page on CDU, "Advise ATC"	♦ Select CON in TSMP and verify ♦ Check FMA ♦ Select CDU, check Engine Failure altitude and report to PF ♦ Advise ATC
	♦ **During cruise:** Refer to One engine drift down procedure in 6.20	
	♦ Prepare return(alternate) plan ♦ Adjust required airspeed ♦ Engine failure/ shutdown checklist ♦ Complete in-flight engine start according to situations ♦ Complete approach briefing to land as soon as possible	♦ Inform ATC of captain intention ♦ Revise destination and flight route plan in CDU ♦ Perform Engine failure/shutdown checklist ♦ Cooperate captain to complete approach and landing in an orderly way
	Engine out landing and parking procedure completed	

Notes:

1. Engage the autopilot when an engine failure occurs, provides more situational awareness to handle the malfunction and carry out more effective management.
2. Land at nearest suitable airport when an engine failure occurs, and the one hour cruise flight time must not be exceeded.
3. Attempt an inflight start if applicable.

6.6.7 In-flight start

Judgement and decision:

The Flight Crew must confirm that the failed engine is not damaged or the shutdown was intentional by the flight crew. In-flight Start could be considered after completing the Engine Failure or Shutdown Checklist. If the decision is made, the PM shall perform the Engine In-Flight Start Checklist when the altitude and airspeed is within the envelope. It should be supervised and confirmed by the PF. PF should always monitor the airplane status, answer the checklist content and monitor the engine start. Abort the In-flight Start resolutely when the engine indications are abnormal during in-flight engine start.

Operation procedure:

condition	PF	PM
After executing the Engine Failure or Shutdown Checklist, make sure that the engine is not damaged or has been shut down intentionally.	♦ Monitor airplane condition ♦ "Engine In-flight Start Checklist" ♦ Reply and crosscheck the checklist content, monitor PM actions and engine parameters.	♦ Carry out Engine In-flight Start Checklist ♦ When the engine parameter is abnormal, abort start attempt immediately

Engine start successfully	♦ Check engine has stabilized at idle and indicates normal parameters ♦ Adjust thrust lever while retrimming airplane. ♦ Select the flight altitude, make the decision and notify ATC	♦ After engine parameters stabilized, report "Engine idle stable" ♦ Report engine parameters and engine parameters ♦ Notify ATC of crew intentions
♦ Select the nearest suitable airport to land.		

Notes:

1. Complete the *Engine Failure or Shutdown* Checklist prior to the Engine In-flight start.
2. Make sure that the engine to be started shows no signs of damage.
3. Satisfy the inflight engine start requirement before the engine in-flight start attempt is made.
4. Engine accelerates slowly during heavy rain ingestion.

6.6.8 Loss of thrust on both engines

Judgement and decision:

Loss of thrust on both engines in-flight is a situation under which immediate measures is required regardless of altitude or speed. Recall items for Loss of thrust on both engines should be completed and a larger airspeed should be established to conduct a rapid windmill start to start the engine. The flight crew should use partial instruments of standby electrical power to control airplane status and start APU as quickly as possible to provide power and satisfy requirement for auxiliary start by starter.

Operation procedure:

Condition 1	PF	PM
Loss thrust on both engines.	♦ Use both hands for controlling to descend and mainain a larger airspeed with	♦ Monitor the airplane condition

	windmill start ♦ "Loss Of Thrust On Both Engines Recall Items" ♦ "Notify ATC"	♦ Carry out the Loss Of Thrust On Both Engines Recall Items ♦ Start APU, power ON ♦ Notify ATC (use the NO.1VHF communication before APU power is on_ ♦ Squawk 7700 ♦ Send distress information" MAYDAY ,MAYDAY, MAYDAY"
Start the two engines successfully.	♦ Maintain airplane status and resume automatic flight. ♦ "Loss Of Thrust On Both Engines Checklist " ♦ Decide intentions and notify ATC	♦ Carry out Loss Of Thrust On Both Engines Checklist ♦ Notify ATC of the Captain's intentions
Condition 2	PF	PM
If one engine starts successfully.	♦ Control airplane status(maintain altitude or enter into drift down), engage autopilot at appropriate time ♦ "Engine In-flight Start Checklist" and start another engine	♦ Notify ATC of maintaining altitude or request descent ♦ Perform Engine In-flight Start Checklist ♦ Resume pressurization control as required

Notes:

1. When the right seat is the PF, the control should be handed over to the left seat when thrust on both engines is lost, the left seat should carry out the PF responsibility.
2. Use the instruments available to control the airplane status and use manual stabilizer trimming when thrust on both engines are lost.
3. Start the APU to restore electrical power as soon as possible (no need to wait for the engine to start successfully).
4. When power is ON, the flight crew should confirm and don’t advance thrust levers too early before engine is stabilized.
5. Because the airplane is in slow depressurization status with a dual engine failure, the flight crew must use the oxygen and engage passenger oxygen as required when the cabin altitude exceeds 10,000 ft.
6. After the windmill start of two engines hasn’t been successful, thrust levers should be retarded to idle when doing auxiliary start by starter.
7. A hung or stalled in-flight start is normally indicated by stagnant RPM and/or increasing EGT.
8. During start, engines may accelerate to idle slowly but action should not be taken if RPM is increasing and EGT is not near or rapidly approaching to the limit.

6.6.9 Engine limit/surge/stall

Judgment and decision:

When RPM/EGT unsual, rapidly approaching or exceeding limits or unusual engine noises are heard, or there is no response to thrust lever movement that could indicate an engine limit/surge/stall. The Flight Crew should control the airplane and carry out the Recall Items, plan to land at the suitable airport.

Operation procedure:

Condition	PF	PM
Engine limit/surge/stall.	♦ Control the airplane status ♦ Carry out Engine Limit or Surge or Stall Recall Items ♦ "Engine Limit or Surge or Stall Checklist"	♦ Monitor the engine parameters ♦ Verify Engine Limit or Surge or Stall Recall Iitems ♦ Carry out Engine Limit or Surge or Stall Checklist
	♦ The captain makes decision based on engine conditions and parameter indications, land at the nearest suitable airport and notify ATC	♦ Notify ATC of captain's intentions ♦ Notify Dispatchers of the company ♦ Monitor engine parameters

Notes:

1. Engine limit/surge/stall after lift off, PF should call out Engine Limit or Surge or Stall Checklist Recall Items after the airplane status has been controlled and above 400 feet AGL.
2. PF/PM will both confirm the failed engine thrust lever, PF retards the thrust lever.
3. After thrust levers are retarded, once engine indications are stabilized and EGT decreases, the thrust levers should be advanced slowly while checking RPM and EGT changes. Once the indications are abnormal, retard thrust levers.

6.7 Fire

6.7.1 Engine fire

Judgment and decision:

Engine fire could happen at any flight phase. The flight crew can confirm this through the engine fire warning lights and fire bell. Carry out the Engine Fire, Severe Damage or Separation Checklist Recall Items when the airplane is stabilzed is above 400 feet AGL. Notify ATC, select squawk 7700 and plan to land at the nearest airport. Transmit the MAYDAY call, noitify ATC and dispatcher of the company (including passenger numbers, remaining fuel quantity, dangerous goods position and nature). Notify ATC and cabin crew as early as possible if passenger evacuation is needed.

6.7.1.1 Engine fire before V1:

Judgment and decision:

When the fire bell is heard, fire warning lights illuminate during takeoff rollout, the captain should reject takeoff before V1. After the airplane has been stopped, carry out the Engine Fire, Severe Damage or Separation Checklist Recall Items.

Operation procedure

Condition	Captain	First officer
Engine fire warning before V1	♦ Call "Reject" and reject takeoff, carry out reject takeoff procedure ♦ Set the parking brake ♦ Carry out Engine Fire, Severe Damage or Separation Checklist Recall Items	♦ Report loudly "X Engine Fire" ♦ Verify the reject takeoff procedure ♦ Carry out and check Engine Fire, Severe Damage or Separation Checklist Recall Items ♦ Notify ATC
Fire warning lights or overheat lights extinguish or the Captain	♦ Check that the warning lights or overheat lights are extinguished. ♦ "Engine Fire, Severe Damage or Separation Checklist"	♦ "Fire warning lights or overheat lights extinguish" ♦ Carry out Engine Fire, Severe Damage or Separation Checklist

considers that evacutation is not needed.	♦ Complete Evacuation Checklist actions by recall items ♦ Announce and perform Evacuation Checklist	♦ Complete Evacuation Checklist actions by recall items ♦ Perform Evacuation Checklist

Notes:

1. PM must report to the captain X engine fire and cancel engine bell when the fire bell rings.
2. Do not use engine reverse thrust on affected engine for reject takeoff.
3. Park the airplane on the runway as soon as possible and consider the effect of wind direction.
4. After "Passenger Evacuation Preparation" call, the Captain makes the PA "Evacuate Immediately through Right/Left exits " is very important for non prepared evacuation, the broadcast must be clear, specific and calm.

6.7.1.2 Engine fire instrument approach procedure after V1

The Captain must continue the takeoff for an engine fire after V1. PM should report "X Engine Fire" when the fire bell rings. PF controls the airplane status and takeoffs normally. Call and complete the Engine Fire, Severe Damage or Separation Checklist Recall Items" after passing a minimum of 400 feet AGL. Notify ATC to return for landing. Complete the Engine Fire, Severe Damage or Separation Checklist after flaps up. If a passenger evacuation may be required, notify the cabin crew as early as possible.

Operation procedure:

Condition	PF	PM
Engine fire after V1	♦ "Continue takeoff" ♦ Check malfunction_ "Cancel Warning Bell" ♦ Continue takeoff to 400 ft AGL.	♦ Check failure_"X Engine Fire" ♦ Cutoff the warning bell ♦ Monitor airplane condition and report abnormal indications

400 feet AGL	♦ "Heading Select, Correct Track, Engine Fire, Severe Damage or Separation Checklist Recall Items" ♦ Confirm and retard engine thrust lever ♦ Guard the normal operating engine start lever and command PM to cut off the affected engine start lever ♦ Monitor engine fire extinguishing	♦ "400 feet" ♦ Engage HDG SEL ,adjust heading to maintain runway centerline ♦ Confirm FMA display ♦ Confirm the PF action and guard the normal operating engine thrust lever ♦ Monitor the airplane condition ♦ Report failure to ATC with a MAYDAY call and initial flight crew intention. ♦ Confirm with PM and cut off the affected engine start lever ♦ Carry out Engine Fire, Severe Damage or Separation Checklist Recall Items
1000 ft AGL or obstacle clearace ,which is higher	♦ "v/s+200"	"1,000 feet Set climb rate to 200 feet/minute
When the airspeed is above 30VREF+40	♦ Check speed ♦ "Flap 1"	♦ "30VREF+40" ♦ Retract Flap to 1 and Monitor flap indicator
When the airspeed is above 30VREF+60	♦ Check speed "Flap UP"	♦ "30VREF+60" ♦ Retract Flap to UP and Monitor flap indicator

Flap up	♦ Check the speed "Level Change, Set Maximum Continuous Thrust" ♦ Check FMA indications ♦ After airplane trimmed , "Engage A/P as required"	♦ Press LVLCHG ♦ check FMA ♦ Select CON (maximum contiuous) ♦ Select EPR to maximum continuous thrust ♦ Verify A/P engaged
When aircraft is stable, and obstacle clearance has been achieved, follow ATC clearance.	♦ Return to the departure airport to land according to revised ATC clearance.	
	♦ "Engine Fire, Severe Damage or Separation Checklist "	♦ Carry out Engine Fire, Severe Damage or Separation Checklist ♦ Notify the Cabin Crew "Passenger Evacuation Preparation" ♦ Notify ATC, request ground assistance. ♦ Notify the company dispatchers.
♦ Complete the After Takeoff and One Engine Inoperative Landing checklists, prepare to land and stop the aircraft on the runway after landing and announce passenger evacuation as required.		

Notes:

1. The flight crew should carry out the Engine Fire, Severe Damage or Separation Checklist Recall Items after the airplane has been effectively controlled and reach the minimum 400 feet AGL.
2. PF retards the affected Engine Thrust Lever after confirmation from the PM, and PM selects the affected Engine Start Lever to CUTOFF after confirmation from the PF, PM pulls and rotates (if a warning still exists) and holds for 1 second the affected

Engine Fire Switch after the confirmation from the PF. If the Engine Fire Switch or OVERHEAT light remains illuminated, the PM with confirmation from the PF will rotate the Fire Switch to other side after 30 seconds have passed since the discharge.

3. Definition of fire extinguishing is a relative term. First Overheat Light and Fire Light must be confirmed to have been extinguished. The flight crew must land at the nearest suitable airport.
4. If the fire can not be extinguished, notify ATC as early as possible and announce emergency situation.
5. If the fire can not be extinguished, notify the Cabin Crew as soon as possible with the expected evacuation route, and provide enough time to prepare the passengers and cabin for the evacuation.
6. If the fire can not be extinguished, consider to select maximum autobrake, stop the airplane as quickly as possible and perform passenger evacuation by taking the influence of wind direction into account.
7. Execute the above procedures in the event of an engine severe damage or separation.
8. When balancing fuel, execute normal fuel balancing procedures and it is prohibited to open only the crossfeed valve.

6.7.1.3 Engine fire at final

Judgment and decision:

Engine fire on final approach is divided into two categories:

1. The Flight crew must always control the airplanes status and the company recommended two phases_above 1000 ft AGL and below 1000 ft AGL. In either case once engine fire occurs, the captain should resolutely make decision and announce according to the aircraft's current status. In all, controlling the airplane is always of first importance.

Perform Engine Fire, Severe Damage or Separation Checklist recall items, notify ATC,land as soon as possible and perform passenger evacuation according to actual situations.

2. The flight crew must control the airplane status, land and land and stop the airplane as soon as possible to carry out engine fire extinguishing and evacuate the passengers as required.

Operation procedure:

Operation procedure **above** 1000 feet:

condition	PF	PM
The Captain decides to perform the recall items during final approach when landing configuraton established	♦ Check failure, "Cancel Warning Bell ♦ "Continue Approach, Engine Fire, Severe Damage or Separation Checklist Recall Items" ♦ Check and retard the affected Engine Thurst Lever ♦ Control the airplane status, adjust engine thrust, use rudder inputs to keep the control wheel neutral, adjust pitch attitude	♦ Announce the failure, "X Engine Fire" ♦ Cancel the fire warning bell ♦ Guard the normal operating Engine Thrust Lever and confirm PF actions. ♦ Monitor airplane status
	♦ Guard the normal operating Engine Start Lever and command PM cut off the affected Engine Start Lever	♦ Confirm with the PF and cutoff Fuel Control Switch of the affected engine
	♦ "Flaps 20,set VREF20+5_Ground Proximity Flap Inhibit to Inhibit position"	♦ Retract the flaps lever to 20 and monitor flaps indicator, adjust MCP speed bug to command speed, and inhibit ground proximity warning flap inhibit switch

	♦ Monitor engine fire extinguishing	♦ Notify ATC and ask for ground assistance ♦ Verify completing all recall items ♦ Carry out Engine Fire, Severe Damage or Separation Checklist according to situations
	♦ Stabilze the airplane for landing.	♦ Notify the Cabin Crew for Passenger Evacuation Preparation ♦ Monitor airplane status and engine parameters
♦ Perform One Engine Landing Checklist according to situations ♦ Vacate or stop on the runway after landing, announce and perform passenger evacuation according to situations.		

Operation procedure **below** 1000:

condition	PF	PM
Engine fire after FAF, the captain decides to land	♦ Confirm failure_"Cancel Fire Warning Bell, ♦ "Continue Approach"_smoothly control the airplane to land	♦ Check failure_"X Engine Fire" ♦ Cancel fire warning ♦ Monitor airplane status ♦ Notify ATC, request ground assistance. ♦ Notify Cabin Crew to "Prepare Passenger Evacuation"
♦ Plan and use maximum braking to full stop the aircraft on the runway after landing. Complete Engine Fire, Severe Damage or Separation Checklist Recall Items. ♦ Announce and carry out passenger evacuation according to the condition.		

Notes:

1. The captain should carefully consider the airplanes position, distance, altitude to the runway to decide whether to carry out the Engine Fire, Severe Damage or Separation Checklist.
2. In a short final, if an engine fire occurs after passing 1000 ft AGL, the flight crew is recommended to maintain the current airplane configuration, land and stop as soon as possible, carry out the recall items, notify ATC and cabin crew, to evacuate the passengers as required.
3. If the PF does not require any assistance or call outs to help maintain a stabilized approach, the PM could select the engine bleed switches to off, to depressurize the airplane in the final position or provide a better climb gradient incase of a go around.
4. Use the the normal operating engine reverse thrust during landing roll-out.
5. Notify the cabin crew of the expected evacuation route, with enough time to prepare the passenger evacuation.
6. When implementing engine fire recall items, in case unable to maintain airplane approach status, the flight crew should resolutely decide to perform go-around.

6.7.1.4 Engine fire on the ground

Judgment and decision:

In case engine fire on ground, the captain should stop taxiing, perform Engine Fire, Severe Damage or Separation Checklist recall items. If the fire cannot be controlled, perform passenger evacuation.

Notes:

The Flight Crew shall consider to stay far away from the terminal or crowded areas and effect of the crosswind pushing and try to place the engine on fire in a downwind position.

The Captain carries out a PA, explain the evacuation route in details. F/O notifys ATC and requires ground assistance.

6.7.2 APU fire

Judgment and decision:

When an APU fire occurs on ground, the flight crew should quickly carry out the APU fire checklist recall items and notify ATC/Fire Services.If APU fire warning light is no longer illuminated, passengers on board should be organized for evacuation by airstairs or boarding bridge.The Captain should use the PA and inform flight attendants of organizing passenger evacuation. The First Officer will advise ATC of airplane situation and ask for ground assistance.

When APU Fire appears in air, the flight crew should quickly carry out APU Fire Checklist. Land at the nearest suitable airport. If APU Fire Warning remains illuminated , advise ATC and ask for ground assistance, and notify the Cabin Crew of preparing passenger evacuation as soon as possible.

Operation procedure:

condition	PF	PM
APU fire on ground	♦ The cockpit personnel or ground personnel carry out APU extinguishing and evacuate the ground personnel and remove equipment. ♦ Evacuate the passengers as required.	
APU fire airborne and airplane condition is stable	♦ "APU Fire Checklist Recall Items"	♦ Carry out APU Fire Recall Items and Checklist
	♦ Land at the nearest suitable airport.	

Notes:

Only one fire extinguishing bottle is available, pull the fire extinguishing bottle switch and rotate to the stop and hold for 1 second, confirm the fire extinguishing bottle has been released.

6.7.3 Wheel well fire

Judgment and decision:

If wheel well fire warning occurs during flight,the Flight Crew performs the Wheel Well Fire Checklist and observes landing gear extension and retraction speed limitations. Airplane performance permitting (fuel remaining, route safety altitude, weather, single engine performance with gear extended), do not retract the landing gear and land at the nearest suitable airport. Request ground emergency assistance for possible tire damaged or gear extension problems and notify the Cabin

Crew "Passenger Evacuation Preparation".

Operation procedure:

condition	PF	PM
Wheel Well Fire warning in air	♦ "Cancel Warning Bell" ♦ Check failure ♦ Set MCP speed below 250 kts ♦ "Wheel Well Fire Checklist" ♦ Land at nearest suitable airport	♦ Cancel warning bell ♦ Confirm failure_"Wheel Well Fire" ♦ Carry out wheel well fire checklist ♦ Notify ATC ♦ Monitor that the Wheel Well Fire Warning light extinguishes, report to PF timing as required
	♦ Command PM to calculate inflight performance for landing gear extension in performance chapter and decide the flight altitude	♦ Calculate the in-flight altitude and speed for landing gear extension in the FCOM performance in-flight chapter and report to PF.
	♦ "Notify ATC"	♦ Notify Captains intention to ATC ♦ Notify the Cabin Crew "Passenger Evacuation Preparation".
Approach and landing	♦ Prepare for passenger evacuation during normal approach and landing; during taxi, take care with airplane direction control; evacuate passengers after steady stop as required.	

Notes:

1. Observe the landing gear extension speed limit _270K_.82M, whichever is lower_
2. During climb , descent, use_LVL CHG and not VNAV
3. Consider the FCOM Performance In-flight Chapter for Flight with Gear Down Long Range Cruise Altitude Capability and Gear Down Engine Inop. . Adjust the flight altitude, routing to satisfy terrain clearances. Do not retract the landing gear except unless fuel remaining, terrain/obstacle clearance, weather become safety issues.

4. Do not use FMC fuel predictions because the gear extension resistance dramatically increases. Work out speed adjustment plan for arrival.
5. Do not use autobrake during landing. Use manual and aerodynamic braking during landing rollout together with maximum reverse thrust and flaps 40 if possible.
6. Notify the cabin crew to prepare for possible passenger evacuation.

6.7.4 Cargo fire

Judgment and decision:

If fire is detected in the associated cargo hold, the flight crew **must** carry out the Cargo Fire Checklist and land at the nearest suitable airport. Notify ATC about the nature of the dangerous goods if loaded,, quantity and location . Carry out passenger evacuation as required

Operation procedure:

Condition	PF	PM
Cargo fire warning, airplane condition stable	♦ "Cancel Warning,verify failure " ♦ Control the airplane condition_"Cargo Fire Checklist" ♦ Land at the nearest suitable airport ♦ Land as soon as possible. Evacuate the passengers if required	♦ Cancel warning_"X Cargo Cire" ♦ Carry out Cargo Fire Checklist ♦ Notify ATC Captain intention ♦ Notify the Cabin Crew to prepare passengers evacuation
If smoke, fumes or fire are reported to exist in the cabin	♦ Wear the oxygen masks 100%, establish crew communication ♦ Carry out Smoke, Fire or Fumes Checklist ♦ Land as soon as possible and carry out passenger evacuation as required	

Notes:

1. Cargo fire is **not a recall item**, but it requires Flight Crew to complete the Checklist as soon as possible.
2. Push Cargo Fire Discharge Switch, and the discharge light may take 30 seconds to illuminate. After the discharging, cargo halon concentration should be enough to contain a fire long enough to land at the nearest suitable airport.

3. If there is smoke or fumes in the cabin, do Smoke, Fire or Fumes Checklist.
4. If passenger evacuation is required, advise Cabin Crew as early as possible for the preparation. After landing, park the airplane as soon as possible, and do Evacuation Checklist.
5. The cargo door is not allowed to open before the Passengers have left the aircraft.

6.8 Flight Controls

6.8.1 Leading Edge or Trailing Edge Device Malfunctions

Leading edge or trailing edge device malfunctions can occur during extension or retraction. This section discusses all flaps up and partial or asymmetrical leading/trailing edge device malfunctions for landings.

All Flaps and Slats Up Landing

The probability of both leading and trailing edge devices failing to extend is remote. If a flaps up landing situation were to be encountered in service, the pilot should consider the following techniques. Training to this condition should be limited to the flight simulator.

After selecting a suitable landing airfield and prior to beginning the approach, consider reduction of airplane gross weight (burn off fuel or fuel jettison) to reduce touchdown speed.

Fly a wide pattern to allow for the increased turning radius required for the higher maneuvering speed. Establish final approximately 10 NM from the runway. This allows time to extend the gear and decelerate to the target speed while in level flight and complete all required checklists. Maintain no slower than flaps up maneuvering speed until established on final. Maneuver with normal bank angles until on final.

Final Approach

Use an ILS glide slope if available. Do not reduce the airspeed to the final approach speed until aligned with the final approach. Before intercepting the descent profile, decrease airspeed to command speed and maintain this speed until the landing is assured.

The rate of descent on final approach is approximately 1,000 fpm due to the higher ground speed. Final approach body attitude is approximately 4° higher than normal. Do not make a flat approach (shallow glide path angle) or aim for the threshold of the runway. This may result in main gear touching down short of the runway. Use a normal aim point approximately 1,800 feet down the runway.

Use manual control of thrust levers. Due to automatic speed protection, autothrottle use may result in higher than desired speed on final. Engines will be at low idle speed due to no flap extension. When engines are near idle RPM, time required for engines to accelerate is longer than normal.

Note: Use of the autopilot during approach phase is acceptable. Do not autoland.

Speedbrakes are not recommended for airspeed reduction below 800 feet. If landing is anticipated beyond the normal touch down zone, go around.

Landing
Fly the airplane onto the runway at the recommended touchdown point. Flare only enough to achieve an acceptable reduction in the rate of descent. Do not allow the airplane to float. Floating just above the runway surface to deplete additional speed wastes available runway and increases the possibility of a tail strike. Do not risk touchdown beyond the normal touchdown zone in an effort to achieve a smooth landing.
Slight forward pressure on the control column may be needed to achieve touchdown at the desired point and to lower the nose wheels to the runway. After lowering the nose wheels to the runway, hold light forward control column pressure and expeditiously accomplish the landing roll procedure. Full reverse thrust is needed for a longer period of time.
Use of autobrakes is recommended. Autobrake setting should be consistent with runway length. Use manual braking if deceleration is not suitable for the desired stopping distance.
Immediate initiation of reverse thrust at main gear touchdown (reverse thrust is more effective at high speeds) and full reverse thrust allows the autobrake system to reduce brake pressure to the minimum level. Less than maximum reverse thrust increases brake energy requirements and may result in excessive brake temperatures.
Leading Edge Slat Asymmetry - Landing
If a leading edge asymmetry/no leading edge device condition occurs, the adjusted VREF provides normal bank angle maneuvering capability but does not allow for 15° overshoot protection in all cases.
Do not hold the airplane off during landing flare. Floating just above the runway surface to deplete the additional threshold speed wastes available runway and increases the possibility of a tail strike.
Note: If the gear is retracted during a go-around and flap position is greater than 20, a landing gear configuration warning occurs.
Trailing Edge Flap Asymmetry - Landing
If a trailing edge flap up asymmetry occurs, full maneuvering capability exists even if the asymmetry occurred at flaps just out of the full up position. Burn off fuel to reduce landing weight and lower approach speed. Fly accurate airspeeds in the landing pattern. At lesser flap settings, excess airspeed is difficult to dissipate, especially when descending on final approach.Pitch attitude and rate of descent on final is higher than for a normal landing. During flare, airspeed does not bleed off as rapidly as normal.

Fly the airplane onto the runway at the recommended touchdown point. Flare only enough to achieve an acceptable reduction in the rate of descent. Do not allow the airplane to float. Floating just above the runway surface to deplete additional speed wastes available runway and increases the possibility of a tail strike. Do not risk touchdown beyond the normal touchdown zone in an effort to achieve a smooth landing.

Note: If the gear is retracted during a go-around and flap position is greater than 20, a landing gear configuration warning occurs.

6.8.2 Flap Extension using the Alternate System

g tWhen extending the flaps using the alternate system, the recommended method for setting command speed differs from the method used during normal flap extension. Since the flaps extend more slowly when using the alternate system, it is recommended that the crew delay setting the new command speed until the flaps reach the selected position. This method may prevent the crew from inadvertently getting into a low airspeed condition if attention to airspeed is diverted while accomplishing other duties.

6.8.3 Jammed or Restricted Flight Controls

Although rare, jamming of the flight control system has occurred on commercial airplanes. A jammed flight control can result from ice accumulation due to water leaks onto cables or components, dirt accumulation, component failure such as cable break or worn parts, improper lubrication, or foreign objects.

A flight control jam may be difficult to recognize, especially in a properly trimmed airplane. A jam in the pitch axis may be more difficult to recognize than a jam in other axes. In the case of the elevator, the jammed control can be masked by trim. Some indications of a jam are:

- unexplained autopilot disengagement
- autopilot that cannot be engaged
- undershoot or overshoot of an altitude during autopilot level-off
- higher than normal control forces required during speed or configuration changes.

If any jammed flight control condition exists, both pilots should apply force to try to either clear the jam or activate the override feature. There should be no concern about damaging the flight control mechanism by applying too much force to either clear a jammed flight control or activate an override feature. Maximum force may result in some flight control surface movement with a jammed flight control. If the jam clears, both pilot’s flight controls are available.

Note: If a control is jammed due to ice accumulation, the jam may clear when moving to a warmer temperature.

Note: There are override features for the control wheel and the control column.

If the jam does not clear, activation of an override feature allows a flight control surface to be moved independent of the jammed control. Applying force to the non-jammed flight control activates the override feature. When enough force is applied, the jammed control is overridden allowing the non-jammed control to operate. To identify the non-jammed flight control, apply force to each flight control individually. The flight control that results in the greatest airplane control is the non-jammed control.

Note: The pilot of the non-jammed control should be the pilot flying for the remainder of the flight.

The non-jammed control requires a normal force, plus an additional override force to move the flight control surface. For example, if a force of 10 lbs (4 kgs) is normally needed to move the surface, and 50 lbs (23 kgs) of force is needed to activate the override, a total force of 60 lbs (27 kgs) is needed to move the control surface while in override. Response is slower than normal with a jammed flight control; however, sufficient response is available for airplane control and landing.

For those controls without override features, limited flight control surface deflection occurs when considerable force is applied to the flight control. This response is due to cable stretch and structural bending. This response may be sufficient for airplane control and landing.

Trim Inputs

If a jammed flight control condition exists, use manual inputs from other control surfaces to counter pressures and maintain a neutral flight control condition. The following table provides trim inputs that may be used to counter jammed flight control conditions.

Jammed Control Surface	Manual Trim Inputs
Elevator	Stabilizer
Aileron	Rudder
Rudder	Aileron

Note: Asymmetric engine thrust may aid roll and directional control.

Approach and Landing

Attempt to select a runway with minimum crosswind. Complete approach preparations early. Recheck flight control surface operation prior to landing to determine if the malfunction still exists. Do not make abrupt thrust, speedbrake, or configuration changes. Make small bank angle changes. On final approach, do not reduce thrust to idle until after touchdown. Asymmetrical braking and asymmetrical thrust reverser deployment may aid directional control on the runway.

Note: In the event of an elevator jam, control forces will be significantly greater than normal and control response will be slower than normal to flare the airplane.

Go Around Procedure

If the elevator is known or suspected to be jammed, a go-around should be avoided if at all possible. To execute a go-around with a jammed elevator, smoothly advance throttles while maintaining pitch control with stabilizer and any available elevator. If a go-around is required, the go-around procedure is handled in the same manner as a normal go-around.

6.8.4 Jammed Stabilizer

During flight test certification the worst-case jammed stabilizer condition wasevaluated. A satisfactory landing could be accomplished without the use of special configurations or speeds. Adequate flare capability was available at flaps 30 and flaps 20 using normal approach speeds. Therefore, a special NNC is not considered necessary.

6.8.5 Unscheduled Stabilizer Trim

Hold the control column firmly to maintain the desired pitch attitude. If uncommanded trim motion continues, the stabilizer trim commands are interrupted when the control column is displaced in the opposite direction.

6.9 FLIGHT MANAGEMENT, NAVIGATION
6.9.1 FMC FAIL
Judgement and decision:

After left or right FMC (if two installed) fail, the related FMC cannot provide navigation and performance data. Flight Crew should select the operating FMC through using FMC Source Select switch. If dual FMC failure has occurred (LNAV and VNAV are not available.), continue with conventional navigation. Refer to the performance data in QRH. When preparing for approach, use the N1 SET Selector to set the N1 bugs.

Operation procedures:

condition	PF	PM
Before takeoff FMC fail.	♦ Select BOTH on N1 SET manually in order to set takeoff N1 thrust. ♦ Input V1, VR, and WT by using speed reference selector, and put it to SET position finally. ♦ Set V2 on MCP.	♦ Refer to QRH to find out Takeoff Performance data and takeoff thrust N1 according to airplane weight.
	♦ When airborne, use conventional navigation flight until landing.	

Condition	PF	PM
FMC fail in flight.	♦ Use conventional navigation flight, complete FMC Fail Checklist.	
Before Approach	♦ Monitor airplane status	♦ Refer to performance data table in QRH to determine speed reference. ♦ Use THRUST REF SET to set go-around EPR manually. ♦ Input WT, VREF by using speed reference selector, and put it to SET position finally.

Notes:

1. During FMC failure, A/T is not available on the ground, however can be used in the air.
2. Engage heading select and ALT HOLD mode when the FMC/s fails in the air. Verify the correct indications on the FMA.
3. Use conventional navigation for flight. Radar vectoring can be applied in radar control area.

6.10 Flight Instrument, Display
AIRSPEED UNRELIABLE
Airspeed Unreliable

Unreliable airspeed indications can result from blocking or freezing of the pitot/static system or a severely damaged or missing radome. When the ram air inlet to the pitot head is blocked, pressure in the probe is released through the drain holes and the airspeed slowly drops to zero. If the ram air inlet and the probe drain holes are both blocked, pressure trapped within the system reacts unpredictably.The pressure may increase through expansion, decrease through contraction, or remain constant. In all cases, the airspeed indications would be abnormal. This could mean increasing indicated airspeed in climb, decreasing indicated airspeed in descent, or unpredictable indicated airspeed in cruise.

If the flight crew is aware of the problem, flight without the benefit of valid airspeed information can be safely conducted and should present little difficulty.Early recognition of erroneous airspeed indications require familiarity with the interrelationship of attitude, thrust setting, and airspeed. A delay in recognition could result in loss of airplane control. The flight crew should be familiar with the approximate pitch attitude for each flight maneuver. For example, climb performance is based on maintaining a particular airspeed or Mach number. This results in a specific body attitude that varies little with gross weight and altitude. Any significant change from the body attitude required to maintain a desired airspeed should alert the flight crew to a potential problem.

When the abnormal airspeed is recognized, immediately return the airplane to the target attitude and thrust setting for the flight regime. If continued flight without valid airspeed indications is necessary, consult the Flight With Unreliable Airspeed/Turbulent Air Penetration table in the Performance Inflight section of the QRH for the correct attitude, thrust settings, and V/S for actual airplane gross weight and altitude.

Ground speed information is available from the FMC and on the instrument displays. These indications can be used as a cross check. Many air traffic control radars can also measure ground speed.

For airplanes equipped with an Angle of Attack (AOA) indicator, maintain the analog needle at approximately the three o'clock position. This approximates a safe maneuvering speed or approach speed for the existing airplane configuration.

Descent

Idle thrust descents to 10,000 feet can be made by flying body attitude and checking rate of descent in the QRH tables. At 2,000 feet above the selected level off altitude, reduce rate of descent to 1,000 FPM. On reaching the selected altitude, establish attitude and thrust for the airplane configuration. If possible, allow the airplane to stabilize before changing configuration and altitude.

Approach

If available, accomplish an ILS approach. Establish landing configuration early on final approach. At glide slope intercept or beginning of descent, set thrust and attitude per the QRH tables and control the rate of descent with thrust.

Landing

Control the final approach so as to touch down approximately 1,000 feet to 1,500 feet beyond the threshold. Fly the airplane on to the runway, do not hold it off or let it “float” to touchdown.

Use autobraking if available. If manual braking is used, maintain adequate brake pedal pressure until a safe stop is assured. Immediately after touchdown, expeditiously accomplish the landing roll procedure.

6.11 FUEL

6.11.1 Fuel Balance

The primary purpose of fuel balance limitations on Boeing airplanes is for the structural life of the airframe and landing gear and not for controllability. A reduction in structural life of the airframe or landing gear can be caused by frequently operating with out-of-limit fuel balance conditions. Lateral control is not significantly affected when operating with fuel beyond normal balance limits.

The primary purpose for fuel balance alerts are to inform the crew that imbalances beyond the current state may result in increased trim drag and higher fuel consumption. The FUEL CONFIGURATION NNC should be accomplished when the fuel balance alert is received.

There is a common misconception among flight crews that the fuel crossfeed valve should be opened immediately after an in-flight engine shutdown to prevent fuel imbalance. This practice is contrary to Boeing recommended procedures and could aggravate a fuel imbalance. This practice is especially significant if an engine failure occurs and a fuel leak is present. Arbitrarily opening the crossfeed valve and starting fuel balancing procedures, without following the checklist, can result in pumping usable fuel overboard.

The misconception may be further reinforced during simulator training. The fuel pumps in simulators are modeled with equal output pressure on all pumps so opening the crossfeed valve appears to maintain a fuel balance. However, the fuel pumps in the airplane have allowable variations in output pressure. If there is a sufficient difference in pump output pressures and the crossfeed valve is opened, fuel feeds to the operating engine from the fuel tank with the highest pump output pressure. This may result in fuel unexpectedly coming from the tank with the lowest quantity.

Fuel Balancing Considerations

The crew should consider the following when performing fuel balancing procedures:

- use of the Fuel Balancing Supplementary Procedure in conjunction with good crew coordination reduces the possibility of crew errors
- routine fuel balancing when not near the imbalance limit increases the possibility of crew errors and does not significantly improve fuel consumption

- during critical phases of flight, fuel balancing should be delayed until workload permits. This reduces the possibility crew errors and allows crew attention to be focused on flight path control
- fuel imbalances that occur during approach need not be addressed if the reason for the imbalance is obvious (e.g. engine failure or thrust asymmetry, etc.).

6.11.2 Fuel Leak

Any time an unexpected fuel quantity indication, FMC or EICAS fuel message, or imbalance condition is experienced, a fuel leak should be considered as a possible cause. Maintaining a fuel log and comparing actual fuel burn to the flight plan fuel burn can help the pilot recognize a fuel leak.

Significant fuel leaks, although fairly rare, are difficult to detect. The NNC assumes the leak is between the strut and the engine. There is no specific fuel leak annunciation on the flight deck. A leak must be detected by discrepancies in the fuel log, by visual confirmation, or by some annunciation that occurs because of a leak. Any unexpected change in fuel quantity or fuel balance should alert the crew to the possibility of a leak. If a leak is suspected, it is imperative to follow the NNC.

6.11.3 Low Fuel

A low fuel condition exists when the FUEL CONFIG light illuminates and the EICAS message LOW FUEL is displayed.

Approach and Landing

In a low fuel condition, the clean configuration should be maintained as long as possible during the descent and approach to conserve fuel. However, initiate configuration changes early enough to provide a smooth, slow deceleration to final approach speed to prevent fuel from running forward in the tanks.

A normal landing configuration and airspeed appropriate for the wind conditions are recommended.

Runway conditions permitting, heavy braking and high levels of reverse thrust should be avoided to prevent uncovering all fuel pumps and possible engine flameout during landing roll.

Go-Around

If a go-around is necessary, apply thrust slowly and smoothly and maintain the minimum nose-up body attitude required for a safe climb gradient. Avoid rapid acceleration of the airplane. If any wing tank fuel pump low pressure light illuminates, do not turn the fuel pump switches off.

6.11.4 Fuel Jettison

Fuel Jettison Fuel jettison should be considered when situations dictate landing at high gross weights and adequate time is available to perform the jettison. When fuel jettison is to be accomplished, consider the following:

- ensure adequate weather minimums exist at airport of intended landing
- fuel jettison above 4,000 feet AGL ensures complete fuel evaporation
- downwind drift of fuel may exceed one NM per 1,000 feet of drop
- avoid jettisoning fuel in a holding pattern with other airplanes below.

6.12 Hydraulics

Proper planning of the approach is important. Consideration should be given to the effect the inoperative system(s) has on crosswind capabilities, autoflight, stabilizer trim, control response, control feel, reverse thrust, stopping distance, go-around configuration and performance required to reach an alternate airfield.

Hydraulic System(s) Inoperative - Landing

If the landing gear is extended using alternate gear extension, the gear cannot be raised. Flaps can be extended or retracted using the alternate flap drive system. However, the rate of flap travel is significantly reduced.

Flaps 20 and an adjusted VREF are used for landing with multiple hydraulic systems inoperative to improve flare authority, control response and go-around capability. The airplane may tend to float during the flare. Do not allow the airplane to float. Fly the airplane onto the runway at the recommended point.

If nose wheel steering is inoperative and any crosswind exists, consideration should be given to landing on a runway where braking action is reported as good or better. Braking action becomes the primary means of directional control below approximately 60 knots where the rudder becomes less effective. If controllability is satisfactory, taxi clear of the runway using differential thrust and brakes. Continued taxi with nose wheel steering inoperative is not recommended due to airplane control difficulties and heat buildup in the brakes.

6.13 Landing Gear

6.13.1 Tire Failure during or after Takeoff

If the crew suspects a tire failure during takeoff, the Air Traffic Service facility serving the departing airport should be advised of the potential for tire pieces remaining on the runway. The crew should consider continuing to the destination unless there is an indication that other damage has occurred (non-normal engine indications, engine vibrations, hydraulic system failures or leaks, etc.).

Continuing to the destination will allow the airplane weight to be reduced normally, and provide the crew an opportunity to plan and coordinate their arrival and landing when the workload is low.

Considerations in selecting a landing airport include, but are not limited to:

• sufficient runway length and acceptable surface conditions to account for the possible loss of braking effectiveness
• sufficient runway width to account for possible directional control difficulties
• altitude and temperature conditions that could result in high ground speeds on touchdown and adverse taxi conditions
• runway selection options regarding "taxi-in" distance after landing
•availability of operator maintenance personnel to meet the airplane after landing to inspect the wheels, tires, and brakes before continued taxi
• availability of support facilities should the airplane need repair.

6.13.2 Partial or All Landing Gear Up Landing

General

Land on all available gear. The landing gear absorbs the initial shock and delays touchdown of airplane body parts. Recycling the landing gear in an attempt to extend the remaining gear is not recommended. A gear up or partial gear landing is preferable to running out of fuel while attempting to solve a gear problem.

Landing Runway

Consideration should be given to landing at the most suitable airport with adequate runway and fire fighting capability. Foaming the runway is not necessary. Tests have shown that foaming provides minimal benefit and it takes approximately 30 minutes to replenish the fire truck’s foam supply.

Prior to Approach
If time and conditions permit, reduce weight as much as possible by burning off or jettisoning (as installed) fuel to attain the slowest possible touchdown speed.At the captain's command, advise the crew and the passengers of the situation, as needed. Coordinate with all ground emergency facilities. For example, fire trucks normally operate on a common VHF frequency with the airplane and can advise the crew of the airplane condition during the landing. Advise the cabin crew to perform emergency landing procedures and to brief passengers on evacuation procedures.
The NNC instructs the crew to inhibit the ground proximity system as needed to prevent nuisance warnings when close to the ground with the gear retracted.
For landing in any gear configuration, establish approach speed early and maintain a normal rate of descent.
Landing Techniques
Attempt to keep the airplane on the runway to minimize airplane damage and aid in evacuation. After touchdown lower the nose gently before losing elevator effectiveness. Use all aerodynamic capability to maintain directional control on the runway. At touchdown speed, the rudder has sufficient authority to provide directional control in most configurations. At speeds below 60 knots, use nose wheel/rudder pedal steering, if available, and differential braking as needed.
Use of Speedbrakes
During a partial gear or gear up landing, speedbrakes should be extended only when stopping distance is critical. Extending the speedbrakes before all gear, or the nose or the engine nacelle in the case of a gear that does not extend, have contacted the runway may compromise controllability of the airplane.
When landing with any gear that indicates up or partially extended, attempt to fly the area with the unsafe indication smoothly to the runway at the lowest speed possible, but before losing flight control effectiveness. A smooth touchdown at a low speed helps to reduce airplane damage and offers a better chance of keeping the airplane on the runway. Since the airplane is easier to control before body parts make ground contact, delay extending the speedbrakes until after the nose and both sides of the airplane have completed touchdown. If the speedbrakes are deployed before all areas have made contact with the runway, the airplane will complete touchdown sooner and at a higher speed.
Some crews or operators may elect to avoid the use of speedbrakes during any gear disagree event. However, most gear disagree events are the result of an indicator malfunction rather than an actual gear up condition. If the crew elects not to use speedbrakes during landing, be aware that stopping distance may rapidly become critical if all gear remain extended throughout touchdown and rollout.

Use of Reverse Thrust
During a partial gear or gear up landing, the thrust reversers may not be available. Both main gear must be on the ground to satisfy the air/ground logic requirement for thrust reverser extension. If both main gear are extended and the nose gear is partially extended or up, reverse thrust is available. However, selecting reverse thrust with the nose gear not extended may produce an additional asymmetric condition that makes directional control more difficult. Reverse thrust should be used only when stopping distance is critical.
If reverse thrust is needed, keep in mind that the airplane is easier to control before body parts make ground contact. If the thrust reversers are deployed before the nose has made contact with the runway, the airplane will complete touchdown sooner and at a higher speed.

After Stop
Accomplish an evacuation, if needed.

Gear Disagree Combinations

Both Main Gear Extended with Nose Gear Up
Land in the center of the runway. After touchdown lower the nose gently before losing elevator effectiveness.

Nose Gear Only Extended
Land in the center of the runway. Use normal approach and flare attitudes maintaining back pressure on the control column until ground contact. The engines contact the ground prior to the nose gear.

One Main Gear Extended and Nose Gear Extended
Land the airplane on the side of the runway that corresponds to the extended main gear down. At touchdown, maintain wings level as long as possible. Use rudder and nose wheel steering for directional control. After all gear, or the engine nacelle where the gear is not extended, have made contact with the runway, braking on the side opposite the unsupported wing should be used as needed to keep the airplane rolling straight.

One Main Gear Only Extended
Land the airplane on the side of the runway that corresponds to the extended main gear down. At touchdown, maintain wings level as long as possible. Use rudder for directional control. After all gear, or the nose or the engine nacelle in the case of gear that do not extend, have made contact with the runway, braking on the side opposite the unsupported wing should be used as needed to keep the airplane

All Gear Up or Partially Extended
Land in the center of the runway. The engines contact the ground first. There is adequate rudder available to maintain directional control during the initial portion of the ground slide. Attempt to maintain the centerline while rudder control is available.

6.13.3 Landing on a Flat Tire

Boeing airplanes are designed so that the landing gear and remaining tire(s) have adequate strength to accommodate a flat nose gear tire or main gear tire. When the pilot is aware of a flat tire prior to landing, use normal approach and flare techniques, avoid landing overweight and use the center of the runway.

Use differential braking as needed for directional control. With a single tire failure, towing is not necessary unless unusual vibration is noticed or other failures have occurred.

In the case of a flat nose wheel tire, slowly and gently lower the nose wheels to the runway while braking lightly. Runway length permitting, use idle reverse thrust. Autobrakes may be used at the lower settings. Once the nose gear is down, vibration levels may be affected by increasing or decreasing control column back pressure. Maintain nose gear contact with the runway.

Flat main gear tire(s) cause a general loss of braking effectiveness and a yawing moment toward the flat tire with light or no braking and a yawing moment away from the flat tire if the brakes are applied harder. Maximum use of reverse thrust is recommended. Do not use autobrakes.

If uncertain whether a nose tire or a main tire has failed, slowly and gently lower the nose wheels to the runway and do not use autobrakes.

Differential braking may be required to steer the airplane. Use idle or higher reverse thrust as needed to stop the airplane.

Note: Extended taxi distances or fast taxi speeds can cause significant increases in temperatures on the remaining tires.

6.14 Evacuation

If an evacuation is planned and time permits, a thorough briefing and preparation of the crew and passengers improve the chances of a successful evacuation. Flight deck preparations should include a review of pertinent checklists and any other actions to be accomplished. Appropriate use of autobrakes should be discussed. If evacuating due to fire in windy conditions, consider positioning the airplane so the fire is on the downwind side.

Notify cabin crew of possible adverse conditions at the affected exits. The availability of various exits may differ for each situation. Crewmembers must make the decision as to which exits are usable for the circumstances.

For unplanned evacuations, the captain needs to analyze the situation carefully before initiating an evacuation order. Quick actions in a calm and methodical manner improve the chances of a successful evacuation.

Method of Evacuation

When there is a need to evacuate passengers and crew, the captain has to choose between commanding an emergency evacuation using the emergency escape slides or less urgent means such as deplaning using stairs, jetways, or other means.

All available sources of information should be used to determine the safest course of action including reports from the cabin crew, other airplanes, and air traffic control. The captain must then determine the best means of evacuation by carefully considering all factors. These include, but are not limited to:

- the urgency of the situation, including the possibility of significant injury or loss of life if a significant delay occurs
- the type of threat to the airplane, including structural damage, fire, reported bomb on board, etc.
- the possibility of fire spreading rapidly from spilled fuel or other flammable materials
- the extent of damage to the airplane
- the possibility of passenger injury during an emergency evacuation using the escape slides.

If in doubt, the crew should consider an emergency evacuation using the escape slides.

If there is a need to deplane passengers, but circumstances are not urgent and the captain determines that the Evacuation NNC is not needed, the normal shutdown procedure should be completed before deplaning the passengers.

Discharging Fire Bottles during an Evacuation

The evacuation NNC specifies discharge of the engine or APU fire bottles if an engine or APU fire warning light is illuminated. However, evacuation situations can present possibilities regarding the potential for fire that are beyond the scope of the NNC and may not activate an engine or APU fire warning. The crew should consider the following when deciding whether to discharge one or more fire bottles into the engines and/or APU:

- if an engine fire warning light is not illuminated, but a fire indication exists or a fire is reported in or near an engine, discharge both available fire bottles into the affected engine
- if the APU fire warning light is not illuminated, but a fire indication exists or a fire is reported in or near the APU, discharge the APU bottle(s)
- the discharged halon agent is designed to extinguish a fire and has very little or no fire prevention capability in the engine nacelles. Halon dissipates quickly into the atmosphere
- there is no reason to discharge the engine or APU fire bottles for evacuations not involving fire indications existing or reported in or near an engine or APU, e.g., cargo fire, security or bomb threat, etc.

6.15 Ditching

Policy

When the captain and flight crew judge and evaluate that ditching is the only emergency action to get the living chance for onboard people in emergency, ditching can be selected. Especially when flying across the sea, sea condition and sea wind have a great influence on touching water for ditching. The evacuation to the life boat also have certain danger. The flight crew should not only know the influence of sea condition and sea wind on touching water but also grasp the procedure and control skills of ditching for performing a good ditching. The flight crew must have enough preparations and a thoughtful plan.

Ditching factors

Successful ditching lies in three main factors. It can be divided into the following according to its importance:

The sea condition and the wind

The airplane type

The skill and technique of the pilot

Common oceanography terminology

Seaface: Can produce the surface of the wave

billow: The surface condition produced by partial wind

Wave: The surface condition produced by long distance welter

The wave surface: The wave faces the observer, the wave surface is opposite to the observer. This definition is applicable whichever the orientation the wave moves.

Main wave: The series of waves with maximum height from the wave apex to wave vale.

Auxiliary wave: The series of waves below the height of the main wave.

Voyage: The passing distance of the wind without obstruction which is blown by the constant wind.

Wave cycle: The time cost of some point in the water passing through two continuous wave apex.(calculated by second).

Speed vector of wave: The magnitude and orientation is usually calculated by NM/h to a fixed reference substance. There is small variation in the horizontal orientation. The wave moves in the vertical orientation like the movement of the blanket which has been vibrated.

Wave Orientation: Refers to the moving orientation of wave, this orientation is not always the certain result caused by spot wind. The wave may be involved in or overpass partial wind. Once the wave is formed, it will move ahead along the forming orientation. It will not stop moving only the deep water stops moving, no matter what the wind orientation altered.

The wave height: Wave apex and wave vale is accounted by feet, mostof wave is lower than 12 and 15 feet, the wave higher than 25 feet. Continous wave has distinctively variation in height.

The best altitude to observe the primary swells is 2,000 feet or above 2,000 feet. The best altitude to observe the secondary is above the water surface altitude.

The influence of sea breeze decides the water direction

The swell's condition decides the direction of touching water regardless of the wind direction when the wind speed is between 0 and 25 KTS. Generally the airplane should touch water parallel with the swells and select the upwind direction to touch water.

When the wind speed is above 25KTS, the middle direction should be selected. It is the safest to touch water with the attitude at a certain angel to the swells and wind band which is not parallel with the swells or towards the upwind direction. When the swells are very high and the airplane is greatly influenced by crosswind, the airplane should also touch water almost parallel with the swells.

The floating time after the airplane touches the water

The airplane's tail first slides into the water at the attitude of 8-12°when the airplane touches the water. Normally the head is high and the tail is low after the airplane stops stable. The floating time in water is not more than 60 min at most. Generally it is 20 min and 13 at least. The people on the airplane should evacuate from the airplane within 13 min.

Life boat evacuation sequence

Generally, the boats besides L1 door and aft doow have precedence to evacuate.

The boat besides R1 door is the last to evacuate_

The other boats can evacuate when they are full of people.

The organization after the life boat off the plane

The flight crew are responsible to set free the people on the life boat and cut off the connecting line between the boats and the airplane immediately to get the life boats leaving the airplane as soon as possible.

After the life boats leave the airplane, the survivals falling into water should be immediately searched and be rescued to the life boat with rescuing equipment. The severely indured should be immediately rescued.

The life boats should avoid the fuel leaking area and the burning area after leaving the airplane. Connect all the life boats, shoot off the sea anchor to reduce the float , get out the life vast and use it.

The position of life boats should keep a certain distance from the airplane but should not be too far because most rescue work is in the place of the air disaster, so they can be easily found.

Location and load of life boat/vest

Load of life boat

B767-300

Type	Number	Location	Normal load	Overload
Entry/service door Life boat	6	L1,L2,L4 R1,R2,R4	60 persons	76 persons
Life boat for emergency door(B2490/1/2)	2	L3,R3	25 persons	30 persons

Location of lisfe vest:

B767-300

Airplane No	Type (PN)	Installed location	Number
B2490 B2491 B2492	63600-501	Under seat of each flight attendant	11 in total
		Back of captain and F/O's seats	2 in total
		Storage box at back of the second observer	2 in total
	63600-101	Under seat of each passenger in economic class	199 in total
		Between armrests of seats in first class	34 in total
		Storage counter in forward service room	3 (as backup)
		Left-side strorage counter in middle service room	5 (as backup)

	P0640-101	Left-side strorage counter in middle service room	7 in total

Evacuation for ditching

Send Distress Signals

Transmit Mayday, current position, course, speed, altitude, situation, intention,time and position of intended touchdown, and type of airplane using existing air-to-ground frequency. Set transponder code 7700 and, if practical, determine the course to the nearest ship or landfall.

Advise Crew and Passengers

Alert the crew and the passengers to prepare for ditching. Assign life raft positions (as installed) and order all loose equipment in the airplane secured. Put on life vests, shoulder harnesses, and seat belts. Do not inflate life vests until after exiting the airplane.

Fuel Burn-Off

Consider burning off fuel prior to ditching, if the situation permits. This provides greater buoyancy and a lower approach speed. However, do not reduce fuel to a critical amount, as ditching with engine thrust available improves ability to properly control touchdown.

Note: Fuel jettisoning may also be considered prior to ditching.

Passenger Cabin Preparation

Confer with cabin personnel either by interphone or by having them report to the flight deck in person to ensure passenger cabin preparations for ditching are complete.

Ditching Final

Transmit final position. Select flaps 30 or landing flaps appropriate for the existing conditions.

Advise the cabin crew of imminent touchdown. On final approach announce ditching is imminent and advise crew and passengers to brace for impact.

Maintain airspeed at VREF. Maintain 200 to 300 fpm rate of descent. Plan to touchdown on the windward side and parallel to the waves or swells, if possible.

To accomplish the flare and touchdown, rotate smoothly to touchdown attitude of 10° to 12°. Maintain airspeed and rate of descent with thrust.

Initiate Evacuation

After the airplane has come to rest, proceed to assigned ditching stations and evacuate as soon as possible, ensuring all passengers are out of the airplane.

Deploy slides/rafts. Be careful not to rip or puncture the slides/rafts. Avoid drifting into or under parts of the airplane. Remain clear of fuel-saturated water.

6.16 Force landing on the earth

Policy_

When the flight crew can not safely land according to normal procedure, the captain could determine to force landing. The captain makes his best to select the forced landing at the airport. The captain can select landing outside the airport if it is not possible to land at the airport. If one or more landing gears cannot be extended, the remained gears should be used to land. It is forbidden to use any partial-extended landing gear and the wing/fuselage with the landing gear not extended to touch the ground. This kind of landing must be performed on the paved surface, and cannot be performed on the grass or soft surface. Before execution, the force landing position (if possible) should be reported to the ATC and HNA operation command center to ask for airport rescue. Before force landing, the captain should command the flight attendant crew to prepare for the cabin safety and the emergency evacuation.

The choice of the forced landing places

The captain should try to select the paved surface to force landing, and the captain can select landing outside the airport if the conditions are not possible for landing at the airport. The following factors should be considered if landing outside the airport:

In the less populated area: make best to close to the residence area, road and lake, carry out upwind.

In the marsh and forest area: choose floral denseness area, keep the minimum allowable speed process upwind.

In the frozen lack surface or river areas: choosethe area which is close to bank without snow pile, drumlin or moves to the orientation of drumlin.

In the dune area: keep the minimum allowable speed along the ridge line of the dune.

In the mountainous area: moves slantingly up to the hillside.

Forced landing preparation and procedure

Advise ATC and company dispatchers of the captain purpose and requirements_

Try to burn off fuel or perform the emergency defueling to reduce the landing weight_

Before the force landing, pay attention to keep some fuel for the observation of terrain and go around.

Make the preparation of division of the work and reinforce the crew cooperation_

Carry out the landing checklist_

If possible, the captain should appoint one flight crew member who do not participate in the flight control to assist the cabin crew to prepare for the forced landing safety_

The captain should broadcast to the passengers if it is possible_

After forced landing the passenger evacuation procedures should be performed.

6.17 Pilot Incapacitation

Judging and Decision Making

Pilot Incapacitation can happen at any age and during any phase of flight. Incapacitation can happen in many forms in an obvious or subtle manner; terminally ill, shock, death, partial loss of physical strength and/or mental functions. Shock and incapacitation are the most dangerous.

The key to recognizing pilot incapacitation early is to use the "crew concept" and standard callout procedure often during flight operations. The right crew cooperation, communication and use of Standard Operational Procedures (SOP) helps to determine if an incapacitation has or is occuring.

When one Crew Member **cannot or does not** answer a standard callout, react correctly to the related standard procedure or current flight phase, the suspecting Pilot should consider if the crew is Incapacitated. If the suspected Crew Member **does not** answer timely for the second time, he/she should be considered incapacitated. The Pilot should announce "I HAVE CONTROL" take over the flight controls immediately.

If one Pilot (PF) does not feel well, he should advise other pilot,(PM) and hand over contol of flight.

Chain of Command

1) Two-pilot crew

If the Captain becomes incapacitated, the First Officer will assume control and take over command responsibility for the duration of flight, or until the Captain recovers.

2) More-than-Two-pilot crew

If the Captain becomes incapacitated, the First Officer will assume control and take over command responsibility until the more Senior First Officer takes control. If a second rated Captain is on board, he/she will then take over Command. Command transfer sequence is normally in the following order; Captain, Senior First Officer, First Officer and Second Officer.

If the previous Captain in command remains incapacitated, the airplane **cannot take off**. If there is any incapacitation during flight, the airplane **cannot take off again** after landing until another qualified replacement captain for this aircraft type joins the Flight Crew.

Operational procedure:

If a Pilot becomes incapacitated during flight, another Pilot should take over to control the airplane and check the controls and switch position, and:

Declare the Emergency and advise "Single Pilot Operation Due To Incapacitation", engage Autopilot to reduce the work load_

Advise ATC to get help_

Engage Autopilot, advise Cabin Crew to move the incapacitated Pilot out of the Cockpit as soon as possible after the airplane is controlled. If there is any difficulty, the seat can be moved back to the end and restrain the Pilot well with the seatbelts and move feet away from the rudder pedals.

Organize the Cockpit workload, make preparations for the Approach and Landing, and ask the Purser to check if any Pilots are on board as Passengers who could help if necessary_

When the Captain is incapacitated, First Officer acts as PF and PM for the flight, advise ATC to get help if necessary and ask for radar guidance, and use Autolanding as necessary. The First Officer **shall not** taxi the aircraft.

Advise the ATC or company dispatchers arrange for an Ambulance and after landing to allow for the incapacitated crew member to be provided with medical attention as soon as possible.

6.18 Bomb Threat Procedure in Air:

- Advise ATC, set Transponder to 7700
- Descend to 8,000 feet or minimum safety altitude immediately
- Select No Smoking and Fasten the Seat Belt switch ON
- Turn off non-essential electrics in area (ask the Cabin Crew to help)
- Ask the explosives expert (if any)to help if onboard
- If possible, place the explosives beside the right Aft Service Door
- Land at the nearest Suitable Airport
- Prepare for evacuation and advise Cabin Crew "Passenger Evacuation Preparation"
- Ask for Rescue Facilities

After landing-

- Taxi to the Safe Zone.
- Perform the Evacuation Procedures.
- Forbid the Passengers to Evacuate of the airplane with personal articles (handbags).

6.19 RVSM Emergency Procedures

6.19.1 Emergency Situation and Handling Principles

6.19.1.1 Emergency Situation

The emergency situations in RVSM operation region mainly refer to the cases which will influence the aircraft's altitude maintaining ability. The reasons of these events include aircraft equipment faults, severe turbulence and adverse weather etc.

For some equipment failure, the safest action may be that flight crews maintain the original designated flight level and route flight when altimeter altitude maintaining ability will not be influenced and there is only relative error. Fight crew and ATC should closely notice the altitude maintained error, and maintain flight separation.

For some equipment with serious failures which don't have altitude remaining ability and in some extreme error case, the safest action may be that the flight members leave the present altitude or route by obtaining ATC correction or revision clearance.

6.19.1.2 Handling Principles

1) The captain has the right to decide the action to be taken according to the situation at that time, and can make the final decision on flight safety, but be responsible for the decision.
2) Flight crew should report the emergency situation to ATC as soon as possible. Before deviate from the designated route or flight level, obtain the clearance from traffic control. Use distress or emergency signals if necessary.
3) Don't give up any possible ways to contact ATC without stops until obtain the clearance when they can't follow ATC clearance or can't obtain ATC clearance. The flight crews are allowed to take actions before obtaining ATC clearance.
4) If cannot receive the corrected ATC clearance in time but need to take actions to avoid the conflict with other aircraft, the flight crew should take actions and fly at the altitude where it's less possible to encounter other aircraft. Flight crew can decide to leave RVSM flight level (the vertical space for ocean flight airspace general will be between FL290-410). That will reduce the possibility to conflict with other aircraft.

5) Report to HNA operation control department dispatching control center by using communication equipment (satellite communication), and obtain necessary assistance.

6.19.2 Emergency Procedures in the Chinese Region

Pilots should notify ATC the emergency situations (for example, equipment failure, weather condition) which will influence the ability to maintain the designated flight level and coordinate with the controller for the action plan. Pilots should be familiar with the pilot and controller's emergency procedures under emergency situation, when the aircraft is in one of the following situations, pilots should notify ATC in time.

1) Do not comply with the RVSM operation requirements due to equipment failure.
2) Loss of redundancy for the altitude measurement system.
3) ATC must be notify, when pilot fly in RVSM airspace by following instrument flight rules, and encounter severe turbulence which will influence altitude maintaining ability then deviate 90 meters (300 feet)from the designated flight level or any other situation above. After flight, report the deviation to the local safety supervision administration office.

6.19.2.1 Emergency handling procedure: encounter adverse weather and aircraft system failure.

The initial actions taken by pilot should be as follows, when the designated flight altitude from controller cannot be maintained and aircraft altitude maintaining performance cannot be determined.
Notify controller and request the following assistance. □Try to maintain the flight altitude cleared by controller, and evaluate the situation at that time. □Observe air traffic by visual or using TCAS (if installed) □Turn on exterior lighting to warn the other aircraft nearby. □Report aircraft position, flight altitude and crew action intention at 121.5 MHz(123.45MHz among pilots can be used as backup)

6.19.2.2 60 meters (200 feet) altitude deviation due to severe turbulence and/or mountain wave

Pilot:	ATC:
□When encountering 60 meters(200feet) altitude deviation or above due to turbulence and/or mountain wave, pilot should report to controller "can not maintain RVSM due turbulence" □If controller doesn't give clearance, request ATC clearance to avoid traffic nears this altitude. □Apply for altitude change if needed. □Report turbulence and/or mountain wave's position and serious degree to the controller.	□Evaluate the traffic condition to determine whether the aircraft can be spaced or not by providing lateral, longitudinal and increase vertical separation methods. If permissible, use appropriate minimum separation. □Report flight conflict to the pilots □Give new air traffic clearance; instruct the aircraft to change flight altitude. □Report it to other aircraft.

6.19.2.3 Encounter mountain wave. Encounter the mountain wave which will not lead to a 60 meters (200 feet) deviation or above. The following procedures are used to instruct pilots to do the handling procedures when encounter light mountain wave.

Pilot should:	ATC should:
□Report to controller that we encounter the mountain wave □Report the position and serious degree of the mountain wave to the controller. □Apply for flight altitude change or deviation from the planned route if needed.	□Report the air traffic conflict at the nearby altitude to the pilot. □If pilot require, direct or guide the aircraft to avoid the other aircraft near this altitude if air traffic is permitted. □Direct the aircraft to change flight level if air traffic is permitted □Report it to other aircraft.

6.19.2.4 Encounter wake turbulence

Pilot should:	Controller should:
□Report to the controller and apply for radar vector, and altitude change. If possible, carry out lateral offset, aircraft offset to the right for 1-2 miles.	□Give radar vector and altitude change clearance. If possible, carry out lateral offset; instruct the aircraft to offset to the right side 1-2 miles (if situation permitted).

6.19.2.5 "Maintaining RVSM is impossible for equipment reasons". Automatic altitude control system, altitude warning system or all master altimeter failure.

Pilot will:	Controller will:
□Report controller "cannot maintain RVSM due equipment" □Apply to controller for RVSM airspace leaving clearance unless operation situation permit other methods. □Consider to announce aircraft emergency situation, report failure and action intention to controller. □If controller provides lateral longitudinal or normal vertical separation, maintain the designated flight altitude. □If ATC can not give enough separation with other aircraft, request climb or descent to the flight level outside RVSM airspace.	□Provide the aircraft with 600 meters (2000feet) vertical separation or use appropriate lateral separation. □Instruct the aircraft to leave airspace, unless operation situation permitted other methods (for example, if the air traffic is not heavy, controller may permit it maintain in the RVSM airspace, and provide 600 meters vertical separation.)

6.19.2.6 One Primary Altimeter Still in Normal Operation Status

Pilots will_	ATC will_
cross check the standby altimeter. notify ATC that the flight is based on one primary altimeter currently. take actions according to “All primary altimeters failure” procedure if the accuracy of primary altimeters can not be confirmed.	confirm that they have been notified that the aircraft is now operated with one primary altimeter._Note_Now the aircraft can still be operated within RVSM space, unless the aircraft reports that “unable to maintain RVSM due equipment reason”. inform that the aircraft is operated with one primary altimeter while handing over the control to the next ATC controller or control unit.

6.19.2.7 Transponder Failure

Pilots will_	ATC will_
□ report ATC and request to continue the operation on cleared altitude. Report while position recovered. □ comply with ATC clearance if ATC gives a new ATC clearance.	□ consider allowing the aircraft continue the operation on cleared altitude, and clear other aircraft to maneuver when necessary. □ give a new ATC clearance if necessary.

6.19.2.8 Emergency Descent or Altitude Change. Pilots can change flight level when it is necessary to change flight level while the aircraft is encountered with failure, icing condition or thunderstorm area circum-navigation.

Note: This emergency descent procedure is the normal procedure, if there are terrain, airspace limit area and airline structure requirement, especially there is a minimum safety limitation in the route (airline) (such as L888, B213, B215) or the limitation area and dangerous area and the detailed requirement for the flight operation (emergency descent after depressurization). Decide to execute procedure according to the situation, report the controller in time.

Pilots_	ATC_
□report ATC the exact position of the aircraft, and request another assigned flight level. □the captain can decide to change the original assigned FL when the aircraft is encountered an emergency, but he must report to ATC and be responsible to the decision. □the method of changing FL is: right turn 30 degrees from the aircraft current heading, and proceed with the new heading 20 kilometers, and then left turn to parallel the original route, climb or descend to a new altitude, then return to the original route. □establish communication with vicinity traffics via broadcasting and transmit a warning message, report squawking, FL, exact position and	□must define clearly the changed altitude and the segment and duration of the changed altitude when he clears an aircraft to change altitude.

intention with current frequency and 121.5 Mhz as appropriate (the air to air frequency between pilots, 123.45 MHz, can be used as a backup)_ visually observe air traffic_ turn on all exterior lights of the aircraft.	

6.19.3 ICAO Emergency Procedures

6.19.3.1 When the aircraft can not proceed with ATC clearance, or maintain area required navigation performance, a revised clearance must be obtained before taking any action. The distress signal MAYDAY or emergency signal PANPAN should be called triple times via radio when it is necessary.

If it is impossible to obtain the clearance beforehand, the ATC clearance should be obtained as soon as possible. Before obtaining the revised clearance, pilots should:

1) Turn left or right 90 degrees away from assigned route or track when possible, the aircraft position relative to the organized route or track system should be considered while determining the turning direction. Other factors that may affect turning direction are_
   (1) the direction to alternate airport, terrain effect
   (2) in lateral offset flight or not
   (3) Assigned flight altitude on the vicinity route or track.
2) After the turn, pilots should:
   (1) Minimize the descent rate as much as possible if practical if the cleared altitude can not be maintained.
   (2) Consider that other aircraft may be cleared lateral offset.
   (3) From any side of the assigned route, maintain a track with 15 nm lateral separation.
   (4) When the offset track is established, climb or descend to an altitude with 500 ft difference with normal operation altitude.
3) Establish communication with vicinity traffics via broadcasting and transmit a warning message, report flight number, FL, position (ATS route name or track code) and intention with current frequency and 121.5 Mhz as appropriate (or 123.45 MHz as a backup)_

4) Observe conflict traffic with visual and reference ACAS.
5) Turn on all exterior lights of the aircraft.
6) The SSR transponder keeps ON.
7) Take necessary action to ensure aircraft safety.
While away from the assigned track to establish and maintain a 15 nm track lateral separation, flight crew should avoid any bank angle that will cause an overshoot of the track to obtain, particularly in an area with minimum lateral separation of 30 nm.

6.19.3.2

When circumnavigation is necessary for dangerous weather, a revised clearance should be obtained before taking any action. Pilots can use WEATHER DEVIATION REQUIRED when they begin to contact ATC to express that they want to obtain ATC communication priority. When necessary, pilots should use the emergency signal PANPAN, best triple times if an action is taken without a revised ATC clearance. Note that pilots are required to carry out the captain right endowed by regulations. [U1]If it is necessary for the aircraft to circumnavigate for the dangerous weather, and it is unable to obtain a clearance beforehand, the ATC clearance should be obtained as soon as practical. Pilots should take following actions before a clearance is obtained_

1) If possible, deviate from the organized track or track system;
2) Establish communication with vicinity traffics via broadcasting and transmit a warning message, report flight number, FL, position (ATS route name or track code) and intention with current frequency and 121.5 Mhz as appropriate (or 123.45 MHz as a backup)_
3) Observe conflict traffic with visual and reference ACAS. There may be a conflict if an aircraft is discovered at or close to the same altitude, pilots should adjust the aircraft track as required to avoid conflict.
4) Turn on all exterior lights of the aircraft.
5) Offset within 10 nm, maintain ATC cleared altitude.
6) Offset more than 10 nm, change altitude as the following table when the aircraft is close to 10 nm.

The centerline track of the route	Offset more than 10 nm	Altitude change
Eastward 000-179	Left	Descend 300 ft
	Right	Climb 300 ft
Westward 180-359	Left	Climb 300 ft
	Right	Descend 300 ft

7) When the offset is back within 10 nm, return to assigned altitude.
8) If communication is not established before offset, try to continue contact with ATC to obtain clearance. If communication is established, keep contact with ATC and notify intention to obtain important traffic information.

6.20 Non-normal operations during ETOPS

ETOPS Extended Range Operation with Two Engine Airplanes (ETOPS) are those flights which include points at a flying distance greater than one hour (in still air) from an adequate airport, at engine out cruise speed.

ETOPS Requirements and Approval

The Minimum Equipment List (MEL) and the Dispatch Deviations Guide (DDG) include dispatch relief levels appropriate to ETOPS. Refer to operators procedures and policies for more information on ETOPS requirements.

Flight and Performance

Crews undertaking ETOPS flights must be familiar with the ETOPS alternate airports listed in the flight plan. These airports must meet ETOPS weather minima which require an incremental increase above conventional alternate minimums at dispatch, and be located so as to ensure that the airplane can divert and land in the event of a system failure requiring a diversion.

Planning an ETOPS flight requires an understanding of the area of operations, critical fuel reserves, altitude capability, cruise performance tables and icing penalties. The Flight Planning and Performance Manual (FPPM) provides guidance to compute critical fuel reserves which are essential for the flight crew to satisfy the requirements of the ETOPS flight profile. The FPPM also provides one engine inoperative altitude capability and cruise and diversion fuel information at ETOPS planning speeds. This information is not included in the FCOM/QRH. Fuel reserve corrections must be made for winds, non-standard atmospheric conditions, performance deterioration caused by engines or airframe, and when needed, flight through forecast icing conditions.

Note: Critical fuel calculations are part of the ETOPS dispatch process and are not normally calculated by the flight crew. The crew normally receives ETOPS critical fuel information in the Computer Flight Plan (CFP).

Procedures

During the last hour of cruise on all ETOPS flights, a fuel crossfeed valve check is done on airplanes with a single crossfeed valve. This verifies that the crossfeed valve is operating so that on the subsequent flight, if an engine fails, fuel is available from both main tanks through the crossfeed valve.

ETOPS engine-out procedures may be different from standard non-normal procedures. Following an engine failure the crew performs a modified “driftdown” procedure determined by the ETOPS route requirements. This procedure typically uses higher descent and cruise speeds, and a lower cruise altitude following engine failure. This allows the airplane to reach an alternate airport within the specific time limits authorized for the operator. These cruise speeds and altitudes are determined by the operator and approved by its regulatory agency and usually differ from the engine-out speeds provided by the FMC. The captain, however, has the discretion to modify this speed if actual conditions following the diversion decision dictate such a change.

Polar Operations

PoRefer to the FMC Polar Navigation section in Volume 2 of the FCOM for specifics about operations in polar regions and a description of the boundaries of the polar regions.

During preflight planning extremely cold air masses should be noted and cold fuel temperatures should be considered. See the Low Fuel Temperature section in this chapter for details regarding recommendations and crew actions.

Due to limited availability of alternate airports relative to other regions, special attention should be given to diversion planning including airport conditions and availability of compatible fuel. Crews should be prepared to operate in QFE and metric altitude where required. Expect changes in assigned cruising levels enroute since standard cruising levels vary by FIR.

Some airports provide QNH upon request, even if their standard is QFE.

Metric wind speed (m/sec) may be all that is available. A simple approximation: 1 m/sec = 2 knots. A feet to meters conversion chart may be useful for planning step climbs, converting minima, etc.

Use caution when using ADF and/or VOR raw data. ADF orientation (true or magnetic) is determined by the heading reference selected by the crew. VOR radials are displayed according to the orientation of the VOR station.

Communications should be handled according to the applicable enroute charts.

Above 82 degrees N, SATCOM is unavailable. HF frequencies and HF SELCAL must be arranged by the flight crew prior to the end of SATCOM coverage.

Routine company communications procedures should include flight following to enable immediate assistance during a diversion or other emergency.

767-200, 767-300

Note: To use SATCOM on the ground, the IRUs must be aligned.

When navigating in the polar regions, magnetic heading should be considered unreliable or totally useless for navigation. Magnetic variations typically are extreme, often are not constant at the same point and change rapidly as airplane position changes. Ensure the computer flight plan shows true tracks and true headings. Grid headings may also be used as a reference for those airplanes equipped with grid heading indicators although no airplane systems use grid heading. For some high latitude airports, grid headings are shown on the instrument approach procedures. Note that unmapped areas in the GPWS terrain database display as magenta dots on the map, regardless of the airplane altitude.

The primary roll mode for polar operations should be LNAV, which may be used with the heading reference switch in the NORM position. HDG SEL/HOLD are functional but require the manual selection of TRUE heading reference.Deviations from planned route may be accomplished in HDG SEL.

Loss of both GPS units results in an increased ANP and possible display of the UNABLE RNP message but normally would not prevent polar operation.

Loss of one or two IRUs does not significantly affect navigation accuracy. Operation on one remaining IRU should be limited to diversion to the nearest suitable airport.

6.21 Warning System

The warning system consists of the following separate systems:

- engine indication and crew alerting system (EICAS)
- warning system
- ground proximity warning system (GPWS)
- traffic alert and collision avoidance system (TCAS)

These systems provide all airplane crew alerting.Alert is defined as a visual, tactile and/or aural alert requiring crew awareness and possible crew action.

6.21.1 Engine Indication and Crew Alerting System (EICAS)

EICAS consolidates engine and subsystem indications and provides a centrally located crew alerting message display. EICAS also displays some system status and maintenance information. EICAS provides:

- system alerts
- maintenance information
- status messages
- communication alerts

System Alert Messages

System alert messages are associated with aircraft-system failures or faults. These may require performance of non–normal procedures, or affect the way the flight crew operates the airplane. There are four categories of system alert messages:

- time-critical warning
- warning
- caution
- advisory

System alert messages not associated with aircraft-system failures or faults but which may affect the way the flight crew operates the airplane include the following:

- configuration
- airspeed
- altitude
- windshear
- ground proximity warning system (GPWS)
- traffic alert and collision avoidance system (TCAS)
- communication alert messages such as SELCAL, ACARS, ATC or PRINTER
- FMC messages (See Chapter 11, Flight Management, Navigation)

Non–normal airplane system conditions not affecting the normal airplane operations are annunciated using status or maintenance messages.

System Alert Level Definitions

Time Critical Warnings

Time critical warnings alert the crew of a non–normal operational condition requiring immediate crew awareness and corrective action to maintain safe flight.Time critical warnings are usually associated with primary flight path control.Master WARNING lights, voice alerts, and ADI indications or stick shakers announce time critical warning conditions.

Warnings

Warnings alert the crew to a non–normal operational or system condition requiring immediate crew awareness and corrective action.

Cautions

Cautions alert the crew to a non–normal operational or system condition requiring immediate crew awareness. Corrective action may be required.

Advisories

Advisories alert the crew to a non–normal operational or system condition requiring routine crew awareness. Corrective action may be required.

Communication Alerts

Communication alerts are triggered by the communication management system.These alerts direct the crew to the appropriate message display:

There are three levels of communication alert:

• low – identifies an incoming communication requiring timely awareness and response
• medium – identify an incoming communication requiring immediate awareness and a prompt response. It is accompanied by an aural chime
• high – reserved for future use.

A detailed description of the communication management system is described in Chapter 5, Communications.

Status Messages

Status messages identify system faults affecting airplane dispatch and are not considered crew alerts.The messages are displayed on the EICAS STATUS page.

Alert Message Displays

Alert messages are displayed in both prioritized and chronological order.

The priority in descending order is:

• warning (red)

• caution (amber)

• advisory (amber, indented)

• medium level communication (white, preceded by a dot)

• low level communication (white, indented, preceded by a dot)

Warnings, cautions, and advisories are displayed from the top down in the EICAS display message area.

The most recent message is displayed at the top of its respective level.

If the number of messages exceeds eleven, the area below the alert field displays a page cue, indicating more than one page of messages is available for display.

Paging is accomplished by pushing the CANCEL/RECALL switch on the display select panel.

Warning alerts can only be cleared by correcting the condition causing the warning. All caution and advisory alerts can be cleared. When the last page is displayed, pushing the CANCEL/RECALL switch clears all displayed caution and advisory alerts. Cleared caution and advisory alerts whose conditions still exist can be recalled by pushing the CANCEL/RECALL switch again. This also recalls the first page for review.

Communication alert messages are displayed at the bottom of the message area. Except for the Communication Alert Line, an overflow of system alert messages displaces communication alerts.

The Communication Alert Line, the bottom line of the EICAS message field (line 11), is reserved for a communication alert (medium or low) if one is active. The Communication Alert Line can not be displaced by a system alert even if more than 10 lines are active.Communication alerts are removed when a pilot selects the appropriate switch on the Pilot’s call panel.

Master Warning/Caution Reset Switches and Lights

Two Master WARNING/CAUTION reset switches each contain a Master WARNING light and Master CAUTION light.

The red Master WARNING lights illuminate when any warning alert or time critical warning occurs (except a stall warning). The lights remain illuminated as long as the warning alert exists or until either Master WARNING/CAUTION reset switch is pushed. Pushing either switch:

• extinguishes both Master WARNING lights
• resets the lights for future warning alerts.

Pushing either Master WARNING/CAUTION reset switch also silences the warning siren and fire bell except for the following warnings:

• landing configuration (for example, when the flaps are in a landing position and landing gear are not down)
• autopilot disconnect
• takeoff configuration

Pushing either Master WARNING/CAUTION reset switch also silences the overspeed warning siren.

The amber Master CAUTION lights illuminate when any caution alert occurs. The lights remain on as long as the caution alert exists or until either Master WARNING/CAUTION reset switch is pushed. Pushing either switch:

• extinguishes both Master CAUTION lights
• resets the lights for future caution alerts.

Flight Deck Panel Annunciator Lights

Flight deck panel annunciator lights are used in conjunction with EICAS messages to:

• help locate and identify affected systems and controls
• reduce the potential for error.

The annunciator lights provide system feedback in response to flight crew action.The lights also assist in fault detection and system preflight configuration when the engines are shut down and to supplement EICAS information.

Aural Alerts

Aural alerts are provided to ensure crew attention, recognition, and response. Aural alerts include synthetic voices and tones. Aural voice alerts are the most direct and rapid method of communicating a specific alert condition to the crew. Aural tones are used to alert the crew and to discriminate between the different alert types and levels. Aural alerts annunciate warnings and cautions. There are no aural annunciations associated with advisories. Aural alerts also annunciate medium level communication alerts. There are no aural alerts associated with low level communication alerts.

The aural alerts are:
- Beeper – used for all system alert caution level messages. The beeper consists of a tone that sounds four times in a second. The beeper automatically silences after one series of four beeps
- Bell – used for fire warnings. The bell sounds repeatedly until crew action is initiated
- Voice – synthetic voices annunciate time critical warning alert conditions. Synthetic voices also annunciate certain normal but time critical operational information, such as approach phase altitude callouts.
- Siren – used to annunciate cabin altitude, configuration, and autopilot disconnect warning alerts. The siren consists of alternating high and low tones
- Clacker – used to annunciate overspeed warning.
- Chime – a high–low tone chime used for medium level communication alerts. The chime sounds once for each communication alert.

All continuous aural alerts are silenced automatically when the respective alert condition no longer exists.

Alert Inhibits

Alerts are inhibited during part of the takeoff in order not to distract the crew. Alerts are also inhibited when they are operationally unnecessary or inappropriate. Alert messages, except for warnings and messages directly relevant to flight operations, are inhibited during engine start to eliminate nuisance messages. Alert messages are inhibited individually at other times, such as during the preflight and postflight phases or engine shutdown, when they are operationally unnecessary.

Message Consolidation

On the ground with both engines shut down, certain caution and advisory alert messages are inhibited by collecting them into more general alert messages. These include individual fuel, hydraulic, door, and electrical messages. For example, two or more individual entry, cargo, and access door EICAS messages are replaced by the EICAS advisory message DOORS.

Engine Start Message Inhibits

During ground engine start, most new caution and advisory alerts are inhibited from engine start switch engagement until one of the following occurs:

- the engine reaches idle RPM
- the start is aborted, or
- 2 minutes elapse from engine start switch engagement.

The following messages are not inhibited:

- ENG FUEL VAL
- ENG SHUTDOWN
- ENG STARTER
- STARTER CUTOUT.

Takeoff Inhibits

Warning Inhibits

The Master WARNING lights and fire bell are inhibited for fire during part of the takeoff. The inhibit begins at nose gear extension during rotation and continues until the first to occur:

- 400 feet AGL, or
- 20 seconds elapsed time

If a fire occurs during the inhibit, an EICAS warning message appears, but the fire bell and Master WARNING lights do not activate. If the warning condition still exists when the inhibit is removed, the fire bell and Master WARNING lights activate immediately.

Note: Takeoff configuration warnings are terminated at rotation.

Caution Inhibits

The Master CAUTION lights and aural annunciations are inhibited for all cautions during part of the takeoff. The inhibit begins at 80 knots and continues until the first to occur:

- 400 feet AGL, or
- 20 seconds elapsed time following nose gear extension

If a caution occurs during the inhibit and exists on the ground when the airspeed decreases below 75 knots, both Master CAUTION lights and aural activate.

Note: EICAS caution messages are not inhibited during takeoff.

Advisory Inhibits

The following EICAS advisory messages are inhibited on takeoff:

- DATALINK LOST to indicate data link is temporarily lost.
- WINDSHEAR SYS to indicate windshear alerting functions are inoperative.

The inhibit begins from the time either engine is advanced to takeoff thrust until the first to occur:

- 400 feet AGL, or
- 20 seconds elapsed time following nose gear extension

All other EICAS advisory messages are not inhibited on takeoff.

Communication Inhibits

The following are inhibited during takeoff:

- EICAS communication alert messages such as SELCAL, ACARS, ATC or PRINTER and associated aural chimes. The CABIN ALERT message is not inhibited. The chime associated with the CABIN ALERT message is inhibited.

The inhibit begins from the time either engine is advanced to takeoff thrust until the first to occur:

- 400 feet AGL, or
- 20 seconds elapsed time following nose gear extension

Inhibits are cleared on the ground with both engines below takeoff thrust. If a message alert occurs during the inhibit and exists when the inhibit ends, the EICAS alert message and aural chime activate.

Landing Inhibits

Communication Inhibits

The following are inhibited during landing:

- EICAS communication alert messages such as SELCAL, ACARS, ATC or PRINTER and associated aural chimes. The CABIN ALERT message is not inhibited. The chime associated with the CABIN ALERT message is inhibited.

The inhibit begins on descent at 800 feet AGL and terminates at:

- less than 75 knots groundspeed
- 900 feet AGL on missed approach

If a communication alert message occurs during the inhibit and exists when inhibit ends, the EICAS alert message and associated aural chime activate.

Engine Shutdown Inhibits

Engine–driven pumps, generators, and other components whose alert messages would result from an engine shutdown are inhibited by the ENG SHUTDOWN message. When an engine is shutdown (FUEL CONTROL switch in cut off or fire handle pulled), the EICAS alert message L ENG SHUTDOWN or R ENG SHUTDOWN is displayed and the following L or R alerts are inhibited:

• ENG ANTI–ICE
• ENG BLEED OFF
• GEN DRIVE
• GEN OFF
• ENG OIL PRESS
• HYD PRIM PUMP
• ENG CONTROL

When the airplane is on the ground and both FUEL CONTROL switches are in the CUT OFF position, the Master CAUTION lights and the caution alert beeper are inhibited. This prevents alerts associated with routine gate operations from triggering nuisance lights and aural alerts.

When the shutdown inhibit is removed, the Master CAUTION lights and alert beeper do not activate for alerts that existed prior to its removal. For example, if the right hydraulic system is depressurized with both engines shutdown, and the left engine is then started, the Master CAUTION lights and beeper do not activate.The Master CAUTION lights and beeper activate only when the alert first occurs, provided no other inhibit is in effect.

Alert Message Inhibits

Alert message inhibits are those inhibits where one message is inhibited by the presence of another alert message. For example, individual fuel or hydraulic pump pressure messages are inhibited by higher priority system pressure messages. Certain alert messages are time delayed, even though discrete system lights may illuminate. Time delay inhibits prevent normal in–transit indications from appearing as EICAS system alert messages. For example, valves are generally only sensed open and/or closed, not in–transit. When a valve is in–transit, the alert message indicating the valve has failed to open or close is inhibited to allow the valve time to move to the commanded position. If the valve is not in the commanded position at the end of the inhibit period, an EICAS system alert message is displayed.

Altitude Alerting Inhibits

Altitude alerting is inhibited in flight with all landing gear down and locked.

Master Caution Lights and Beeper Inhibit
The Master CAUTION lights and the associated alert beeper are inhibited for the L and R ENG SHUTDOWN caution level message.

EICAS Event Record
The flight crew can manually capture and record any suspect condition into EICAS memory using the EICAS EVENT RECORD switch.
Systems which provide recorded information when the switch is activated include:

- anti–ice, ice detection
- flight controls/flaps and slats
- air systems
- fuel quantity and fuel management
- APU
- hydraulic
- electrical
- landing gear and brakes
- electronic engine control
- performance
- fire protection

Only the last manual event recorded will be retained for future retrieval.
The eventrecord function also has an automatic feature. When an EICAS event occurs,conditions are automatically written to EICAS memory.

EICAS Failure Indications
If a fault is detected in one of the cathode ray tubes (CRTs), the faulty display is blanked. Engine indications and crew alerting messages appear on the operable display. An EICAS DISPLAY advisory message displays when one CRT fails.
To ensure that all engine indications can be displayed with a CRT failure, an EICAS compacted display mode is available. The compacted display mode is described in the Engines, APU chapter.
If the EICAS control panel fails an EICAS CONT PNL advisory message displays and the EICAS full up engine mode automatically displays. The full engine mode is described in Chapter 7, Engines, APU. The cancel and recall switches will not operate when the EICAS control panel fails, however, brightness and computer select controls remain operative.
If both EICAS computers or CRTs fail, a standby engine indicator (SEI) is automatically activated. The SEI, system lights and indicators are used to monitor the engines and system operation when a total EICAS failure occurs.

6.21.2 Warning System

The warning system consists of flight deck speakers, Master WARNING/CAUTION lights, EICAS alert messages, and stick shaker motors.

The warning system controls and activates alerts for:

- fire (See Chapter 8, Fire Protection)
- cabin altitude (See Chapter 2, Air Systems)
- autopilot disconnect (See Chapter 4, Automatic Flight)
- configuration
- airspeed
- altitude
- crew alertness
- ground proximity warning system (GPWS)
- windshear
- traffic alert and collision avoidance system (TCAS)

Configuration Alerts

Takeoff

Takeoff configuration warnings are armed when the airplane is on the ground and thrust is in the takeoff range on either engine. Takeoff configuration warnings consist of:

- Master WARNING lights illuminate
- CONFIG warning light illuminates
- aural warning siren sounds
- applicable EICAS configuration warning alert message(s) are displayed.

Takeoff configuration warning messages include:

- FLAPS
- PARKING BRAKE
- SPOILERS
- STABILIZER

Takeoff configuration warnings are disarmed at rotation.

Existing takeoff configuration warning are:

- cancelled when the configuration error is corrected
- terminated at rotation

When a takeoff configuration warning occurs, pushing either Master WARNING/CAUTION reset switch resets the Master WARNING lights but does not silence the siren or clear the EICAS alert message. Before reaching rotation, the siren can be silenced and the EICAS alert message cleared only by retarding both thrust levers or correcting the condition. If thrust is reduced, the EICAS takeoff configuration message remains displayed for 10 seconds so the crew can positively identify the configuration problem.

Holding the configuration test switch in the takeoff (T/O) position simulates accelerating an engine to takeoff power. No warnings occur when testing an airplane properly configured for takeoff. If the airplane is not configured for takeoff a configuration warning results. Releasing the test switch cancels the test.

Landing

The landing configuration warning system alerts the crew that the landing gear is not extended for landing. The landing configuration warning activates if:

- the airplane is in flight, and
- any landing gear is not down and locked, and
- either of the following conditions exists:
- flaps in a landing position (25 or 30), or
- any thrust lever is at idle with radio altitude below 800 feet.

The landing configuration warning consists of:

- Master WARNING lights illuminate
- CONFIG warning light illuminates
- aural warning siren activates
- the GEAR NOT DOWN EICAS warning alert message is displayed.

With the flaps in a landing position, the siren and alert message cannot be deactivated with the Master WARNING/CAUTION reset switches. The siren and message continue until the condition is corrected or the gear override switch is pushed.

If the warning is due to an idle thrust setting at low altitude, pushing either Master WARNING/CAUTION reset switch silences the siren and extinguishes the Master WARNING lights. The EICAS message remains displayed until the configuration error is corrected.

Holding the configuration test switch in the landing (LDG) position results in a configuration warning regardless of landing gear position. All warning indications disappear when the switch is released.

Airspeed Alerts
Stall Warning
Warning of an impending stall is provided by left and right stick shakers, which independently vibrate the left and right control columns. If the flaps are in the retracted position and the angle of attack continues to increase, a control column nudger moves the control column forward. Both systems are energized in flight and deactivated on the ground through air/ground logic.
Holding the stall warning tests switches to either the L or R position checks the left and right stall warning systems, respectively. If the systems are tested at the same time, both columns vibrate and the control column nudger activates.
Overspeed Warning
An overspeed warning occurs if Vmo/Mmo limits are exceeded. The overspeed warning consists of:

- Master WARNING lights illuminate
- OVSPD light illuminates
- the EICAS warning alert message OVERSPEED is displayed
- aural warning clacker sounds

All warning indications remain activated until airspeed is reduced below Vmo/Mmo.The aural warning can be silenced by pushing either Master WARNING/CAUTION reset switch.
Altitude Alerts
Altitude alerting occurs when approaching or departing the MCP–selected altitude.
Approaching A Selected Altitude
At 900 feet prior to reaching the selected altitude, the ALT light on each pilot’s altimeter illuminates. At 300 feet prior to reaching the selected altitude, the ALT lights extinguish.
Deviating From A Selected Altitude
When deviating 300 feet from the selected altitude:

- the Master CAUTION lights illuminate
- the caution aural sounds
- the EICAS caution message ALTITUDE ALERT is displayed

- the ALT ALERT light illuminates.

When deviating more than 900 feet from the selected altitude, or upon returning to within 300 feet of the selected altitude:

- the Master CAUTION lights extinguish
- the EICAS caution message ALTITUDE ALERT is no longer displayed
- The ALT ALERT light extinguishes.

Resetting To A Selected Altitude

Altitude alerting is reset when:

- the airplane returns to within 300 feet of the altitude selected or deviates more than 900 feet from the altitude selected
- the MCP-selected altitude is changed

Altitude Alert Inhibits

Altitude alerting is inhibited in flight with all landing gear down and locked.

6.21.3 Ground Proximity Warning System (GPWS)

Introduction

The ground proximity warning system (GPWS) provides time-critical alerts for potentially hazardous flight conditions involving imminent impact with the ground. GPWS is enabled whenever power is applied to the airplane. Override or inhibit switches allow the flight crew to inhibit certain GPWS alerts.

GPWS provides voice callouts (Mode 6) to assist the flight crew with situational awareness and to advise the flight crew of the aircraft's approximate height above the ground.

In addition to aircraft configuration, GPWS requires inputs from the following for proper operation:

- air data system
- inertial reference system
- instrument landing system
- radio altimeters

Note: Loss of an input does not necessarily inhibit operation of the entire GPWS.

Standard GPWS alerts are radio altitude based and provided for the following:

- excessive and severe descent rate (Mode 1)
- excessive terrain closure rate (Mode 2)
- altitude loss after takeoff or go-around (Mode 3)
- unsafe terrain clearance when not in the landing configuration (Mode 4)
- excessive deviation below an ILS glide slope (Mode 5)
- windshear (Mode 7)

GPWS (Enhanced)

In addition to standard alerts, enhanced GPWS provides look-ahead terrain awareness, including alerting and display functions. These functions compare the airplane's geographic position and altitude against an internal terrain database to predict and display potential conflicts between the airplane flight path and terrain.

In addition to standard GPWS inputs, enhanced GPWS requires inputs from the following for proper operation:

- global positioning system

Note: Loss of an input does not necessarily inhibit operation of the entire GPWS.

GPWS Alert Prioritization

GPWS and Windshear Warning System alerts are prioritized based on the level of hazard and the required flight crew response. The following are listed in order of decreasing priority:

GPWS Alerts

Condition	Alert Level	Description
Windshear - Immediate	Warning	Mode 7 - Actual windshear conditions (downdraft) A windshear immediate-alert warning inhibits all other GPWS and windshear alerts.
Ground proximity - Immediate	Warning	Mode 1 - Severe decent rate
Ground proximity - Immediate	Warning	Mode 2 - Severe terrain closure rate
Terrain - Awareness	Warning	Look-Ahead - Terrain along flight path (Near)
Windshear - Awareness	Warning	Predictive - Windshear condition along flight path
Ground proximity - Immediate	Caution	Mode 2 - Excessive terrain closure rate
Terrain - Awareness	Caution	Look-Ahead - Terrain along flight path

Condition	Alert Level	Description
Windshear -	Caution	Predictive - Windshear adjacent to flight path

GPWS Immediate-Alerts

GPWS immediate-alert warnings (Modes 1-2) are accompanied by:

- visual alerts (see tables)
- aural alerts (see tables)

If illuminated, pushing a Master WARNING/CAUTION Reset switch resets the Master WARNING lights but does not inhibit the GPWS warning.

GPWS immediate-alert cautions (Modes 1-5) are accompanied by:

- visual alerts (see tables)
- voice aural alerts (see tables)

GPWS Immediate-Alert Warnings

Aural Alert	Visual Alert	Description
PULL UP	PULL UP light (red) Master WARNING lights	Follows SINK RATE alert if descent rate becomes severe. Follows TERRAIN alert if excessive terrain closure rate continues and landing gear and/or flaps are not in landing configuration (Mode 2).

GPWS Immediate-Alert Cautions

Aural Alert	Visual Alert	Description
TERRAIN	GND PROX light (amber)	Excessive terrain closure rate. (Mode 2)
DON'T SINK	GND PROX light (amber)	Excessive altitude loss after takeoff or go–around. (Mode 3)
GLIDE SLOPE	GND PROX light (amber)	Deviation below glide slope. (Mode 5) Volume and repetition rate increase as deviation increases. **Note:** Pushing the GND PROX G/S INHB switch cancels or inhibits the alert below 1,000 feet radio altitude.

SINK RATE	GND PROX light (amber)	Excessive descent rate. (Mode 1)
TOO LOW, FLAPS	GND PROX light (amber)	Unsafe terrain clearance at low airspeed with flaps not in landing configuration. (Mode 4) **Note:** Pushing the GND PROX FLAP OVRD switch to OVRD inhibits the alert.
TOO LOW, GEAR	GND PROX light (amber)	Unsafe terrain clearance at low airspeed with landing gear not down. (Mode 4) **Note:** Pushing the GND PROX/CONFIG GEAR OVRI switch to OVRD inhibits the alert.
TOO LOW, TERRAIN	GND PROX light (amber)	Follows DON'T SINK if another descent is initiated after initial alert and before climbing to the altitude where the initial descent began. (Mode 3) Unsafe terrain clearance at low airspeed with either landing gear not down or flaps not in landing position. (Mode 4) **Note:** Pushing the GRND PROX FLAP OVRD switch to OVRD inhibits the alert, when the alert is due to flaps not in landing position. **Note:** Pushing the GND PROX/CONFIG GEAR OVRD switch to OVRD inhibits the alert, when the alert is due to gear not down.

GPWS Voice Callouts

GPWS provides voice callouts (Mode 6) to assist the flight crew with situational awareness and to advise the flight crew of the aircraft's approximate height above the ground.

Callout	Description
ONE THOUSAND	Airplane is at 1,000 feet AGL
FIVE HUNDRED	Airplane is at 500 feet AGL
FOUR HUNDRED	Airplane is at 400 feet AGL
THREE HUNDRED	Airplane is at 300 feet AGL
TWO HUNDRED	Airplane is at 200 feet AGL
ONE HUNDRED	Airplane is at 100 feet AGL
FIFTY	Airplane is at 50 feet AGL
FORTY	Airplane is at 40 feet AGL
THIRTY	Airplane is at 30 feet AGL
TWENTY	Airplane is at 20 feet AGL
TEN	Airplane is at 10 feet AGL
MINIMUMS	Airplane reaching the DH set in the captain's Decision Height Reference Window.
BANK ANGLE, BANK ANGLE	Voice callout occurs when airplane roll angle reaches: • 35 degrees • 40 degrees • 45 degrees **Note:** Callout is reset when roll angle decreases below 30 degrees.

6.21.4 Traffic Alert and Collision Avoidance System (TCAS)[U2]

TCAS alerts the crew to conflicting traffic. The system identifies a three–dimensional airspace around the airplane where a high likelihood of air traffic conflicts exist. These dimensions depend upon closure rates between the airplane and potentially conflicting traffic.

TCAS interrogates operating transponders in other aircraft, analyzes the replies, predicts flight paths and designates possible conflicting traffic as a "traffic aircraft."

When the system designates a traffic aircraft, TCAS provides the flight crew with a situational display. Additionally, TCAS may provide an aural annunciation and flight path guidance.

Note: Other aircraft that do not have an operating transponder can not initiate situational displays, aural annunciations or flight path guidance.

Note: TCAS is independent of ground–based air traffic control.

During normal operations, when TCAS designates a traffic aircraft, the system provides the following advisories and displays:

- Resolution Advisories (RA) and Displays
- Traffic Advisories (TA) and Displays
- Proximate Traffic and Other Traffic Displays

Normal Operations

TCAS is enabled from the Transponder Panel. The system is normally operated with the TCAS Mode Selector in the TA/RA mode.

The TA ONLY mode may be used:

- during engine out operations to prevent RAs when adequate thrust may not be available to follow the RA commands
- when intentionally operating near other traffic that may cause RAs, such as during parallel approaches or during VFR operations.

Resolution Advisories (RA) and Displays

A Resolution Advisory (RA) is an immediate-threat prediction that traffic aircraft will enter the TCAS collision airspace within approximately 20 to 30 seconds. If altitude data from the traffic aircraft's transponder is not available, no RA can be provided.

When TCAS issues a RA:

- a voice alert sounds
- vertical guidance is displayed
- symbology is displayed

Voice Alert

When a RA is predicted, one of several initial RA voice alerts will sound. These voice alerts aurally elaborate on the displayed Vertical Guidance and are described in this Chapter under:

• Voice Annunciations for ADI Guidance

Vertical Guidance

Vertical guidance is displayed for a traffic-avoidance maneuver. Traffic avoidance is ensured by adjusting or maintaining:

• an ADI pitch attitude outside the displayed red RA regions

Note: If the traffic aircraft also has TCAS and an operating mode S transponder,vertical guidance is coordinated with the traffic aircraft.

Display Symbology

The RA traffic symbol is a filled red square with an accompanying data tag when the traffic aircraft is providing altitude information.

The data tag appears in red and contains the following information about the traffic aircraft:

• a two-digit number proceeded with a "+" or a "-" sign and positioned above or below the RA symbol. This number represents, in hundreds of feet, the relative vertical position and altitude difference between the airplane and the traffic aircraft.

• a vertical arrow appears to the right of the RA symbol when the traffic aircraft is either climbing or descending in excess of 500 feet per minute.

The RA is displayed as follows:

HSI

• When the red TRAFFIC message appears and the traffic aircraft is within the selected display range, the traffic symbol's relative position is displayed.

• When the traffic aircraft is outside the selected range, the red OFFSCALE message appears.

• When TCAS is unable to track the traffic aircraft's bearing, the red RA symbol is displayed below the TRAFFIC message.

Traffic Advisories (TA) and Displays

A Traffic Advisory (TA) is a prediction that traffic aircraft will enter the TCAS collision airspace within approximately 35 to 40 seconds. TAs are intended to assist the crew in establishing visual contact with the traffic aircraft.

When TCAS issues a TA:

- a voice alert sounds
- symbology is displayed

Voice Alert

When a TA is predicted, TRAFFIC, TRAFFIC sounds once.

Display Symbology

The TA traffic symbol is a filled amber circle with an accompanying data tag when the traffic aircraft is providing altitude information.

The data tag appears in amber and contains the following information about the traffic aircraft:

- a two-digit number proceeded with a "+" or a "-" sign and positioned above or below the TA symbol. This number represents, in hundreds of feet, the relative vertical position and altitude difference between the airplane and the traffic aircraft.
- a vertical arrow appears to the right of the TA symbol when the traffic aircraft is either climbing or descending in excess of 500 feet per minute.

The TA is displayed as follows:

HSI

- When the amber TRAFFIC message appears and the traffic aircraft is within the selected display range, the traffic symbol's relative position is displayed.
- When TCAS is unable to track the traffic aircraft's bearing, the amber TA symbol is displayed below the TRAFFIC message.
- When the traffic aircraft is outside the selected range, the amber OFFSCALE message appears.

Automatic TA and RA Display

TCAS automatically displays RA and TA symbols on the HSI when:

- a RA or TA occurs, and
- neither pilot has pushed the EFIS Traffic (TFC) Switch, and
- the HSI Mode Selector is in the VOR, APP, or MAP mode, and
- the TCAS Mode Selector is in TA ONLY or TA/RA

Proximate Traffic and Other Traffic Displays

Proximate Traffic is a traffic aircraft that is neither a RA nor a TA but is within:

- six miles laterally, and
- 1,200 feet vertically

Other Traffic is a traffic aircraft that is neither a RA, TA, or Proximate Traffic

When TCAS identifies Proximate Traffic or Other Traffic:

- symbology is displayed

Display Symbology

The Proximate Traffic symbol is a filled diamond and the Other Traffic symbol is a hollow diamond. Both Proximate Traffic and Other Traffic symbols are displayed with an accompanying data tag when the traffic aircraft is providing altitude information.

The data tag contains the following information about the traffic aircraft:

- a two-digit number proceeded with a "+" or a "-" sign and positioned above or below the Proximate or Other Traffic symbol. This number represents, in hundreds of feet, the relative vertical position and altitude difference between the airplane and the traffic aircraft.
- a vertical arrow appears to the right of the Proximate or Other Traffic symbol when the traffic aircraft is either climbing or descending in excess of 500 feet per minute.

Proximate Traffic and Other Traffic are displayed as follows:

HSI

- When Proximate Traffic is within the selected display range, the traffic aircraft's relative position is displayed as a filled white diamond.
- When Other Traffic is within the selected display range, the traffic aircraft's relative position is displayed as an unfilled white diamond.

TCAS Voice Annunciations

Voice Annunciations for ADI Guidance

Voice Annunciation	Condition	Response
TRAFFIC, TRAFFIC	TCAS has issued a TA	Attempt to visually locate the traffic
CLIMB, CLIMB	Present ADI pitch attitude is within the red RA regions	Adjust ADI pitch attitude to remain outside the red RA regions
DESCEND, DESCEND	Present ADI pitch attitude is within the red RA regions	Adjust ADI pitch attitude to remain outside the red RA regions
ADJUST VERTICAL	TCAS requires change in pitch	Adjust ADI pitch attitude

Voice Annunciation	Condition	Response
MAINTAIN VERTICAL SPEED MAINTAIN	Present ADI pitch attitude is outside the red RA regions	Continue to keep ADI pitch attitude outside the red RA regions
CLIMB, CROSSING CLIMB CLIMB, CROSSING CLIMB	Present ADI pitch attitude is within the red RA regions Airplane will climb through the traffic aircraft's altitude	Adjust ADI pitch attitude to remain outside the red RA regions
MAINTAIN VERTICAL SPEED CROSSING MAINTAIN	Present ADI pitch attitude is outside the red RA regions Airplane will pass through the traffic aircraft's altitude	Continue to keep ADI pitch attitude outside the red RA regions
DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	Present ADI pitch attitude is within the red RA regions Airplane will descend through the traffic aircraft's altitude	Adjust ADI pitch attitude to remain outside the red RA regions
INCREASE CLIMB, INCREASE CLIMB INCREASE DESCENT, INCREASE DESCENT	TCAS requires change in pitch attitude Present ADI pitch attitude is within the red RA regions	Adjust ADI pitch attitude to remain outside the red RA regions

Voice Annunciation	Condition	Response
CLEAR OF CONFLICT	Vertical guidance is no longer displayed and traffic symbology changes to TA Separation between the airplane and the traffic aircraft is increasing	Attempt to visually locate the traffic aircraft

Inhibits

INCREASE DESCENT RAs are inhibited below approximately 1,450 feet radio altitude.

DESCEND RAs are inhibited below approximately 1,100 feet radio altitude.

RAs are inhibited below approximately 1,000 feet radio altitude. Below approximately 1,000 feet when the TA/RA mode is selected on the transponder panel, the TA mode is enabled automatically. All TCAS voice annunciations are inhibited below approximately 500 feet radio altitude.

Note: All TCAS alerts are inhibited by the following

- PWS Annunciations
- GPWS Immediate-Alert Annunciations
- Windshear Immediate-Alert Annunciations

Non–Normal Operations

HSI Messages

When the HSI message:

- TCAS OFF is displayed, neither TA ONLY nor TA/RA is selected with the TCAS Mode Selector. The system cannot display symbology or vertical guidance. Voice Annunciations will not occur.
- TCAS FAIL is displayed, the system cannot display symbology or vertical guidance. Voice Annunciations will not occur.

• TCAS OFF does not display if TCAS FAIL is annunciated.

EICAS Messages

When the EICAS advisory message:

• TCAS is displayed, the system cannot display symbology or vertical guidance. Voice annunciations will not occur.

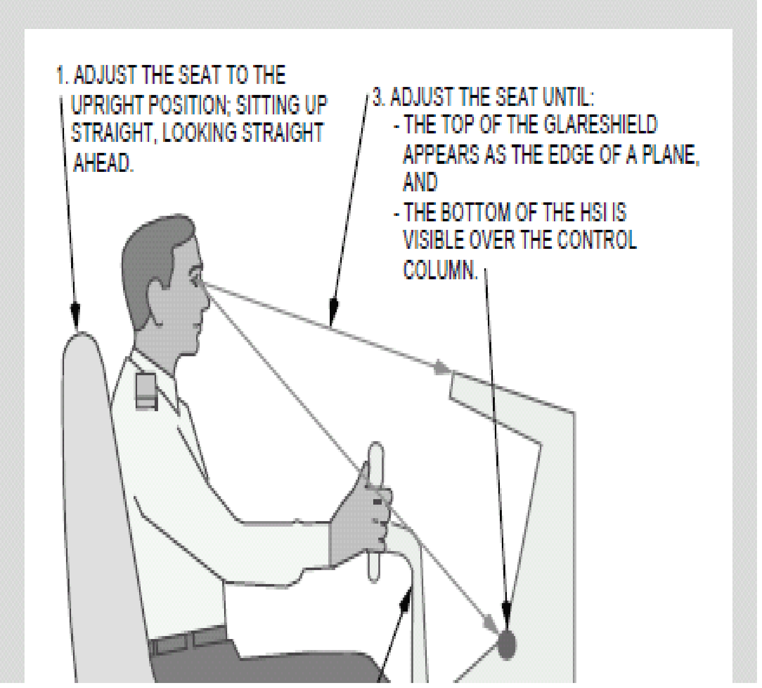
• TCAS OFF is displayed, neither TA ONLY nor TA/RA is selected with the TCAS Mode Selector. The system cannot display symbology or vertical guidance. Voice annunciations will not occur.

Note: The TCAS OFF message is inhibited below approximately 400 feet radio altitude.

Chapter 7 Operation Technique and Instruction

7.1 Taxi

7.1.1 Pilot seat adjustment



7.1.2 Cockpit's view

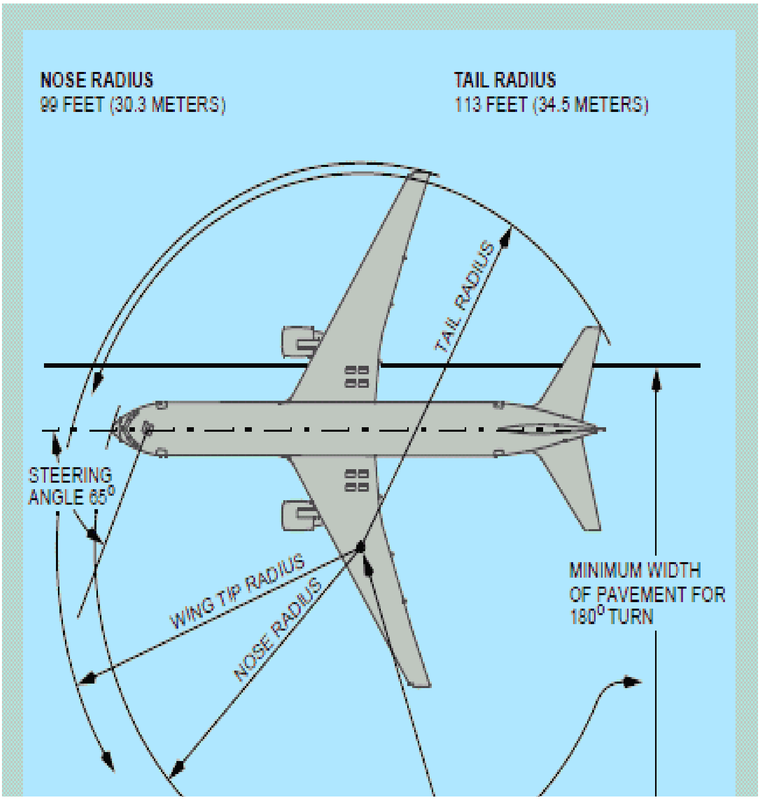
There is a large area near the airplane where personnel, obstacles or guidelines on the ground cannot be seen, particularly in the oblique view across the flight deck. Special care must be exercised in the parking area and while taxiing. When parked, the pilot should rely on ground crew communication to a greater extent to ensure a safe, coordinated operation. The pilot's seat should be adjusted for optimum eye position. The rudder pedals should be adjusted so that it is possible to apply maximum braking with full rudder deflection.
During taxiing, the pilot's heels should be on the floor, sliding the feet up on the rudder pedals only when required to apply brakes to slow the taxi speed, or when maneuvering in close quarters on the parking ramp.

7.1.3 The relationship of pilot's seat between nose wheel and main wheels:

A/C Type	Pilot's seat (before nose wheel)ft(m)	Pilot's seat (before main wheel)ft(m)
B767-300	7. 5(2.3)	82(25.0)

7.1.4 Turning Radius

The wing tip swings the largest arc while turning and determines the minimum obstruction clearance path. All other portions of the airplane structure remain within this arc.



Caution: Do not try to make a turn away from the obstacles within 15 ft(4.6m) of the wing tip or within 40 ft(12.3m) of the nose.

7.1.5 Thrust use

Thrust use during ground operation demands sound judgment and technique. Even at relatively low thrust the air blast effects from the large, high bypass engines can be destructive and cause injury. Airplane response to thrust lever movement is slow, particularly at high gross eights. Engines noise level in the flight deck is low and not indicative of thrust output. Idle thrust is adequate for taxiing under most conditions. A slightly higher thrust setting is required to begin taxiing. Allow time for airplane response before increasing thrust further.

Excess thrust while taxiing may cause foreign objects to deflect into the lower aft fuselage, stabilizer, or elevators, especially when the engines are over an unimproved surface. Run-ups and taxi operations should only be conducted over well maintained paved surfaces and runways.

7.1.6 Taxi speed and Braking

To begin taxi, release brakes, smoothly increase thrust to minimum required for the airplane to roll forward, and then reduce thrust as required to maintain normal taxi speed. A turn should normally not be started until sufficient forward speed has been attained to carry the airplane through the turn at idle thrust.

The airplane may appear to be moving slower than it actually is due to the flight deck height above ground. Consequently, the tendency may be to taxi faster than desired. This is particularly true during runway turnoff after landing. The ground speed display (as installed) on the flight instruments may be used to determine actual taxi speed. The appropriate taxi speed depends on turn radius and surface condition.

Note: Some taxi speeds, usually between 10 and 20kts, can cause an increase in airplane vibration, especially on rough taxiways. If this occurs, a slight increase or decrease in speed reduces or eliminates the vibration and increases passenger comfort.

Taxi speed should be closely monitored during taxi out, particularly when the active runway is some distance from the departure gate. Normal taxi speed is approximately 20 knots, adjusted for condition. On long straight taxi routes, however at speeds greater than 20 knots use caution when using the nose wheel steering wheel to avoid overcontrolling the nose wheels. When approaching a turn, seed should be slowed to an appropriate speed for conditions. On a dry surface, use approximately 10 knots for turn angles greater than those typically required for high speed runway turnoffs.

Note: High taxi speed combined with heavy gross weight and a long taxi distance can result in tire sidewall overheating.

Avoid prolonged brake application to control taxi speed as this causes high brake temperatures and increased wear of brakes. If taxi speed is too high, reduce speed with a steady brake application and then release the brakes to allow them to cool. Braking to approximately 10 knots and subsequence release of the brakes results in less heat build-up in the tires and brakes than when the brakes are constantly applied.

Under normal conditions, differential braking and braking while turning should be avoided. Allow for decreased braking effectiveness on slippery surfaces.

Avoid following other airplanes too closely. Jet blast is a major cause of foreign object damage.

Note: When taxi or landing rolling out speed is below 60kts, the use of reverse thrust above reverse idle is not recommended due to the possibility of foreign object damage and engine surge. Use of idle reverse thrust may be necessary on slippery surfaces for airplane control while taxiing.

7.1.7 Life of the carbon brakes

The wear of the brake depends on the times used for the brakes. For example, a steady brake will have low wear than times of light brakes. Long time and continuous light brakes will make aircraft stop accelerating and taxi with constant speed, thus make more brakes wearing than normal brakes.

The correct brake during taxi should include: slow down aircraft by brakes and release brakes at low speed, and repeat then.

During landing, the wearing of the light brake with long time high energy is the same as the light brakes with short time low energy. This is different from steel brakes, the wearing of the steel brakes varies with the energy during deacceleration.

7.1.8 Antiskid Inoperative

With antiskid inoperative, tire damage or blowouts can occur if moderate to heavy braking is used. With this condition, it is recommended that taxi speed be adjusted to allow for very light braking.

7.1.9 Nose Wheel/Rudder Pedal Steering

The captain's and first officer's (installed) positions are equipped with a nose wheel steering wheel. The nose wheel steering wheel is used to turn the nosewheel through the full range of travel at low taxi speeds. Maintain positive pressure on the nose wheel steering wheel at all times during a turn to prevent the nose wheels form abruptly returning to center. Rudder pedal steering turns the nose wheels through a limited range of travel. Straight ahead steering and large radius turns may be accomplished with rudder pedal steering.

If nose wheel "scrubbing" occurs while turning, reduce steering angle and/or taxi speed. Avoid stopping the airplane in a turn as excessive thrust is required to start taxiing again.

Differential thrust may be required at high weights during tight turns. This should only be used as required to maintain the desired speed in the turn.

After completing a turn, center the nose wheels and allow the airplane to roll straight ahead. This relieves stresses in the main and nose gear structure prior to stopping.

7.1.10 Taxi – Adverse Weather

When taxiing on a slippery or contaminated surface, particularly with strong crosswinds, use reduced speeds. Use of differential engine thrust assists in maintaining airplane momentum through the turn. When nearing turn completion, placing both engines to idle thrust reduces the potential for nose gear skidding. Avoid using large nose wheel steering inputs to correct for skidding. Differential braking may be more effective than nose wheel steering on slippery or contaminated surfaces. If speed is excessive, reduce speed prior to initiating a turn.

> **Note:** A slippery surface is any surface where the braking capability is less than that on a dry surface. Therefore, a surface is considered "slippery" when it is wet or contaminated with ice, standing water, slush, snow or any other deposit that results in reduced braking capability.

During prolonged ground operations, periodic engine run-ups should be accomplished to minimize ice build-up. These engine run-ups should be performed according to the chapter SP as defined in FCOM.

Engine exhaust may form ice on the ramp and takeoff areas of the runway, or blow snow or slush which may freeze on airplane surfaces. If the taxi route is through slush or standing water in low temperatures, or if precipitation is falling with temperatures below freezing, taxi with flaps up.

Extended or prolonged taxi times in heavy snow may necessitate de-icing prior to takeoff.

To reduce the possibility of flap damage after making an approach in icing conditions or landing on a runway covered with snow or slush, do not retract the flaps until the flap area has been checked for debris by maintenance.

Low visibility_ Pilots need to get a good understanding of runway surface lighting, markings and symbols. To ensure safety, pilot must correctly understand stop lighting, ILS important area signs, functions and procedures of holding points and low visibility taxi route. Many airports have special procedures in low visibility. For example, airports approved to takeoff and land when RVR is lower than 1200 feet (350 m) according to FAA standards are required to have low visibility taxiing plan.

7.1.11 Taxi Consideration

1. Progressively follow taxi position on the airport diagram, and know the related NOTAMS. Assuring all crew members know the expected taxi way.
2. Making sure all the ground personnel and equipments are removed.
3. During low visibility conditions, call out all signs to verify position
4. If unfamiliar with the airport consider requesting a FOLLOW ME vehicle or progressive taxi instructions.
5. Use standard radio phraseology
6. Read back all clearance and make records. If any crewmember is in doubt regarding the clearance, verify taxi routing with the written clearance or with ATC. Stop the airplane if the clearance is in doubt.
7. When ground obstruction clearance is in doubt, stop the airplane and obtain a wing-walker.
8. Switching on taxi lights when taxiing in daytime or night. During taxi, switch off taxi light in case of stopping taxiing; all required lightings shall be used during taxi in the evening, and turn off all exterior lightings in case of stopping taxi.
9. Avoid distractions during critical taxi phases; avoid hurry due to ATC or other personnel_

10. Consider delaying checklist accomplishment until stopped during low visibility operations.
11. When taxiing in the busy area, observation of the aircrafts shall be made to avoid conflict; the taxi speed shall be below 8kts when taxiing close to obstacles.
12. When conflict during taxi, ATC clearance shall be followed strictly; when ATC clearance is not possible, the pilot seeing the conflict aircraft from the left cockpit side shall stop taxiing.
13. The distance between big aircrafts is 200m and 300m for heavy aircrafts during proceeding taxi.

7.2 Takeoff

7.2.1 Initiating Takeoff Roll

Autothrottle and F/D use is recommended for all takeoffs. However, do not follow F/D commands until liftoff.

A rolling takeoff procedure is recommended for setting takeoff thrust. It expedites the takeoff and reduce the risk of foreign object damage or engine surge/stall due to a tailwind or crosswind. Flight test and analysis prove that the change in takeoff roll distance due to the rolling takeoff procedure is negligible when compared to a standing takeoff.

Rolling takeoffs are accomplished in two ways:

- If cleared for takeoff before or while entering the runway, maintain normal taxi speed. When the airplane is aligned with the runway centerline_ensure the nose wheel steering wheel is released and apply takeoff thrust by advancing the thrust levers to just above 1.1.EPR(PW or RR).Allow the engines to stabilize momentarily then promptly advance the thrust levers to takeoff thrust (autothrottle EPR, N1 or THR). There is no need to stop the airplane before increasing thrust.
- If holding in position on the runway, ensure the nose wheel steering wheel is released, release brakes, then apply takeoff thrust as described above.

Note: Brakes are not normally held with thrust above idle unless a static run-up in icing conditions is required.

A standing takeoff procedure may be accomplished by holding the brakes until the engines are stabilized, ensure the nose wheel steering wheel is released, then release the brakes and promptly advance the thrust levers to takeoff thrust (autothrottle EPR, N1 or THR).

Allowing the engines to stabilize provides uniform engine acceleration to takeoff thrust and minimize directional control problems. This is particularly important if crosswinds exist or the runway surface is slippery. The exact initial setting is not as important as setting symmetrical thrust.

Note: Under tailwind conditions, before airspeed reaches 5 nm/h, slight EPR (if installed) vibration may happen to some engines.

Note: Allowing the engines to stabilize for more than approximately 2 seconds before advancing thrust levers to takeoff thrust may adversely affect takeoff distance.

If thrust is to be set manually, smoothly advance thrust levers toward takeoff thrust. Final thrust adjustments should be made, with reference to the digital readouts, by 60 knots.
During takeoff, if an engine exceedance occurs after thrust is set and the decision is made to continue the takeoff, do not retard the thrust lever in an attempt to control the exceedance. Retarding the thrust levers after thrust is set invalidates takeoff performance. When the PF judges that altitude (minimum 400 feet AGL) and airspeed are acceptable, the thrust lever should be retarded until the exceedance is within limits and the appropriate NNC accomplished.
Use of nose wheel steering wheel is not recommended above 30 knots. However, pilots must use caution when using the nose wheel steering wheel above 20 knots to avoid over-controlling the nose wheels resulting in possible loss of directional control. Limited circumstances such as inoperative rudder pedal steering may require the use of the nose wheel steering wheel at low speeds during takeoff and landing when the rudder is not effective.
Light forward pressure is held on the control column. Keep the airplane on centerline with rudder pedal steering and rudder. The rudder becomes effective between 40 and 60 knots. Maximum nose wheel steering effectiveness is available when above taxi speeds by using rudder pedal steering.
Regardless of which pilot is making the takeoff, the captain should keep one hand on the thrust levers until V1 in order to respond quickly to a rejected takeoff condition. After V1, the captain’s hand should be removed from the thrust levers.
The PM should monitor engine instruments and airspeed indications during the takeoff roll and announce any abnormalities. The PM should announce “80” when passing 80 knots and PF should verify that his airspeed indicator is in agreement.
A pitot system blocked by protective covers or foreign objects can result in no airspeed indication, or airspeed indications that vary between instruments. It is important that aircrews ensure airspeed indicators are functioning and reasonable at the 80 knot callout. If the accuracy of either primary airspeed indication is in question, reference the standby airspeed indicator. Another source of speed information is the ground speed indication. Earlier detection of the problem is very important to correct decision (takeoff or rejected). Refer to unreliable speed for more discussions.

PM should verify that takeoff thrust has been set and the throttle hold mode (THR HLD) is engaged. A momentary autothrottle overshoot of 4% N1 may occur but thrust should stabilized at +/-2%N1, after THR HLD. Thrust should be adjusted by the PM, if required, to –0%+1% target N1. When THR HLD mode is displayed, A/T can not change the position of the thrust lever. THR HLD mode keeps engaged until another mode is selected.

Note: Takeoff into headwind of 20 knots or greater may result in THR HLD before the auto throttle can make final thrust adjustments.

The THR HLD mode protects against thrust lever movement if a system fault occurs. Lack of the THR HLD annunciation means the protective feature may not be active. If THR HLD annunciation does not appear, no crew action is required unless a subsequent system fault causes unwanted thrust lever movement. As with any autothrottle malfunction, the autothrottle should then be disconnected and desired thrust set manually. Before another thrust mode is selected, THR HLD mode should remain engaged.

If full thrust is desired when THR HLD mode is displayed, the thrust levers must be manually advanced. When making a V1(MCG)-limited takeoff, do not exceed the fixed derate thrust limit except in an emergency.

After the airplane is in the air, pushing GA switch advances the thrust to maximum available thrust and GA is annunciated.

7.2.2 Rotation and Liftoff

Takeoff speeds are established based on minimum control speed, stall, and tail clearance margins. Shorter bodied airplanes are normally governed by stall speed margin while longer bodied airplanes are normally limited by tail clearance margin. When a smooth continuous rotation is initiated at VR, tail clearance margin is assured because computed takeoff speeds depicted in the QRH, airport analysis, or FMC, are developed to provide adequate tail clearance.

Above 80 knots, relax the forward control column pressure to the neutral position. For optimum takeoff and initial climb performance, initiate a smooth continuous rotation at VR toward 15º of pitch attitude. The use of stabilizer trim during rotation is not recommended. After liftoff use the FD as the primary pitch reference cross checking indicated airspeed and other flight instruments.

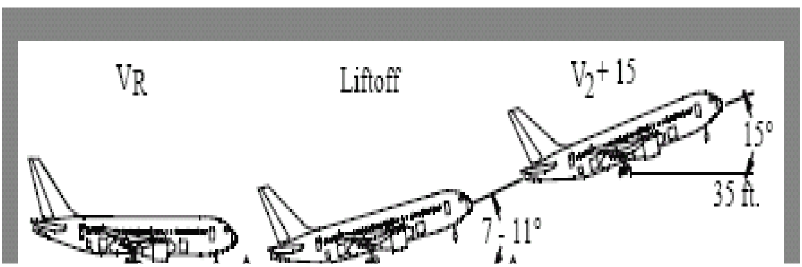
Note: Do not adjust takeoff speeds or rotation rates to compensate for increased body length.

With a consistent rotation technique, where the pilot uses approximately equal control forces and similar visual cues, the resultant rotation rate differs slightly depending upon airplane body length.

Using the technique above, liftoff attitude is achieved in approximately 4 seconds. Resultant rotation rates vary from 2 to 2.5 degrees/second with rates being lowest on longer airplanes.

Note: The F/D pitch command is not used for rotation.

Typical Rotation, All engines
B767-300



Takeoff Tail Clearance

Note: Airplane has minimum clearance for flap1 takeoff. In case of lighter weight, takeoff with a larger flap setting can be considered.

Type	Flaps	Pitch attitude (degree)	Tail minimum clearance from the ground inch(cm)	Tail strike pitch attitude (degree)
B767-300	5 15 20	7.5	24(61)	9.6

7.2.3 Crosswind Takeoff

Airplane has very good crosswind capability. Initial runway alignment and smooth symmetrical thrust application result in good crosswind control capability during takeoff. A smooth and positive correction shall be made for direction deviation.

Note: Engine surge can occur with a strong crosswind or tailwind component if takeoff thrust is set before brake release. Therefore, the rolling takeoff procedure is strongly advised when crosswinds exceed 20 knots or tailwinds exceed 10 knots.

Directional Control

Initial runway alignment and smooth symmetrical thrust application result in good crosswind control capability during takeoff. Light forward pressure on the control column during the initial phase of takeoff roll (below approximately 80 knots) increases nose wheel steering effectiveness. Any deviation from the centerline during thrust application should be countered with immediate smooth and positive control inputs. Smooth rudder control inputs combined with small control wheel inputs result in a normal takeoff with no overcontrolling. Large control wheel inputs can have an adverse effect on directional control near V1(MCG) due to the additional drag of the extended spoilers.

Note: With wet or slippery runway conditions, the PM should give special attention to ensuring the engines have symmetrically balanced thrust indications.

Rotation and Takeoff

Begin the takeoff roll with the control wheel approximately centered. Throughout the takeoff roll, gradually increase control wheel displacement into the wind only enough to maintain approximately wings level.

Note: Excessive control wheel displacement during rotation and liftoff increases spoiler deployment. As spoiler deployment increases, drag increases and lift is reduced which results in reduced tail clearance, a longer takeoff roll, and slower airplane acceleration.

At liftoff, the airplane is in a sideslip with crossed controls. A slow, smooth recovery from this sideslip is accomplished by slowly neutralizing the control wheel and rudder pedals after liftoff.

Gusty Wind and Strong Crosswind Conditions

For takeoff in gusty or strong crosswind conditions, use of a higher thrust setting than the minimum required is recommended. When the prevailing wind is at or near 90° to the runway, the possibility of wind shifts resulting in gusty tailwind components during rotation or liftoff increases. During this condition, consider the use of thrust settings close to or at maximum takeoff thrust. The use of a higher takeoff thrust setting reduces the required runway length and minimizes the airplane exposure to gusty conditions during rotation, liftoff, and initial climb.

To increase tail clearance during strong crosswind conditions, consider using a higher VR if takeoff performance permits. This can be done by:

- using improved climb takeoff performance methods
- increasing VR speed to the performance limited gross weight rotation speed, not to exceed actual gross weight VR + 20 knots. Set V speeds for the actual gross weight. Rotate at the adjusted (higher) rotation speed.This increased rotation speed results in an increased stall margin, and meets takeoff performance requirements.

Avoid rotation during a gust. If a gust is experienced near VR, as indicated by stagnant airspeed or rapid airspeed acceleration, momentarily delay rotation. This slight delay allows the airplane additional time to accelerate through the gust and the resulting additional airspeed improves the tail clearance margin. Do not rotate early or use a higher than normal rotation rate in an attempt to clear the ground and reduce the gust effect because this reduces tail clearance margins. Limit control wheel input to that required to keep the wings level. Use of excessive control wheel increases spoiler deployment which has the effect of reducing tail clearance. All of these factors provide maximum energy to accelerate through gusts while maintaining tail clearance margins at liftoff. The airplane is in a sideslip with crossed controls at this point. A slow, smooth recovery from this sideslip is accomplished after liftoff by slowly neutralizing the control wheel and rudder pedals.

B767-300 crosswind takeoff standard_unit_kts_

	90°tailwind	45°crosswind	headwind	tailwind
Dry runway	35 _17.5m/s_	40 _20m/s_	50 _25 m/s_	10 _5 m/s_
Wet runway	30 _15 m/s_	35 _17.5 m/s_	50 _25 m/s_	10 _5m/s_
Ice_ standing water/ snow	20 _10 m/s_	25 _12.5m/s_	50 _25 m/s_	6 _3m/s_

Note_

1. In the strong gust, crosswind limit is based on the steady crosswind components.
2. If asymmetrical thrust is used, the crosswind guidance is reduced by 5kts on wet or contaminated runway.
3. On slippery runway, crosswind capability depends on the surface conditions, aircraft loading and pilot's technique.

7.2.4 Reduced Thrust Takeoff

Many operators prefer a less than maximum thrust takeoff whenever performance limits and noise abatement procedures permit. The reduced thrust takeoff lowers EGT and extends engine life. Operation with reduced takeoff thrust requires that the engine inoperative climb gradient is not less than the regulatory minimum, or that required to meet obstacle clearance criteria. Therefore, there is no need for additional thrust beyond the reduced takeoff thrust in the event of an engine failure.

The reduced thrust takeoff may be done using the Assumed Temperature Method (ATM), a Fixed Derate (as installed), or a combination of both (as installed). Regardless of the method, use the takeoff speeds provided by the airport analysis, FMC (if available), QRH (PI chapter), Flight Planning and Performance Manual (FPPM), AFM, or other approved source corresponding to the assumed (higher) temperature and/or selected derate.

Note: Reduced thrust takeoffs are not recommended if potential windshear conditions exist.

Assumed Temperature Method(ATM)

The ATM achieves a takeoff thrust less than the maximum takeoff thrust by assuming a temperature that is higher than the actual temperature. The thrust reduction authorized by most regulatory agencies is limited to 25% below any certified takeoff thrust rating.

The primary thrust setting parameter (EPR/N1) is not considered a limitation. Takeoff speeds consider ground and in-air minimum control speeds (VMCG and VMCA) with full takeoff thrust for the actual temperature. If conditions are encountered during the takeoff where additional thrust is desired, such as windshear, the crew should not hesitate to manually advance thrust levers to maximum takeoff thrust.

The assumed temperature method of computing reduced thrust takeoff performance is always conservative. Actual performance is equal to or better than the performance obtained if actually operating at the assumed temperature. This is because the true airspeed at the actual temperature is lower than at the assumed temperature.

Note: Do not use the ATM if conditions that affect braking such as a runway contaminated by slush, snow, standing water, or ice exist. ATM takeoffs are allowed on a wet runway if suitable performance accountability is made for the increased stopping distance on a wet surface.

7.2.5 Improved Climb Performance Takeoff

When allowed by field length limit, an increased climb limit weight is achieved by using the excess field length to accelerate to higher takeoff and climb speeds. This improves the climb gradient, thereby raising the climb and obstacle limited weights. V1, V2 and VR are increased and must be obtained from dispatch or by airport analysis.

7.2.6 Initial Climb

After liftoff use the flight director as the primary pitch reference cross checking indicated airspeed and other flight instrument. If the F/D is not used, indicated airspeed and attitude become the primary pitch reference. After liftoff, the F/D commands pitch to maintain an airspeed of V2+15 knots to 25 knots until another pitch mode is engaged.

V2+15 is the optimum climb speed with takeoff flaps. It results in the maximum altitude gain in the shortest distance form takeoff. Acceleration to higher speeds reduces the altitude gain. If airspeed exceeds V2+15 during the initial climb, stop the acceleration but do not attempt to reduce airspeed to V2+15. Any speed between V2+15 and V2+25 knots results in approximately the same takeoff profile. Crosscheck indicated airspeed for proper initial climb speed.

Retract the landing gear after a positive rate of climb is indicated on the altimeter. Do not apply brakes after becoming airborne. Braking is automatically applied when the landing gear lever is placed in the upper position. After gear and flaps are retracted, the PM should verify the gear and flaps indications are normal.

7.2.7 Takeoff flaps retraction schedules B767-300

Takeoff flaps	Speed(knots)	Selected flaps
20 or 15	Vref30+20	5
	“F” Vref30+40	1
	“F” Vref30+60	UP
5	“F” Vref30+40	1
	“F” Vref30+60	UP
Final climb	Vref30+80	

“F”= Minimum flap retraction speed of the next flap setting displayed in speed band (if installed)

7.3 Climb

7.3.1 Climb Thrust

Once climb thrust is set, EEC will compensate for the thrust change and maintain climb thrust according to the ambient condition automatically during climb out.

7.3.2 Reduced Thrust Climb

Engine service life may be extended by operating the engines at less than full climb rated thrust.

The Thrust Management Computer (TMC) or the FMC THRUST LIMIT page (as installed) provides two reduced thrust climb selections:

- CLB 1 depends upon the specific derate thrust limit options selected by the customer
- CLB 2 depends upon the specific derate thrust limit options selected by the customer.

Reduced thrust climb may also be automatically selected by the TMC depending upon the amount of thrust reduction made for takeoff when using the fixed derate method (as installed). If the thrust reduction for takeoff is made using the assumed temperature method, there is no automatic selection of reduced thrust climb.

Climb thrust reductions are gradually removed as the airplane climbs until full climb thrust is restored. If rate of climb should drop below approximately 500 feet per minute, the next higher climb rating should be selected.

Prior to takeoff, if the pilot overrides the automatically selected climb thrust limit (as installed) after the takeoff selection has been completed, the takeoff derate (as installed) is also changed. To override the automatically selected climb thrust limit without changing the takeoff derate, wait until airborne. After the climb is established, select the desired climb thrust mode on the Thrust Mode Select Panel (TMSP).

Note: Use of reduced thrust for climb increases total trip fuel and should be evaluated by each operator.

7.3.3 Low Altitude Level Off

Occasionally, a low altitude climb restriction may be required after takeoff. This level-off altitude should be set in the MCP altitude window. When the airplane approaches this altitude with TO as the engaged pitch mode FMA, the pitch mode FMA changes to ALT CAP and the autothrottle FMA re-engages into EPR or N1 (as installed). This prevents the thrust levers from rapidly retarding to target the airspeed selected in the IAS/Mach speed window, which is normally set to V2 for takeoff. ALT CAP occurs as a function of climb rate. The higher the climb rate to the MCP altitude, the sooner ALT CAP engagement occurs. For example, takeoff from sea-level to a 1,000 feet level off altitude results in the pitch mode FMA changing from TO to ALT CAP as low as approximately 400 feet AGL.

During the low-altitude level off, the following technique allows the autothrottle FMA to engage into SPD for proper airspeed control and prevent excessive airspeed increase near the flap placard speed range:

- allow the pitch mode FMA to change from TO to ALT CAP
- immediately set the IAS/Mach speed window to a speed appropriate for flap retraction
- engage the autothrottle SPD mode.

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Note: For airplanes with manual climb thrust selection, the CLB switch on the thrust mode select panel (TMSP) must be selected prior to engaging the autothrottle SPD mode to preclude exceeding autothrottle climb thrust limits.

7.3.4 Climb Modes

1) **Economy Climb:** The normal economy climb speed schedule of the FMC minimizes trip cost. It varies with gross weight and is influenced by cost index. The FMC generates a fixed speed schedule as a function of cost index and weight.

   Economy climb speed normally exceeds 250 knots for all gross weights. FMC climb speed is limited to 250 knots below 10,000 feet (FAA Airspace), or a lower waypoint speed restriction, if entered. If the use of a higher speed below 10,000 feet is allowed, ECON speed provides additional cost savings.

2) **Maximum Rate Climb**: A maximum rate climb provides both high climb rates and minimum time to cruise altitude. Maximum rate climb can be approximated by using the following:

   - flaps up Maneuver Speed + 50 knots until intercepting 0.78M

Note: The FMC does not provide maximum rate climb speeds.

3) **Maximum Angle Climb**: The FMC provides maximum angle climb speeds. Maximum angle climb speed is normally used for obstacle clearance, minimum crossing altitude or to reach a specified altitude in a minimum distance. It varies with gross weight and provides approximately the same climb gradient as flaps up maneuvering speed.

7.4 Cruise

7.4.1 Maximum Altitude

Maximum altitude is the highest altitude at which the airplane can be operated. It is determined by three characteristics, which are unique to each airplane model. The FMC predicted maximum altitude is the lowest of:

- maximum certified altitude (structural)-determined during certification and is usually set by the pressurization load limits on the fuselage.
- thrust limited altitude- the altitude at which sufficient thrust is available to provide a specific minimum rate of climb.(Refer the long range cruise maximum operating altitude table in the PI chapter of the QRH). Depending on the thrust rating of the engines, the thrust limited altitude may be above or below the maneuver altitude capability.
- buffet or maneuver limited altitude- the altitude at which a specific maneuver margin exists prior to buffet onset. This altitude provides at least a 0.2g margin (33°bank) for FAA operations or a 0.3g (40°bank) for CAA/JAA operations prior to buffet.

Although each of these limits are checked by the FMC, available thrust may limit the ability to accomplish anything other than relatively minor maneuvering. The amber band limits do not provide an indication of maneuver capability as limited by available thrust.

The maneuvering speed indication on speed tape(if installed) can not guarantee flying with this speed. Reducing speed to the amber area may cause aircraft not able to maintain speed and/or altitude, because drag may exceed the available thrust with the speed decreasing, especially during turning.

7.4.2 Optimum Altitude

Optimum altitude is the cruise altitude for minimum cost when operating in the ECON mode, and for minimum fuel burn when in the LRC or pilot-selected speed modes. In ECON mode, optimum altitude increases as either airplane weight or cost index decreases. In LRC or selected speed modes, optimum altitude increases as either airplane weight or speed decreases. On each flight, optimum altitude continues to increase as weight decreases during the flight.

For shorter trips, optimum altitude as defined above may not be achievable since the top of descent (T/D) point occurs prior to completing the climb to optimum altitude.
Flight plans not constrained by short trip distance are typically based on conducting the cruise portion of the flight within plus or minus 2000 feet of optimum altitude. Since the optimum altitude increases as fuel is consumed during the flight, it is necessary to climb to a higher cruise altitude every few hours to achieve the flight plan fuel burn. This technique, referred to as step climb cruise, is typically accomplished by initially climbing 2000 feet below optimum. For most flights, one or more step climbs may be required before reaching T/D. It may be especially advantageous to request an initial cruise altitude above optimum if altitude changes are difficult to obtain on specific routes. This minimizes the possibility of being held at a low altitude/high fuel consumption condition for long periods of time. The request/accepted initial cruise altitude should be compared to the thrust limited or the maneuver margin limited altitudes. Remember, a cruise thrust limited altitude is dependent upon the cruise level temperature. If the cruise level temperature increases above the chart value for gross weight, maximum cruise thrust will not maintain desired cruise speed.
The selected cruise altitude should normally be as close to optimum as possible. Optimum altitude is the altitude that gives the minimum trip cost for a given trip length, cost index, and gross weight. It provides approximately a 1.5 load factor (approximately 48º bank to buffet onset) or better buffet margin. As deviation from optimum cruise altitude increases, performance economy deteriorates.
Some loss of thrust limited maneuver margin can be expected above optimum altitude. Levels 2000 feet above optimum altitude normally allows approximately 45º bank prior to buffet onset. The higher the airplane flies above optimum altitude, the more the thrust margin is reduced. Before accepting an altitude above optimum, determine that it will continue to be acceptable as the flight progresses under projected conditions of the temperature and turbulence.
On airplanes with higher thrust engines, the altitude selection is most likely limited by maneuver margin to initial buffet. Projected temperature and turbulence conditions along the route of flight should be reviewed when requesting/accepting initial cruise altitudes as well as subsequent step climbs.

Step Climb

Step altitude may be planned to be step up or step down. Optimum step points are a function of the route length, flight condition, speed mode, present airplane altitude, step to altitude and gross weight.

FMC does not compute an optimum step point. The crew must enter a STEP to altitude. The FMC then computes the ETA and distance to step climb point based upon gross weight. A fuel savings or penalty to destination is computed assuming the step climb is performed. Initiate a cruise climb to the new altitude as close as practicable to the step climb point.

7.4.3 Cruise Speed

Cruise speed is automatically computed by the FMC and displayed on the CRZ page. It is also displayed by the command air speed when VNAV is engaged. The default cruise speed mode is ECON cruise. The pilot can also select LRC, engine out modes, or overwrite fixed Mach or CAS values on the CRZ page target speed line.

ECON cruise is a variable speed schedule that is a function of gross weight, cruise altitude, cost index, and headwind component. It is calculated to provide minimum operating cost for the entered cost index. Entry of zero for cost index results in maximum range cruise.

Headwinds increase the ECON CRZ speed. Tailwinds decrease ECON CRZ speed, but not below the zero wind maximum range cruise airspeed.

LRC is a variable speed schedule providing fuel mileage 1% less than the maximum available. LRC wind correction is not necessary.

Required Time of Arrival(RTA) speed is generated to meet a time required at an RTA specified waypoint on the FMC LEGS page.

7.4.4 Cruise Performance Economy

The flight plan fuel burn from departure to destination is based on certain assumed conditions. These include takeoff gross weight, cruise altitude, route of flight, temperature, enroute winds, and cruise speed.

Actual fuel burn should be compared to the flight plan fuel burn throughout the flight.

The planned fuel burn can increase due to:

- temperature above planned
- a lower cruise altitude than planned

- cruise altitude more than 2000 feet above optimum altitude
- speed faster than planned or appreciably slower than long range cruise speed when long range cruise was planned
- stronger headwind component
- fuel imbalance
- improperly trimmed airplane
- excessive thrust lever adjustments

Cruise fuel penalties include:

- ISA+10_: 1% increase in trip fuel
- 2000 feet above/below optimum altitude: 1% to 2% increase in trip fuel
- 4000 feet below optimum altitude: 3% to 5% increase in trip fuel
- 8000 feet below optimum altitude: 8% to 14% increase in trip fuel
- cruise speed 0. 1M above LRC: 1% to 2% increase in trip fuel

For cruise within 2000 feet of optimum, long range cruise speed can be approximated by using 0.80M. Long range cruise also provides the best buffet margin at all cruise altitudes.

Note: if a discrepancy is discovered between actual fuel burn and flight plan fuel burn that cannot be explained by one of the items above, a fuel leak should be considered. Accomplish the applicable non-normal checklist.

7.5 Descent

7.5.1 Descent Planning

Flight deck workload typically increases as the airplane descends into the terminal area. Distractions must be minimized and administrative and nonessential duties completed before descent or postponed until after landing. Perform essential duties early in the descent so more time is available during the critical approach and landing phases.

Operational factors and/or terminal area requirements may not allow following the optimum descent schedule. Terminal area requirements can be incorporated into basic flight planning but ATC, weather, icing and other traffic may require adjustments to the planned descent schedule.

Proper descent planning is necessary to arrive at the desired altitude at the proper speed and configuration. The distance required for the descent is approximately 3.5 NM/1000 feet altitude loss for no wind correction using ECON speed. Rate of descent is dependent upon thrust, drag, airspeed schedule and gross weight.

7.5.2 Descent Speed

The default FMC descent speed schedule is an economy descent from cruise altitude to the airport speed transition altitude followed by a descent at ten knots less than this speed. The speed schedule is adjusted to accommodate waypoint speed/altitude constraints displayed in the LEGS pages, and speed/altitude constraints displayed on the DES page. If desired, the ECON speed schedule can be modified by alternate Mach, Mach/IAS, or IAS values on the DES page target speed line. If the FMC information is not available, use target speeds from the Descent Rates table in this chapter.

7.5.3 Descent Path

An FMC path descent is the most economical descent method. At least one waypoint-related altitude constraint below cruise altitude on a LEGS page generates a descent guidance path. The path is built form the lowest constraint upward, assuming idle thrust, or approach idle below the anti-ice altitude entered on the DESCENT FORECAST page.

The path is based on the descent speed schedule, any entered speed/altitude constraints or forecast use anti-ice. The path reflects descent wind values entered on the DESCENT FORECAST page.

7.5.4 Descent Constraints

Descent constraints may be automatically entered in the route when selecting an arrival procedure, or manually entered through the CDU.
Set all mandatory altitude restrictions and “at or above” constraints in the Mode Control Panel (MCP) altitude window. The next altitude may be set when the restriction has been assured or further clearance has been received.
Shallow vertical path segments may result in the autothrottle supplying partial power to maintain the target speed. Vertical path segments steeper than an idle descent may require the use of speedbrakes for speed control.
Deceleration requirements below cruise altitude (such as at 10,000MSL) are accomplished based on a rate of descent of approximately 500 fpm.
When a deceleration is required at top of descent, it is performed in level flight.

7.5.5 Descent Rate

Descent rate tables provide typical rates of descent below 20000 feet with idle thrust and speedbrakes extended or retracted.

Target speed	Descent rate_FPM_	
	Clean configuration	With speedbrake
M0.78/290KTs	1800	2700
250KTs	1500	2000
Vref30+80	1200	1600

Normally, descent with idle thrust and in clean configuration (no speedbrakes). Maintain cruise altitude until the proper distance or time out for the planned descent and then hold the selected airspeed schedule during descent. Deviations from this schedule may result in arriving too high at destination and require circling to descend, or arriving too low and far out requiring extra time and fuel to reach destination.

The speedbrake may be used to correct the descent profile if arriving too high or too fast. The descent procedure is normally initiated during descent and should be completed when passing transition level_ the lower altitude shall take precedence_.
Maintaining the desired descent profile and using the map mode to maintain awareness of position ensures a more efficient operation.
Maintain awareness of the destination weather and traffic conditions, and consider the requirements of a potential diversion. Review the airport approach charts and discuss the plan for the approach, landing, and taxi routing to parking. Complete the approach briefing as soon as practical, preferably before arriving at top of descent. This allows full attention to be given to airplane control.

7.6 Approach

7.6.1 Instrument Approaches

Complete the approach preparations before arrival in the terminal area. Set decision altitude/height DA(H) or minimum descent altitude/height MDA(H). Crosscheck radio and pressure altimeters whenever practical. Do not completely abandon enroute navigation procedures even though air traffic is providing radar vectors to the initial or final approach fix. Check ADF/VOR selector set to the proper position. Verify ILS, VOR and ADF are tuned and identified if required for the approach.
Check that the marker beacon is selected on the audio panel. The course and glide slope signals are reliable only when their warning flags are not displayed, localizer and glide slope pointers are in view, and the ILS identifier is received. Confirmed the published approach inboud course is set or displayed.
Do not use radio navigation aid facilities that are out of service even though flight deck indications appear normal. Radio navigation aids that are out of service may have erroneous transmissions that are not detected by airplane receivers and no flight deck warning is provided to the crew.

7.6.2 Approach Category

FAA Category	Speed
C	121KTs or more but less than 141KTs
D	141KTs or more but less than 166KTs
Speed—based upon a speed of Vref in the landing configuration at maximum certificated landing weight.	

ICAO Category	VAT	Range of speeds for initial approach	Range of speed for final approach	Max speed for visual maneuvering (circling)	Max speed for missed approach	
					Interm-ediate	final
C	121/140	160/240	115/160	180	160	240
D	141/165	185/250	130/185	205	185	265
Vat—Speed at threshold, based on the landing configuration at maximum certificated landing weight, 1.23 or 1.3 stall speed (this speed is based on the aircraft certification).						

7.6.3 Initial approach

When flying with QNH, the initial approach phase may be completed by using LANV and VANV if course and glideslope was selected via CDU for an entire approach procedure. Ensuring the sequence of the LEG pages, altitude constraints and MAP display is complying with ATC's clearance. For ATC's final clearance change or limitations, HDG SEL, altitude window and knobs and proper VS modes may be used to change. The sequence of the legs can only be changed when time permits.

Caution: When LNAV is used to intercept the final course, ensuring the information from raw data is correct for intercepting LOC to avoid descent before LOC is captured. If required, use HDG SEL or HDG HOLD to intercept the final course heading.

7.6.4 Delayed Flap Approach (Noise Abatement)

If the approach is not being conducted in adverse conditions that would make it difficult to achieve a stabilized approach, the final flap selection may be delayed to conserve fuel or to accommodate speed requests by air traffic.

Intercept the glide slope with gear down and flaps 20 at flaps 20 speed. The thrust required to descend on the glide slope may be near idle.

Approaching 1,000 feet AFE, select landing flaps, allow the speed to bleed off to the final approach speed, then adjust thrust to maintain it. Do the Landing checklist.

Note: For particularly noise sensitive areas, use the technique above but delay extending the landing gear until 1,500 feet AFE.

7.6.5 Missed Approach

Mandatory Missed Approach

For all instrument approached, initiate go-around immediately under the following conditions:

- During instrument approach, one ground navigation facility or flight instrument malfunction affecting safe instrument approach occurs;
- During ILS final approach for instrument flight, total deviation for any localizer and/or localizer indication occurs;

- When navigation instrument indicates obvious deviation and runway is invisible;
- When based on RNP approach and FMC indicates ANP information exceeds RNP;
- Loss of radio communication during radar approach.

Implementation of go-around

If a missed approach is required following a autopilot approach, leave the autopilots engaged. Push either GA switch, call for flaps 20, ensure go-around thrust for the nominal climb rate is set and monitor autopilot performance. Retract the landing gear after a positive rate of climb is indicated on the altimeter.

At typical landing weights, actual thrust required for a normal go-around is usually considerably less than maximum go-around thrust. This provides a thrust margin for windshear or other situations requiring maximum thrust. If full thrust is desired after thrust for the nominal climb rate has been established, press GA a second time.

If a missed approach is required following a single autopilot or manual instrument approach, or a visual approach, push either GA switch, call for flaps 20, ensure set go-around thrust, and rotate smoothly toward 15 degrees pitch attitude. Then follow flight director commands and retract the landing gear after a positive rate of climb is indicated on the altimeter.

During an automatic go-around initiated at 50 feet, approximately 30 feet of altitude is lost. If touchdown occurs after a go-around is initiated, the go-around continues. Observe that the autothrottle apply go-around thrust or manually apply go-around thrust as the airplane rotates to the go-around attitude.

The GA pitch mode initially commands a go-around attitude and then transitions to speed as the rate of climb increases. Command speed automatically moves to a target airspeed for the existing flap position. The GA roll mode maintains existing ground track. Above 400 feet AGL, select a roll mode as appropriate.

The minimum altitude for flap retraction during a normal takeoff is not normally applicable to a missed approach procedure. However, obstacles in the missed approach flight path must be taken into consideration. During training, use 1000 feet AGL to initiate acceleration for flap retraction, as during the takeoff procedure.

Note: Selection of pitch and roll modes below 400 feet AGL does not change the autopilot and flight director modes.

When accomplishing a missed approach from a dual-autopilot approach, initial selection of a pitch mode, or when altitude capture occurs above 400 feet AGL the autopilot reverts to single autopilot operation.

If initial maneuvering is required during the missed approach, accomplish the missed approach procedure through gear up before initiating the turn. Delay further flap retraction until initial maneuvering is complete and a safe altitude and appropriate speeds are attained.

Command speed automatically increases to maneuvering speed for the existing flap position. Retract flaps on the normal flap speed schedule.

When the flaps are retracted to the desired position and the airspeed approaches maneuvering speed._select LVL CHG and ensure climb thrust is set. VNAV may be selected if the flaps are up. Verify the airplane levels off at selected altitude and proper speed is maintained.

If VNAV is used during go-around, the FMC missed approach profile should contain the appropriate holding speeds and altitudes.

If a diversion to an alternate airport is required, delay use of VNAV until appropriate FMC entries are completed.

Note: FMC speeds may not comply with speed/altitude restrictions when using VNAV at low altitude._

7.7 Landing

7.7.1 Crosswind Landing Correction

When autothrottle is used for autolanding, the speed will be set to Vref+5KTs. Keeping autothrootle on will make aircraft provide sufficient protection for wind and gust. When autothrottle is disengaged or plan to be disengaged before landing, the approach speed correction for approach is: add 1/2 reported headwind on basis of the Vref, and add the total gust for reported wind.

When speed is corrected based on the wind, the maximum command speed should not exceed Vref+20KTs, or landing flaps placard speed minus 5KTs, this not only provides sufficient low maneuvering speed margin, but also reduces the possibility of flaps load reliefing. Using the reduced landing flaps setting (flaps 30) also may increase the flaps load reliefing margin. The following table presents the example of the wind increment for runway heading 360:

Reported wind_kts_	Wind increment	Approach speed_kts_
360°/16	8	Vref +8
Wind calm	0	Vref +5
360°/20 gust30	10+10	Vref +20
060°/24	6	Vref +6
090°/15	0	Vref +5
090°/l5 gust25	0+10	Vref +10

If Vref +20KTs exceeds landing flaps placard speed minus 5KTs, using landing flaps placard speed minus 5KTs.

When autothrottle is disengaged, the minimum speed is set Vref +5 KTs. The correction of the gust shall be made until landing, the steady headwind correction will disappear with the airplane touch the runway.

Note: No wind correction for tailwind.

The relationship between wind angle and the target speed (unit: kts)

Wind angle	Wind correction	Speed cursor
Below 30 degrees	1/2	Vref +1/2 wind
45 degrees	1/3	Vref +1/3 wind
60 degrees	1/4	Vref +1/4 wind
90 degrees	0	Vref +5

7.7.2 Crosswind landing

Four ways of crosswind landing:

- Sideslip_
- De-crab(de-crab during flare)_
- Crab_
- Combination of sideslip and crab

During crosswind landing and maintain crab, make cockpit on the upper wind of the centerline, ensuring main landing gear on the centerline when touchdown.

Crosswind capability

After studying the aerodynamic of the normal landing configuration, dry runway, double engine and single engine condition, the table below present the crosswind guidance:

B767-300 auto landing for crosswind criteria_unit_kts_

	Headwind	crosswind	tailwind
767_300	25 _12.5m/s _	25 _12.5 m/s_	10 _5 m/s_

B767-300 crosswind landing crieatia_unit_kts_

	90°crosswind	45°crosswind	headwind	tailwind
Dry runway	35 _17.5 m/s_	40 _20 m/s_	50 _25 m/s_	10 _5 m/s_
Wet runway	30 _15 m/s_	35 _17.5 m/s_	50 _25 m/s_	10 _5 m/s_
Ice/snow	20 _10 m/s_	25 _12.5 m/s_	50 _25 m/s_	6 _3 m/s_

Low visibility crosswind criteria_unit_kts_

	90°crosswind	45°crosswind	headwind	tailwind
Visibility below 3KM	30 _15 m/s_	35 _17.5 m/s_	50 _25 m/s_	10 _5 m/s_
Visibility below 1KM	20 _10 m/s_	25 _12.5 m/s_	50 _25 m/s_	Not allowed

Note_

1. In strong wind condition, the crosswind crieatia is based on the steady crosswind crosswind component, below 200 feet from the threshold elevation. A go around must be performed if onboard equipment detects the crosswind is beyond the limit or ATC reported crosswind exceed the limt.
2. If asymmetry thrust is used, crosswind guidance should minus 5kts on wet or contaminated runway.
3. On slippery runway, crosswind capability is based on the runway surface condition, aircraft loading and pilot's flying technique.
4. When autothrottle is used for landing, Vtarget= Vref +5_no wind correction is required.
5. When manual thrust is used for landing, Vtarget= Vref+wind correction
   Wind correction=1/2 crosswind component+(gust-total steady wind value)
   Note: wind unit is kts_1m/s≈2kts_
   i. Maximum wind correction is 20Kt_minimum is 5Kt_
   ii. Wind direction is based on the runway direction.
6. When non normal checklist is used for landing speed correction, wind correction must be corrected if autothrust is not used.(the same as step 4).

Sideslip (Wing Low)

The sideslip crosswind technique aligns the airplane with the extended runway centerline so that main gear touchdown occurs on the runway centerline.

The initial phase of the approach to landing is flown using the crab method to correct for drift. Prior to the flare the airplane centerline is aligned on or parallel to the runway centerline. Downwind rudder is used to align the longitudinal axis to the desired track as aileron is used to lower the wing into the wind to prevent drift. As steady sideslip is established with opposite rudder and low wing into the wind to hold the desired course. Touchdown is accomplished with the upwind wheels touching just before the downwind wheels. Overcontrolling the roll axis must be avoided because overbanking could cause the engine nacelle or outboard wing flap to contact the runway.

Properly coordinated, this maneuver results in nearly fixed rudder and aileron control positions during the final phase of the approach, touchdown, and beginning of the landing roll.

De-crab during flare

The objective of this technique is to maintain wings level throughout the approach, flare, and touchdown.

On final approach, a crab angle is established with wings level to maintain the desired track. Just prior to touchdown while flaring the airplane, downwind rudder is applied to eliminate the crab and align the airplane with the runway centerline.

As rudder is applied, the upwind wing sweeps forward developing roll. Hold wings level with simultaneous application of aileron control into the wind. The touchdown is made with cross controls and both gear touching down simultaneously. Throughout the touchdown phase upwind aileron application is utilized to keep the wings level.

Touchdown In Crab

The airplane can land using crab only (zero sideslip) up to the landing crosswind guideline speeds.

On dry runways, upon touchdown the airplane tracks toward the upwind edge of the runway while de-crabbing to align with the runway. Immediate upwind aileron is needed to ensure the wings remain level while rudder is needed to track the runway centerline. The greater the amount of crab at touchdown, the larger the lateral deviation from the point of touchdown. For this reason, touchdown in a crab only condition is not recommended when landing on a dry runway in strong crosswinds.

On very slippery runways, landing the airplane using crab only reduces drift toward the downwind side at touchdown, permits rapid operation of spoilers and autobrakes because all main gears touchdown simultaneously, and may reduce pilot workload since the airplane does not have to be de-crabbed before touchdown. However, proper rudder and upwind aileron must be applied after touchdown to ensure directional control is maintained.

Combination of sideslip and crab

If the crew elects to fly the sideslip to touchdown, it may be necessary to add a crab during strong crosswinds. Main gear touchdown is made with the upwind wing low and crab angle applied. As the upwind gear touches first, a slight increase in downwind rudder is applied to align the airplane with the runway centerline. At touchdown, increased application of upwind aileron should be applied to maintain wings level.

7.7.3 Flare and Touchdown

Unless an unexpected or sudden event occurs, such as windshear or collision avoidance situation, it is not appropriate to use sudden, violent or abrupt control inputs during landing. Begin with a stabilized approach on speed, in trim and on glide path.

When the threshold passes under the airplane nose and out of sight, shift the visual sighting point to the far end of the runway. Shifting the visual sighting point assists in controlling the pitch attitude during the flare.

Maintaining a constant airspeed and descent rate assists in determining the flare point. Initiate the flare when the main gear is approximately 20 feet above the runway by increasing pitch attitude approximately 2º-3º. This slows the rate of descent.

After the flare is initiated, smoothly retard the thrust levers to idle, and make small pitch attitude adjustments to maintain the desired descent rate to the runway. Ideally, main gear touchdown should occur simultaneously with thrust levers reaching idle. A smooth power reduction to idle also assists in controlling the natural nose-down pitch change associated with thrust reduction. Hold sufficient back pressure on the control column to keep the pitch attitude constant.

Note_ Do not trim during the flare or after touchdown. Trimming in the flare increases the possibility of a tail strike.

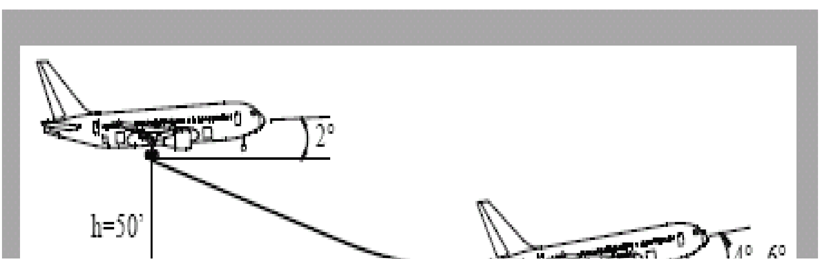
Typically, the pitch attitude increases slightly during the actual landing, but avoid over-rotating. Do not increase the pitch attitude after touchdown; this could lead to a tail strike.

Shifting the visual sighting point down the runway assists in controlling the pitch attitude during the flare. A smooth thrust reduction to idle also assists in controlling the natural nose down pitch change associated with thrust reduction. Hold sufficient back pressure on the control column to keep the pitch attitude constant.
Avoid rapid control column movements during the flare. Do not allow the airplane to float; fly the airplane onto the runway. Do not extend the flare by increasing pitch attitude in an attempt to achieve a perfectly smooth touchdown. Do not attempt to hold the nose wheels off the runway.

7.7.4 Landing Flare Profile

The following diagrams use these conditions:

- 3° approach glide path
- flare distance is approximately 1,000 to 2,000 feet beyond the threshold
- typical landing flare times range from 4 to 8 seconds and are a function of approach speed
- airplane body attitudes are based upon typical landing weights, flaps 30,Vref 30 + 5 (approach) and Vref 30 + 0 (landing), and should be reduced by 1° for each 5 knots above this speed. Touchdown Body Attitudes



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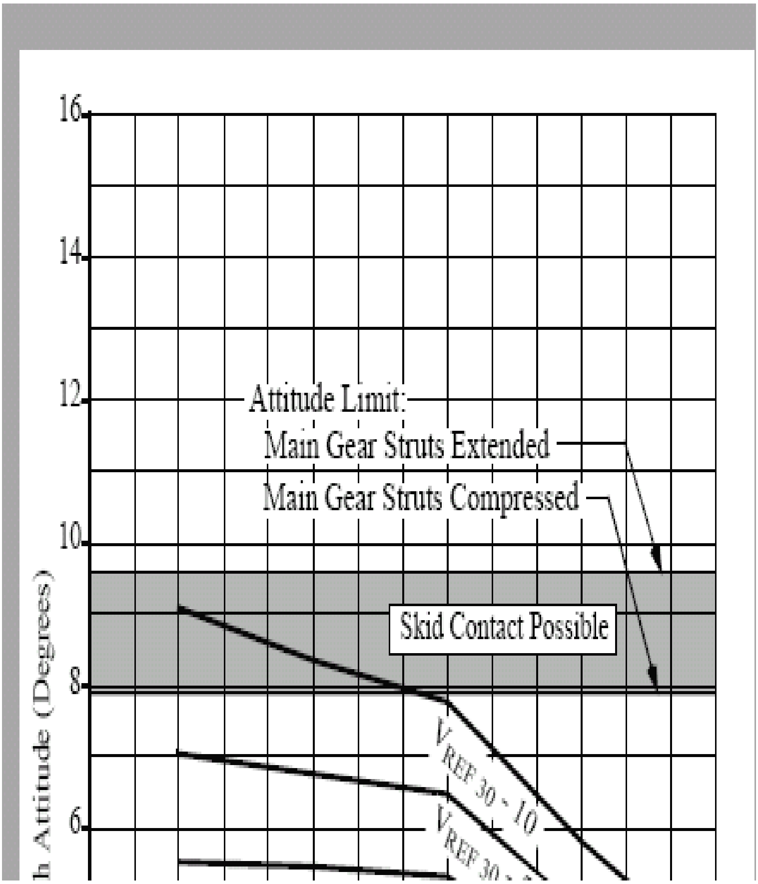


7.7.5 Avoid Tail Strike

A tail strike on landing tends to cause more serious damage than the same event during takeoff and is usually more expensive and time consuming to repair. In the worst case, the tail can strike the runway before the landing gear, thus absorbing large amounts of energy for which it is not designed. The aft pressure bulkhead is often damaged as a result.
Any one of the following risk factors may precede a tail strike:

Unstabilized Approach

An unstabilized approach is the biggest single cause of tail strike. Flight crews should stabilize all approach variables-on centerline, on approach path, on speed, and in the final landing configuration-by the time the airplane descends through 1000feet above ground level. This is not always possible. Under normal conditions, if the airplane descends through 1000 feet AGL(IMC), or 500 feet AGL(VMC), with these approach variables not stabilized, a go-around should be considered.

Flight recorder data show that flight crews who continue with an unstabilized condition below 500 feet seldom stabilize the approach. When the airplane arrives in the flare, it often has either excessive or insufficient airspeed. The result is a tendency toward large power and pitch corrections in the flare, often culminating in a vigorous pitch change at touchdown resulting in tail strike shortly thereafter. If the pitch is increased rapidly when touchdown occurs as ground spoilers deploy, the spoilers add additional nose up pitch force, reducing pitch authority, which increases the possibility of tail strike. Conversely, if the airplane is slow, increasing the pitch attitude in the flare does not effectively reduce the sink rate; and in some cases, may increase it.

A firm touchdown on the main gear is often preferable to a soft touchdown with the nose rising rapidly. In this case, the momentary addition of power may aid in preventing the tail strike. In addition, unstabilized approaches can result in landing long or a runway over run.

Holding Off in the Flare

The second most common cause of a landing tail strike is an extended flare, with a loss in airspeed that results in a rapid loss of altitude, (a dropped-in touchdown). This condition is often precipitated by a desire to achieve an extremely smooth/soft landing. A very smooth/soft touchdown is not essential, nor even desired, particularly if the runway is wet.

Trimming in the Flare

Trimming the stabilizer in the flare may contribute to a tail strike. The FP may easily lose the feel of the elevator while the trim is running. Too much trim can raise the nose, even when this reaction is not desired. The pitch up can cause a balloon, followed either by dropping in or pitching over and landing in a three-point attitude. Flight crews should trim the airplane during the approach, but not in the flare.

Mishandling of Crosswind

When the airplane is placed in a forward slip attitude to compensate for the wind effects, this cross-control maneuver reduces lift, increases drag, and may increase the rate of descent. If the airplane then descends into a turbulent surface layer, particularly if the wind is shifting toward the tail, the stage is set for tail strike.

The combined effects of high closure rate, shifting winds with the potential for a quartering tail wind, can result in a sudden drop in wind velocity commonly found below 100 feet. Combining this with turbulence can make the timing of the flare very difficult. The PF can best handle the situation by using additional thrust, if required, and by using an appropriate pitch change to keep the descent rate stable until initiation of the flare. Flight crews should clearly understand the criteria for initiating a go-around and plan to use this time-honored avoidance maneuver when needed.

Over-Rotation during Go-Around

Go-around is initiated very late in the approach, such as during the landing flare or after touching down, are a common cause of tail strikes. When then go-around mode is initiated, the flight director immediately commands a go-around pitch attitude. If the FP abruptly rotates up to the pitch command bar, a tail strike can occur before the airplane responds and begins climbing. During a go-around, an increase in thrust as well as a positive pitch attitude is needed. If the thrust increase is not adequate for the increased pitch attitude, the resulting speed decay will likely result in a tail strike. Another contributing factor in tail strikes may be a strong desire by the flight crew to avoid landing gear contact after initiating a late go-around when the airplane is still over the runway. In general, this concern is not warranted because a brief landing gear touchdown during a late go-around is acceptable. This hand been demonstrated during autoland and go-around certification program.

7.7.6 Pitch and Roll Limit Conditionss

The Ground Contact Angles - Normal Landing figure illustrates body roll angle/pitch angles at which the airplane structure contacts the runway. Prolonged flare increases the body pitch attitude 2° to 3°. When prolonged flare is coupled with a misjudged height above the runway aft body contact is possible.

Fly the airplane onto the runway at the desired touchdown point and at the desired airspeed. Do not hold it off and risk the possibility of a tailstrike.

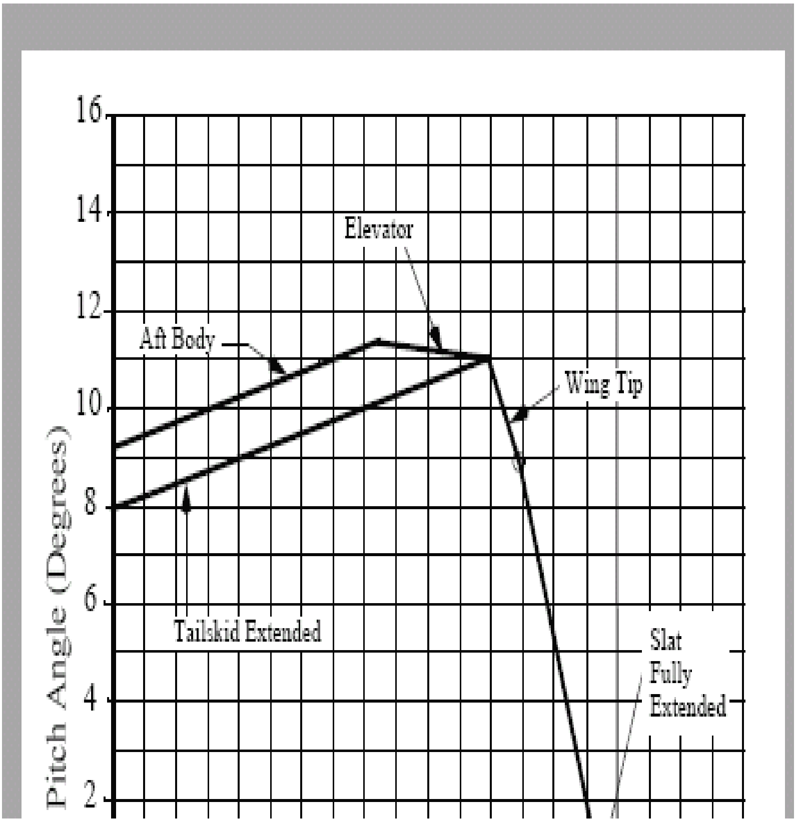
Note: A smooth touchdown is not the criterion for a safe landing.

Ground Contact Angles - Normal Landing

Conditions

- Pitch about main gear centerline
- Roll about main gear outside tire
- Valid for all control surface positions
- Valid for all flap detents
- Struts fully compressed

767-300



7.7.7 Bounced Landing Recovery

If the airplane should bounce, hold or re-establish a normal landing attitude and add thrust as necessary to control the rate of descent. Thrust need not be added for a shallow bounce or skip. When a high, hard bounce occurs, initiate a go-around.

Apply go-around thrust and use normal go-around procedures. Do not retract the landing gear until a positive rate of climb is established because a second touchdown may occur during the go-around.

Bounced landings can occur because higher than idle thrust is maintained through initial touchdown, disabling the automatic speedbrake deployment even when the speedbrakes are armed.

7.7.8 After Touchdown And Landing Roll

Avoid touching down with thrust above idle since this may establish an airplane nose up pitch tendency and increases landing roll.

After main gear touchdown, initiate the landing roll procedure. If the speedbrakes do not extend automatically move the speedbrake lever to the UP position without delay. Fly the nose wheels smoothly onto the runway without delay. Control column movement forward of neutral should not be required. Do not attempt to hold the nose wheels off the runway. Holding the nose up after touchdown for aerodynamic braking is not an effective braking technique.

To avoid the risk of tailstrike, do not allow the pitch attitude to increase after touchdown. However, applying excessive nose down elevator during landing can result in substantial forward fuselage damage. Do not use full down elevator. Use an appropriate autobrake setting or manually apply wheel brakes smoothly with steadily increasing pedal pressure as required for runway condition and runway length available. Maintain deceleration rate with constant or increasing brake pressure as required until stopped or desired taxi speed is reached.

7.7.9 Directional Control and Braking during Landing Roll

If the nose wheels are not promptly lowered to the runway, braking and steering capabilities are significantly degraded and no drag benefit is gained. Rudder control is effective to approximately 60 knots. Rudder pedal steering is sufficient for maintaining directional control during the rollout. Do not use the nose wheel steering tiller until reaching taxi speed. In a crosswind, displace the control wheel into the wind to maintain wings level which aids directional control. Perform the landing roll procedure immediately after touchdown. Any delay markedly increases the stopping distance. Stopping distance varies with wind conditions and any deviation from recommended approach speeds.

7.7.10 Automatic Brakes Use

Use of the autobrake system is recommend whenever the runway is limited, when using higher than normal approach speeds, landing on slippery runways, or landing in a crosswind.

For normal operation of the autobrake system select a deceleration setting_

• MAX AUTO: Used when minimum stopping distance is required. Deceleration rate is less than that produced by full manual braking
• 3 or 4: Should be used for wet or slippery runways or when landing rollout distance is limited
• 1 or 2: These settings provide a moderate deceleration suitable for all routine operations.

Immediate initiation of reverse thrust at main gear touchdown and full reverse thrust allow the autobrake system to reduce brake pressure to the minimum level. Since the autobrake system senses deceleration and modulates brake pressure accordingly, the proper application of reverse thrust results in reduced braking for a large portion of the landing roll.

The importance of establishing the desired reverse thrust level as soon as possible after touchdown cannot be overemphasized. This minimizes brake temperatures and tire and brake wear and reduces stopping distance on very slippery runways.

The use of minimum reverse thrust as compared to maximum reverse thrust can double the brake energy requirements and result in brake temperatures much higher than normal.

After touchdown, crewmembers should be alert for autobrake disengagement annunciations. The PM should notify the PF anytime the autobrakes disengage.

When transitioning from the autobrake system to manual braking, the PF should notify the PM. Techniques for release of autobrakes can affect passenger comfort and stopping distance. These techniques are:

• stow the speedbrake handle. When stopping distance within the remaining runway is assured, this method provides a smooth transition to manual braking, is effective before or after thrust reversers are stowed, and is less dependent on manual braking technique
• smoothly apply brake pedal force as in a normal stop, until the autobrake system disarms. Following disarming of the autobrakes, smoothly release brake pedal pressure. Disarming the autobrakes before coming out of reverse thrust provides a smooth transition to manual braking
• manually position the autobrake selector off (normally done by the PM at the direction of the PF).

7.7.11 Manual Braking

The following technique for manual braking provides optimum braking for all runway conditions:

The pilot's seat and rudder pedals should be adjusted so that it is possible to apply maximum braking with full rudder deflection.
Immediately after main gear touchdown, smoothly apply a constant brake pedal pressure for the desired braking. For short or slippery runways, use full brake pedal pressure.

- do not attempt to modulate, pump or improve the braking by any other special techniques
- do not release the brake pedal pressure until the airplane speed has been reduced to a safe taxi speed
- the antiskid system stops the airplane for all runway conditions in a shorter distance than is possible with either antiskid off or brake pedal modulation.

The antiskid system adapts pilot applied brake pressure to runway conditions by sensing an impending skid condition and adjusting the brake pressure to each individual wheel for maximum braking. When brakes are applied on a slippery runway, several skid cycles occur before the antiskid system establishes the right amount of brake pressure for the most effective braking.
If the pilot modulates the brake pedals, the antiskid system is forced to readjust the brake pressure to establish optimum braking. During this readjustment time, braking efficiency is lost.
Low available braking coefficient of friction on extremely slippery runways at high speeds may be interpreted as a total antiskid failure. Pumping the brakes degrades braking effectiveness. Maintain steadily increasing brake pressure, allowing the antiskid system to function at its optimum.
Although immediate braking is desired, manual braking techniques normally involve a four to five second delay between main gear touchdown and brake pedal application even when actual conditions reflect the need for a more rapid initiation of braking. This delayed braking can result in the loss of 800 to 1,000 feet of runway. Directional control requirements for crosswind conditions and low visibility may further increase the delays. Distractions arising from a malfunctioning reverser system can also result in delayed manual braking application.

7.7.12 Braking with Antiskid Inoperative

When the antiskid system is inoperative, the following techniques apply:

- ensure that the nose wheels are on the ground and the speedbrakes are extended before applying the brakes
- initiate wheel braking using very light pedal pressure and increase pressure as ground speed decreases
- apply steady pressure and DO NOT PUMP the pedals.

Antiskid-off braking requires even greater care during lightweight landings.

7.7.13 Brake Cooling

A series of taxi-back or stop and go landings without additional in-flight brake cooling can cause excessive brake temperatures. The energy absorbed by the brakes from each landing is cumulative.

Extending the gear a few minutes early in the approach normally provides sufficient cooling for a landing. Total in-flight cooling time can be determined from the Performance Inflight section of the QRH.

The optional brake temperature monitoring system may be used for additional flight crew guidance in assessing brake energy absorption. This system indicates a stabilized value approximately fifteen minutes after brake energy absorption.Therefore, an immediate or reliable indication of tire or hydraulic fluid fire, wheel bearing problems, or wheel fracture is not available. The brake temperature monitor readings may vary between brakes during normal braking operations.

Note: Brake energy data provided in the QRH should be used to identify potential overheat situations.

Close adherence to recommended landing roll procedures ensures minimum brake temperature build up.

7.7.14 Reverse Thrust Operation

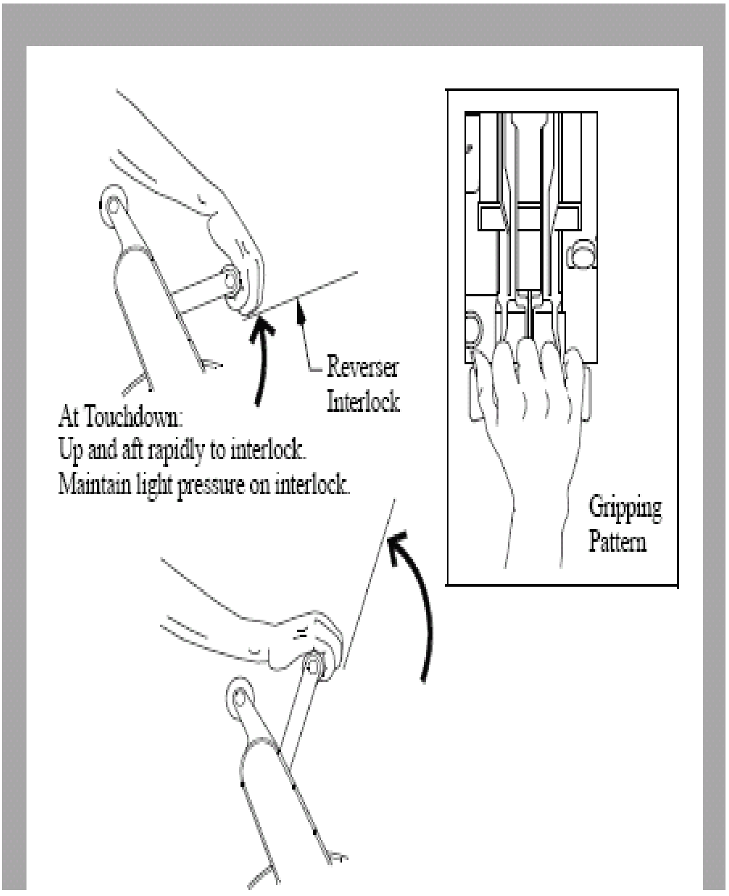
Awareness of the position of the forward and reverse trust levers must be maintained during the landing phase. Improper seat position as well as long sleeved apparel may cause inadvertent advancement of the forward thrust levers, preventing movement of the reverse thrust levers.

The position of the hand should be comfortable, permit easy access to the autothrottle disconnect switch, and allow control of all thrust levers, forward and reverse, through full range of motion.

Note: Reverse thrust always reduces the “brake only” stopping distance, brake and tire wear. Reverse thrust is most effective at high speeds.

After touchdown, with the thrust levers at idle, rapidly raise the reverse thrust levers up and aft to the interlock position, then to the number 2 reverse thrust detent. Conditions permitting, limit reverse thrust to the number 2 detent. The PM should monitor engine operating limits and call out any engine operational limits being approached or exceeded, any thrust reverser failure, or any other abnormalities.

Maintain reverse thrust as required, up to maximum, until the airspeed approaches 60 knots. At this point start reducing the reverse thrust so that the reverse thrust levers are moving down at a rate commensurate with the deceleration rate of the airplane. The thrust levers should be positioned to reverse idle by taxi speed, then to full down after the engines have decelerated to idle. The PM should call out 60 knots to assist the PF in scheduling the reverse thrust. The PM should also call out any inadvertent selection of forward thrust as reverse thrust is cancelled. If an engine surges during reverse thrust operation, quickly select reverse idle on all engines.



7.7.15 Overweight Landing

The actual landing weight should not exceed the maximum limited landing weight unless in emergency situation.

Flight dispatchers and captain have the responsibility to ensure the landing weight in destination airport should be below maximum landing weight. In emergency situation, if urgent return is required, captain should consider fuel burning off(if applicable), PCN, runway surface, landing distance, and complete related checklist. Then, control the aircraft smoothly and avoid hard landing. Report shall be made to ground maintenance and dispatch office immediately after landing, and make a note on the log book.

Operation Instruction

Overweight landings may be safely accomplished by using normal landing procedures and techniques. There are no adverse handling characteristics associated with overweight landings. Landing distance is normally less than takeoff distance for flaps 25 or 30 landings at all gross weight. However, wet or slippery runway field length requirements should be verified from the landing distance charts in the PI chapter of the QRH. Brake energy limits will not be exceeded for flaps 25 or 30 landings at all gross weights.

Overweight Autoland Policy

Boeing does not recommend overweight autolands. Autopilots on Boeing airplanes are not certified for automatic landings above maximum landing weight. At higher than normal speeds and weights, the performance of these systems may not be satisfactory, and has not been thoroughly tested. An automatic approach may be attempted, however the pilot should disengage the autopilot prior to flare height and accomplish a manual landing.

In an emergency, should the pilot determining that an overweight autoland is the safest course of action, the approach and landing should be closely monitored by the pilot and the following factors considered:

- touchdown may be beyond the normal touchdown zone; allow for additional landing distance.
- touchdown at higher than normal sink rates may result in exceeding structural limits.

- plan for a go-around or manual landing if autoland performance is unsatisfactory; automatic go-arounds can be initiated until just prior to touchdown, and can be continued even if the airplane touches down after initiation of the go-around.

7.7.16 Controlled Flight Into Terrain _CFIT_

Information on CFIT accidents provided by ICAO reveals the existence of some other important factors other than their relevance with GPWS. For this reason, all flight crew members have the responsibility and obligation to observe the following regulations to prevent the occurrence of CFIT accidents:

(1) The regulation on minimum safe altitude shall not be violated;

(2) Flight crew shall correctly select flight guidance system and auto-pilot/auto-flight function;

(3) Wrong navigation shall be avoided and the accuracy of NAVIDS shall be crosschecked;

(4) ATC instruction shall be correctly understood and any doubt thereof confirmed;

(5) The requirements of approach and departure procedures shall be followed and their standards strictly executed;

(6) IFR altitude descent shall not be done visually;

(7) Flight altimeter setting shall be crosschecked to avoid wrong setting;

(8) Aircraft banding turn shall not be bigger than 30 degrees under normal condition.

(9) Full understanding of operational environment is necessary prior to conducting a flight especially when it concerns the terrain conditions at terminal area and sector safety altitude.

Chapter 8 Adverse Weather

8.1 General

Because of the effects of high temperature, rain, turbulence and windshear, some more considerations shall be made by flight crews when operating in adverse weather condition. Generally, the following shall be observed in adverse weather operation:

1. No assumed temperature or reduced takeoff is permitted.
2. For providing the increased acceleration-stopping distance performance, reduce V1 to minimum V1(assuming all the weight limitations are considered)
3. If crosswind exceeds 15kts (8m/s), or slush or wet snow exceeds 1/2 inch (13mm), no takeoff on slippery runway is recommended.
4. The following shall be observed to improve stall margin:
   1) If runway length is sufficient, consider using flaps 5 to improve climb procedure.
   2) If runway is limited by the expected takeoff flaps setting, consider using the bigger flaps settings and improving climb performance. So, additional stall margin and minimum performance penalty is to be provided.

Takeoff/Landing in Adverse Weather Conditions

Takeoff

(1)No takeoff shall be made when a thunderstorm may affect takeoff operation;

(2)A takeoff shall be postponed under heavy rain, stormy rain or when windshear is reported or detected to be existing on the takeoff and climb-out paths;

(3)Weather radar shall be switched on prior to alignment with runway for takeoff so as to determine circumnavigation plan and the ATC shall be notified as early as possible.

(4)Anti-icing measure shall be correctly used for engines and main wings when icing conditions exist;

Landing

When approaching to land under medium to heavy rain conditions, the glass panels of the cockpit windshields are wet with rainwater affecting flight visibility and creating double image, which is liable to induce wrong sense of vision to pilots and which makes it difficult to maintain aircraft attitude. All this prolongs the reaction time on the part of pilots in the control of aircraft. The standing water on runway deteriorates braking action. The combination of the above factors are susceptible to lead to the occurrence of unsafe event.

For these reasons, flight crew members are expected to observe the following regulations:

(1) Definite sharing of responsibilities, close cooperation and coordination, prompting each other.
(2) The PF shall fly by IFR and maintain a steady attitude;
(3) PM shall readily keep the aircraft under control and keep a sharp lookout to the outside environment;
(4) They shall strictly follow HNA regulations on go around and stabilized approach;
(5) HNA forbids landing under heavy rain;
(6) Surveillance or monitoring approach procedures are recommend

8.2 Cold Weather Operation

Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice and snow on the aircraft, ramps, taxiways and runways.
Icing conditions exist when OAT(on the ground) or TAT(in-flight) is 10°C_50°F_or below and meet the followings when in icing conditions(767 FCOM, SP16):

- visible moisture(clouds, fog with visibility less than one mile, rain, snow, sleet, ice crystals, and so on) is present, or
- standing water, ice, or snow is present on the ramps, taxiways, or runways.
- When OAT is below 10_, when OAT reaches or below due point condition. (**AC-121-50 CAAC** advisory bulletin *Ground operation in icing condition* 5_)

Caution: Do not operate engine or wing anti-ice when the total air temperature (TAT) is above 10°C (50°F).

Altitude Correction in Low Temperature

When OAT is not the same as ISA, the pressure altimeter error could be caused because of non standard air density. The more difference between actual temperature and ISA, the bigger for the pressure altimeter error. When temperature is above ISA, actual altitude is higher than indicated altitude. When temperature is below ISA, actual altitude is lower than indicated altitude. The very low temperature will cause big pressure altimeter error, and reduce the altitude related to the terrain. When above the altimeter source altitude, the higher the aircraft, the bigger of the errors. Normally, when altimeter error is realized, especially operation in the airport with high terrain and/or obstacles in low temperature condition (-30_ /-22_ or below), altimeter correction shall be considered. In addition, the enroute minimum altitude and/or flight level with terrain requirement shall also be considered. In certain situations, the temperature between 0_ and -30_ shall be corrected.
Operator shall coordinate with each airport or enroute and local or enroute ATC when operating in cold conditions. The followings shall be included:

- Confirming the assigned minimum altitude or flight level may provide the sufficient ground clearance in the forcasted minimum temperature condition.

- The altimeter correction procedure in the published procedures, including the chart being used.
- Confirming the assigned suitable low temperature condition or route. If available, flight shall be conducted according to the published procedure (no altimeter correction).

Pilots shall be noted, in the very low temperature, when the published minimum altitude is very high than the airport elevation, the error may exceed 1000ft, the potential unsafe terrain altitude may be caused if the altimeter correction is not made.

Minimum flight altitude corrections_*Flight Operation Manual* 9.1.1.3_

In order to determine the geometrical altitude of the aircraft and thus ensure adequate obstacle clearance, corrections have to be applied when Outside Air Temperature and/or pressure differ from standard atmosphere.

1. Temperature correction

The calculated minimum safe altitudes/heights must be corrected when the OAT is much lower than the standard atmosphere.

1) Temperature correction at low altitude

(1)Approximate correction

Increase obstacle elevation by 4% per 10°C below ISA of the height above the elevation of the altimeter setting source or decrease aircraft indicated altitude by 4% per 10°C below ISA of the height above the elevation of the altimeter setting source.

(2) Accurate corrections

Table 1— Altitude/height adjustment

Airport Temperature	Absolute altitude above altimeter setting surface								
	200	300	400	500	1000	2000	3000	4000	5000
0° C	20	20	30	30	60	120	170	230	290
−10° C	20	30	40	50	100	200	290	390	490
−20° C	30	50	60	70	140	280	430	570	710
−30° C	40	60	80	100	190	380	570	760	950
−40° C	50	80	100	120	240	480	720	970	1210
−50° C	60	90	120	150	300	600	890	1190	1500

For colder weather conditions, apply the Table 1 for more accurate corrections.

2) High altitude temperature corrections

The graph given in Table 2 has to be used en-route for high altitude operation. It does not take into account the elevation of the altimeter setting source.

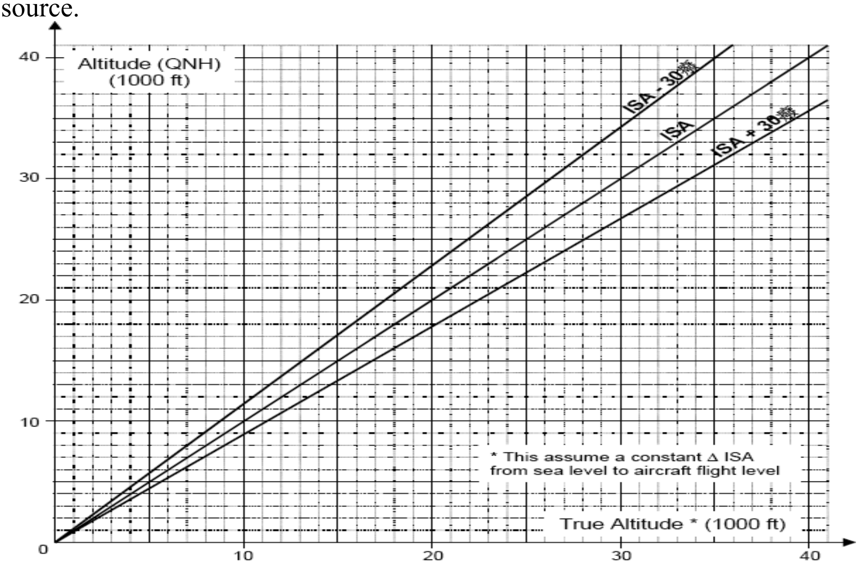


Table 2 - High altitude temperature corrections

Example: Given: MEA = FL200 / ISA-30°C

Find: min FL = 230

2. Pressure correction

When flying at levels with the altimeter set to 1013hPa, the minimum safe altitude must be corrected for deviations in pressure when the pressure is lower than the standard atmosphere (1013hPa).

An appropriate correction is 28 ft per hPa below 1013hPa, Altimeter indication readouts subtract.

The Table 3 gives more accurate data. The following correction is to be applied to the indicated altitude (reference 1013 hPa) to determine the geometrical aircraft altitude.

Example: Given: Indicated altitude = 20000 ft, ISA, local QNH = 995 hPa
Find: Geometrical (true) altitude = 20000 - 510 = 19490 ft.
When using the QNH or QFE altimeter setting (giving altitude or height above QFE datum respectively), a pressure correction is not required.

8.2.1 Contamination Effect

No one is allowed to release an aircraft with snow, frost and/or ice on its wings, control surfaces, engine air inlets or any other main surfaces (the existence of 3 mm of frost on the surface of the under-
wing is permissible). The aerodynamics of aircraft may deteriorate when c ontaminated with
snow, frost and/or ice. Components parts liable to contamination are generally the following parts:

(1) Lift augmentation apparatus;
(2) Control surfaces;
(3) Engine cowling and guide vanes;
(4) Undercarriage;
(5) Sensors and some other parts;
(6) Wings.

Aerodynamics deterioration may be detected by its:

(1) Visible reduction in lift, stall acceleration and increase in stall speed;
(2) Reduction in critical angle of attack and increase in taxiing distance;
(3) Increase in aircraft weight, drag and fuel consumption rate;
(4) Displaced lift center and deterioration in control quality.

Impact of Icing to Aircraft System:

(1) When ice forms in engine air inlets, the air induction of engines is affected with reduction in maximum thrust and engine liability to surging;
(2)If the main area of a control surface has adhesions of ice, frost or snow, the control surface may freeze where it is or it may be hampered from moving;
(3) The formation of ice on undercarriage may damage its device or equipment when it is retracted while the falling of the pieces of ice and snow may bring damage to aircraft;
(4) When contamination exists near a probe, probe orifice or sensor, flight instruments, engine instruments and automatic system may provide derroneous information.

8.2.2 Before Flight Preparation

Although removal of surface snow, ice or frost is normally a maintenance function, the flight crew should use additional care and scrutiny during preflight preparation to inspect areas where surface snow or frost could change or affect normal system operations.

Aircraft exterior check……………………………………Caption or F/O
Pitot probes and static ports………………………………………...check
Verify that all pitot probes and static ports are free of ice and snow.
Water rundown after snow removal may refreeze immediately forward of static ports and cause an ice buildup which disturbs airflow over the static ports resulting in erroneous static readings even when static ports themselves are clear.
Body (including radar dome), antenna……………………………...check
Surface……………………………………………………………check

Take with light coatings of frost, up to 1/8 inch(3mm) in thickness on lower wing surfaces due to cold fuel, is permissible; however, all leading edge devices, all control surfaces, tab surfaces, upper wing surfaces and balance panel cavities must be free of snow or ice. Thin hoarfrost is acceptable on the upper surface of the fuselage provided all vents and ports are clear. Thin hoarfrost is a uniform white deposit of fine crystalling texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings or lettering.

The underneath of the aircraft shall be checked as well to ensure no visual ice; when icing condition exists (such as rain, small rain, fog), the proper way of checking visual ice on upper wing surface shall be made if frost or ice has been formed on the lower surface of the wing tank, or suspect visual has been formed on the upper wing surface during aircraft parked.

The visual ice is not easy to be found under the snow/slush. In some situations, the visual ice can only be found by touching. Maintenance shall check according to the maintenance manual.

Control balance cavities……………………………………………….check

Check drainage after snow removal. Puddle water may refreeze in flight.

Landing gear…………………………………………..……..……. check

Landing gear doors, struts, landing gear doors, wheel and spin should be free of snow or ice.

Air conditioning inlets and exits………………………….. ……. …clear

Verify that the air inlets and exits, including the outflow valve, are clear of snow or ice. If the APU is operating, check that the outflow valve is full open.

Engine inlets……………………………………………………….clear

Verify that the inlet cowling is free of ice or snow. Verify that the fan is free to rotate.

Fuel tank vents……………………………………………………. clear

Check all fuel tank vents. All trances of ice or frost should be removed.

APU air inlets………………………………………….. ……. …check

The APU inlet door and cooling air inlet must be free of snow or ice prior to APU start.

Drainage and onboard water supplying equipment……check no freezing

Cockpit preparation……………………………………………..F/O

PITOT HEAT…………………….……………..…Verify extinguished

8.2.3 Airframe de-icing

Aircrafts de-icing/anti-icing in most domestic airports are normally performed in the parking bay, after pushback and before engine start (when all doors are closed if pushback is not required).In the airport with special de-icing area (such as Beijing and some overseas airports), de-icing/anti-icing are performed after engine start and taxi to assigned area based on the situation to de-icing/anti-icing with engine shutdown or in idle conditions.

If there is snow or ice observed or suspected prior to takeoff, check wing and tail surfaces and clear snow or ice.

Note_Take with light coatings of frost, up to 1/8 inch(3mm) in thickness on lower wing surfaces due to cold fuel, is permissible; however, all leading edge devices, all control surfaces, tab surfaces, upper wing surfaces and balance panel cavities must be free of snow or ice.

Note_Thin hoarfrost is acceptable on the upper surface of the fuselage provided all vents and ports are clear. Thin hoarfrost is a uniform white deposit of fine crystalling texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings or lettering.

Air/ground communication……………….established C F/O

Parking brake.................……………………………………....set C

All doors and windows……………………..……closed C F/O

When APU or engine is operating, use fluids on airplane surfaces:

Bleed switch…………………………………………………….OFF

Before de-icing, put associated APU/engine bleed switch to OFF.

After de-icing:

Deicing/anti-icing report……….received and recorded C F/O

Type of fluids

Density (only for II and IV)

The local time of the last time using anti-ice fluid

Oral confirmation: “ De-icing/anti-icing Checklist is completed”

Hold over time …………..……………..Confirmed C F/O

Using the hold over time on the back of De-icing/anti-icing Checklist on board.

Captain shall determine the final hold over time based ATIS, crew observation and experience and crew member coordination.

About 1 minute after de-icing completion:

Bleed switch…………………………………………………ON

Note: Protection time for fluids varies, based on meteorological conditions and usage method.

Note: To prevent ice and snow in flap cavities, retract flaps up during anti-icing/de-icing.

In low temperature, if the taxi route goes by way of snow or standing water, retract flaps during taxing. Taxi with flaps down will make flap and flap setting easy to get accumulated and slush snow from main landing gear. Leading edge should also be suspected of slush snow.

Warning: During taxi, if flap is in UP position, complete Before Takeoff Checklist after flaps are in takeoff configuration.

Caution: During taxi on snow or ice-covered taxiway or runway, special care should be taken because big speed or heavy crosswind may cause sideslip. Reduce speed at all turns.

8.2.4 Anti-ice operation

Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice, snow, slush and standing water on the airplane, ramps, taxiways, and runways. Icing conditions exist when OAT (on the ground) or TAT (in-flight) is 10°C or below and any of the following exist:

- visible moisture (clouds, fog with visibility less than one nautical mile, rain, snow, sleet, ice crystals, and so on) is present, or
- ice, snow, slush or standing water is present on the ramps, taxiways, or runways.

Engine Anti-ice Operation

Engine anti-ice must be selected ON immediately after both engines are started and remain on during all ground operations when icing conditions exist or are anticipated, except when the temperature is below –40°C OAT.

WARNING: Do not rely on airframe visual icing cues before activating engine anti–ice. Use the temperature and visible moisture criteria in the procedure. Late activation of engine anti-ice until icing conditions can be detected from the cockpit may result in engine damage or shutdown.

CAUTION: Do not use engine anti-ice when OAT is above 10°C.

When engine anti-ice is needed:

ENG INE ANTI-ICE selectors ....ON

When engine anti-ice is no longer needed on the ground:

ENGINE ANTI-ICE selectors ....AUTO

When engine anti-ice is needed in the air:

ENGINE ANTI-ICE selectors ....AUTO

8.2.5 Secure Procedure

Do the following steps after completing the normal Secure Procedure:
If the airplane will be attended, do the normal Secure Procedure with the following modification:

PACK CONTROL selectors .... AUTO F/O

If the airplane will not be attended, or if staying overnight at off-line stations or at airports where normal support is not available, the flight crew must arrange for or verify that the following steps are done:

Cabin altitude mode selector ....MAN F/O

Cabin altitude manual control ....DESCEND F/O

Position the outflow valve fully closed to inhibit the intake of snow or ice.

Wheel chocks ....Verify in place C or F/O

Parking brake.. Released C

Reduces the possibility of frozen brakes.

Cold weather maintenance procedures for securing the airplane may be required. These procedures are found in the approved Aircraft Maintenance Manual.

8.3 Hot Weather Operation

During ground operation the following considerations will help keep the airplane as cool as possible:

• If a ground source of conditioned air is available, the supply should be plugged in immediately after engine shutdown and should not be removed until either the APU or the engines are started.
• If a ground source of conditioned air is not available, use both air conditioning packs and recirculation fans.
• Keep all doors and windows, including cargo doors, closed as much as possible.
• Electronic components which contribute to a high temperature level in the flight deck should be turned off while not in use.
• Open all passenger cabin gasper outlets and close all window shades on the sun–exposed side of the passenger cabin.
• Open all flight deck air outlets.

Note: If only a ground source of conditioned air is supplied (no bleed air from the APU or ground external air), then TAT probes are not aspirated. Because of high TAT probe temperatures, the FMCs or TMSP may not accept an assumed temperature derate. Delay selecting an assumed temperature derate until after bleed air is available.

8.4 Operation under Low Visibility Condition

The following regulations shall be abided by other than the instrument flight rules specified in Flight Regulations of Civil Aviation of China when conducting flight operation under low visibility conditions.

(1) When the weather condition at destination is reported to be near the standard margin, the flight crew shall in good time obtain the weather forecast and weather report of the destination and alternate airports and make full preparation for and study on approach procedures and methods and make every member know exactly what responsibilities each should do;

(2) When the received weather report at the destination airport is lower than minima prior t approach, an attempted landing shall be forbidden;

(3) When weather condition is lower than minima at alternate airport enroute within one hour, takeoff is forbidden. When the weather condition is lower than minima for more than one hour with weather forecast reporting that the weather will turn for the better, takeoff is , however, permitted, provided that the weather will be at minima when the aircraft arrives with assurance that a reliable alternate airport is available at the same time.

(4) Prior to the conduct of initial approach, navigation aids, ILS, VOR call-signs shall be verified for their accuracies concerning frequencies, call-signs and indications.

(5) Stabilized approach shall be strictly followed. The length of the final leg of ILS during approach shall not be less than 8 nautical miles and glide path shall not be intercepted prior to intercepting flight course;

(6) The PF shall strictly abide by IFR prior to establishing visual reference while the PNF is in charge of looking for runway and monitoring the indications of various instruments and prompting in a timely manner the PF and reporting in good time when visual reference has been established.

(7) When low cloud or heavy mist is encountered, landing lights may be used as appropriate. Go around shall be made immediately when runway is not clearly visible below the DH with the appearance of glowing screen.

(8) Surveillance or monitoring approach shall be used as far as possible under low visibility condition.

8.4.1 Takeoff Minima

Flight crew must get low visibility training and passed. The airport devices must meet the rules specified in HNA operation regulations.

Basic takeoff minima shall be used at airports with no published takeoff minima:

(1) VIS not below 1600 meters for twin-engine aircraft.

(2) When airport no declaration for low visibility operation, HNA's rule for minimum takeoff standard for all kinds of aircrafts is: twin engines RVR400m(including), and the following must be meet:

- The pilot-in-command may use the value obtained from observation instead of the RVR or visibility of the portion of initial takeoff run;
- Runway edge lights, runway threshold lights and runway end lights are mandatory for nighttime operations;
- Different categories of aircraft at least have the following different positions for RVR report control:

When an airport declares to carry out operations of low visibility procedures, the following requirements to observe the following restrictions:

Available visual facilities	Runway visual range
Runway edge lights+ runway centerline signs and touchdown zone_stop zone(two RVR measurements)	RVR350_1200FT _
Runway edge lights+ runway centerline signs and touchdown segment_runway middle segment_stop segment(three RVR measurements)	RVR200(700FT)

Note:

(1) The flying pilots shall have completed the training for low-
visibility subject specified in the flight training program

(2) The equipment on board must meet the requirement specified in "Flight Operation Manual" for low visibility flight.

(3) The aircraft takeoff performance satisfies the airport limitation requirements;

8.4.2 Alternate Airport Standards for Takeoff

When meteorological conditions conform to the takeoff standards of the airport but are lower than the landing standards of the airport, a alternate airport for takeoff shall be selected. This alternate airport shall meet the following provisions:

(1) For twin engine aircraft, the distance between an alternate airport and takeoff airport shall not be greater than a distance of 60 minutes at cruising speed with one engine failure and under still wind conditions;
(2) The aircraft shall atleast be able to climb to the minimum safe altitude of the alternate route and maintain to reach the alternate airport for takeoff when experiencing one-engine failure;
(3) The facilities of the alternate airport for takeoff shall meet the requirements of the aircraft with engine failure.

8.4.3 Non-Precision Approach Landing Minima

The minimum decision height (MDH) of a non-precision approach shall not be less than 75m unless visual guidance has been established, otherwise the approach shall not be continued.
The visual facility and visibility (or RVR) between 75m and 100m of MDH shall be as follows:

Approach Navaids	A/C Classified	ILS_GP – Inop.	VOR	NDB
Full set Visual aids	C D	800m 1200m	800m 1600m	1200m 1600m
Medium visual aids	C D	1200m 1600m	1200m 1600m	1200m 1600m
Basic visual aids	All types	1,600m	1,600m	1,600m

Note:
Full-set visual aids includes: 720m to 900 m long high/medium-intensity approach centerline light, runway edge lights, runway threshold lights, runway end lights.
Medium visual aids include: 420m to 719 m long high/medium-intensity approach centerline light, runway edge lights, runway threshold lights, runway end lights.
Basic visual aids include: less than 420 m long high/medium-intensity approach centerline light, low-intensity approach light with any length,runway edge lights, runway threshold lights, runway end lights.
Non-precision approach Visibility versus Minima when MDH at or above 100m:

MDH_m_	Visibility or RVR_m_	
	A/C Classification	
	C	D
100_120	1,200	1,600
121_140	1,600	2,000
141_160	2,000	2,400
161_180	2,400	2,800
181_205	2,400	2,800
206_225	2,800	3,200
226_250	3,200	3,600
251_270	3,600	4,000
271_290	4,000	4,400
291__	4,000	4,400

Note: When RVR exceeds 1500m, approach and landing use visibility.

8.4.4 Instrument Visual Circle to Land Minima

Visual circle to land is the continuation of precision instrument approach procedure. When the angle of intersection between designated landing direction and instrument approach direction is bigger than 30, the performance requirements for go around shall be met after establishing visual contact, during the process of circling maneuver to align with the runway for landing and within the range of this visual maneuver. In whatsoever the situations, the visual circling approach minima shall be MDH 300 m(1000 ft), visibility 5000m(3 miles).

8.4.5 Cat. I Precision Instrument Approach Landing Minima

(1) The minimum Cat. I precision instrument approach is DA/DH _visibility or RVR.

(2) The minimum RVR of Cat. I precision instrument approach is the value of the touchdown RVR. If touchdown RVR is not available, mid-runway RVR may be used instead;

(3) For runway without RVR report, the minimum for instrument flight is based on visibility.

(4) When the RVR of the runway to be used for Cat. I precision instrument approach is less than 800m, the following conditions shall be met:

- The airborne equipment shall be equivalent to the equipment for Cat. II operation (radio altimeter for low altitude and auto-throttle except guarantee for airworthiness for Cat. I operation) is obtained;
- The pilot-in-command and co-pilot have received classroom training for Cat. II operation and besides the pilot-in-command has logged more than 100 hours of flying experience on the type of aircraft being flown;
- The pilot-in-command has been checked as qualified for the execution of approach to land according to the landing minima

Cat. I Precision Instrument Approach Landing Minima:

Navaids		ILS		ILS offset course	
Decision height		60m		75m	
Visual aids	A/C cat.	RVR _m_	Runway visibility _m_	RVR _m	Runway visibility _m_
CAT I precision approach lighting system	C D	550 600	800 800	800 800	800 800
Simplified high-intensity approach lighting system	C,D	800	800	800	800
runway edge lights and runway markings	C,D	1,200	1,200	1,200	1,200

8.4.6 The alternate minima for destination airport

When selecting of the alternate airport, the weather report, forecast of the airport or combination analysis of report and forecast should be met:

(1) Airport with only one approaching system and procedure: MDA or DH is added by 120 (400 feet); VIS is added by1600 meters (1 mile)

(2) Airport with two or more than two non-precision approach facilities and procedures, and can provide approaches of different runways: MDA or DH is added by 60 meters (200 feet); VIS is added by 800 meters (1/2 mile)_and take the higher value of the two low-standard runways.

8.5 Thunderstorm

8.5.1 Detour Thunderstorm

(1) Check exterior aircraft thoroughly, verify all static dischargers are in good conditions, and weather radar work normally. When weather report there is possible thunderstorm en route or onboard weather radar check the potential dangerous weather is encountered, aircraft may not be dispatched according to the instrument flight regulation until onboard weather radar operates normally.

(2) It is necessary for the pilot-in-command and the flight dispatcher to analyze prior to departure the nature of thunderstorm, intensity_range_its development trend, its moving direction and speed and select a routing that circumnavigates the thunderstorm area and appropriate alternate airport and jointly study and decide the release of aircraft on the basis of meteorological information and in particular the recent weather reports and forecasts.

(3) The principle is to treat every thunderstorm as dangerous weather. Actions shall be taken as soon as possible to avoid thunderstorm area when thunderstorm is forcasted or has been known.

(4) Flying into CB or TCU is strictly prohibited.

(5) Switching on weather radar before takeoff, check takeoff route and prepare the detour route in advance and advice ATC as soon as possible.

(6) When thunderstorm is encountered in flight, captain must judge the intensity of the thunderstorm, distributions, movement direction and cloud base, ceilings, and make the decision of detour or return and report the decision to ATC.

A. When possible, detour between the storm cells of a squall line rather than directly above them. Keep the radar antenna tilted down during overflight to properly assess the most severe cells, which may be masked by clouds formations.

B. Try to avoid the thunderstorm from the upwind side. Report ATC as soon as possible and obtain ATC clearance. Although severe turbulence and hail can be encountered in any direction outside a thunderstorm, strong drafts and hail are more often encountered outside the body of the cell on the downwind side. Avoid Cirrus and Cirrostratus layers downwind from the storm tops. Such layer may be formed by cumulonimbus tops and may contain hail, even though the radarscope shows little or no return echoes.

C. Avoid flight under the anvil. The greatest possibility of encountering hail is downwind of the cell, where hail falls from the anvil or is tossed out from the side of the storm. Hail has been encountered as much as 20 NM downwind from large thunderstorms.

D. When detouring near the landing airport or in the poor visibility, the current location and altitude must be watched, below the safety altitude is prohibited strictly.

(7) If detour is made to keep away from the thunderstorm, give full allowances for turning and withdrawal and abide by the following regulations:

A. Detouring thunderstorm is only approved on the aircraft that weather radar is working normally.

B. At the safety altitude, the off course range of airplane cannot exceed the effective semi-diameter of navigational apparatus (except for the airplane with inertial navigational device); when it fly around the clouds, the distance between aircraft and clouds shall be above the followings:

- Flight altitude 10000ft_5 nautical miles
- Flight altitude 20000ft_7.5 nautical miles
- Flight altitude 30000ft_10 nautical miles

When aircraft is penetrating between two thunderstorms, the distance between the two thunderstorms shall be more than two times mentioned above.

Note: Deviation shall be more safer according to the development of the thunderstorm, moving speed.

C. Detouring from the top or bottom of the thunderstorm is strictly prohibited.

D. During takeoff, landing phase, the expected distance for takeoff, landing and missed approach should be above 3 NM away from the thunderstorm.

8.5.2 Penetration of Thunderstorm

When the aircraft is trapped in a thunderstorm area and unable to turn back and forced to penetrate in clouds, the flight crew shall conduct instrument flight calmly, resourcefully and with total concentration of mind. They shall avoid by all means to be frightened out of their wits. Besides, they shall abide by the following principles:

1) Prompt report shall be made to the ATC and immediate and proper preparation shall be made to penetrate the thunderstorm area including checking safety belts that they are fastened securely, switching on cockpit illumination device, engaging safety belt annunciators, notifying flight attendants and broadcasting to the

passengers, etc.;

2) They shall select an altitude for penetration with relatively slow current, avoiding roll clouds area and zero-degree isotherm area, the actual flight altitude shall not be less than 1000m;
3) Attention shall be made to the turbulent flying speed specified for the type of aircraft being flown during the flight operation.
4) Attention shall also be paid to aircraft position all the times while maintaining communication with the ground. The selected heading shall be kept as far as possible. When heading change is necessary, steep turn shall not be made.
5) Attention shall also be paid to the running condition of the engines. Timely use of de-icing/anti-icing device shall be made.

Post-Penetration Inspection

An all-round inspection shall be made as far as possible after penetration with respect to flight instruments, engine instruments, heating system of pitots, radio and navigational equipment, compass readouts and electrical systems(including tripping-switches). If aircraft is in doubt with lightening, captain shall check any visual damage of the operation damage. If the obvious damage is not possible to be found in flight and no flight danger by captain's judgment, aircraft can continue to the destination. If captain judge aircraft is damaged and is not able to continue to the destination, landing at the nearest and suitable airport shall be preferred.

Report: Corporate regulations on report about abnormal situation shall be followed.

After Landing Check

A thorough check must be made after landing, and contact with ground maintenance and provide the related information. If aircraft is confirmation with damage by lightening or electricity, contact FOC immediately, filling unsafe event form and technical record. Discussion on malfunction removal and aircraft release shall be made together.

8.5.3 Moderate to Heavy Rain

When the flight is in or expected to be flying in heavy rain or hail. complete the following procedures_

Engine start switches…………………………………………CONT

This selection will approach to minimum idle thrust and provide continuous ignition.

8.6 Operation on Contaminated Runway

8.6.1 Requirement of Contaminated Runway

For aircraft of Boeing series, no takeoff or landing is permitted on a runway with standing water of more than 13 mm(inclusive) in depth or standing snow of more than 90 mm(inclusive) in depth.

No takeoff or landing is permitted on a runway covered with snow, slush, water or ice unless the following conditions are satisfied:

(1) The depth of snow or slush along the full length of the required shortest runway shall not exceed the maximum value specified for the type of aircraft in question. The general guiding principle: The width of runway cleared of contamination is 40m. when the runway cannot be cleared of contamination within a suitable time to reach a width of 40m, the following requirements shall be complied with:
- B767: at least 35 m wide;
- Provided that the corresponding crosswind restriction is reduced by 10kt.

(2) The snow at both sides of runway length and width shall be removed to ensure sufficient ground clearance when the outer wheels of different types of aircraft touch down on the runway edges and when flaps are extended at the same time.

(3) The usable part of runway shall be clearly identified.

(4) The runway centerlines shall be marked out clearly when necessary.

Note: When loose snow, wet snow, slush or standing water are found on runway, particular caution shall be exercised, especially under crosswind conditions.

(5) A relatively big addition may be required to the accelerate-stop distance. Immediate aborted takeoff shall be made when the pilot-in-command feels that the aircraft loses its normal speed;

(6) Nose-wheel steering shall be carefully manipulated to avoid the nose-wheel from skidding or to avoid increase in drag by excessive revision;

(7) The friction of tire on ground surface is always the principal method for speed reduction for all aircraft. That's why it is necessary for the pilot to do their best to select a runway with good braking action prior to takeoff or landing.

(8) The friction coefficient of a runway covered with ice and snow is measurable although there may be difference between the measured results and the actual experienced braking conditions due to the uneven distribution of ice and snow covering the runway as w ell as different methods adopted in measuring the friction coefficient;

(9) The following criteria may be applied with respect to runway covered with deposits (e.g. standing water, slush or wet snow):

_ When a dry runway is covered with standing water for more than 10%, it shall be regarded as a wet runway, on which wet runway revision and restrictions shall be applied.

_ When airport temperature is nearing zero with standing water, slush or wet snow on runway and provided that the reported friction coefficient (if any) does not impose any restrictions, the following rules shall apply;

- ♦ When scattered deposits cover 10% or less than 10% of runway, the operation on runway shall be treated as wet runway operation.
- ♦ When scattered deposits cover 11% to 25% of runway, the braking action on runway shall be treated as medium.
- ♦ When scattered deposits cover 25% to 50% of runway, the braking action on runway shall be treated as medium to poo r
- ♦ When scattered deposits cover more than 50% of runway, the braking action on runway shall be treated as poor.

_ Pilot's report may be used as a reference.

Note: Supposing the friction coefficient is measured by the use of friction test vehicle (SFT) of BV11 or SAAB brand. These two brands of friction test vehicles are equipped with high pressure tires and the test is conducted at speed of 95 km/h. The reported friction coefficient under the above is acceptable and may be us ed as a basis for revision.

(10) If the reported braking action along the runway is variable, the reported value shall be used as follows:

_ For takeoff and landing weight calculation: The mean value of braking action of the last 2/3 section of runway in use shall be used.

_ For determining maximum crosswind: The minimum value of the entire runway shall be used. But, if this value is effective for the last 1/3 section of runway, and according to normal calculation criteria, the aircraft weight permits takeoff or landing at the first 2/3 section of runway, the available last 1/3 section of runway may be neglected, in other word, the runway length is thus reduced. In this case the crosswind restrictions may be based on the minimum value of the first 2/3 section of runway.

(11) Normally a measure shall be taken to improve braking action when landing or takeoff is to be made within the limits of a required shortest runway and width;
(12) At some airports, sanding method is applied.
(13) When chemical products are used to improve runway braking action, the deposits generated thereafter on the runway make the runway surface slippery. The deposits need to be removed away prior to takeoff or landing.
(14) If the method for improving braking action exists, even if the method may induce flight delay, it should be considered.
(15) Reverse thrust, spoilers, speedbrake, etc. shall be operating normally prior to takeoff or landing on a wet or slippery runway unless the runway length has available margin or the overall requirement for such operation can be met according to en route guide;
(16) Tire tread conditions have significant impact on braking action. Seriously damaged tires are not fit for operation on a wet or slippery runway.
(17) Takeoff speed shall be adjusted according to the requirements for ***in-flight performance.***

8.6.2 Brake performance

When landing on slippery runways contaminated with ice, snow, slush or standing water, the reported braking action must be considered. Advisory information for reported braking actions of good, medium and poor is contained in the PI section of the QRH. The performance level associated with good is representative of a wet runway; the performance level associated with poor is representative of a the ice covered runway. Also provided in the QRH are stopping distances for the various autobrake settings and for non-normal configurations. Pilots should use extreme caution to ensure adequate runway length is available when poor braking action is reported.

Pilots should keep in mind slippery/contaminated runway advisory information is based on an assumption of uniform conditions over the entire runway. This means a uniform depth for slush/standing water for a contaminated runway or a fixed braking coefficient for a slippery runway. The data cannot cover all possible slippery/contaminated runway combinations and does not consider factors such as rubber deposits or heavily painted surfaces near the end of the most runways. With these caveats in mind, it is up to the airline to determine operating policies based on the training and operating experience of their flight crews.

One of the commonly used runway descriptors is coefficient of friction. Ground friction measuring vehicles typically measure this coefficient of friction. Much work has been done in the aviation industry to correlate the friction reading from these ground friction measuring vehicles to airplane performance. Use of ground friction vehicles raises the following concerns:

- the measured coefficient of friction depends on the type of ground friction measuring vehicle used. There is not a method, accepted worldwide, for correlating the friction measurements from the different friction measuring vehicles to each other, or to the airplane's braking capability.
- most testing to date, which compares ground friction vehicle performance to airplane performance, has been done at relatively low speeds(100knots or less). The critical part of the airplane's deceleration characteristics is typically at higher speeds(120 to 150 knots).
- ground friction vehicles often provide unreliable readings when measurements are taken with standing water, slush or snow on the runway. Ground friction vehicles might not hydroplane (aquaplane) when taking a measurement while the airplane may hydroplane (aquaplane). In this case, the ground friction vehicles would provide an optimistic reading of the runway's friction capability. The other possibility is the ground friction vehicles might hydroplane (aquaplane) when the airplane would not, this would provide an overly pessimistic reading of the runway's friction capability. Accordingly, friction readings from the ground friction vehicles may not be representative of the airplane's capability in hydroplaning conditions.
- ground friction vehicles measure the friction of the runway at a specific time and location. The actual runway coefficient of friction may change with changing atmospheric conditions such as temperature variations, precipitation etc. Also, the runway condition changes as more operations are performed.

The friction readings from ground friction measuring vehicles do supply an additional piece of information for the pilot to evaluate when considering runway conditions for landing. Crews should evaluate these readings in conjunction with the PIREPS (pilot reports) and the physical description of the runway (snow, slush, ice etc.) when planning the landing. Special care should be taken in evaluating all the information available when braking action is reported as poor or if slush/standing water is present on the runway.

The following reports shall be made for brake measurement and brake performance

(1) Report in simple and clear language by ATC
(2) ATIS advice
(3) the snowing information

Takeoff or landing on runway that brake action is reported as unreliable or poor(friction factor is 0.25 and below) is prohibited.
Table of Braking Performance versus Friction Coefficient
(Crosswind shall be less than aircraft type restrictions.)

Reported braking performance	**Reported friction coefficient**	**Maximum crosswind**
Good	More than 0.4	30KTs
Good, generally good	0.36 to 0.39	25KTs
General	0.30 to 0.35	20KTs
General/rather poor (Poor)	0.26 to 0.29	15KTs
Poor	Below 0.25	5KTs

8.6.3 TAXI

When taxiing on a slippery or contaminated surface, particularly with strong crosswinds, use reduced speeds. Use of differential engine thrust assists in maintaining airplane momentum through the turn. When nearing turn completion, placing both engines to idle thrust reduces the potential for nose gear skidding. Avoid using large nose wheel steering inputs to correct for skidding. Differential braking may be more effective than nose wheel steering on slippery or contaminated surfaces. If speed is excessive, reduce speed prior to initiating a turn.

Note: A slippery surface is any surface where the braking capability is less than that on a dry surface. Therefore, a surface is considered "slippery" when it is wet or contaminated with ice, standing water, slush, snow or any other deposit that results in reduced braking capability. The regulations specified in CAAC and HNA operation manual must be observed when landing and taking off on contaminated runway. Flight crew may reduce crosswind standard according to QRH corrected data(such as takeoff weight, speed). Control airplane should be based on the techniques recommended for slippery runway.

8.6.4 Takeoff

Slush, standing water, or deep snow reduces the airplane takeoff performance because of increased rolling resistance and reduction in tire-to-ground friction.

Most operators specify weight reductions to the AFM field length and/or obstacle limited takeoff weight based upon the depth of powdery snow, slush, wet snow or standing water and a maximum depth where the takeoff should not be attempted.

Slush or standing water may cause damage to the airplane. The recommended maximum depth for slush, standing water, or wet snow is 0.5 inch (12.7mm) on the runway. For dry snow the maximum depth is 4 inches (102mm).

A slippery runway (wet, compact snow, ice) also increases stopping distance during a rejected takeoff. Takeoff performance and critical takeoff data are adjusted to fit the existing conditions. Check the airport analysis or the PI section of the QRH for takeoff performance changes with adverse runway conditions.

During wet runway or slippery conditions, the PM must give special attention to ensuring that the thrust on the engines advances symmetrically. Any tendency to deviate from the runway centerline must immediately be countered with steering action and, if required, slight differential thrust. Forward pressure on the control column during the initial portion of the takeoff roll (below approximately 80 knots) increases nose wheel steering effectiveness.

During takeoffs on icy runways, lag in rudder pedal steering and possible nose wheel skidding must be anticipated. Keep the airplane on the centerline with rudder pedal steering and rudder. The rudder becomes effective between 40-60 knots. If deviations from the centerline cannot be controlled either during the start of the takeoff roll or until the rudder becomes effective, immediately reject the takeoff.

Effect of Deicing/Anti-icing Fluids on Takeoff

Testing of deicing/anti icing fluids has shown that some of the fluid remains on the wing during takeoff rotation and during initial climb out. The residual fluid causes a temporary decrease in lift and increase in drag. These effects are more significant at lower ambient temperatures (approaching -20_) where the fluid tends to stay on the wing longer. The recommended rotation rate should be observed to avoid too fast rotation. No performance adjustments are required for the application of deicing/anti-icing fluids. Takeoff operations with reduced thrust based on derates and/or the assumed temperature method are permitted. Use normal rotation rates.

8.6.5 Landing

On very slippery runways, landing the aircraft using crab only reduces drift toward the downwind side at touchdown, permits rapid operation of spoilers and autobrakes because all main gears touchdown simultaneously, and may reduce pilot workload since the aircraft does not have to be de-crabbed before touchdown. However, proper rudder and upwind aileron must be applied after touchdown to ensure directional control is maintained.

On slippery runway, the crosswind capability is based on surface condition, aircraft load and pilot's skills.

8.7 Turbulence

8.7.1 Flying in turbulence area

Severe turbulence should be avoided if at all possible. However, if severe turbulence is encountered, use the turbulent air penetration procedure listed in the Supplementary Procedures chapter of the FCOM. Turbulent air penetration speeds provide high/low speed margins in severe turbulent air. During manual flight, maintain wings level and smoothly control attitude. Use the attitude indicator as the primary instrument. In extreme updrafts or downdrafts, large altitude changes may occur. Do not use sudden or large control inputs. After establishing the trim setting for penetration speed, do not change pitch trim. Allow altitude and airspeed to vary and maintain attitude. However, do not allow the airspeed to decrease and remain below the turbulent air penetration speed because stall/buffet margin is reduced. Maneuver at bank angles below those normally used. Set thrust for penetration speed and avoid large thrust changes. Flap extension in an area of known turbulence should be delayed as long as possible because the airplane can withstand higher gust loads with the flaps up.

Normally, no changes to cruise altitude or airspeed are required when encountering moderate turbulence. If operating at cruise thrust limits, it may be difficult to maintain cruise speed. If this occurs, select a higher thrust limit (if available) or descend to a lower altitude.

Severe Turbulence

Severe turbulence should be avoided if at all possible. If severe turbulence cannot be avoided, an increased buffet margin is recommended. This can be obtained by descending approximately 4,000 feet below optimum altitude. The autothrottle should be off in severe turbulence.

8.7.2 Clear Air Turbulence (CAT)

(1) A clear air turbulence exists at any altitude, especially when an aircraft is operating at an altitude higher than 15000 ft;

(2) A clear air turbulence may produce a very serious impact on flight operation;

(3) When a clear air turbulence is encountered in flight, it shall be reported in good time to the ATC with information including time and location of occurrence and its intensity (light, moderate, strong, extremely strong), or broadcasted on communication frequency between aircraft;

(4) A clear air turbulence is unpredictable and therefore it is necessary to notify flight attendants to check the safety situation of the passenger cabins after getting rid of the clear air turbulence;

(5) In many cases, a clear air turbulence is the result of upper jet stream with wind velocity change of more than 50KT. Attention shall be paid to tuning in to the ATC or flying pilots' reports while in the air.

8.8 Windshear

8.8.1 General

Windshear is a change of wind speed and/or direction over a short distance along the flight path. It will be regarded as severe windshear when airspeed change is more than 15kts or vertical speed change exceeds 500 ft/min. Improper or ineffective vertical flight path control has been one of the primary factors in many cases of flight into terrain. Low altitude windshear encounters are especially significant because windshear can place the crew in a situation which requires the maximum performance capability of the airplane. Windshear encounters near the ground are the most threatening because there is very little time or altitude to respond to and recover from an encounter.

Airplane Performance in Windshear

Knowledge of how windshear affects airplane performance can be essential to the successful application of the proper vertical flight path control techniques during a windshear encounter.

The wind component is mostly horizontal at altitudes below 500 feet. Horizontal windshear may improve or degrade vertical flight path performance. Windshear that improves performance is first indicated in the flight deck by an increasing airspeed. This type of windshear may be a precursor of a shear that decreases airspeed and degrades vertical flight path performance.

Airspeed decreases if the tailwind increases, or headwind decreases, faster than the airplane is accelerating. As the airspeed decreases, the airplane normally tends to pitch down to maintain or regain the in-trim speed. The magnitude of pitch change is a function of the encountered airspeed change. If the pilot attempts to regain lost airspeed by lowering the nose, the combination of decreasing airspeed and decreasing pitch attitude produces a high rate of descent. Unless this is countered by the pilot, a critical flight path control situation may develop very rapidly. As little as 5 seconds may be available to recognize and react to a degrading vertical flight path.

In critical low altitude situations, trade airspeed for altitude, if possible. An increase in pitch attitude, even though the airspeed may be decreasing, increases the lifting force and improves the flight path angle. Proper pitch control, combined with maximum available thrust, utilizes the total airplane performance capability.

The crew must be aware of the normal values of airspeed, altitude, rate of climb, pitch attitude and control column forces. Unusual control column force may be required to maintain or increase pitch attitude when airspeed is below the in-trim speed. If significant changes in airspeed occur and unusual control forces are required, the crew should be altered to a possible windshear encounter and be prepared to take action.

The following indications are regarded as clues for windshear

- Thunderstorm activity
- Virga(rain that evaporates before reaching the ground)
- Pilot reports
- Low level windshear alerting system warning

The following conditions are indications of windshear encounters:

- WINDSHEAR warning

(dual horns followed by“WINDSHEAR,WINDSHEAR,WINDSHEAR”) or

- unacceptable flight path deviations

Note: Unacceptable flight path deviations are recognized as uncontrolled changes from normal steady state flight conditions below 1000 feet AGL, in excess of any of the following:

- 15 knots indicated airspeed
- 500 fpm vertical speed
- 5 degrees pitch attitude
- 1 dot displacement from the glideslope
- unusual thrust lever position for a significant period of time.

8.8.2 Crew Action

Avoidance_

Flight crew shall try to use all measures to collect windshear information. When windshear is informed or windshear is detected, delay the planned departure or arrivals until windshear condition disappears. Although pilots have the windshear detect and recovery training in the simulator, it is more difficult to recover from windshear in real flight. So, the prior choice for windshear precaution is to avoid.

Precautions

If windshear is suspected, be especially alert to any of the danger signals and be prepared for the possibility of an inadvertent encounter. The following precautionary actions are recommended if windshear is suspected:

Takeoff

- Use maximum takeoff thrust instead of reduced thrust
- Use the longest suitable runway
- Use FDs during takeoff and initial climbout.
- Be alert for any airspeed fluctuations during takeoff and initial climb. Such fluctuations may be the first indication of windshear.
- Know the all-engine initial climb pitch attitude. Rotate at the normal rate to this attitude for all non-engine failure takeoffs. Minimize reductions from the initial climb pitch attitude until terrain and obstruction clearance is assured, unless stick shaker activates.
- Crew coordination and awareness are very important. Develop an awareness of normal values of airspeed, attitude, vertical speed, and airspeed build-up. Closely monitor vertical flight path instruments such as vertical speed and altimeters. The PM should be especially aware of vertical flight path instruments and call out any deviations from normal.
- Should airspeed fall below the trim airspeed, unusual control column forces may be required to maintain the desired pitch attitude. Stick shaker must be respected at all times.
- If windshear should be encountered near VR, and airspeed suddenly decreases, there may not be sufficient runway left to accelerate back to the normal VR. If there is insufficient runway left to stop, initiate a normal rotation at least 2000 feet before the end of the runway even if airspeed is low. Higher than normal attitudes may be required to lift-off in the remaining runway.

Approach and Landing

- Use the smallest flap for landing according to the runway length.
- Increase the appropriate airspeed correction (the same as gust correction), maximum 20KTS.

- Avoid large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases
- Crosscheck FDs commands using vertical flight path instruments.
- Crew coordination and awareness are very important, particularly at night or in marginal weather conditions. Closely monitor the vertical flight path instruments such as vertical speed, altimeters, and glideslope displacement. The PM should call out any deviations from normal. Use of the autopilot and autothrottle for the approach may provide more monitoring and recognition time.

Recovery

Windshear encountered in takeoff roll:

- If windshear is encountered prior to V1, there may be not sufficient runway remaining to stop if RTO is initiated at V1, at VR, rotate at a normal rate to 15 degree pitch attitude. Once airborne, perform the windshear escape maneuver.
- If windshear is encountered near the normal rotation speed and airspeed decrease suddenly, there may not be sufficient runway left to accelerate back to normal takeoff speed. If there is not sufficient runway left to stop the aircraft, initiate a normal rotation at lease 2000 feet before the end of the runway, even speed is low. Higher than normal attitude may be required to lift off in the remaining runway. Ensure maximum thrust is set.

Windshear encounter in flight:

- Perform the windshear escape maneuver.

Maneuvering in case of windshear

PF	PM
Manual Flight ● Disconnect autopilot ● Press either GA switch ● Aggressively apply maximum thrust ● Disconnect autothrottle ● Simultaneously roll wings level and rotate toward an initial pitch attitude of 15° ● Retract speedbrakes ● Follow FDs GA guidance (if available). **Auto Flight** ● Press either GA switch** ● Verify GA mode annunciation ● Verify thrust advances to GA power ● Retract speedbrakes ● Monitor system performance***	● Assure maximum* thrust ● Verify all required actions have been completed and call out any omissions.
● Do not change flap or gear configuration until windshear is no longer a factor ● Monitor vertical speed and altitude ● Do not attempt to regain lost airspeed until windshear is no longer a factor.	● Monitor vertical speed and altitude ● Call out any trend toward terrain contact, descending flight path, or significant airspeed changes.

Note: Backward control column force increases as the airspeed decreases. In all cases, the pitch attitude that results in intermittent stick shaker or initial buffet is the upper pitch attitude limit. Flight at intermittent stick shaker may be required to obtain a positive terrain separation. Smooth, steady control will avoid a pitch attitude overshoot and stall.

Note: * Maximum thrust is "maximum certified thrust". When engines have no electronical thrust limit, the overpressure thrust or fire wall thrust can be used when all measures have been taken and ground contact is imminent.

Note:**If GA is not available, disconnect A/P and A/T and fly manually.

Warning: *****Severe windshear may exceed the performance of the AFDS. The pilot flying must be prepared to disconnect the autopilot and autothrottle and fly manually.**

8.9 Volcanic Ash

8.9.1 Identifying Volcanic Ash

Very tiny floating particles and other rock dust gushing out of a erupting volcano into atmosphere form volcanic ash, which may extend several hundred kilometers and reach a very high altitude depending on the magnitude and endurance time of the volcano eruption.

Although volcanic ash is not a weather phenomenon, it is an extremely dangerous situation existing in atmosphere. It shall therefore be treated like an inclement weather by taking an avoidance measure.

When an aircraft encounters volcanic ash, its thrust may deteriorate, its dynamic and static pressure piping may be blocked, leading edges of aircraft wings, windshield panels and landing lights may have serious abrasions even to the point of engine flameout.

8.9.2 Phenomena when Encountering Volcanic Ash in Flight

(1) Appearance of smoke and ash in the cockpit;
(2) A sour smelling similar to smoke dissipating from electrical appliance;
(3) Possibility to induce engine from operating normally, e.g. engine surge, increase in exhaust gas temperature (EGT), fire emitting from tailpipe and/or engine flameout, etc.;
(4) An illumination of orange-red color accompanied with electric discharge in the form of lighted ball or other forms of electric discharge phenomena may be visible on the exterior of engine air inlets during nighttime;
(5) Fire alarm may happen in the cargo hold.

8.9.3 Handling of Volcanic Ash Encountered in Flight

(1) The most important thing to do when encountering volcanic ash is to a void it;
(2) Volcanic ash floating particles may be invisible, especially under IMC conditions or at nighttime. Even if it is visible, it is difficult to visually differentiate volcanic ash from ordinary cloud layers. Volcanic ash does not display on airborne radar or ATC radar. Consequently, it is necessary for pilots to rely on the reports of ATC and pilots of other aircraft to determine the location of volcanic ash and avoid the volcanic ash cloud area in the light of this information. Pilots shall try their best to operate on the upwind side of the volcanic ash cloud.
(3) When a flight dispatcher releases a flight, he shall provide the flight crew with pertinent NOTAM or some other advisory reports and a flight plan which will enable the flight crew to avoid the anticipated or reported volcanic ash cloud and to operate in the upwind direction

of volcanic ash cloud;

(4) It is suggested that pilots shall immediately reduce thrust to idle at permissible altitude so as to minimize accumulation of ash in the engines and try to change heading to avoid the volcanic ash cloud;

(5) It is very difficult to restart engines when operating in such ash cloud conditions. According to records, there were some occasions in whic h engines were successfully restarted at a relatively lower altitude (10 000—20 000 ft) only after several attempts. Moreover, the slowing down of acceleration does not indicate failure of engine start. Such case at a relatively high altitude is normal.

(6) Volcanic ash may also block dynamic and static pressure system leading to unreliable indications of airspeed and exhaust pressure ratio. Airplane Operating Manual (AOM) shall be complied with in the handling of unreliable indication of airspeed.

(7) Windshields may be worn rough and become translucent. If the aircraft is equipped with auto-landing device, it is wise to consider to divert to an airport with auto-landing capability. The illumination of landing lights may deteriorate for being subjected to erosion of material similar to corrosive.

(8) Volcanic ash may extend as far as several hundred kilometers. For this reason, pilots shall refrain from making an attempt to penetrate or overfly such ash cloud layers. The following are recommended procedures:

- Report to ATC of encountering ash cloud and of the intention of the pilot-in-command;
- Adopt 180 degrees-turn to break away from the ash cloud;
- Disengage the already engaged auto-throttle, which may prevent the auto-throttle from increasing engine thrust;
- Push thrust lever to idle (if obstacle clearance permits) so as to provide extra stall margin and reduce exhaust temperature;
- Monitor exhaust temperature. If the exhaust temperature continues rising, measures shall be taken in accordance with aircraft type manual.

8.9.4Procedures After Breaking Away from Volcanic Ash

After breaking away from volcanic ash cloud, it is necessary to restart engines if need be out of safety consideration:

(1) Switch on continuous ignition device;

(2) Switch on auxiliary bleed, including all air-conditioned units, nacelles and anti-icing devices on aircraft wings. Attempt shall be made to improve engine surge margin by reducing engine pressure

ratio.

(3) All situations shall be evaluated after avoiding volcanic ash cloud;

(4) Observe Corporate procedures for making a report on unsafe even.

8.9.5 Takeoff/Landing at Airport with Volcanic Ash Deposits

Landing

(1) Braking action may deteriorate when runway is covered with volcanic ash deposits;

(2) The wet ash on runway may also deteriorate braking action;

(3) It is recommended to use reverse thrust as appropriate when visibility is becoming poor because of the blowing ash;

(4) Aircraft condition shall be checked and evaluated after landing.

Takeoff

(1) It is recommended to avoid taking off against blowing ash dust when taking off on a runway with volcanic ash deposits;

(2) The procedure to lower takeoff flaps shall be postponed;

It is recommended to adopt takeoff run so as to avoid volcanic ash being blown about.