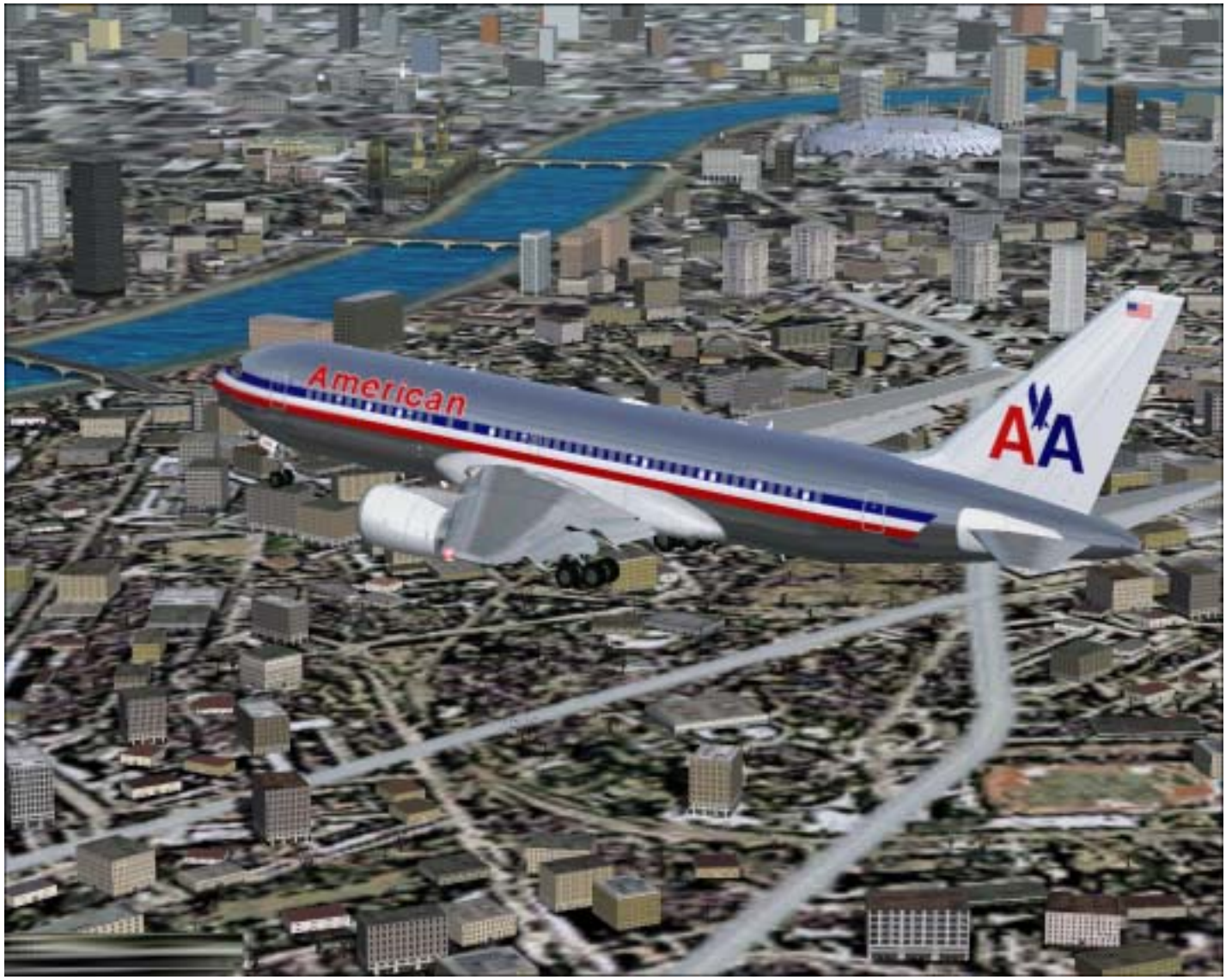
OPERATIONS MANUAL
FLT CREW TRAINING

PROJECT OPENSKY
B767

TAXI, TAKEOFF, CLIMB, CRUISE, DESCENT & LANDING



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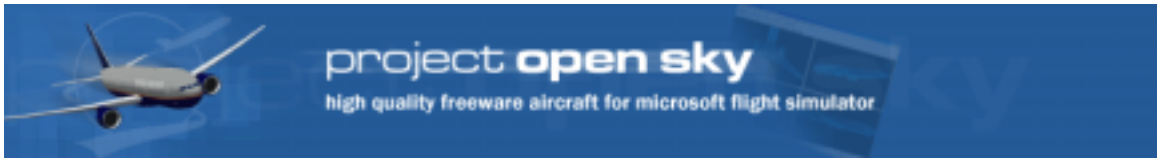

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The procedures contained within are this author's interpretation of generic flight operations. These procedures are not always accurate in all situations.

All diagrams have been recreated to mimic actual procedures or scenarios, however, are not taken from actual materials whatsoever.

This manual is not intended for real world flight.

Project Opensky aircraft are intended as a freeware add-on for Microsoft Flight Simulator 2002.

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Project Opensky Boeing 767-200, 767-200ER, 767-300, -300ER, 767-400 Series
Version 2002.4.4

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Flight model based on the most realistic data for the Boeing 767-200, Boeing 767-300, actual experiences on 767 flight decks, and several friends who will remain anonymous.

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PREFACE

This manual serves as a reference for operating procedures and training maneuvers. The flight profiles show the basic recommended configuration during flight.

The maneuvers should normally be accomplished as illustrated. However, due to airport traffic, ATC distance separation requirements, and radar vectoring, modifications may be necessary.

Exercise good judgment.

PRINCIPLE DIMENSION AND AREAS

Boeing 767-200/ -200ER – Aircraft Reference Manual

Flight Simulator 2002 Professional Edition

1) Height – 52 ft and 0 in

2) Length -- 159 ft and 2 in

3) Width -- 156 ft and 1 in

4) Engine to Ground Distance:
Minimum -- 2 ft and 5 in
Maximum -- 2 ft and 10 in

5) Fuselage to Engine Distance: (fuselage centerline to engine centerline)
28 ft and 8 in (255 in)

6) Landing Gear:
Track -- 15 ft 3 in
Wheelbase -- 64 ft and 7 in

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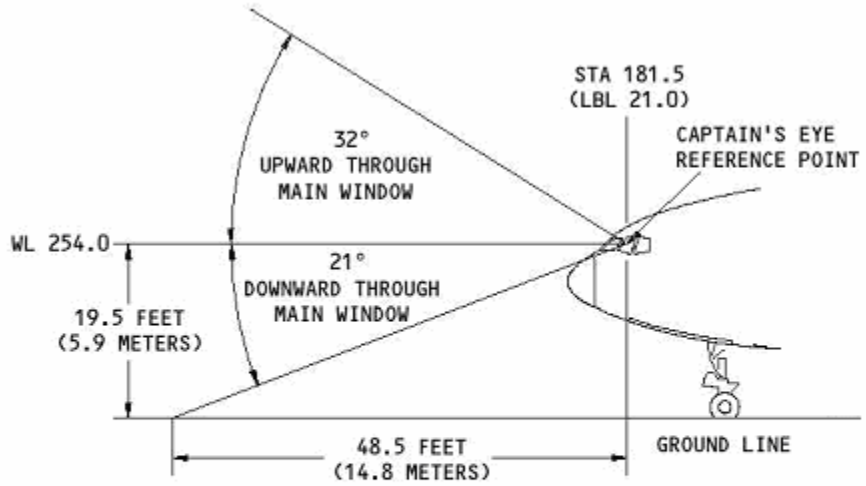
BASIC PILOT INFORMATION

Pilot's view reference point is approximately 19.5 feet from the ground, with ground visibility limited to 48.5 feet looking down at an angle of 21 degrees:



NOTE: PITCH = −1°

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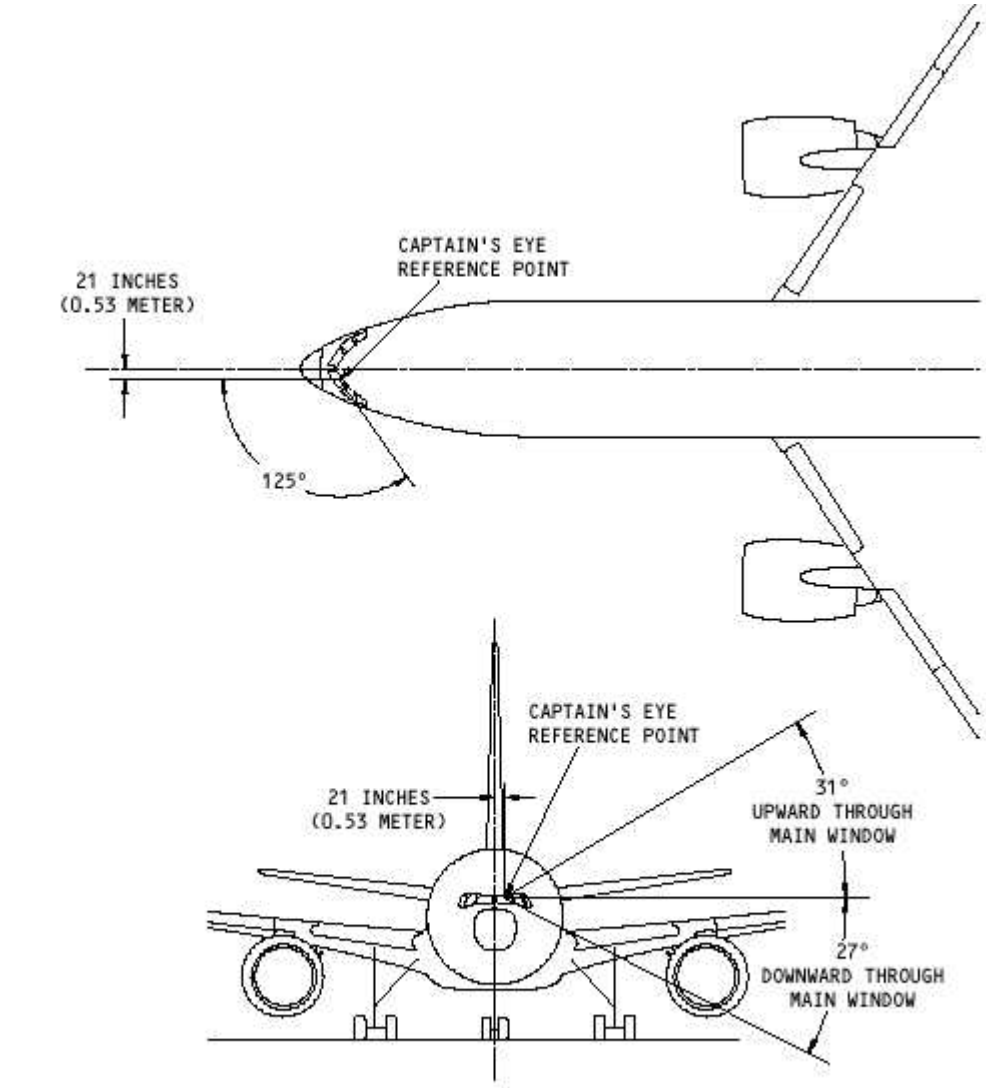
For proper engine and aircraft operations, the captain must view the EICAS as the engines and wings **are not** visible from the flight deck. Pilot's rearward view is based on the captain's eye reference point with 129 degrees of travel.



NOTE: HEAD ROTATED ABOUT POINT 3.3 INCHES (0.08 METER)
AFT OF CAPTAIN"S EYE REFERENCE POSITION

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TAXI

1) The nose wheel steering and the engine thrust are used to taxi the airplane.

2) Make sure you have the necessary clearance when you go near a parked airplane or other structures.

3) Set takeoff flaps. Opensky recommended setting is Flaps 15.

4) When the APU in the taxi airplane or the parked airplane is on you must have a minimum clearance of 50 feet between the APU exhaust port and the adjacent airplane's wingtip (fuel vent).

5) The taxi speed must not be more than approximately 30 knots. Speeds more than 30 knots added to long taxi distances would cause heat to collect in the tires. Recommended speed is 20 knots. Beware of changing GS numbers due to tailwinds during taxi.

6) Before making a turn, decrease the speed of the airplane to a speed of approximately 8 to 12 knots. Make all turns at a slow taxi speed to prevent tire skids.

7) Do not try to turn the airplane until it has started to move.

8) Make sure you know the taxi turning radius.

9) Monitor the wingtips and the horizontal stabilizer carefully for clearance with buildings, equipment, and other airplanes.

10) When a left or right engine is used to help make a turn, use only the minimum power possible.

11) Do not let the airplane stop during a turn.

12) Do not use the brakes to help during a turn. When you use the brakes during a turn, they will cause the main and nose landing gear tires to wear.

13) When it is possible, complete the taxi in a straight-line roll for a minimum of 10 feet.
NOTE: This will remove the torsional stresses in the landing gear components, and in the tires.

14) Use the Inertial Reference System (IRS) in the ground speed (GS) mode to monitor the taxi speed.

15) If the airplane taxi speed is too fast (with the engines at idle), operate the brakes slowly and smoothly for a short time. NOTE: This will decrease the taxi speed.

16) If the taxi speed increases again, operate the brakes as you did in the step before.

17) Always use the largest radius possible when you turn the airplane. NOTE: This will decrease the side loads on the landing gear, and the tire wear will be decreased.

18) Extra care must be given to turn the aircraft due to the fuselage length and wingspan. A minimum distance from the edge of the pavement must be maintained to reverse the aircraft’s direction. Minimum distance is 129 FT.:

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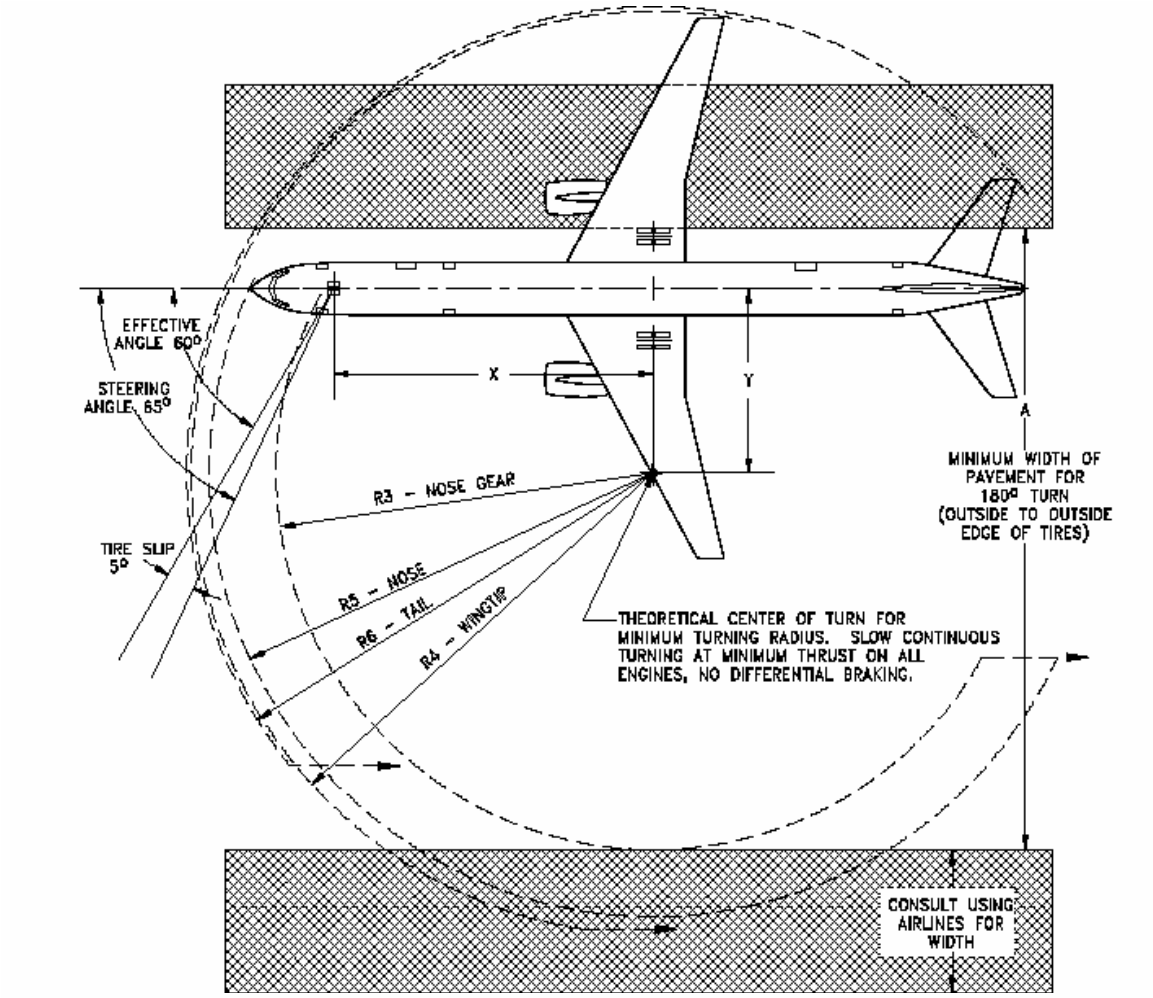

19) Operate the brakes to stop the airplane.

20) Set the parking brake after the airplane has stopped.

TAKEOFF

1) Align aircraft with runway centerline.

2) Increase power to approximately 55% N1, pause briefly to verify that engines have stabilized.

3) Watch EICAS indicator for engine problems or aircraft alarms.

4) Increase power smoothly to pre-determined N1 speeds based on aircraft takeoff weight, (85% - 105% N1). This can either be done manually or using the autothrottle with the autopilot engaged.

5) At Vr, smoothly rotate aircraft 8 degrees upwards at a pitch rate of 2 – 3 degrees per second. DO NOT rotate more than 8 degrees to avoid tail strike. Tail strike will occur at 9 degrees rotation. (For V-Speed Table, 767200PERFORMANCE.PDF, 767300PERFORMANCE.PDF.)

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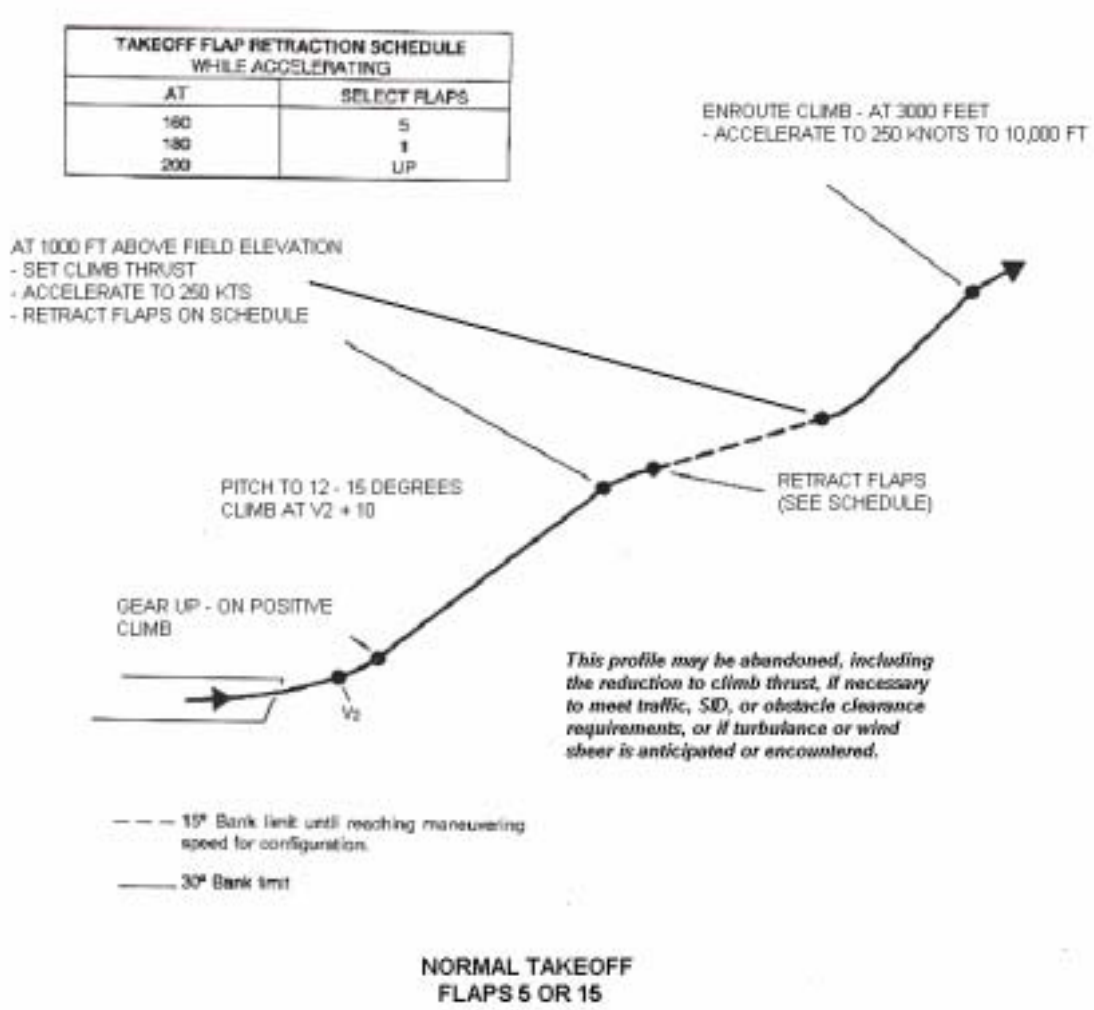
6) Hold nose at +12 - 15 degrees after positive rate of climb is confirmed, then raise landing gear after V2 (see below).



NORMAL TAKEOFF
FLAPS 5 OR 15

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7) Set initial climbout speed to V2+10 KTS.

8) Maintain +15 degrees climb to 1000 FT, or obstacle clearance, whichever is higher. +10 degrees climb after 1000 FT.

9) At 1000 FT above field elevation, begin slat retraction per retraction table. Maximum slat speed limits are:

Slat Position	Max Speed
1	250
5	230
15	210
20	210
25	180
30	180

10) Increase speed to 230 – 250 in accordance with ATC instructions (max 250 KTS below 10,000 FT).

11) For full maneuverability beneath 10,000 FT, slats must be fully retracted with aircraft at minimum safe airspeed.

CLIMB

1) Select highest CLB N1 setting. Once climb thrust or airspeed is set, the autopilot will compensate for environmental condition changes automatically during the climb.

2) It is recommended that the aircraft be flown manually up to 15,000 FT, weather and ATC traffic conditions permitting. However, in high traffic conditions, to easy the workload of the pilot, the autopilot MCP altitude intervention may be engaged above a minimum altitude of 80 FT with the landing gear up.

3) Climb settings use a 10 – 20% derate of thrust up to 10,000 FT, then increases linearly to max thrust at 30,000 FT.

4) For **enroute climb**, climb at a rate of 1800 - 3000 FPM, pursuant to ATC and traffic conditions. If there is no altitude or airspeed restrictions, accelerate to the recommended speed. The sooner the aircraft can be accelerated to the proper climb speed, the more fuel and time efficient the flight.

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5) As **engine and wing icing** may occur during the climb and descent, the engine anti-icing system should be in the AUTO or ON position whenever icing is possible. NOTE: Failure to do so may result in engine stall, overheating, or engine damage.

6) **For normal economy climb**, follow ATC speed restrictions of 250 KTS below 10,000 FT. If permitted by ATC and no speed restriction below 10,000 FT, increase speed to 280 KTS. Above 10,000 FT, climb at 330 KTS or .785 MACH. Climb speed table is as follows:

ALTITUDE	SPEED
Sea Level to 10,000 FT	250 KTS
Above 10,000 FT	330 KTS/.785 MACH

7) **Max climb speed** is 330 knots until reaching .785 MACH at initial cruise altitude.

8) **For engine out climb**, speed and performance various with gross weight and altitude, however 260 knots at 1000 – 1500 FPM may be used.

9) Set **standard barometer** above airport transition level (depends on local airport geography).

CRUISE

1) **Cruise** at .785 - .80 MACH.

2) **Headwinds** will increase engine power, reduce cruise speed and decrease range.

3) **Tailwinds** will decrease engine power, increase cruise speed and increase range.

4) Follow previously entered FMC waypoints.

5) **Fuel Freeze --** Extended operation at cruise altitude will lower fuel temperature. Fuel cools at a rate of 3 degrees C per hour, with a max of 12 degrees C in extreme conditions. Fuel temperatures tend to follow TAT (total air temperature). To raise fuel temperature/TAT, a combination of factors can be employed:

   - Descend into warmer air.
   - Deviate to warmer air.
   - Increase Mach speed.

   An increase of 0.01 MACH will increase TAT by 0.5 – 0.7 degrees C.

6) **Increased fuel burn** can result from:
   - High TAT
   - Lower cruiser altitude than originally planned.
   - More than 2,000 FT above the optimum calculated altitude.
   - Speed faster or slower than .80 MACH cruise.
   - Strong headwind.
   - Unbalanced fuel.
   - Improper aircraft trim.

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7) **Fuel penalties** are:

- 2000 FT above optimum – 3 percent increase in fuel usage
- 4000 FT below optimum – 5 percent increase in fuel usage
- 8000 FT below optimum –12 percent increase in fuel usage
- M.01 above M.80 – 3 percent increase in fuel usage
- Higher climb rates, 3000 fpm over 29,000 – increased fuel usage

8) In the case of **engine out cruise**, it may be necessary to descend. NOTE: For 767 **ETOPS (Extended Twin-engine Operations)** limitations, divert to the nearest available airfield within **180 minutes** (3 hr) to avoid overstressing engines and unnecessary risk. Use good judgement to select an airfield that can accommodate an aircraft of this size. Consideration must also be giving to ground facilities to accommodate number of passengers on board.

9) Trim aircraft for proper elevator alignment.

10) In case of engine out cruise, trim rudder for directional alignment.

11) Deviate from flight plan for weather, turbulence, or traffic as necessary after receiving clearance from ATC.

DESCENT

1) Descent at pre-determined TOD (Top of Decent)

2) Descend at 320 KT above 10,000 FT.

3) Use speedbrakes or thrust to minimize vertical path error.

4) Proper descent planning is necessary to ensure proper speed and altitude at the arrival point. Distance required for descent is 3NM/1000FT. Descent rates are as follows:

Intended Speed	**Decent Rate**	
	CLEAN	WITH SPEEDBRAKES
.785 MACH/320 KTS	2300 FPM	5500 FPM
250 KTS	1400 FPM	3500 FPM
VREF 30 + 80 KTS	1100 FPM	2400 FPM

5) Plan to descend so that aircraft is at approximately 10,000 FT above ground level, 250 KTS, 30 miles from airport.

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6) At average gross weights, it requires 60 seconds and 5 NMs to decelerate from 290 KTS to 250 KTS for level flight without use of the speedbrakes. It requires 100 seconds to slow from 290 KTS to minimum clean airspeed. Using speedbrakes will reduce the times and distances by half.

7) Arm speedbrakes and autobraking to position 1 or 2 on initial descent.

8) Set airport altimeter below transition level.

9) Avoid using the landing gear for drag above 180-200 KTS to avoid damage to doors or passenger discomfort.

10) **Recommended approach planning**, ATC and airport rules permitting:

- 250 KTS below 10,000 FT, 30 miles from airport.
- 180-230 KTS, 23 miles from airport.
- 160 KTS, 16 – 17 miles from airport.
- VREF, 5 – 7 miles from airport.

11) **In case of rapid descend due to depressurization**, bring aircraft down to a safe altitude as smoothly as possible. Using the autopilot is recommended. Check for structural damage. Avoid high load maneuvering.

12) **Bank Angle Protection (BAP)** is not available on the 767. Over 36 degrees of bank, an audio “bank angle” alarm will sound.

13) **Stall recovery** can be accomplished by lowering the aircraft’s nose and increasing power at once to gain airspeed. Beware of terrain. Accelerate to VREF 30 + 80 KTS. Do not retract gear until confirmed stall recovery and positive rate of climb. Keep nose at 5 degrees above the horizon or less.

14) If deployed, do not retract slats during the recovery, as it will result in altitude loss.

15) In the event of engine out approach, approach at VREF+5 @ flaps 20.

16) Under normal conditions land at VREF @ flaps 30. (For V-Speed Table, 767200PERFORMANCE.PDF, 767300PERFORMANCE.PDF.)

17) **ILS Approach** - During initial maneuvering for the approach, extend flaps to 5 and slow to 180-200kts. When the localizer is alive, extend flaps to 15 and slow to 170kts. At one dot below glideslope intercept, extend the landing gear and flaps to 20. Begin slowing to final approach speed. At the final approach fix, extend flaps to 30 and slow to Vref + 5. Be stabilized by 1000 feet above field level. This means, gear down, flaps 30, Vref +5 and engines spooled. Plan to cross the runway threshold at Vref.

18) **Visual Approach** - Similar to the ILS approach. The major difference is that aircraft must be stabilized by 500 feet above field level, as opposed to 1000 feet.

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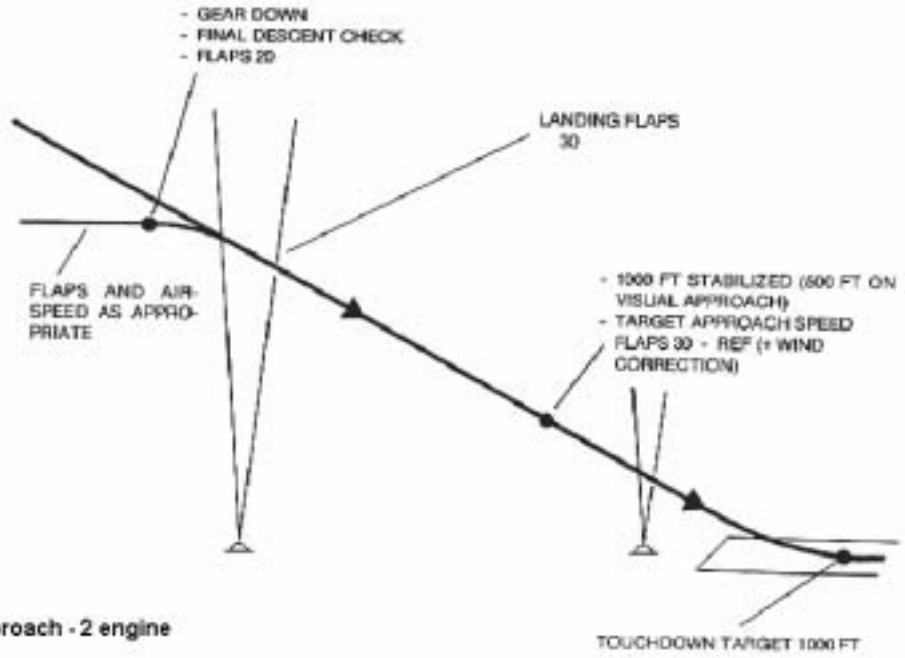
767 Normal ILS Approach

MINIMUM MANEUVERING SPEEDS	
SELECTED FLAPS	SPEED
UP	220
1	200
5	180
15/20	160



ILS Approach - 2 engine

19) A stabilized approach at Vref +5 will result in a pitch attitude of 2-3 degrees nose up. Cross the threshold at Vref. Begin the landing flare at about 30ft. Only about 1-2 degrees of pitch up is necessary. The tail will strike at approximately 9 degrees. Slowly reduce thrust to nearly idle. Landing with thrust at idle will result in a firm touchdown. Set thrust just above idle. At touchdown, fly the nosewheel on. At touchdown, autospoilers should deploy. Deploy reverse thrust. Normally, autobrakes 1 is sufficient stopping power. 2 is sufficient for short or wet runways. Be out of reverse thrust by 80kts to prevent foreign object damage to the engines.

20) For **wind correction**, add ½ the steady state wind plus all of the gust factor to the Vref. Do not add more than 20 kts. When landing in a crosswind, do not bank excessively as wingtip or engine pod strike may occur.

21) The Project Opensky 767 is a CATII/III aircraft, meaning the aircraft is capable of landing on autopilot in conditions where visibility is down to 50ft AGL.

22) Land the aircraft.

23) Disengage (autopilot autothrottle will disengage) reverse thrust at 80 knots.

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24) Disengage autobraking at 60 knots or as necessary.

25) Turn off onto high-speed taxiways at 30 knots or less.

26) Reverse thrust is most effective at higher speeds. Slow to safe taxi speed with braking and exit the runway.

27) Decelerate to 8 – 12 knots for 90 degree turns.

28) Taxi to gate.

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Project Opensky Boeing 767 – Frequently Asked Questions

Q) I'm ready to fly right now. What are the best freeware and payware panels and sounds available today?

A) New and exciting add-ons come out daily. We feel the best currently are:

Best Payware Panel:

Wilco 767 Pilot In Command
http://www.wilcopub.com

Best Freeware Panels:

Vanessa Leightower's 767 panel
Marco Coelho (Terblanche Jordaan)'s 767/757 panel

Both of these files can be downloaded at:

www.avsim.com
www.flightsim.com

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Best Payware Sounds:

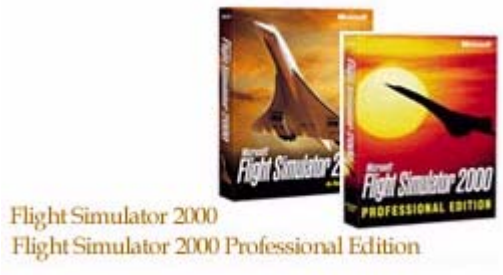
Wilco Publication 767 PIC

http://www.wilcopub.com

Best Freeware Sounds:

Ryuji Ozawa 767 sounds.

www.avsim.com
www.flightsim.com



Q) What sound settings do you recommend?

A) Set your sound options for the engines to 1/8th maximum value. Decrease Navigation also to 1/8th bar. As for the other sounds, increase them all to 8/8th bar. In the 767, you are a long way away from the engines and the landing gear. You're separated from the cabin by the flight deck door, and the cabin is expansive.

For the most part, you mainly hear the hiss of pressurized air and the sounds of the flight deck. You practically don't hear the engines at all, except on takeoff, climbout, and when the thruster reverses engage. Other than that, the large PWs, RRs, or GEs are quiet as a mouse.

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Q) What type of flight-testing did Project Opensky perform on the 767 series?

A) Project Opensky Members have done extensive flight-testing with the 767. Project Opensky flight-testing is intense with many aircraft cycles. Tests included: engine out flight, in-flight engine restarts, engine out landings, CAT I/II/III landings, stall recovery, BAP, RTOs, minimum unstick tests, ETOPS, cold weather testing, 24 knot crosswind approaches with up to 38 knot gusts, and enroute flight testing of a maximum of 64 knot headwinds and 134 knot tailwinds. All weather was flown as downloaded from Microsoft real weather website.

Q) What other freeware add-ons to you recommend to increase realism?

A) **Enviro** to add ATC traffic and **FSUIPC** to environment and visibility smoothing. Both are available at Avsim.com or Flightsim.com.

Q) When flying the Project Opensky 767, what will happen if I do not follow the procedures as they are listed in this manual?

A) You will crash. Project Opensky is not responsible for stupidity.

Frequently Asked Questions – Asking real pilots – Answers straight from the pros.

Q) So in real life, how does a 767 handle?

A) Pitch is effective but heavy--like a truck, don't need to overcontrol but you need to give positive pressure. Turning, the outboard ailerons lock fully out at about 270 kts with both ailerons functioning, roll rate is very brisk-very light on the control, i.e. better than the 777 with the outboards locked out. The roll rate is much slower, very stiff and much more solid with outboard ailerons locked out.

Q) How is landing a 767?

A) Landing attitude is relatively flat, only about 1-3 degrees above horizon on the approach. The 767 on landing wants to pitch up after the mains touch. It is very easy to strike the tail. You have to push forward on the yoke at touchdown.

Q) How are the brakes on a 767?

A) Brakes on 767-300s are carbon fibre. Very smooth and very effective. Older –200 brakes are steel. Takes more effort.

Q) How are the speedbrakes?

A) Speedbrakes are so-so, not super effective but not ineffective. The 767 is somewhat tough to slow up in flight because it has so much mass. Proper decent planning is essential. You don't want to get caught behind your decent profile, or in a late decent.

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Q) Let's be honest, this thing is certified up to 41,000 – 43,000 ft, but can it really make it?

A) Climb rates are dependant on aircraft loading. Above 10,000 ft, you can go 2000 fpm, but then dropping to 1500 fpm higher up. When up at FL390 to FL410 it really dogs out. It is certified up to FL430. You can always make FL410 unless it is very hot out and you are very heavy.

Q) For the 767-200s, what happens if you loose an engine on takeoff?

A) Well, no one wants that. Many pilots worry about loosing an engine, especially in mountainous areas like Zurich. You must drop the nose the gain airspeed, rudder it out, but watch for terrain. The 767-200s are really underpowered.

Q) Do you cut the throttles completely when landing?

A) Typically, we keep the throttles going all the way down to touchdown. The 767 can land heavy, so you don't want to crunch it in.

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A LITTLE BIT ABOUT THE AUTHOR

My name is Warren and I travel around 100,000 miles a year. Most of my travels in recent years have been on the 767 and 777, which are now my favorite aircraft. I believe in the most realism possible. A lot of credit goes to Nick Peterson, Simon Ng, Kitaguchi-san and several other friends who helped along the way. Also, lots of credit goes to Matt Zagoren for taking the trouble to compile his 767 documentation and allowing us to reference it.

I am not an airline captain, but love flight. Formally, I used to fly a Cessna 172 and a twin-engine Piper Cherokee. My goal is to give the flight simulator community the closest possible experience to flying a real 767.

My hobbies are flight, automobile track racing, and screenwriting.

I cannot promise I'll answer every single question, but someone at the forum will try to get an answer for you. Please send general comments to the forum at: www.project-opensky.com.

Remember that Project Opensky creates these aircraft for free, because we enjoy it. Do not bog us down with ignorant or unnecessary comments or criticism. If you feel you can do better, by all means, please do so, so that we may all benefit from everyone's hard work.

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