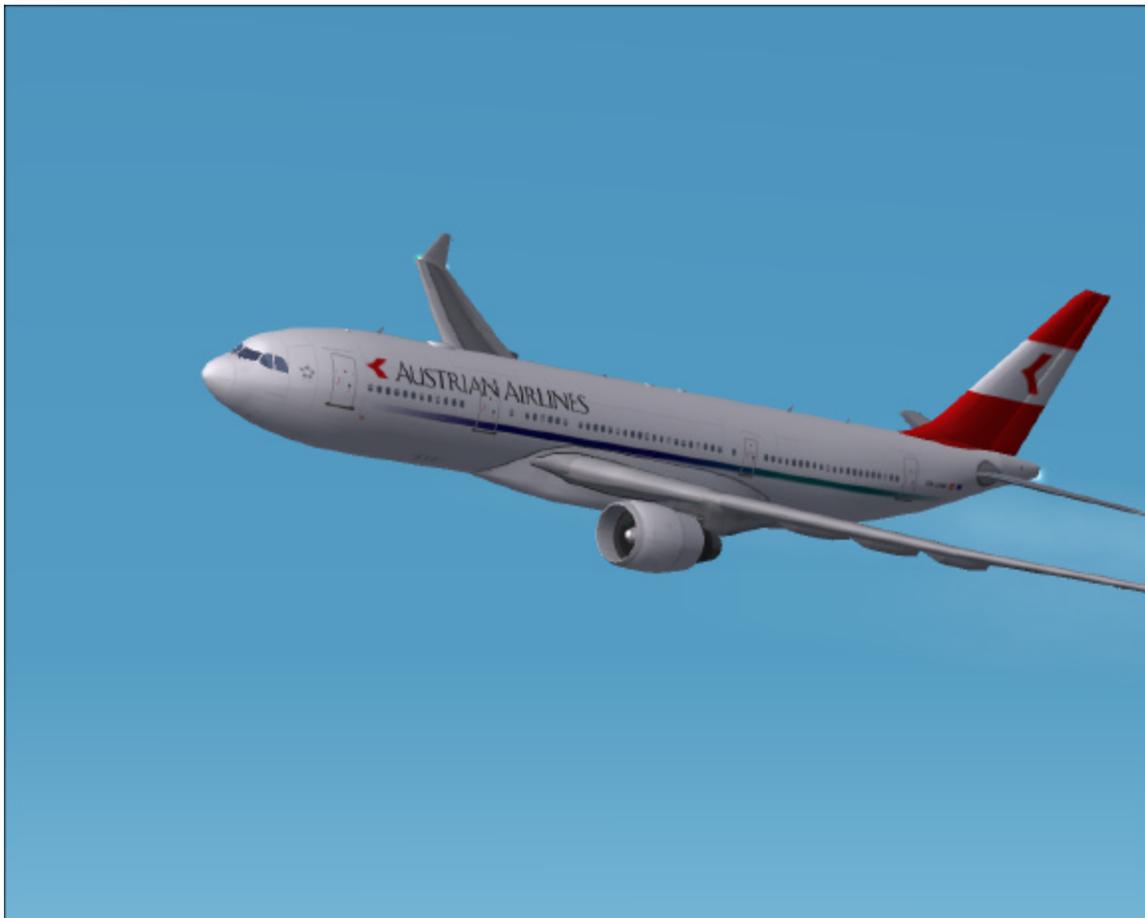


PROJECT OPENSKY



A330-200/300



TAXI, TAKEOFF, CLIMB, CRUISE, DESCENT & LANDING

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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.



**Project Opensky Boeing A330-200/-300 v1 & v2
Version 2002.5.5**

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Flight model based on the most realistic data for the Airbus A330-200, -300, and actual flight experience on A330 and other Airbus series flight decks.



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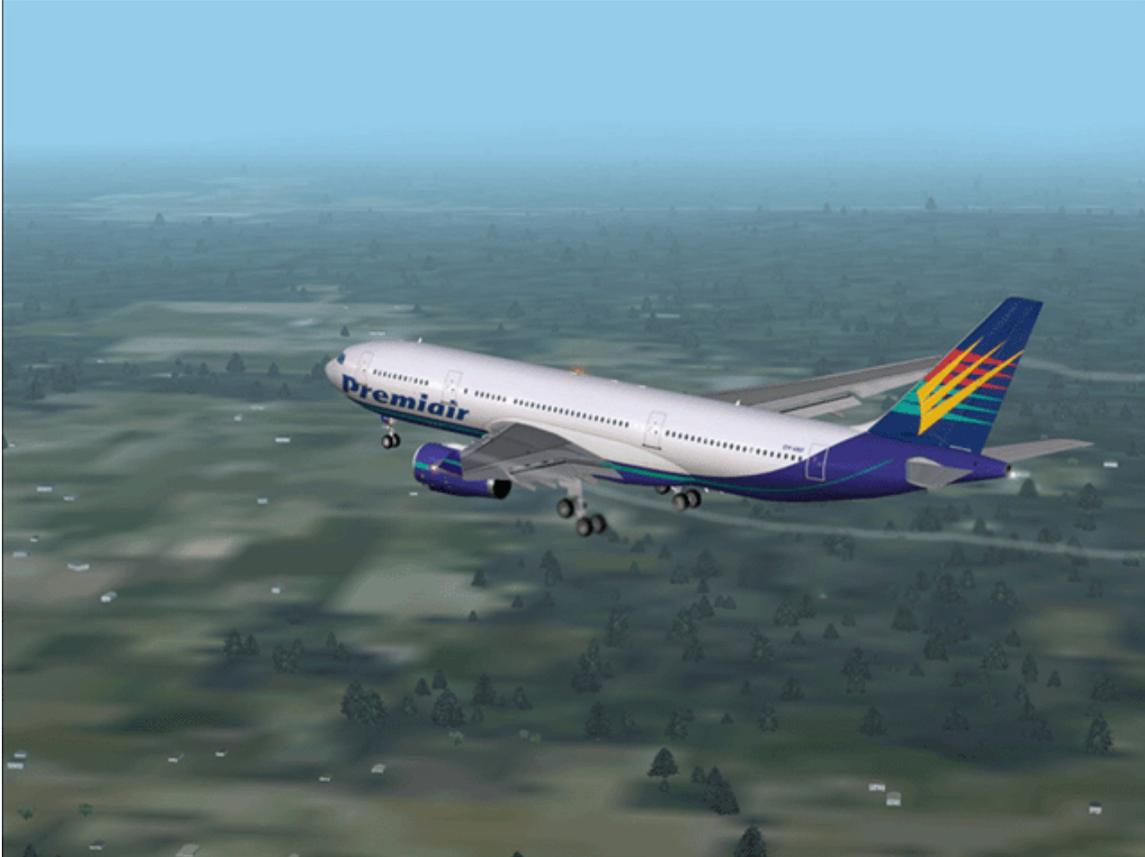
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PREFACE

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

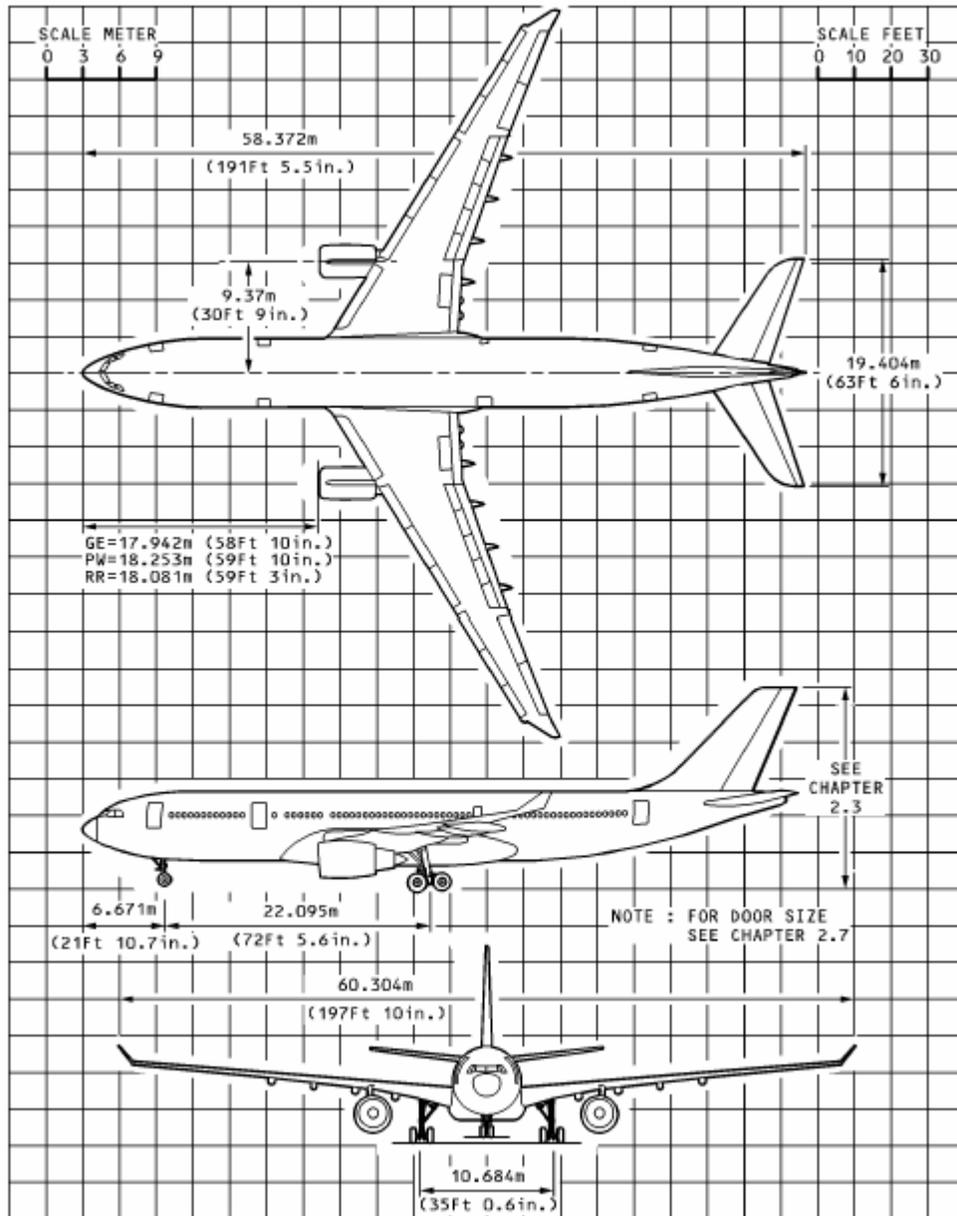
Airbus A330-200, A330-300 – Aircraft Reference Manual

Flight Simulator 2002 Professional Edition

Airbus A330-200/300 - Specs

Dimensions (-200):

Span 197 ft 10 in
Length 194 ft 11 in
Height 57 ft 20 in



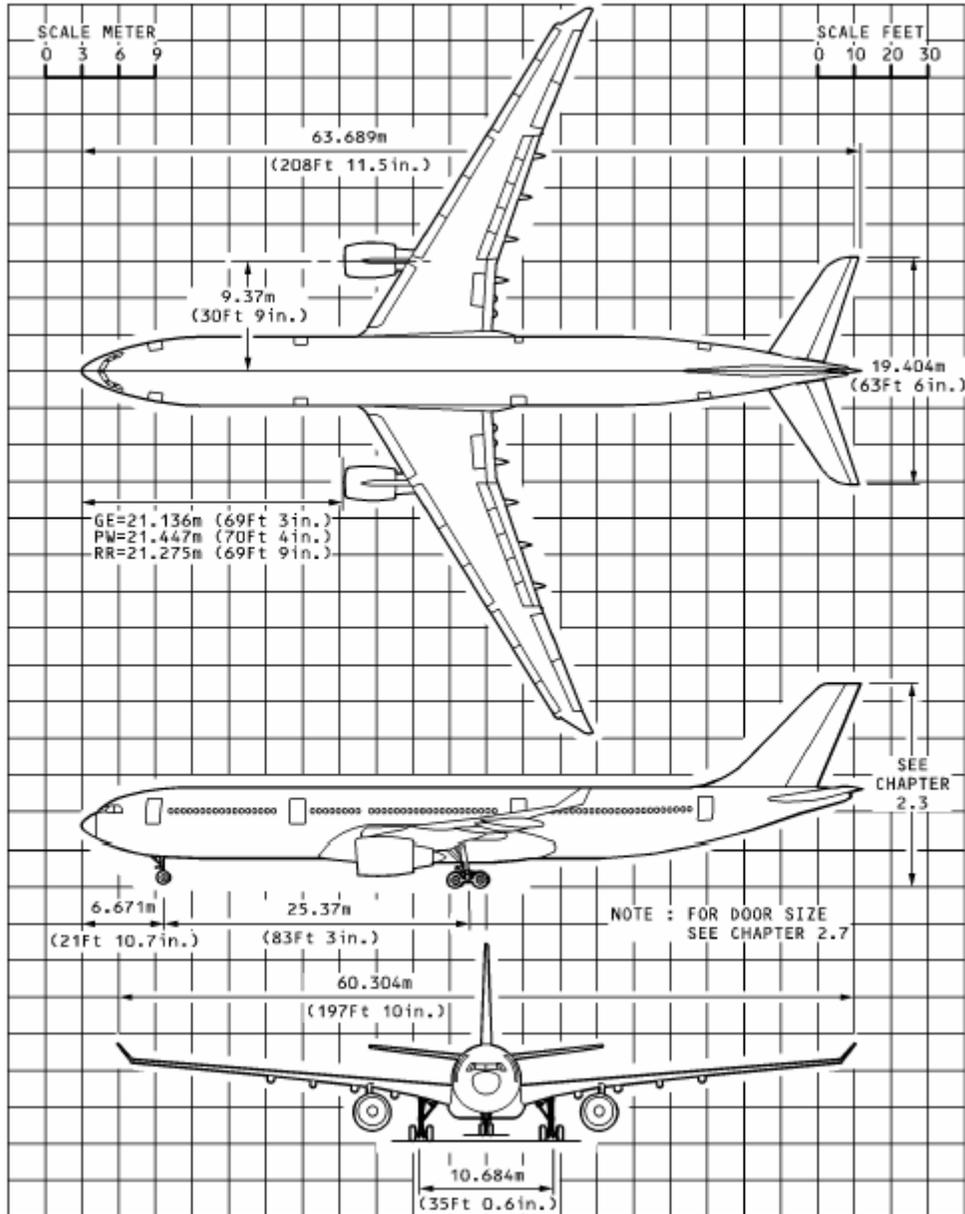
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Dimensions (-300):

Span 197 ft 10 in
Length 208 ft 12 in
Height 57 ft 20 in



Engines:

GE CF6-80E1

TO Thrust Rating: 72,000 lb x 2

PW4000

TO Thrust Rating: 68,000 lb x2

RR Trent 772B

TO Thrust Rating: 71,100 lb x2

Weight and Capacities

MaxTOW: 507,400 lb (-200)

ZFW: 343,242 lb (-200)

Max Fuel Cap.: 36,750 US Gal (248,430 lb)

Performance

Typical Cruise Speed:

M.80 - Econ Cruise

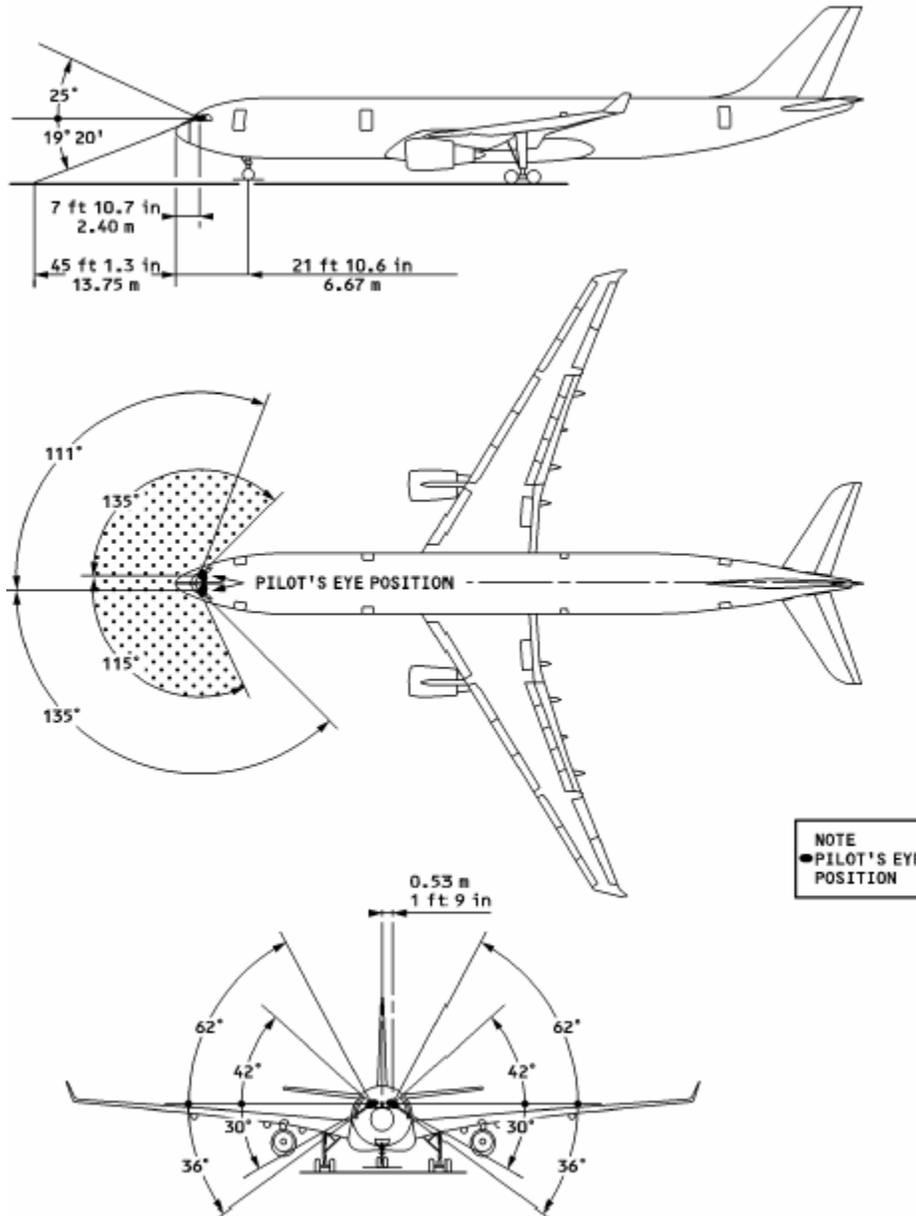
M.82 – Max/High Speed Cruise

Range: 6,650 nm (-200), 4,750 nm (-300)

Fuel flow: 5300 pph per engine (10,600 pph total) @ cruise FL330 @ M.80

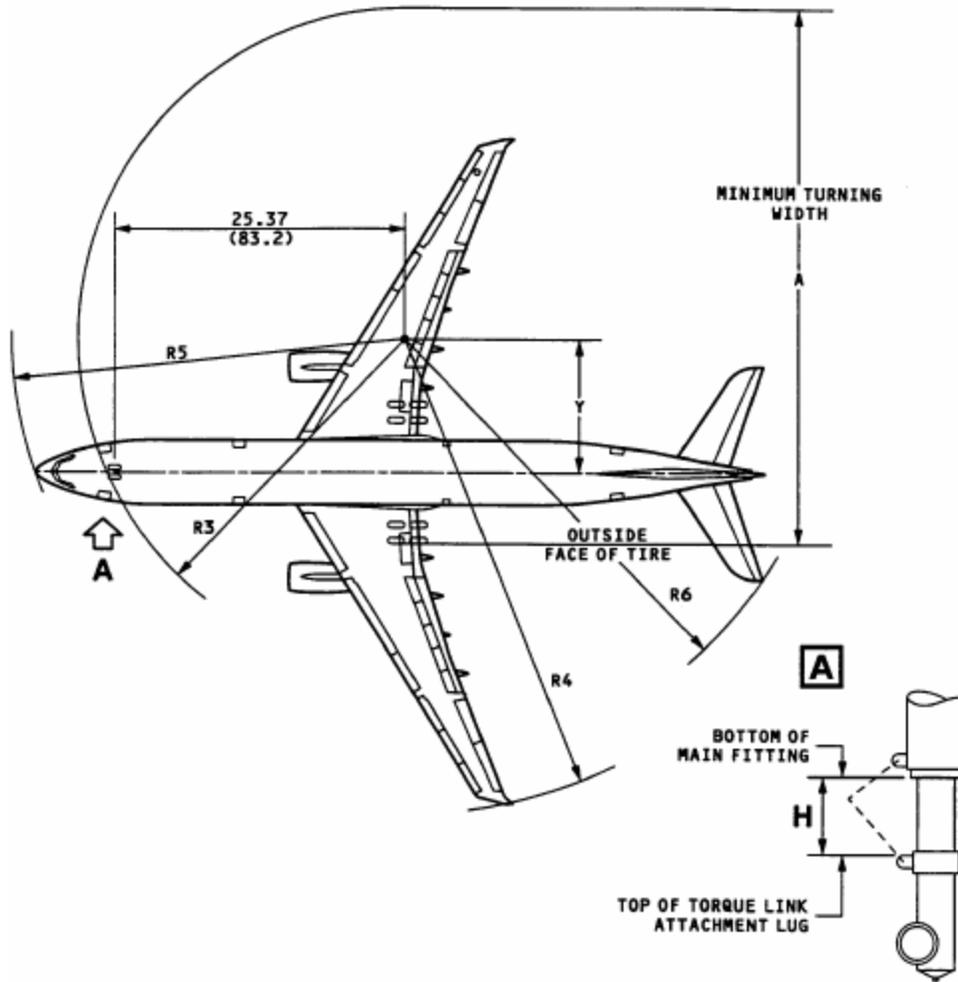
BASIC PILOT INFORMATION

Pilot's view reference point is approximately 19.20 feet from the ground, with ground visibility limited to 45.10 feet looking down at an angle of 19.20 degrees. 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 135 degrees of max travel.



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 position 2.
- 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. **Caution: The A330-200/-300 is an extremely long aircraft. Take particular care of the wheelbase when turning.**
- 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) Again, 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 with 60 degree steering angle is 166 FT:



MINIMUM TURNING RADII (WITH TIRE SLIP) AND MINIMUM TURNING WIDTH FOR 180° TURN ARE AS SHOWN.

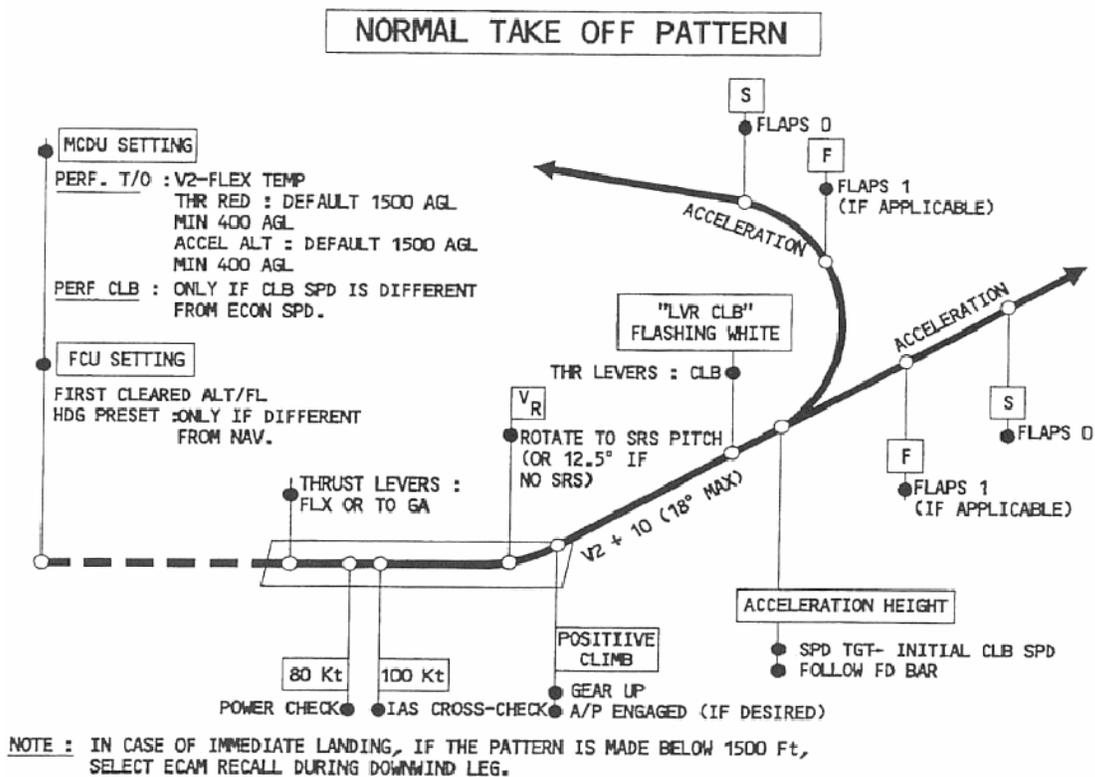
TURN TYPE	EFFECTIVE TURN ANGLE	STEERING ANGLE	FEET METERS	Y	A	R3	R4	R5	R6
2	60.50°	65.08°	ft m	46.8 14.3	164.8 50.3	97.3 29.7	149.4 45.6	115.4 35.2	130.3 39.7

- 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. **Caution: DO NOT rotate more than 8 degrees to avoid tail strike. Tail strike will occur at 9 degrees rotation.**
- 6) Hold nose at +10 degrees after positive rate of climb is confirmed, then raise landing gear after V2 (see below).
- 7) Set initial climbout speed to **V2+15 KTS, 1500 fpm.** **Caution: do not exceed 15 degrees of bank below 230 knots on initial climbout.**
- 8) Maintain +10 degrees climb to 1500 FT, or obstacle clearance, whichever is higher. +12-15 degrees climb after 1500 FT. **Caution: on heavy climbout, lower nose as necessary to gain airspeed. Beware of terrain.**



- 9) At 1500 FT above field elevation, begin slat retraction per retraction table. Maximum slat speed limits are:

Slat Position	Max Speed
1	250
2	210
3	180
4	160

- 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 FLEX 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 ease 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.
- 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 300 KTS or .785 MACH. Climb speed table is as follows:

ALTITUDE	SPEED
Sea Level to 10,000 FT	250 KTS
Above 10,000 FT	300 KTS/.820 MACH

- 7) **Max climb speed** is 300 knots until reaching .800 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 .80 MACH (Econ), .82 MACH (Max).
- 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.
- 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.84 – 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 engine failure, divert to the nearest available airfield 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 300 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:

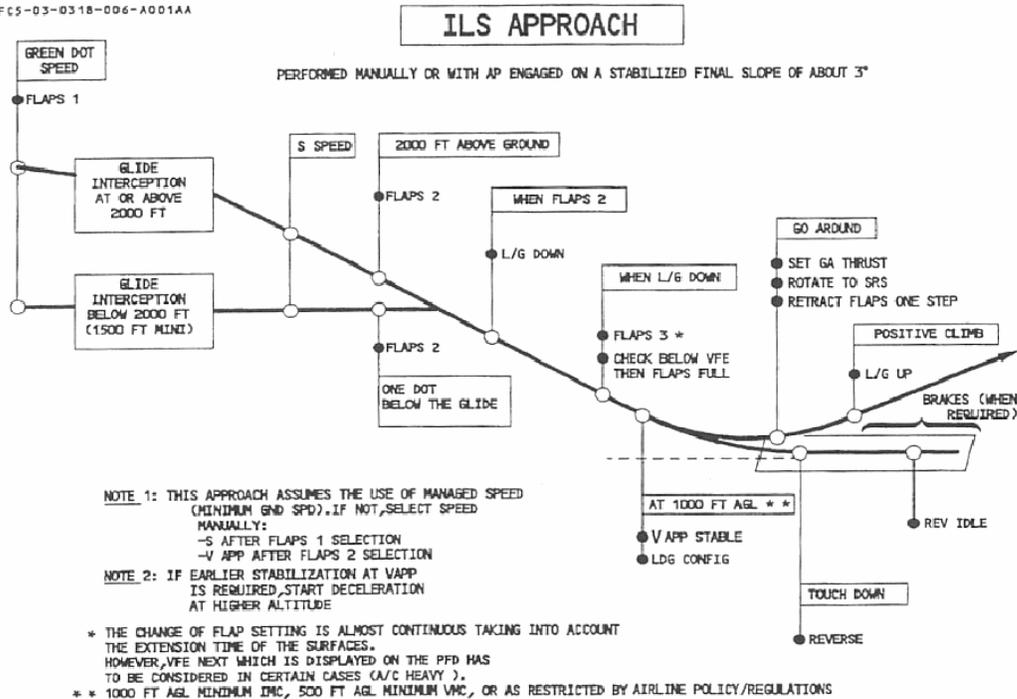
Intended Speed	Decent Rate	
	CLEAN	WITH SPEEDBRAKES
.820 MACH/300 KTS	2500 FPM	5500 FPM
250 KTS	1400 FPM	3500 FPM
VREF 30 + 80 KTS	1100 FPM	2400 FPM

- 5) Plan to descend so that aircraft is at approximately 10,000 FT above ground level, 250 KTS, 30 miles from airport.
- 6) At average gross weights, it requires 60 seconds and 5 NMs to decelerate from 300 KTS to 250 KTS for level flight without use of the speedbrakes. It requires 110 seconds to slow from 300 KTS to minimum clean airspeed. Using speedbrakes will reduce the times and distances by half.
- 7) Arm speedbrakes and autobraking to position Low or Med 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 due to buffeting.
- 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.
 - Slow to VREF at GS capture.
 - 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) **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.
- 13) If deployed, do not retract slats during the recovery, as it will result in altitude loss.
- 14) In the event of engine out approach, approach at VREF+5 @ flaps position 3.
- 15) Under normal conditions land at VREF @ flaps position 4.

- 16) **ILS Approach** - During initial maneuvering for the approach, extend flaps to position 1 and slow to 180-200kts. When the localizer is alive, extend flaps to 2 and maintain speed, keep at 180 knots. **At glideslope intercept, extend the landing gear, extend flaps to 4 and slow to $V_{ref} + 5$.** Be stabilized by 1000 feet above field level. This means, gear down, flaps 4, $V_{ref} + 5$ and engines spooled. Plan to cross the runway threshold at V_{ref} . The A330 will maintain nose up angle of +4 degrees.

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- 17) **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.

- 18) A stabilized approach at $V_{ref} +5$ will result in a pitch attitude of 2-3 degrees nose up. Cross the threshold at V_{ref} . 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 Low position is sufficient stopping power. Med is sufficient for short or wet runways. Be out of reverse thrust by 80kts to prevent foreign object damage to the engines.
- 19) For **wind correction**, add $\frac{1}{2}$ the steady state wind plus all of the gust factor to the V_{ref} . Do not add more than 20 kts. When landing in a crosswind, do not bank excessively as wingtip or engine pod strike may occur.
- 20) The Project Opensky A330 is a CATII/III aircraft, meaning the aircraft is capable of landing on autopilot in conditions where visibility is down to 50ft AGL.
- 21) Land the aircraft. **To avoid tail strike, do not flare, flying the aircraft straight onto the runway.**
- 22) Disengage (autopilot autothrottle will disengage) reverse thrust at 80 knots.
- 23) Disengage autobraking at 60 knots or as necessary.
- 24) Turn off onto high-speed taxiways at 30 knots or less.
- 25) Reverse thrust is most effective at higher speeds. Slow to safe taxi speed with braking and exit the runway.
- 26) Decelerate to 8 – 12 knots for 90 degree turns.
- 27) Taxi to gate.

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

Q) Is this right? The A330 doesn't climb like a rocket...

A) People need to get over this notion that planes climb straight to their cruise altitude. Typical climb profile to initial flight level for the A330-300 is 1500 fpm to 1500 AGL, 250 knots 1800 fpm to 10000FT, increase to 300 knots over 10000 FT, 1800 fpm to FL240, 1300 fpm to FL270. Initial flight level typically is somewhere between FL280 or FL290. Final climb is about 300 fpm to FL280 or 290.

A330-300 is a bit more underpowered than –200.

Q) The A330 is a big aircraft, about as big as a 777. How is taxing the A330?

A) Taxiing the A330 is pretty easy. You should never exceed 32 – 33% N1 even when heavy to break away and start rolling. Should coast when heavy at about 29% N1. When light, should coast at idle thrust. Not accelerate, but coast.

Q) The nose seems to bit a bit high on landing. Is this correct?

A) Landing angle is about 4 degrees nose up. More than Boeings.

Q) The handling of the A330 seems a lot different than a Boeing during a turn. Why is this?

A) Uses more rudder in a turn than Boeings. In addition, A330 flight system is fly-by-wire.

Q) I seem to loose airspeed quickly. What should I do?

Be careful not to let the A330 climb to fast. Nose too high up causes speed loss.

Project Opensky – A330 – Frequently Asked Questions

Q) Climbout seems a bit slow when heavy... Am I doing this right?

A) After vR, rotate the nose upwards smoothly. Avoid overrotation. When the wheels are off the ground, raise the landing gear as soon as reasonably possible to gain airspeed. Hold max 1500 fpm until 1500' AGL. Lower the nose as necessary to gain airspeed. The A330 will climb, however, speed is crucial. If terrain permits, do not sacrifice airspeed for altitude.

Q) So what's a typical climb profile like for an A330-200 or -300?

A) Climb to 1500 fpm to 1500' AGL, then accelerate to 250 knots (or ATC restriction) @ 1800 FPM. Pulling sharply on the flight stick will result in rapid airspeed loss from bleeding airspeed. Above 10,000' feet, accelerate to 300 knots, 1800 fpm. Initial flight level when heavy should be in the neighborhood of FL280 to FL330. Step climb to final cruise altitude as weight permits.

Q) Nose angle seems high on landing? Different than Boeings. Is this correct?

A) Yes, Airbuses are more angled on approach, where Boeing aircraft are more flat. Verify your trim and landing weight, however, you should see about +4 degrees nose up. Fly straight at the glideslope intercept at about 180 – 190 knots. At intercept, lower the landing gear and extend to flaps 4. The A330 will maintain about 4 degrees nose up attitude. If you are seeing more than this, adjust your trim.

Q) Should I flare on landing?

A) To avoid tail strike, it is recommended to fly the aircraft straight onto the runway.

Q) What are the operating speeds of the A330?

A) Sorry, I had to edit these pages out. I cannot release all of the information I received.

However, let's assume a flight from Zurich to Kennedy. Here are some samples you can use:

TO speeds – at 447,100 lbs (includes ZFW + fuel required for trip 3931 nm)
Temp = 10 deg C., Runway=Dry, Runway Slope=0, Pressure Altitude= 0FT
Required runway length = 3750 M

v1/vR/v2 – 147/160/165 - CONF 1+F (**Flaps position 1**)

Landing Speed (Total weight = 355,200 lbs) \approx ZFW (343,242) + Fuel (12,000 reserve)
VREF – 142 knots + wind component

(Disclaimer – not always accurate in all situations...)

Q) How do I calculate fuel and range? Can you give me a sample trip fuel calculation to use as a reference?

A) Sure. Let's continue the above example. Here we will assume a trip from Zurich, Switzerland to New York Kennedy.

Total trip length (example):

3931nm total trip length.

Next, calculate your travel time, fuel required, then total fuel:

- 1) Total travel time (westbound – assuming aloft winds):
 $3931 \text{ nm} / 425 \text{ Average ground speed} = \mathbf{9.24 \text{ hrs}}$

<Note> Assume Average GS – Westbound – 425 knots, Eastbound 525 knots)

- 2) Fuel Required:
 $9.24 \text{ hr} * 5300 \text{ lb per hour fuel usage} = 49,021 \text{ lbs} \times 2 \text{ engines} = \mathbf{98,043 \text{ lbs}}$

- 3) Calculate your total fuel:
 $98,043 \text{ lbs (required fuel)} + 12,000 \text{ lbs (alternate/reserve fuel)} + 2,000 \text{ lbs (taxi fuel)} = \mathbf{112,043 \text{ lbs.}}$

As you can see here, you only need 112,000 lbs fuel to cross the Atlantic on a westbound flight. Only take the fuel you need. Split this and place fuel in both left and right main wing tanks.

Here, your total weight on takeoff would be:

Takeoff weight -	343,242 lbs
+ trip fuel -	112,043 lbs
=====	
Total weight	455,285 lbs

As you can see here, you are well below the MTOW of 507,000 lbs.

At this configuration, according to the Airbus documentation, **you should be able to climb directly from brake trip to FL330 in 17 minutes.** If you cannot do this, you are doing something wrong.

Q) What if I can't climb this quickly or am losing too much airspeed? What could be wrong?

A) Verify that you only have the fuel you need, do not simply fill up to 100% fuel on all tanks. You will be over the MTOW. Other than that, confirm your gear is up and flaps are clean.

Q) Typically what engine speeds should I be seeing? Do the engines really work this hard?

A) Yes. Of course, it varies by atmospheric conditions, but typically, at cruise, you should see about 88 – 89% N1 @ M.80, 92 – 94% N1 at M.82.