



Crosswind Guidelines

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Purpose

- Understand origin of crosswind guidelines
- Discuss crosswind values
- Discuss crosswind effects on high by-pass engine airplanes
- Review takeoff and landing techniques



Crosswind Guidelines

- Provided to assist operators develop crosswind policies
- No certification requirement
 - Maximum available during certification
- AFM “Demonstration”

MAXIMUM CROSSWIND (TYPICAL)

The maximum demonstrated crosswind component for takeoff and landing is 36 knots reported wind at 10 meter height. This component is not considered to be limiting on a dry runway with all engines operating.



Origin of Guidelines

- Light weight, AFT CG
 - Load on nose wheel
- Runway condition
 - Friction coefficient
- Tire side force capability
- Aerodynamic controls
 - Lateral/directional
- Engine out RTO
- Flight test data/analysis
- Simulator trials



Crosswind Guidelines (Typical)

757/767 *Flight Crew Training Manual*

Takeoff Crosswind Guidelines

Runway Condition	Crosswind—Knots
Dry	40
Wet	25
Standing Water/Slush	15
Snow - No Melting	20
Ice - No Melting	15

Landing Crosswind Guidelines

Runway Condition	Crosswind—Knots
Dry	40
Wet	40
Standing Water/Slush	20
Snow - No Melting	35
Ice - No Melting	17



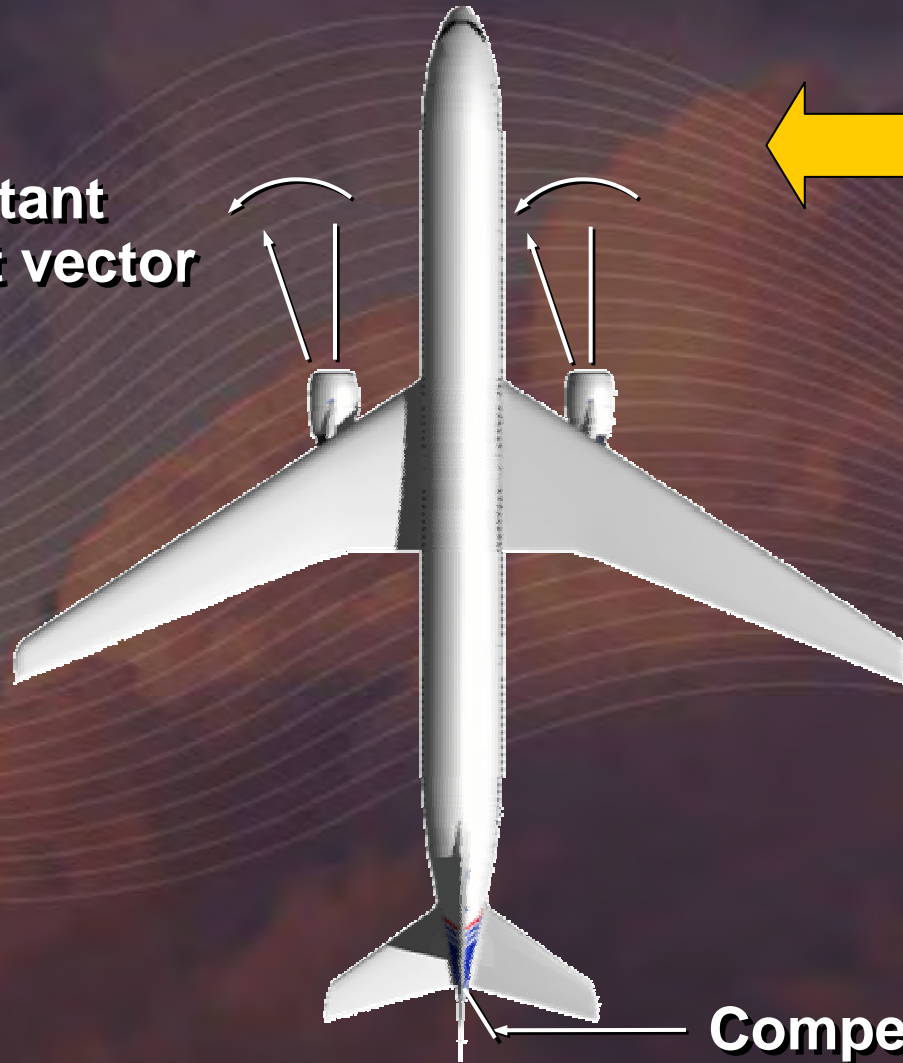
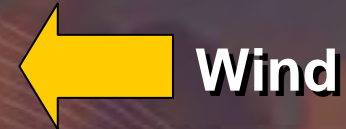
Crosswind Takeoff

- Low speed/weight controllability most affected
- Tire side force capability limits crosswind
 - Side force affected by
 - Runway surface and contamination
 - Aft CG and lower GW
- Engine inlet distortion—high bypass ratio engines
 - Effect of crosswind entering nacelle turns airplane downwind
 - Most noticeable on 777

Effect of Crosswind on Engine Inlet



Resultant thrust vector



Compensating rudder



Crosswind Takeoff Techniques

- Rolling takeoff recommended
 - Minimizes disrupted airflow into engine
- Smooth application of thrust
- Light forward pressure on elevator
- Moderate aileron into wind
- Maintain centerline with rudder pedal steering and rudder
- Don't preset rudder—anticipate rudder reversal



Crosswind Takeoff Techniques

(continued)

- Don't use tiller past taxi speed
(except some classic 747-100)
- Don't rotate faster than normal
 - Tailstrikes



Crosswind Landing

- Pilot crosswind landing technique significantly affects crosswind capability
- Flight control aerodynamic forces and tire side-force are the limiting factors



Crosswind Landing Techniques

- Side slip (wing low)
- Crab (to touchdown)
- Combination slip/crab
- Decrab during flare



Crosswind Landing Techniques



Side Slip (Wing Low)

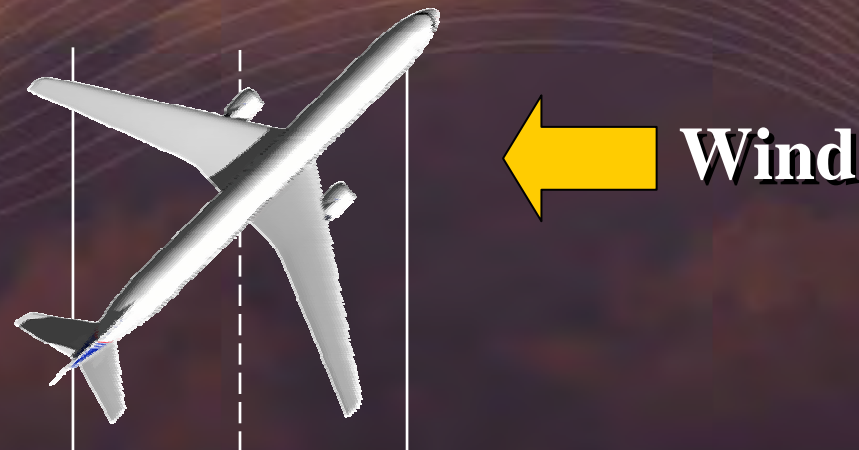
- Upwind wing lowered into wind
- Opposite rudder maintains runway alignment
- Reduced x-wind capability





Crab (To Touchdown)*

- Airplane touches down in crab
- Flight deck is over upwind side of runway
 - Main gear is on runway center
- Airplane will decrab at touchdown
- Maintain directional control during roll out with rudder and aileron



* Full crab not recommended for maximum crosswind on Long Beach products



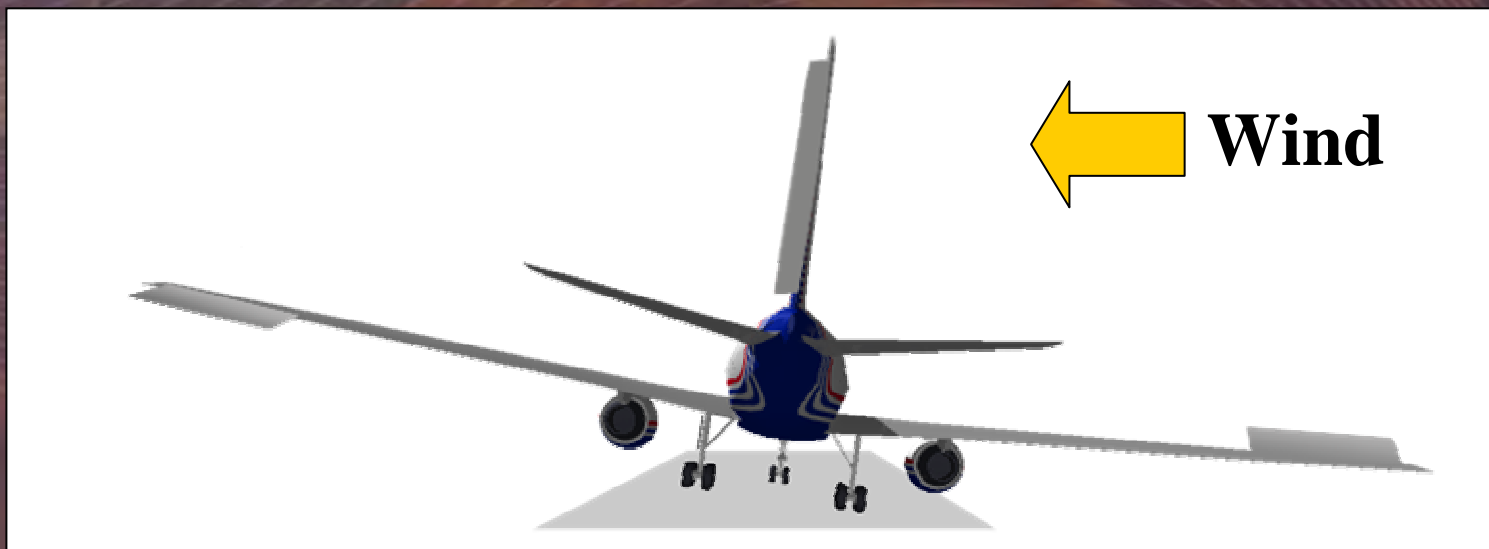
De-Crab During Flare

- Maintain crab on the approach
- During flare, apply rudder to align airplane with runway and opposite aileron to keep wings level



Combination Crab and Side Slip

- De-crab using rudder to align longitudinal axis with runway. Increase aileron to maintain wing low
- Touchdown on upwind tire, wing slightly low





Crosswind Guidelines

Side Slip (only)

- Side slip only technique reduces maximum crosswind capability
- Based on 2/3 control input criteria
- Remaining 1/3 control available for gust recovery



Crosswind Guidelines (continued)

Side Slip (only)

Control Limit Sideslip Only Landing (2/3 lateral control (rolling moment) or 2/3 pedal input)											FCTM ↓
Airplane	OEW	1.1* OEW	Flaps	Vref (1.1 OEW)	Sideslip	Bank	%Max Whl	%Max Rud	Crosswind	Control Limit Criteria*	Recommended Crosswind
	1000 lb	1000 lb		kts	deg	deg			kts		kts
747-200	380	418	30	121	7.9	4	44	40	16.6	2/3 Lateral Control	16
747-400	400	440	30	121	7.5	4.1	43	30	15.8	2/3 Lateral Control	16
767-200	180	198	30	117	11.7	Not det.	46	67	23.7	2/3 pedal	24
767- 300ER	200	220	30	119	12.3	Not det.	48	67	25.4	2/3 pedal	24



Common Questions

- Airplane crosswind structural design
- Auto land limitations
- Disconnection of autopilot for manual crosswind landings
- Auto throttle use in strong gusty crosswinds
- Pure crosswind wind additives to V_{ref}

Crosswind Landings - After Touchdown



- Idle thrust
- Deploy reversers normally
 - Slippery/contaminated runways
- Check speedbrakes up
- Maintain aileron into the wind to keep wings level
- Smoothly but positively lower the nosegear
- Rudder control effective to about 60 knots
- Rudder pedal steering sufficient until taxi speed
- Use asymmetrical braking if necessary
- Use tiller upon reaching taxi speed



Crosswind Landings

- Common Problems
 - Unstable approaches
 - Holding airplane off until below V_{ref}
 - Bounced landings
- Alternatives
 - Go around
 - Be careful not to over-rotate during rejected landing
 - Terrain clearance and missed approach procedure
 - Wait or divert
- Training
 - How does your airline approach crosswind training?
 - Recurrent training plans?
 - Are your pilots maintaining proficiency?



Crosswind Guideline Summary

- Guidelines not limits
- Airline can use guidelines to establish company policies
- Runway condition affects crosswind capability
- Most gust conditions have minor affect on crosswind capability
- Landing crosswind technique affects crosswind capability