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B-747-400

Operational Data

Manual

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FUNCTION

The Aircraft Operational Data Manual (ODM) serves to provide trained Delta Flight Operations and Operations Control personnel with some of the information and instructions necessary for safe and economical operation of the aircraft.

AUTHORITY

This manual is published by the General Manager – Performance Engineering, Dept. 088, ATL under the authority of the Vice President – Operations Reliability and Control.

The procedures and data contained in this manual include those in the FAA Approved Airplane Flight Manual and aircraft manufacturer's data.

RESPONSIBILITY

The General Manager – Performance Engineering has been designated the responsibility for the quality of this manual.

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All manual holders and users are encouraged to contribute their suggestions and criticisms regarding the manual so that its function is well served. Inputs concerning data and technical content should be addressed to Performance Engineering, Dept. 088, ATL.

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Revision Notification

Publication: B-747-400 OPERATIONAL DATA MANUAL

Date: 23 Sep 16

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REMOVE	INSERT	REMARKS
TABLE OF CONTENTS	TABLE OF CONTENTS	Date updated to reflect revision.
COVER PAGE	COVER PAGE	Cover page updated to reflect revision.
LIST OF EFFECTIVE PAGES Page <i>i</i>	LIST OF EFFECTIVE PAGES Page <i>i</i>	List of Effective Pages updated to reflect revision.
QUICK REFERENCE Pages: All	QUICK REFERENCE Pages: All	Changed the table title and eliminated fair nomenclature to make it consistent with new FAA policy
ABNORMAL Pages: 4-28 – 4-31	ABNORMAL Pages: 4-28 – 4-31	Eliminated “fair” nomenclature to make it consistent with new FAA policy

**Pages not displaying a revision date of 23 Sep 16 were unchanged and included only for filing purposes.*

This list is effective with ODM Revision #27

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END

747-400 QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES

RUNWAY CONDITION ASSESSMENT MATRIX

For additional guidance regarding the classification of the braking action based on existing contaminant types and the ICAO/Runway Condition Code values, please refer to Airway Manual, Supplemental, 4 – Weather, Braking Action.

Reported Braking Action		Reported Runway Surface Conditions			
PIREP	Definition	Runway Contaminant	ICAO/Runway Condition Code	Mu ⁽²⁾	RCR
--	--	• Dry	6		--
Good	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal	- Frost - Wet or Damp 1/8" or less depth of: - Water - Slush - Dry Snow - Wet Snow	5	40 or higher	19 & above
Good to Medium	Braking deceleration OR directional control is between Good and Medium.	-15°C and colder OAT: Compacted Snow	4	39 to 30	
Medium	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	- Wet ("slippery when wet" runway) - Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 1/8" depth of: - Dry Snow - Wet Snow Warmer than -15°C OAT: - Compacted Snow	3	29 to 21	13 – 18
Medium to Poor	Braking deceleration OR directional control is between Medium and Poor.	Greater than 1/8" depth of: - Water - Slush	2	20 or lower	
Poor	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	• Ice	1		6 – 12
Nil ⁽¹⁾	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	- Wet Ice - Water on top of Compacted Snow - Dry Snow or Wet Snow over Ice	0		5 & below
--	--	• Unreliable	9 (ICAO only)	N/A	N/A

⁽¹⁾ Operations on any runway with a PIREP or runway contaminant of nil are prohibited.

⁽²⁾ The overlapping Mu scales reflect the inherent inaccuracies of ground based Mu devices. Do not base the calculation of a landing distance solely on runway friction meter readings.

Braking actions "GOOD TO MEDIUM (4)" and "MEDIUM TO POOR (2)" are not displayed on the following pages. It is acceptable to interpolate between the provided data to calculate the desired landing performance when these conditions are present.

CROSSWIND

On slippery runways, crosswind guidelines are a function of runway surface condition, airplane loading and assume proper pilot technique. The following crosswind guidelines are applicable to all Delta aircraft for takeoff and landing.

	DRY	GOOD	MEDIUM	POOR
Crosswind Limit	Aircraft Limits	Aircraft Limits	20KTS	10KTS
Tailwind Limit	10KTS*	10KTS*	5KTS	0KTS

*Or as permitted by Delta special pages.

747-400 QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).									
	DRY (6)						GOOD (5)			
	AB 1	AB 2	AB 3	AB 4	Max AB	Max Manual	AB 3	AB 4	Max AB	Max Manual
860,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
840,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
820,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
800,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
780,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
760,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
740,000	12,900	11,500	10,100	8,800	7,200	6,400	10,100	8,900	8,100	7,900
720,000	12,600	11,200	9,900	8,600	7,100	6,200	9,900	8,700	8,000	7,800
700,000	12,200	11,000	9,700	8,400	6,900	6,000	9,700	8,400	7,800	7,600
680,000	11,900	10,700	9,500	8,200	6,700	5,900	9,500	8,200	7,600	7,400
660,000	11,600	10,400	9,200	8,000	6,600	5,700	9,200	8,000	7,400	7,200
640,000	11,300	10,100	9,000	7,800	6,400	5,600	9,000	7,800	7,200	7,000
620,000	11,000	9,900	8,800	7,600	6,300	5,400	8,800	7,600	7,000	6,800
600,000	10,600	9,600	8,500	7,400	6,100	5,200	8,500	7,400	6,800	6,700
580,000	10,300	9,300	8,300	7,200	5,900	5,100	8,300	7,200	6,700	6,500
560,000	10,000	9,000	8,100	6,900	5,800	4,900	8,100	7,000	6,500	6,300
540,000	9,700	8,800	7,800	6,700	5,600	4,800	7,800	6,800	6,300	6,100
520,000	9,300	8,500	7,600	6,500	5,500	4,700	7,600	6,600	6,100	5,900
500,000	9,000	8,200	7,400	6,300	5,300	4,500	7,400	6,400	5,900	5,700
480,000	8,700	7,900	7,200	6,100	5,100	4,400	7,200	6,200	5,700	5,500
460,000	8,400	7,700	6,900	5,900	5,000	4,300	6,900	6,000	5,600	5,400

BASIS: Zero wind • Four Engine Reverse Thrust • Touchdown Speed = V_{REF}30 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

NOTE: Flaps 30 Landing may not be possible for weights greater than 750,000 lb. due to V_{FE} limitations.

Shaded areas could correspond to Caution or Melt Zone in Brake Cooling charts. Refer to Abnormal section.

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)						GOOD (5)			
0	-600	-500	-500	-400	-300	-200	-500	-400	-300	-300
2,000	0	0	0	0	0	0	0	0	0	0
4,000	600	500	500	400	300	200	500	400	300	300
6,000	1,200	1,100	900	700	600	500	900	700	700	700
8,000	1,900	1,600	1,400	1,100	800	700	1,400	1,100	1,000	1,000

CORRECTIONS

	DRY (6)						GOOD (5)			
PER 1 KT HEADWIND	-50	-50	-50	-50	0	0	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	100	100	50	150	100	100	100
PER 5 KTS ADD'L SPD	350	350	400	350	300	200	400	350	300	250
PER 10°C ABOVE ISA	300	250	200	150	150	100	200	200	150	150
PER 10°C BELOW ISA	-250	-250	-200	-150	-150	-100	-200	-200	-150	-150
PER 1% UP SLOPE	-250	-150	-50	0	0	-50	-50	0	-100	-150
PER 1% DOWN SLOPE	250	100	50	0	0	50	50	50	150	150
2 REVERSERS INOP	600	200	100	0	0	100	100	100	300	300
4 REVERSERS INOP	900	200	100	0	0	300	100	300	700	700
MANUAL SPOILERS	0	0	0	0	0	300	0	0	0	300

Note: Do not operate when Braking Action is Nil.

747-400 QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	MEDIUM (3)				POOR(1)			
	AB 3	AB 4	Max AB	Max Manual	AB 3	AB 4	Max AB	Max Manual
860,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
840,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
820,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
800,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
780,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
760,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
740,000	11,000	10,500	10,500	10,500	13,600	13,600	13,600	13,600
720,000	10,700	10,300	10,300	10,300	13,300	13,300	13,300	13,300
700,000	10,400	10,000	10,000	10,000	12,900	12,900	12,900	12,900
680,000	10,200	9,800	9,800	9,800	12,600	12,600	12,600	12,600
660,000	9,900	9,500	9,500	9,500	12,300	12,300	12,300	12,300
640,000	9,700	9,300	9,300	9,300	11,900	11,900	11,900	11,900
620,000	9,400	9,000	9,000	9,000	11,600	11,600	11,600	11,600
600,000	9,200	8,800	8,800	8,800	11,200	11,200	11,200	11,200
580,000	8,900	8,500	8,500	8,500	10,900	10,900	10,900	10,900
560,000	8,700	8,300	8,300	8,300	10,500	10,500	10,500	10,500
540,000	8,400	8,000	8,000	8,000	10,200	10,200	10,200	10,200
520,000	8,200	7,800	7,800	7,800	9,900	9,900	9,900	9,900
500,000	7,900	7,500	7,500	7,500	9,500	9,500	9,500	9,500
480,000	7,700	7,200	7,200	7,200	9,200	9,200	9,200	9,200
460,000	7,400	7,000	7,000	7,000	8,900	8,900	8,900	8,900

BASIS: Zero wind • Four Engine Reverse Thrust • Touchdown Speed = V_{REF}30 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

NOTE: Flaps 30 Landing may not be possible for weights greater than 750,000 lb. due to V_{FE} limitations.

Shaded areas could correspond to Caution or Melt Zone in Brake Cooling charts. Refer to Abnormal section.

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)				POOR (1)			
0	-500	-500	-500	-500	-600	-600	-600	-600
2,000	0	0	0	0	0	0	0	0
4,000	500	500	500	500	600	600	600	600
6,000	1,000	1,000	1,000	1,000	1,300	1,300	1,300	1,300
8,000	1,500	1,400	1,400	1,400	1,900	1,900	1,900	1,900

CORRECTIONS	MEDIUM (3)				POOR (1)			
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	150	250	250	250	250
PER 5 KTS ADD'L SPD	400	350	350	300	400	350	350	350
PER 10°C ABOVE ISA	250	250	250	250	350	350	350	350
PER 10°C BELOW ISA	-250	-200	-200	-200	-250	-250	-250	-250
PER 1% UP SLOPE	-200	-250	-250	-300	-500	-500	-500	-550
PER 1% DOWN SLOPE	300	350	350	350	900	900	900	900
2 REVERSERS INOP	500	800	800	800	1,600	1,600	1,600	1,600
4 REVERSERS INOP	1,500	1,800	1,800	1,800	4,100	4,000	4,100	4,000
MANUAL SPOILERS	0	0	0	300	0	0	0	300

Note: Do not operate when Braking Action is Nil.

747-400 QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 25

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).									
	DRY (6)						GOOD (5)			
	AB 1	AB 2	AB 3	AB 4	Max AB	Max Manual	AB 3	AB 4	Max AB	Max Manual
860,000	16,400	14,300	12,500	10,500	8,500	8,000	12,500	10,600	9,900	9,400
840,000	16,000	14,000	12,200	10,300	8,400	7,800	12,200	10,400	9,700	9,200
820,000	15,700	13,700	12,000	10,100	8,200	7,600	12,000	10,200	9,500	9,000
800,000	15,300	13,400	11,700	9,900	8,100	7,400	11,700	10,000	9,300	8,800
780,000	14,900	13,100	11,500	9,700	7,900	7,200	11,500	9,700	9,100	8,700
760,000	14,600	12,800	11,200	9,500	7,700	7,000	11,200	9,500	8,900	8,500
740,000	14,200	12,500	11,000	9,300	7,600	6,800	11,000	9,300	8,700	8,300
720,000	13,800	12,200	10,700	9,100	7,400	6,700	10,700	9,100	8,500	8,100
700,000	13,500	11,900	10,500	8,900	7,200	6,500	10,500	8,900	8,300	7,900
680,000	13,100	11,600	10,200	8,700	7,100	6,300	10,200	8,700	8,100	7,700
660,000	12,700	11,300	10,000	8,500	6,900	6,100	10,000	8,500	7,900	7,600
640,000	12,400	11,000	9,700	8,200	6,800	5,900	9,700	8,300	7,700	7,400
620,000	12,000	10,700	9,500	8,000	6,600	5,700	9,500	8,100	7,500	7,200
600,000	11,600	10,400	9,200	7,800	6,400	5,600	9,200	7,900	7,200	7,000
580,000	11,300	10,100	9,000	7,600	6,300	5,400	9,000	7,700	7,000	6,800
560,000	10,900	9,800	8,700	7,400	6,100	5,200	8,700	7,500	6,800	6,600
540,000	10,500	9,500	8,400	7,200	6,000	5,000	8,400	7,300	6,600	6,500
520,000	10,200	9,200	8,200	7,000	5,800	4,900	8,200	7,100	6,500	6,300
500,000	9,800	8,900	7,900	6,800	5,600	4,800	7,900	6,800	6,300	6,100
480,000	9,500	8,600	7,700	6,600	5,500	4,700	7,700	6,600	6,100	5,900
460,000	9,100	8,300	7,400	6,400	5,300	4,600	7,400	6,400	5,900	5,700

BASIS: Zero wind • Four Engine Reverse Thrust • Touchdown Speed = VREF25 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded areas could correspond to Caution or Melt Zone in Brake Cooling charts. Refer to Abnormal section.

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)						GOOD (5)			
0	-700	-600	-500	-400	-300	-300	-500	-400	-400	-400
2,000	0	0	0	0	0	0	0	0	0	0
4,000	700	600	500	400	300	300	500	400	400	400
6,000	1,400	1,200	1,000	800	600	500	1,000	800	700	700
8,000	2,100	1,700	1,400	1,200	900	800	1,400	1,200	1,100	1,100

CORRECTIONS

	DRY (6)						GOOD (5)			
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	0	-50	-50	-50	-50
PER 1 KT TAILWIND	200	150	150	100	100	50	150	100	100	100
PER 5 KTS ADD'L SPD	400	400	400	400	300	200	400	400	300	250
PER 10°C ABOVE ISA	350	300	250	200	150	100	250	200	200	150
PER 10°C BELOW ISA	-300	-250	-250	-200	-150	-100	-250	-200	-150	-150
PER 1% UP SLOPE	-300	-150	-50	0	0	-50	-50	0	-100	-150
PER 1% DOWN SLOPE	250	50	0	0	0	50	0	50	150	150
2 REVERSERS INOP	700	100	100	0	0	200	100	100	400	400
4 REVERSERS INOP	900	200	100	0	0	300	100	300	800	800
MANUAL SPOILERS	0	0	0	0	0	300	0	0	0	300

Note: Do not operate when Braking Action is Nil.

747-400 QUICK REFERENCE CHART

OPERATIONAL LANDING DISTANCES FEET

FLAPS 25

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	MEDIUM (3)				POOR(1)			
	AB 3	AB 4	Max AB	Max Manual	AB 3	AB 4	Max AB	Max Manual
860,000	13,500	13,000	13,000	13,000	16,900	16,900	16,900	16,900
840,000	13,200	12,700	12,700	12,700	16,500	16,500	16,500	16,500
820,000	12,900	12,400	12,400	12,400	16,100	16,100	16,100	16,100
800,000	12,600	12,100	12,100	12,100	15,700	15,700	15,700	15,700
780,000	12,400	11,900	11,900	11,900	15,400	15,400	15,400	15,400
760,000	12,100	11,600	11,600	11,600	15,000	15,000	15,000	15,000
740,000	11,800	11,300	11,300	11,300	14,600	14,600	14,600	14,600
720,000	11,500	11,000	11,000	11,000	14,300	14,300	14,300	14,300
700,000	11,300	10,800	10,800	10,800	13,900	13,900	13,900	13,900
680,000	11,000	10,500	10,500	10,500	13,500	13,500	13,500	13,500
660,000	10,700	10,200	10,200	10,200	13,200	13,200	13,200	13,200
640,000	10,400	9,900	9,900	9,900	12,800	12,800	12,800	12,800
620,000	10,200	9,700	9,700	9,700	12,400	12,400	12,400	12,400
600,000	9,900	9,400	9,400	9,400	12,100	12,100	12,100	12,100
580,000	9,600	9,100	9,100	9,100	11,700	11,700	11,700	11,700
560,000	9,300	8,800	8,800	8,800	11,300	11,300	11,300	11,300
540,000	9,100	8,600	8,600	8,600	11,000	11,000	11,000	11,000
520,000	8,800	8,300	8,300	8,300	10,600	10,600	10,600	10,600
500,000	8,500	8,000	8,000	8,000	10,200	10,200	10,200	10,200
480,000	8,200	7,700	7,700	7,700	9,900	9,900	9,900	9,900
460,000	8,000	7,500	7,500	7,500	9,500	9,500	9,500	9,500

BASIS: Zero wind • Four Engine Reverse Thrust • Touchdown Speed = VREF25 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded areas could correspond to Caution or Melt Zone in Brake Cooling charts. Refer to Abnormal section.

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)				POOR (1)			
0	-600	-500	-500	-500	-700	-700	-700	-700
2,000	0	0	0	0	0	0	0	0
4,000	600	500	500	500	700	700	700	700
6,000	1,100	1,100	1,100	1,100	1,400	1,400	1,400	1,400
8,000	1,700	1,600	1,600	1,600	2,100	2,100	2,100	2,100

CORRECTIONS

	MEDIUM (3)				POOR (1)			
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	150	250	250	250	250
PER 5 KTS ADD'L SPD	400	350	350	350	400	350	350	350
PER 10°C ABOVE ISA	250	250	250	250	350	350	350	350
PER 10°C BELOW ISA	-250	-200	-200	-200	-300	-300	-300	-300
PER 1% UP SLOPE	-200	-250	-250	-300	-500	-550	-550	-600
PER 1% DOWN SLOPE	250	350	350	400	950	950	1,000	950
2 REVERSERS INOP	600	900	900	900	1,900	1,900	1,900	1,900
4 REVERSERS INOP	1,900	2,200	2,200	2,200	5,200	5,100	5,100	5,100
MANUAL SPOILERS	0	0	0	300	0	0	0	300

Note: Do not operate when Braking Action is Nil.

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DEFINITIONS AND ASSUMPTIONS

ISA International Standard Atmosphere temperature, in °C, for a given pressure altitude. ISA temperature for Sea Level is 15°C (59°F).

ISA DEVIATION The difference between the standard ISA temperature and the ambient temperature in °C.

STATIC AIR TEMPERATURE (SAT) The ambient still air temperature outside of the aircraft. Sometimes known as the Outside Air Temperature (OAT).

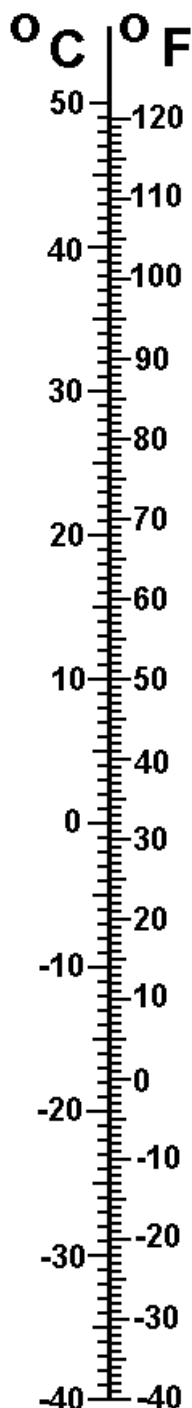
TOTAL AIR TEMPERATURE (TAT) The total of the ambient air temperature (SAT) plus the increase in temperature due to compression heating.

VMO/MMO Maximum allowable operating indicated airspeed or Mach number.

VB Buffet boundary speed.

TEMPERATURE CONVERSION AND STATIC AIR TEMPERATURE

°C



ALTITUDE - FEET	ISA DEVIATION					
	ISA-20°C	ISA-10°C	ISA	ISA+10°C	ISA+20°C	ISA+30°C
36,000 & Higher	-76.5	-66.5	-56.5	-46.5	-36.5	-26.5
35,000	-74.2	-64.2	-54.2	-44.2	-34.2	-24.2
34,000	-72.3	-62.3	-52.3	-42.3	-32.3	-22.3
33,000	-70.3	-60.3	-50.3	-40.3	-30.3	-20.3
32,000	-68.3	-58.3	-48.3	-38.3	-28.3	-18.3
31,000	-66.3	-56.3	-46.3	-36.3	-26.3	-16.3
30,000	-64.3	-54.3	-44.3	-34.3	-24.3	-14.3
29,000	-62.4	-52.4	-42.4	-32.4	-22.4	-12.4
28,000	-60.4	-50.4	-40.4	-30.4	-20.4	-10.4
27,000	-58.4	-48.4	-38.4	-28.4	-18.4	-8.4
26,000	-56.5	-46.5	-36.5	-26.5	-16.5	-6.5
25,000	-54.5	-44.5	-34.5	-24.5	-14.5	-4.5
24,000	-52.5	-42.5	-32.5	-22.5	-12.5	-2.5
23,000	-50.5	-40.5	-30.5	-20.5	-10.5	-0.5
22,000	-48.5	-38.5	-28.5	-18.5	-8.5	+1.5
21,000	-46.6	-36.6	-26.6	-16.6	-6.6	+3.4
20,000	-44.6	-34.6	-24.6	-14.6	-4.6	+5.4
19,000	-42.6	-32.6	-22.6	-12.6	-2.6	+7.4
18,000	-40.6	-30.6	-20.6	-10.6	-0.6	+9.4
17,000	-38.7	-28.7	-18.7	-8.7	+1.3	+11.3
16,000	-36.7	-26.7	-16.7	-6.7	+3.3	+13.3
15,000	-34.7	-24.7	-14.7	-4.7	+5.3	+15.3
14,000	-32.7	-22.7	-12.7	-2.7	+7.3	+17.3
13,000	-30.7	-20.7	-10.7	-0.7	+9.3	+19.3
12,000	-28.8	-18.8	-8.8	+1.2	+11.2	+21.2
11,000	-26.8	-16.8	-6.8	+3.2	+13.2	+23.2
10,000	-24.8	-14.8	-4.8	+5.2	+15.2	+25.2
5000	-14.9	-4.9	+5.1	+15.1	+25.1	+35.1
0	-5.0	+5.0	+15.0	+25.0	+35.0	+45.0

RULE OF THUMB: For standard temperature (ISA) at or below 36,000 feet:

Double altitude (in thousands of feet), subtract 15, change sign.

EXAMPLES:	<u>ALT</u>	<u>DOUBLE ALT</u>	<u>SUBTRACT 15</u>	<u>CHANGE SIGN</u>
	0	0	-15	+15
	<u>ALT</u>	<u>DOUBLE ALT</u>	<u>SUBTRACT 15</u>	<u>CHANGE SIGN</u>
	33	66	51	-51

TOTAL AIR TEMPERATURE vs STATIC AIR TEMPERATURE**°C**

TAT °C	INDICATED MACH NUMBER													
	.40	.50	.60	.70	.74	.75	.76	.77	.78	.80	.82	.84	.86	.88
75	64	58	52	44	41	40	39	38	37	35	34	32	30	28
70	59	54	47	39	36	35	34	33	33	31	29	28	26	24
65	55	49	42	35	32	31	30	29	28	27	25	23	21	20
60	50	44	38	30	27	26	25	24	24	22	21	19	17	15
55	45	39	33	26	23	22	21	20	19	18	16	14	13	11
50	40	35	28	21	18	17	16	15	14	13	12	10	8	7
45	35	30	24	17	14	13	12	11	10	9	7	6	4	2
40	30	25	19	12	9	8	7	6	6	4	3	1	0	-2
35	25	20	14	7	5	4	3	2	1	0	-1	-3	-5	-6
30	21	16	10	3	0	-1	-2	-3	-3	-4	-6	-7	-9	-11
25	16	11	5	-2	-4	-5	-6	-7	-7	-9	-10	-12	-13	-15
20	11	6	0	-6	-9	-10	-11	-12	-12	-13	-15	-16	-18	-19
15	6	1	-4	-11	-13	-14	-15	-16	-16	-18	-19	-21	-22	-24
10	1	-3	-9	-15	-18	-19	-20	-21	-21	-22	-23	-25	-27	-28
5	-4	-8	-14	-20	-22	-23	-24	-25	-25	-27	-28	-29	-31	-32
0	-8	-13	-18	-24	-27	-28	-29	-30	-30	-31	-32	-34	-35	-37
-5	-13	-18	-23	-29	-31	-32	-33	-34	-34	-35	-37	-38	-40	-41
-10	-18	-23	-28	-33	-36	-37	-38	-39	-39	-40	-41	-43	-44	-45
-15	-23	-27	-32	-38	-40	-41	-42	-43	-43	-44	-46	-47	-48	-50
-20	-28	-32	-37	-43	-45	-46	-47	-48	-48	-49	-50	-51	-53	-54
-25	-33	-37	-42	-47	-49	-50	-51	-52	-52	-53	-54	-56	-57	-58
-30	-38	-42	-46	-52	-54	-54	-55	-55	-56	-58	-59	-60	-61	-63
-35	-42	-46	-51	-56	-58	-59	-60	-61	-61	-62	-63	-64	-66	-67
-40	-47	-51	-56	-61	-63	-63	-64	-64	-65	-66	-68	-69	-70	-71
-45	-52	-56	-60	-65	-67	-68	-69	-70	-70	-71	-72	-73	-74	-76
-50	-57	-61	-65	-70	-72	-72	-73	-73	-74	-75	-76	-78	-79	-80
-55	-62	-65	-70	-74	-76	-77	-78	-79	-79	-80	-81	-82	-83	-84

NORMAL OPERATING SPEED LIMIT

Vmo / Mmo

PRESSURE ALTITUDE	INDICATED Vmo (KIAS)	MACH Mmo
0	365	0.552
5,000	365	0.601
10,000	365	0.655
15,000	365	0.716
17,000	365	0.742
19,000	365	0.769
21,000	365	0.798
23,000	365	0.828
25,000	365	0.859
27,000	365	0.891
29,000	363	0.920
31,000	348	0.920
33,000	333	0.920
35,000	319	0.920
37,000	304	0.920
39,000	291	0.920
41,000	278	0.920
43,000	265	0.920
45,000	253	0.920

EN ROUTE FUEL TEMPERATURE

FOR DETERMINING DISPATCH CAPABILITY BASED ON FUEL FREEZE POINT.

USE ONLY WHEN FUEL PREDICTION IS NOT AVAILABLE

FUEL TYPE		ISA	JET A	JP-5	JET A1	Jet B	TS-1
ADJUSTED FUEL FREEZE TEMP.			-37°C	-43°C	-44°C	-47°C	-57°C
MACH	FLT LEVEL		MAXIMUM ISA DEVIATION - °C				
0.82	330	-50.4	-15	-20	-21	-23	-32
	350	-54.3	-11	-16	-17	-19	-28
	360 & HIGHER	-56.5	-8	-14	-15	-17	-26
0.83	330	-50.4	-15	-20	-21	-24	-33
	350	-54.3	-11	-17	-17	-20	-29
	360 & HIGHER	-56.5	-9	-14	-15	-18	-27
0.84	330	-50.4	-16	-21	-22	-25	-33
	350	-54.3	-12	-17	-18	-21	-29
	360 & HIGHER	-56.5	-10	-15	-16	-18	-27
0.85	330	-50.4	-16	-22	-23	-25	-34
	350	-54.3	-12	-18	-19	-21	-30
	360 & HIGHER	-56.5	-10	-16	-16	-19	-28
0.86	330	-50.4	-17	-22	-23	-26	-34
	350	-54.3	-13	-18	-19	-22	-31
	360 & HIGHER	-56.5	-11	-16	-17	-20	-28
0.87	330	-50.4	-18	-23	-24	-26	-35
	350	-54.3	-14	-19	-20	-22	-31
	360 & HIGHER	-56.5	-12	-17	-18	-20	-29

INSTRUCTIONS:

1. Locate type of fuel being used.

NOTE: THE ADJUSTED FUEL FREEZING TEMPERATURE IS THE BASIC FUEL FREEZING TEMPERATURE + 3°C (PER THE APPROVED AIRCRAFT FLIGHT MANUAL).

2. Move down to the Mach number and Altitude expected en route and read the Maximum ISA Deviation.
3. Do not dispatch aircraft into en route temperatures colder than the Maximum ISA Deviation obtained in Step 2 above.

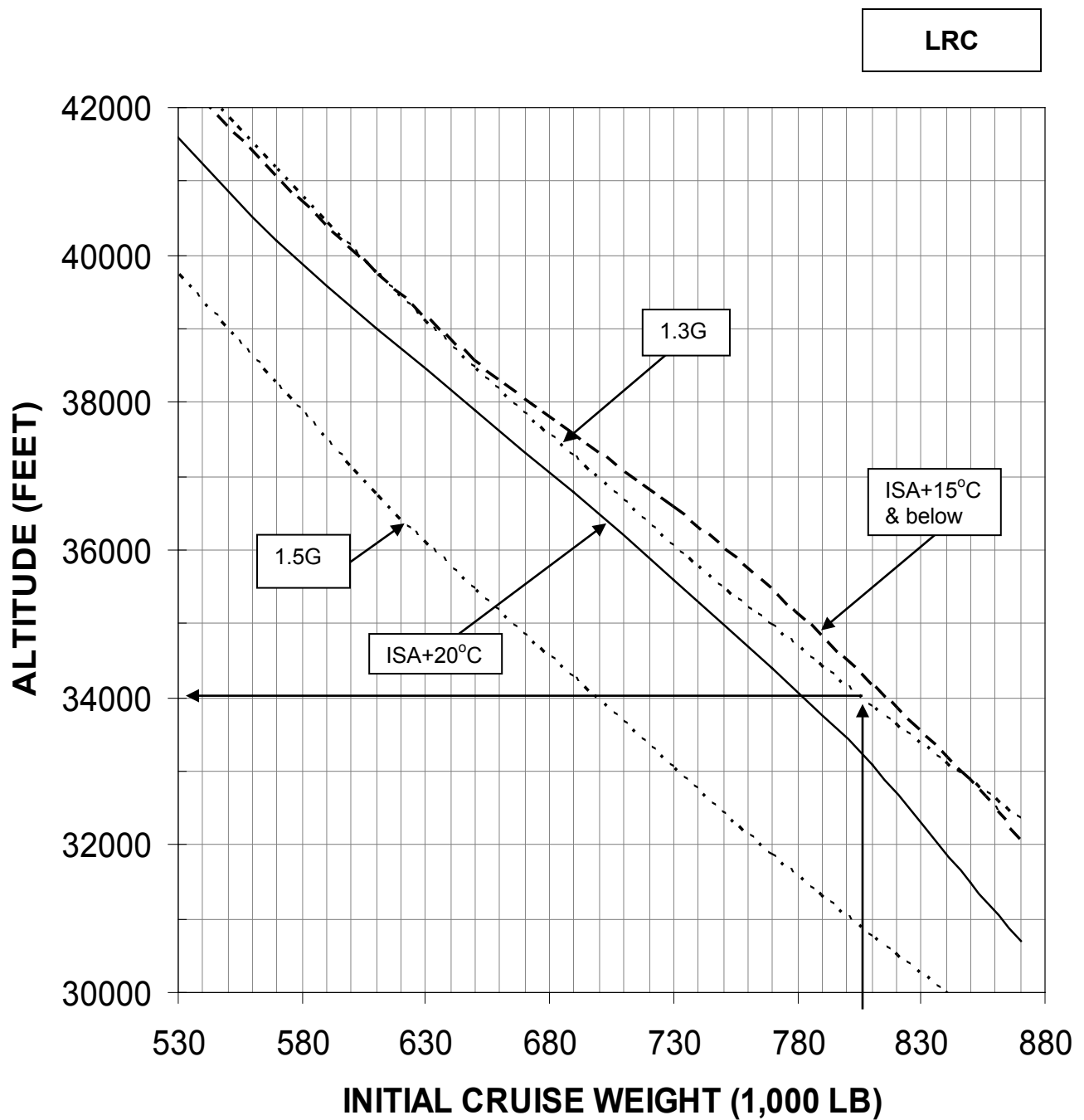
EXAMPLE:

Fuel Type = Jet A (adjusted freeze point -37°C).

Expected Flight Level = 360.

Expected Mach Number = 0.86.

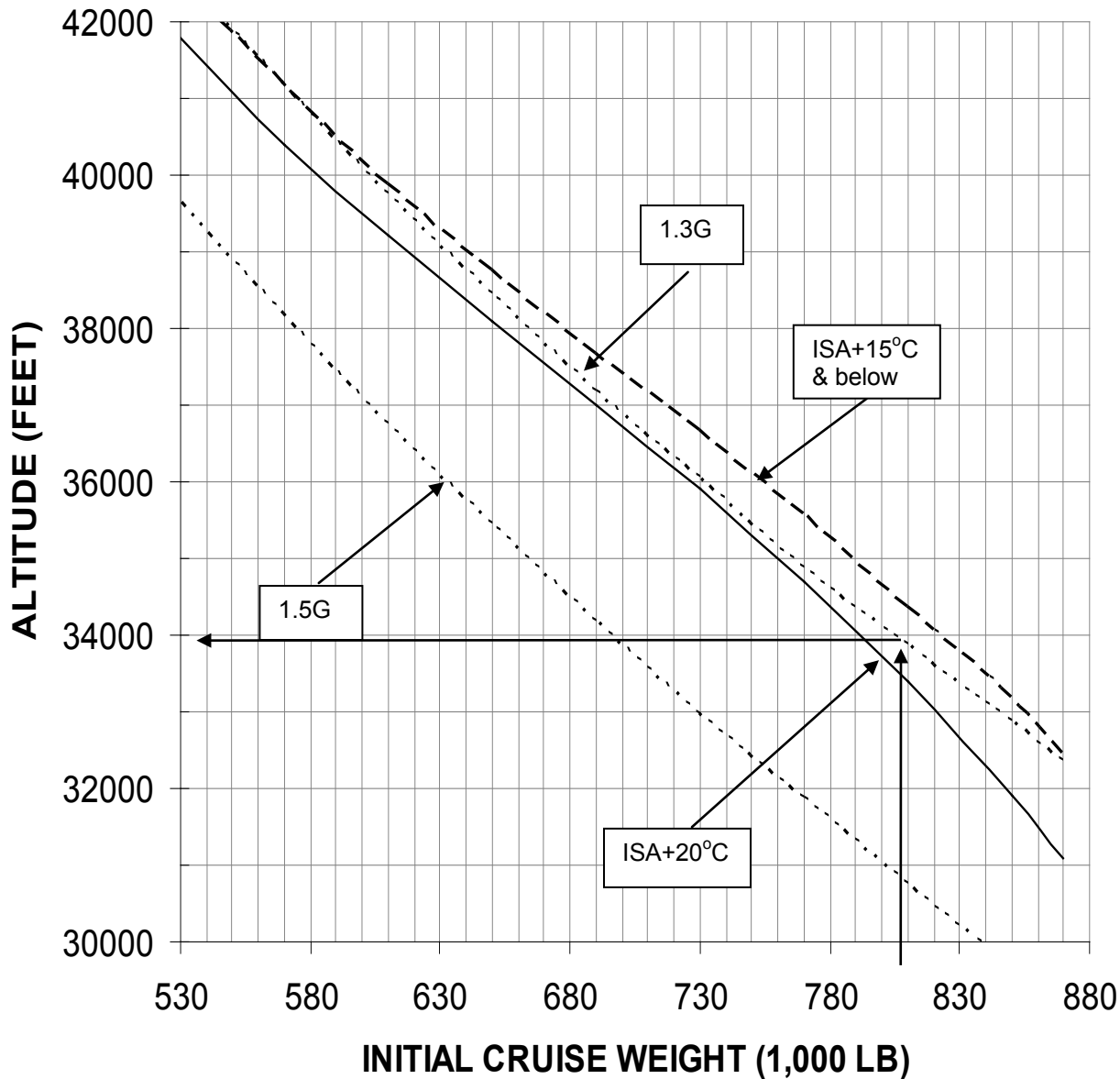
1. Enter the top of the Chart under JET A (Adjusted Fuel Freezing Temperature = -37°C).
2. Move down the chart to the flight conditions of Mach 0.86 and FL 360 and read the Maximum ISA Deviation (-11°C).
3. Do not dispatch aircraft into temperatures colder than ISA -11°C at FL 360.

MAXIMUM RECOMMENDED INITIAL CRUISE ALTITUDE

Example: - Initial cruise weight = 800,000 lbs
- Climb to the 1.3g buffet limit altitude
- Maximum recommended initial cruise altitude = FL340

MAXIMUM RECOMMENDED INITIAL CRUISE ALTITUDE

.85 MACH



Example: - Initial cruise weight = 800,000 lbs
 - Climb to the 1.3g buffet limit altitude
 - Maximum recommended initial cruise altitude = FL340

BUFFET ONSET BOUNDARY SPEEDS

KIAS

FLIGHT LEVEL	CRUISE WEIGHT LBS	V _B M KIAS	G / BANK ANGLE - DEGREES					
			1.0 / 0°		1.15 / 30°		1.5 / 48°	
			LOW	HIGH	LOW	HIGH	LOW	HIGH
410	850,000	.85 253						
	800,000							
	750,000							
	700,000		243	268+				
	650,000		230	273+				
	600,000		219	278+	240	269+		
390	850,000	.85 266						
	800,000							
	750,000		253	283+				
	700,000		237	288+				
	650,000		227	290+	248	283+		
	600,000		217	290+	236	290+		
370	850,000	.85 278	267	294+				
	800,000		255	300+				
	750,000		245	303+	271	290+		
	700,000		235	303+	257	298+		
	650,000		225	303+	244	303+		
	600,000		216	303+	234	303+		
350	850,000	.85 291	261	317+				
	800,000		252	318+	276	309+		
	750,000		242	318+	263	314+		
	700,000		233	318+	253	318+		
	650,000		224	318+	242	318+		
	600,000		214	318+	232	318+	271	312+
330	850,000	.85 304	258	332+	282	327+		
	800,000		249	332+	271	331+		
	750,000		241	332+	261	333+		
	700,000		232	332+	251	333+	298	318+
	650,000		223	332+	241	333+	281	327+
	600,000		213	332+	231	333+	267	333+
310	850,000	.85 318	256	347+	278	347+		
	800,000		248	347+	268	347+		
	750,000		239	347+	259	347+	304	337+
	700,000		231	347+	249	347+	289	344+
	650,000		222	347+	239	347+	277	347+
	600,000		212	347+	229	347+	275	347+
290	850,000	.85 332	254	362+	362	362+	329	343+
	800,000		247	362+	362	362+	311	353+
	750,000		238	362+	362	362+	297	360+
	700,000		229	362+	362	362+	287	362+
	650,000		220	362+	362	362+	275	362+
	600,000		211	362+	362	362+	263	362+

NOTE: Buffet Speeds shown with a **following + sign** are higher than the aircraft V_{mo}/M_{mo}.
The displayed speed is V_{mo}/M_{mo}.

 Aircraft is above buffet onset ceiling at this weight and altitude.

End of Section

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DEFINITIONS AND ASSUMPTIONS

- V₁ - Takeoff Decision Speed** The speed that determines the go or no-go decision in the event of an engine failure. No time is allowed after V₁ for reaction or decision. Action must be initiated at or before V₁. The Federal Aviation Regulations define V₁ as “the speed at which an engine failure has been recognized and action initiated to either continue or stop the takeoff”.
- V_R - Rotation Speed** The speed at which the pilot begins rotation of the aircraft to the takeoff pitch attitude. V_R is selected so that, with normal rate of rotation, the aircraft will lift off and attain a height of 35 feet at a speed of V₂.
- V₂ - Takeoff Safety Speed** The speed used to achieve the required gradient during the second climb segment (landing gear retracted and flaps in the takeoff position).

NOTE: The following takeoff speeds may only be used with a manual weight data record based on ARM takeoff performance weight limits. These speeds may not be used with takeoff performance weight limits from AWABS. Optimum V₁ speeds are calculated in AWABS versus Balanced or fixed V₁ speeds which are to be used for a manual WDR.

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TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO / 10

V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
880,000	10,000	161 / 187 / 194					
	8,000	161 / 187 / 194					
	6,000	166 / 181 / 189	165 / 184 / 192				
	4,000	164 / 180 / 189	163 / 180 / 189	163 / 180 / 189	166 / 183 / 191		
	2,000	162 / 178 / 188	161 / 178 / 188	161 / 178 / 188	161 / 179 / 188	165 / 180 / 188	167 / 186 / 191
	0	160 / 177 / 188	160 / 177 / 188	160 / 177 / 188	160 / 177 / 188	162 / 178 / 188	169 / 183 / 189
870,000	10,000	163 / 186 / 192					
	8,000	163 / 186 / 192					
	6,000	165 / 181 / 189	166 / 183 / 191				
	4,000	163 / 179 / 188	163 / 179 / 188	163 / 179 / 188	165 / 182 / 190		
	2,000	162 / 178 / 187	160 / 178 / 187	160 / 177 / 187	160 / 178 / 187	164 / 180 / 188	168 / 185 / 190
	0	159 / 176 / 187	159 / 176 / 187	159 / 176 / 187	159 / 176 / 187	161 / 177 / 187	168 / 182 / 188
860,000	10,000	164 / 184 / 191					
	8,000	164 / 184 / 191					
	6,000	165 / 181 / 189	166 / 181 / 190				
	4,000	162 / 179 / 188	162 / 179 / 188	162 / 179 / 188	164 / 180 / 189	166 / 183 / 189	
	2,000	161 / 177 / 187	160 / 177 / 187	160 / 177 / 187	160 / 177 / 187	164 / 179 / 187	170 / 183 / 189
	0	159 / 175 / 187	159 / 175 / 187	159 / 175 / 187	158 / 175 / 187	161 / 177 / 187	167 / 180 / 187
840,000	10,000	166 / 181 / 189					
	8,000	166 / 181 / 189					
	6,000	163 / 179 / 187	164 / 179 / 187	164 / 179 / 188			
	4,000	161 / 177 / 187	161 / 177 / 187	161 / 177 / 187	161 / 178 / 187	166 / 180 / 187	
	2,000	160 / 175 / 186	158 / 175 / 186	158 / 175 / 186	158 / 175 / 186	162 / 177 / 186	168 / 180 / 186
	0	157 / 174 / 185	157 / 174 / 185	157 / 174 / 185	157 / 174 / 185	159 / 175 / 185	164 / 178 / 185
820,000	10,000	163 / 178 / 186					
	8,000	163 / 178 / 186					
	6,000	161 / 176 / 185	161 / 176 / 185	161 / 176 / 185	164 / 178 / 185		
	4,000	159 / 174 / 184	159 / 174 / 184	159 / 174 / 184	159 / 175 / 184	163 / 177 / 184	
	2,000	158 / 173 / 184	156 / 173 / 184	156 / 173 / 184	156 / 173 / 184	160 / 175 / 184	165 / 178 / 184
	0	155 / 171 / 183	155 / 171 / 183	155 / 171 / 183	155 / 171 / 183	157 / 172 / 183	162 / 175 / 183
800,000	10,000	160 / 175 / 184	160 / 175 / 184				
	8,000	160 / 175 / 184	160 / 175 / 184				
	6,000	159 / 173 / 183	159 / 173 / 183	159 / 173 / 183	162 / 175 / 183		
	4,000	156 / 172 / 182	156 / 172 / 182	156 / 172 / 182	157 / 172 / 182	161 / 174 / 182	
	2,000	155 / 170 / 182	154 / 170 / 182	154 / 170 / 182	154 / 170 / 182	158 / 172 / 182	163 / 175 / 182
	0	153 / 168 / 181	153 / 168 / 181	153 / 168 / 181	153 / 168 / 181	155 / 170 / 181	160 / 172 / 181

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY
KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO / 10
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
780,000	10,000	158 / 172 / 181	158 / 172 / 181	160 / 173 / 181			
	8,000	158 / 172 / 181	158 / 172 / 181	160 / 173 / 181			
	6,000	156 / 170 / 180	156 / 170 / 180	156 / 170 / 180	159 / 172 / 180		
	4,000	154 / 169 / 180	154 / 169 / 180	154 / 169 / 180	154 / 169 / 180	159 / 172 / 180	
	2,000	153 / 167 / 179	151 / 167 / 179	151 / 167 / 179	151 / 167 / 179	156 / 169 / 179	160 / 172 / 179
	0	151 / 165 / 179	150 / 165 / 179	150 / 165 / 179	150 / 165 / 179	153 / 167 / 179	157 / 170 / 179
760,000	10,000	155 / 169 / 179	155 / 169 / 179	157 / 170 / 179	160 / 171 / 179		
	8,000	155 / 169 / 179	155 / 169 / 179	157 / 170 / 179	160 / 171 / 179		
	6,000	154 / 167 / 178	154 / 167 / 178	154 / 167 / 178	156 / 169 / 178	159 / 171 / 178	
	4,000	152 / 166 / 177	151 / 166 / 177	151 / 166 / 177	152 / 167 / 177	156 / 169 / 177	
	2,000	150 / 164 / 177	149 / 164 / 177	149 / 164 / 177	149 / 164 / 177	153 / 166 / 177	158 / 169 / 177
	0	148 / 162 / 176	148 / 162 / 176	148 / 162 / 176	148 / 162 / 176	150 / 164 / 176	155 / 167 / 176
740,000	10,000	153 / 166 / 176	152 / 166 / 176	154 / 167 / 176	157 / 168 / 176		
	8,000	153 / 166 / 176	152 / 166 / 176	154 / 167 / 176	157 / 168 / 176		
	6,000	151 / 164 / 175	151 / 164 / 175	151 / 164 / 175	154 / 166 / 175	156 / 168 / 175	
	4,000	149 / 163 / 175	149 / 163 / 175	149 / 163 / 175	149 / 163 / 175	153 / 166 / 175	
	2,000	148 / 161 / 174	146 / 161 / 174	146 / 161 / 174	146 / 161 / 174	151 / 163 / 174	155 / 166 / 174
	0	145 / 159 / 174	145 / 159 / 174	145 / 159 / 174	145 / 159 / 174	148 / 161 / 174	152 / 164 / 174
720,000	10,000	150 / 163 / 174	150 / 163 / 174	152 / 164 / 174	154 / 165 / 174		
	8,000	150 / 163 / 174	150 / 163 / 174	152 / 164 / 174	154 / 165 / 174		
	6,000	149 / 161 / 173	149 / 161 / 173	149 / 161 / 173	151 / 163 / 173	154 / 165 / 173	
	4,000	146 / 160 / 172	146 / 160 / 172	146 / 160 / 172	147 / 160 / 172	151 / 163 / 172	
	2,000	145 / 158 / 172	144 / 158 / 172	144 / 158 / 172	144 / 158 / 172	148 / 160 / 172	152 / 163 / 172
	0	142 / 156 / 171	142 / 156 / 171	142 / 156 / 171	142 / 156 / 171	145 / 158 / 171	150 / 161 / 171
700,000	10,000	147 / 160 / 171	147 / 160 / 171	149 / 161 / 171	151 / 162 / 171		
	8,000	147 / 160 / 171	147 / 160 / 171	149 / 161 / 171	151 / 162 / 171		
	6,000	146 / 158 / 170	146 / 158 / 170	146 / 158 / 170	148 / 160 / 170	151 / 162 / 170	
	4,000	144 / 156 / 170	144 / 156 / 170	144 / 156 / 170	144 / 157 / 170	148 / 159 / 170	
	2,000	142 / 155 / 169	141 / 155 / 169	141 / 155 / 169	141 / 155 / 169	145 / 157 / 169	150 / 160 / 169
	0	140 / 153 / 169	140 / 153 / 169	140 / 153 / 169	140 / 153 / 169	142 / 155 / 169	147 / 158 / 169
680,000	10,000	145 / 157 / 168	144 / 157 / 168	146 / 157 / 168	148 / 159 / 168		
	8,000	145 / 157 / 168	144 / 157 / 168	146 / 157 / 168	148 / 159 / 168		
	6,000	143 / 155 / 168	143 / 155 / 168	143 / 155 / 168	145 / 157 / 168	148 / 159 / 168	
	4,000	141 / 153 / 167	141 / 153 / 167	141 / 153 / 167	141 / 154 / 167	145 / 156 / 167	
	2,000	139 / 151 / 167	138 / 151 / 167	138 / 152 / 167	138 / 152 / 167	143 / 154 / 167	147 / 157 / 167
	0	137 / 150 / 166	137 / 150 / 166	137 / 150 / 166	137 / 150 / 166	140 / 152 / 166	144 / 155 / 166

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO / 10

$V_1 / V_R / V_2$

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
660,000	10,000	142 / 153 / 166	142 / 153 / 166	143 / 154 / 166	146 / 156 / 166		
	8,000	142 / 153 / 166	142 / 153 / 166	143 / 154 / 166	146 / 156 / 166		
	6,000	140 / 152 / 165	140 / 152 / 165	140 / 152 / 165	143 / 153 / 165	145 / 155 / 165	
	4,000	138 / 150 / 164	138 / 150 / 164	138 / 150 / 164	139 / 151 / 164	143 / 153 / 164	
	2,000	136 / 148 / 164	135 / 148 / 164	135 / 148 / 164	135 / 148 / 164	140 / 151 / 164	144 / 154 / 164
	0	134 / 147 / 163	134 / 147 / 163	134 / 147 / 163	134 / 147 / 163	137 / 148 / 163	141 / 151 / 163
640,000	10,000	139 / 150 / 163	139 / 150 / 163	140 / 151 / 163	143 / 152 / 163		
	8,000	139 / 150 / 163	139 / 150 / 163	140 / 151 / 163	143 / 152 / 163		
	6,000	137 / 148 / 131	137 / 148 / 131	137 / 148 / 131	140 / 150 / 134	142 / 152 / 136	
	4,000	135 / 147 / 162	135 / 147 / 162	135 / 147 / 162	136 / 148 / 162	140 / 150 / 162	
	2,000	133 / 145 / 161	132 / 145 / 161	132 / 145 / 161	132 / 145 / 161	137 / 148 / 161	141 / 150 / 161
	0	130 / 143 / 161	130 / 143 / 161	131 / 143 / 161	131 / 143 / 161	134 / 145 / 161	138 / 148 / 161
620,000	10,000	136 / 147 / 160	136 / 147 / 160	137 / 147 / 160	140 / 149 / 160		
	8,000	136 / 147 / 160	136 / 147 / 160	137 / 147 / 160	140 / 149 / 160		
	6,000	134 / 145 / 160	134 / 145 / 160	134 / 145 / 160	137 / 147 / 160	140 / 149 / 160	
	4,000	132 / 143 / 159	132 / 143 / 159	132 / 143 / 159	133 / 144 / 159	137 / 147 / 159	
	2,000	130 / 142 / 159	129 / 142 / 159	129 / 142 / 159	129 / 142 / 159	134 / 144 / 159	138 / 147 / 159
	0	127 / 140 / 158	127 / 140 / 158	127 / 140 / 158	127 / 140 / 158	130 / 142 / 158	135 / 145 / 158
600,000	10,000	133 / 143 / 157	133 / 143 / 157	134 / 144 / 157	137 / 146 / 157		
	8,000	133 / 143 / 157	133 / 143 / 157	134 / 144 / 157	137 / 146 / 157		
	6,000	131 / 142 / 157	131 / 142 / 157	131 / 142 / 157	134 / 143 / 157	136 / 145 / 157	
	4,000	129 / 140 / 156	129 / 140 / 156	129 / 140 / 156	130 / 141 / 156	133 / 143 / 156	
	2,000	127 / 138 / 156	126 / 138 / 156	126 / 138 / 156	126 / 138 / 156	130 / 141 / 156	135 / 144 / 156
	0	124 / 137 / 156	124 / 137 / 156	124 / 137 / 156	124 / 137 / 156	127 / 138 / 155	132 / 142 / 155
580,000	10,000	129 / 139 / 154	129 / 139 / 154	131 / 140 / 154	133 / 142 / 154		
	8,000	129 / 139 / 154	129 / 139 / 154	131 / 140 / 154	133 / 142 / 154		
	6,000	127 / 138 / 154	127 / 138 / 154	127 / 138 / 154	130 / 139 / 154	133 / 142 / 154	
	4,000	125 / 136 / 153	125 / 136 / 153	125 / 136 / 153	126 / 137 / 153	130 / 139 / 153	
	2,000	123 / 135 / 153	122 / 135 / 153	122 / 135 / 153	123 / 135 / 153	127 / 137 / 153	131 / 140 / 153
	0	*121 / 134 / 154	*121 / 134 / 154	*121 / 134 / 154	*121 / 134 / 154	124 / 135 / 153	128 / 138 / 153
560,000	10,000	125 / 135 / 151	125 / 135 / 151	127 / 136 / 151	129 / 138 / 151		
	8,000	125 / 135 / 151	125 / 135 / 151	127 / 136 / 151	129 / 138 / 151		
	6,000	123 / 134 / 150	124 / 134 / 150	124 / 134 / 150	126 / 135 / 150	129 / 138 / 150	
	4,000	121 / 133 / 151	122 / 133 / 151	122 / 133 / 151	123 / 133 / 151	126 / 136 / 150	
	2,000	120 / 131 / 151	119 / 131 / 151	119 / 131 / 151	120 / 132 / 151	123 / 134 / 150	128 / 137 / 150
	0	*121 / 130 / 151	*121 / 130 / 151	*121 / 130 / 151	*121 / 130 / 151	121 / 132 / 151	125 / 135 / 150

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

Speeds marked with an asterisk (*) are limited by Vmcg.

TAKEOFF SPEEDS

DRY RUNWAY
KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO / 10
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
540,000	10,000	122 / 132 / 148	122 / 132 / 148	123 / 133 / 148	126 / 134 / 148		
	8,000	122 / 132 / 148	122 / 132 / 148	123 / 133 / 148	126 / 134 / 148		
	6,000	120 / 130 / 148	120 / 130 / 148	120 / 131 / 148	123 / 132 / 148	126 / 134 / 148	
	4,000	118 / 129 / 148	118 / 129 / 148	118 / 129 / 148	119 / 130 / 148	123 / 132 / 148	
	2,000	*118 / 128 / 148	*118 / 128 / 148	*118 / 128 / 148	*118 / 128 / 148	120 / 131 / 148	124 / 133 / 148
	0	*121 / 127 / 149	*121 / 127 / 149	*121 / 127 / 149	*121 / 127 / 149	118 / 129 / 148	122 / 131 / 148
520,000	10,000	118 / 128 / 145	118 / 128 / 145	120 / 129 / 145	122 / 131 / 145		
	8,000	118 / 128 / 145	118 / 128 / 145	120 / 129 / 145	122 / 131 / 145		
	6,000	117 / 127 / 145	117 / 127 / 145	117 / 127 / 145	119 / 129 / 145	122 / 131 / 145	
	4,000	116 / 126 / 146	116 / 126 / 146	*115 / 126 / 146	116 / 127 / 145	119 / 129 / 145	
	2,000	*118 / 125 / 146	*118 / 125 / 146	*118 / 125 / 146	*118 / 125 / 146	117 / 127 / 145	121 / 130 / 145
	0	*121 / 124 / 147	*121 / 124 / 147	*121 / 124 / 146	*121 / 124 / 146	*117 / 125 / 146	118 / 128 / 145
500,000	10,000	115 / 125 / 143	115 / 125 / 143	116 / 126 / 142	119 / 127 / 142		
	8,000	115 / 125 / 143	115 / 125 / 143	116 / 126 / 142	119 / 127 / 142		
	6,000	*113 / 124 / 143	114 / 124 / 143	114 / 124 / 143	116 / 125 / 142	119 / 127 / 142	
	4,000	*115 / 123 / 143	*115 / 123 / 143	*115 / 123 / 143	*114 / 124 / 143	116 / 126 / 142	
	2,000	*118 / 122 / 144	*118 / 122 / 144	*118 / 122 / 144	*118 / 122 / 144	*113 / 124 / 143	117 / 126 / 142
	0	*121 / 124 / 147	*121 / 124 / 147	*121 / 124 / 147	*121 / 124 / 147	*117 / 122 / 143	115 / 125 / 143
480,000	10,000	112 / 122 / 140	112 / 122 / 140	113 / 122 / 140	115 / 123 / 139		
	8,000	112 / 122 / 140	112 / 122 / 140	113 / 122 / 140	115 / 123 / 139		
	6,000	*113 / 120 / 140	*113 / 120 / 140	*113 / 120 / 140	112 / 122 / 140	115 / 124 / 139	
	4,000	*115 / 119 / 141	*115 / 119 / 141	*115 / 119 / 141	*114 / 120 / 140	113 / 122 / 140	
	2,000	*118 / 121 / 143	*118 / 121 / 143	*118 / 121 / 143	*118 / 121 / 142	*113 / 120 / 140	114 / 123 / 140
	0	*121 / 124 / 146	*121 / 124 / 146	*121 / 124 / 146	*121 / 124 / 146	*117 / 121 / 142	113 / 121 / 140
460,000	10,000	*110 / 118 / 137	*110 / 118 / 137	*109 / 119 / 137	111 / 120 / 137		
	8,000	*110 / 118 / 137	*110 / 118 / 137	*109 / 119 / 137	111 / 120 / 137		
	6,000	*113 / 117 / 138	*113 / 117 / 138	*113 / 117 / 138	110 / 118 / 137	111 / 120 / 137	
	4,000	115 / 118 / 139	115 / 118 / 139	115 / 118 / 139	114 / 117 / 138	109 / 119 / 137	
	2,000	*118 / 121 / 142	*118 / 121 / 142	*118 / 121 / 142	*118 / 121 / 142	*113 / 117 / 138	110 / 119 / 137
	0	*121 / 124 / 146	*121 / 124 / 146	*121 / 124 / 146	*121 / 124 / 146	*117 / 121 / 142	*111 / 118 / 137
420,000	10,000	*110 / 114 / 135	*110 / 114 / 135	*109 / 115 / 134	108 / 116 / 134		
	8,000	*110 / 114 / 135	*110 / 114 / 135	*109 / 115 / 134	108 / 116 / 134		
	6,000	*113 / 116 / 136	*113 / 116 / 136	*113 / 116 / 136	*109 / 115 / 135	108 / 117 / 134	
	4,000	*115 / 118 / 139	*115 / 118 / 139	*115 / 118 / 139	*114 / 117 / 137	*109 / 115 / 134	
	2,000	*118 / 121 / 142	*118 / 121 / 142	*118 / 121 / 142	*118 / 121 / 142	*113 / 117 / 137	108 / 116 / 134
	0	*121 / 124 / 146	*121 / 124 / 146	*121 / 124 / 146	*121 / 124 / 146	*117 / 121 / 142	*111 / 114 / 135

 Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

Speeds marked with an asterisk (*) are limited by V_{mcg}.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO / 20

V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
880,000	10,000	163 / 180 / 187	160 / 180 / 186	157 / 181 / 187	152 / 183 / 187		
	8,000	163 / 180 / 187	160 / 180 / 186	157 / 181 / 187	152 / 183 / 187		
	6,000	162 / 177 / 185	162 / 177 / 185	162 / 177 / 185	161 / 180 / 186	164 / 179 / 185	
	4,000	158 / 173 / 182	158 / 173 / 182	158 / 173 / 182	160 / 176 / 184	164 / 179 / 185	
	2,000	157 / 172 / 181	155 / 172 / 181	155 / 172 / 181	155 / 172 / 181	161 / 176 / 183	168 / 180 / 185
	0	154 / 170 / 181	154 / 170 / 181	154 / 170 / 181	154 / 170 / 181	156 / 172 / 181	164 / 176 / 183
870,000	10,000	164 / 179 / 185	161 / 179 / 185	158 / 179 / 185	154 / 181 / 186		
	8,000	164 / 179 / 185	161 / 179 / 185	158 / 179 / 185	154 / 181 / 186		
	6,000	161 / 176 / 184	161 / 176 / 184	161 / 176 / 184	162 / 178 / 185	165 / 178 / 184	
	4,000	157 / 173 / 181	157 / 173 / 181	157 / 173 / 181	159 / 175 / 183	165 / 178 / 184	
	2,000	156 / 171 / 181	154 / 171 / 181	154 / 171 / 181	154 / 171 / 181	160 / 174 / 182	167 / 178 / 183
	0	154 / 169 / 180	154 / 169 / 180	153 / 169 / 180	153 / 169 / 180	156 / 171 / 180	162 / 175 / 182
860,000	10,000	163 / 177 / 184	162 / 177 / 184	159 / 178 / 184	155 / 180 / 184		
	8,000	163 / 177 / 184	162 / 177 / 184	159 / 178 / 184	155 / 180 / 184		
	6,000	160 / 174 / 182	160 / 174 / 182	160 / 174 / 183	163 / 177 / 183	164 / 177 / 183	
	4,000	157 / 172 / 181	157 / 172 / 181	157 / 172 / 181	158 / 174 / 182	164 / 177 / 183	
	2,000	156 / 170 / 180	154 / 170 / 180	154 / 171 / 180	154 / 171 / 180	159 / 173 / 181	165 / 177 / 182
	0	153 / 169 / 180	153 / 169 / 180	153 / 169 / 180	153 / 169 / 180	155 / 170 / 180	161 / 174 / 181
840,000	10,000	160 / 174 / 182	160 / 174 / 182	162 / 175 / 182	158 / 177 / 182		
	8,000	160 / 174 / 182	160 / 174 / 182	162 / 175 / 182	158 / 177 / 182		
	6,000	158 / 172 / 180	158 / 172 / 180	158 / 172 / 180	161 / 174 / 181	162 / 176 / 181	
	4,000	155 / 170 / 180	155 / 170 / 180	155 / 170 / 180	156 / 171 / 180	161 / 174 / 180	
	2,000	154 / 169 / 179	153 / 169 / 179	152 / 169 / 179	152 / 169 / 179	157 / 171 / 179	163 / 174 / 180
	0	152 / 167 / 179	152 / 167 / 179	152 / 167 / 179	151 / 167 / 179	154 / 169 / 179	159 / 171 / 179
820,000	10,000	157 / 171 / 179	157 / 171 / 179	159 / 172 / 179	161 / 174 / 180		
	8,000	157 / 171 / 179	157 / 171 / 179	159 / 172 / 179	161 / 174 / 180		
	6,000	156 / 169 / 178	156 / 169 / 178	156 / 169 / 178	158 / 171 / 179	162 / 173 / 179	
	4,000	153 / 168 / 178	153 / 168 / 178	153 / 168 / 178	153 / 169 / 178	158 / 171 / 178	
	2,000	152 / 166 / 177	151 / 166 / 177	150 / 166 / 177	150 / 166 / 177	155 / 168 / 177	160 / 171 / 177
	0	150 / 165 / 177	150 / 165 / 177	150 / 165 / 177	149 / 165 / 177	152 / 166 / 177	157 / 169 / 177
800,000	10,000	155 / 169 / 177	155 / 169 / 177	156 / 169 / 177	159 / 171 / 177		
	8,000	155 / 169 / 177	155 / 169 / 177	156 / 169 / 177	159 / 171 / 177		
	6,000	153 / 167 / 176	153 / 167 / 176	153 / 167 / 176	156 / 168 / 176	159 / 170 / 176	
	4,000	151 / 165 / 176	151 / 165 / 176	151 / 165 / 176	151 / 166 / 176	156 / 168 / 176	
	2,000	150 / 164 / 175	148 / 164 / 175	148 / 164 / 175	148 / 164 / 175	153 / 166 / 175	157 / 168 / 175
	0	148 / 162 / 174	147 / 162 / 174	147 / 162 / 174	147 / 162 / 174	150 / 164 / 174	154 / 166 / 174

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO / 20
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
780,000	10,000	152 / 166 / 175	152 / 166 / 175	154 / 166 / 175	157 / 168 / 175		
	8,000	152 / 166 / 175	152 / 166 / 175	154 / 166 / 175	157 / 168 / 175		
	6,000	151 / 164 / 174	151 / 164 / 174	151 / 164 / 174	153 / 165 / 174	156 / 167 / 174	
	4,000	149 / 162 / 173	149 / 162 / 173	149 / 162 / 173	149 / 163 / 173	153 / 165 / 173	
	2,000	148 / 161 / 173	146 / 161 / 173	146 / 161 / 173	146 / 161 / 173	150 / 163 / 173	155 / 165 / 173
	0	145 / 159 / 172	145 / 159 / 172	145 / 159 / 172	145 / 159 / 172	148 / 161 / 172	152 / 163 / 172
760,000	10,000	150 / 163 / 172	150 / 163 / 172	151 / 163 / 172	154 / 165 / 172		
	8,000	150 / 163 / 172	150 / 163 / 172	151 / 163 / 172	154 / 165 / 172		
	6,000	149 / 161 / 171	149 / 161 / 171	148 / 161 / 171	151 / 163 / 171	154 / 164 / 171	
	4,000	146 / 159 / 171	146 / 160 / 171	146 / 160 / 171	147 / 160 / 171	151 / 162 / 171	
	2,000	145 / 158 / 170	144 / 158 / 170	144 / 158 / 170	144 / 158 / 170	148 / 160 / 170	152 / 163 / 170
	0	143 / 156 / 170	143 / 156 / 170	143 / 156 / 170	142 / 156 / 170	145 / 158 / 170	149 / 161 / 170
740,000	10,000	147 / 160 / 170	147 / 160 / 170	149 / 161 / 170	151 / 162 / 170		
	8,000	147 / 160 / 170	147 / 160 / 170	149 / 161 / 170	151 / 162 / 170		
	6,000	146 / 158 / 169	146 / 158 / 169	146 / 158 / 169	148 / 160 / 169	151 / 162 / 169	
	4,000	144 / 157 / 168	144 / 157 / 168	144 / 157 / 168	144 / 157 / 168	148 / 159 / 168	
	2,000	143 / 155 / 168	141 / 155 / 168	141 / 155 / 168	141 / 155 / 168	145 / 157 / 168	150 / 160 / 168
	0	140 / 153 / 167	140 / 153 / 167	140 / 153 / 167	140 / 153 / 167	143 / 155 / 167	147 / 158 / 167
720,000	10,000	145 / 157 / 167	145 / 157 / 167	146 / 158 / 167	149 / 159 / 167		
	8,000	145 / 157 / 167	145 / 157 / 167	146 / 158 / 167	149 / 159 / 167		
	6,000	144 / 155 / 167	144 / 155 / 167	143 / 155 / 167	146 / 157 / 167	148 / 159 / 167	
	4,000	141 / 154 / 166	141 / 154 / 166	141 / 154 / 166	142 / 154 / 166	146 / 156 / 166	
	2,000	140 / 152 / 165	139 / 152 / 165	139 / 152 / 165	139 / 152 / 165	143 / 154 / 165	147 / 157 / 165
	0	137 / 150 / 165	137 / 150 / 165	137 / 150 / 165	137 / 150 / 165	140 / 152 / 165	144 / 155 / 165
700,000	10,000	142 / 154 / 165	142 / 154 / 165	144 / 155 / 165	146 / 156 / 165		
	8,000	142 / 154 / 165	142 / 154 / 165	144 / 155 / 165	146 / 156 / 165		
	6,000	141 / 152 / 164	141 / 152 / 164	141 / 152 / 164	143 / 154 / 164	146 / 156 / 164	
	4,000	139 / 151 / 164	139 / 151 / 164	139 / 151 / 164	139 / 151 / 164	143 / 153 / 164	
	2,000	137 / 149 / 163	136 / 149 / 163	136 / 149 / 163	136 / 149 / 163	140 / 151 / 163	144 / 154 / 163
	0	134 / 147 / 163	134 / 147 / 163	134 / 147 / 163	135 / 147 / 163	137 / 149 / 163	142 / 152 / 163
680,000	10,000	140 / 151 / 162	139 / 151 / 162	141 / 151 / 162	143 / 153 / 162		
	8,000	140 / 151 / 162	139 / 151 / 162	141 / 151 / 162	143 / 153 / 162		
	6,000	138 / 149 / 162	138 / 149 / 162	138 / 149 / 162	140 / 151 / 162	143 / 153 / 162	
	4,000	136 / 148 / 161	136 / 148 / 161	136 / 148 / 161	137 / 148 / 161	140 / 150 / 161	
	2,000	134 / 146 / 161	133 / 146 / 161	133 / 146 / 161	133 / 146 / 161	137 / 148 / 161	142 / 151 / 161
	0	131 / 144 / 160	132 / 144 / 160	132 / 144 / 160	132 / 144 / 160	134 / 146 / 160	139 / 149 / 160

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO / 20

V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
660,000	10,000	137 / 148 / 160	137 / 148 / 160	138 / 148 / 160	140 / 150 / 160		
	8,000	137 / 148 / 160	137 / 148 / 160	138 / 148 / 160	140 / 150 / 160		
	6,000	135 / 146 / 159	135 / 146 / 159	135 / 146 / 159	138 / 148 / 159	140 / 150 / 159	
	4,000	133 / 144 / 159	133 / 144 / 159	133 / 144 / 159	134 / 145 / 158	138 / 147 / 158	
	2,000	131 / 143 / 158	130 / 143 / 158	130 / 143 / 158	130 / 143 / 158	135 / 145 / 158	139 / 148 / 158
	0	128 / 141 / 158	129 / 141 / 158	129 / 141 / 158	129 / 141 / 158	131 / 143 / 158	136 / 146 / 158
640,000	10,000	134 / 145 / 157	134 / 145 / 157	136 / 145 / 157	138 / 147 / 157		
	8,000	134 / 145 / 157	134 / 145 / 157	136 / 145 / 157	138 / 147 / 157		
	6,000	132 / 143 / 126	132 / 143 / 126	132 / 143 / 126	135 / 144 / 129	137 / 146 / 132	
	4,000	130 / 141 / 156	130 / 141 / 156	130 / 141 / 156	131 / 142 / 156	135 / 144 / 156	
	2,000	128 / 140 / 155	127 / 140 / 155	127 / 140 / 155	127 / 140 / 155	132 / 142 / 155	136 / 145 / 155
	0	125 / 138 / 155	126 / 138 / 155	126 / 138 / 155	126 / 138 / 155	128 / 140 / 155	133 / 143 / 155
620,000	10,000	131 / 141 / 154	131 / 141 / 154	133 / 142 / 154	135 / 144 / 154		
	8,000	131 / 141 / 154	131 / 141 / 154	133 / 142 / 154	135 / 144 / 154		
	6,000	129 / 140 / 154	129 / 140 / 154	129 / 140 / 154	132 / 141 / 154	135 / 143 / 154	
	4,000	127 / 138 / 153	127 / 138 / 153	127 / 138 / 153	128 / 139 / 153	132 / 141 / 153	
	2,000	125 / 136 / 153	124 / 136 / 153	124 / 136 / 153	124 / 137 / 153	129 / 139 / 153	133 / 142 / 153
	0	122 / 135 / 153	122 / 135 / 153	123 / 135 / 153	123 / 135 / 153	125 / 137 / 153	130 / 140 / 153
600,000	10,000	128 / 138 / 152	128 / 138 / 152	129 / 139 / 152	132 / 140 / 152		
	8,000	128 / 138 / 152	128 / 138 / 152	129 / 139 / 152	132 / 140 / 152		
	6,000	126 / 136 / 151	126 / 136 / 151	126 / 136 / 151	129 / 138 / 151	132 / 140 / 151	
	4,000	124 / 135 / 151	124 / 135 / 151	124 / 135 / 151	125 / 136 / 151	129 / 138 / 151	
	2,000	122 / 133 / 150	121 / 133 / 150	121 / 133 / 150	121 / 133 / 150	125 / 136 / 150	130 / 138 / 150
	0	*121 / 131 / 150	*121 / 131 / 150	*121 / 131 / 150	*121 / 131 / 150	122 / 133 / 150	127 / 136 / 150
580,000	10,000	124 / 134 / 148	124 / 134 / 148	126 / 135 / 148	128 / 137 / 148		
	8,000	124 / 134 / 148	124 / 134 / 148	126 / 135 / 148	128 / 137 / 148		
	6,000	122 / 132 / 148	122 / 133 / 148	123 / 133 / 148	125 / 134 / 148	128 / 136 / 148	
	4,000	120 / 131 / 148	120 / 131 / 148	120 / 131 / 148	121 / 132 / 148	125 / 134 / 148	
	2,000	118 / 129 / 147	118 / 129 / 147	118 / 129 / 147	118 / 129 / 147	122 / 132 / 147	126 / 135 / 147
	0	*121 / 128 / 147	*121 / 128 / 147	*121 / 128 / 147	*121 / 128 / 147	118 / 130 / 147	123 / 133 / 147
560,000	10,000	121 / 131 / 145	121 / 131 / 145	122 / 131 / 145	125 / 133 / 145		
	8,000	121 / 131 / 145	121 / 131 / 145	122 / 131 / 145	125 / 133 / 145		
	6,000	119 / 129 / 145	119 / 129 / 145	119 / 129 / 145	121 / 131 / 145	124 / 133 / 145	
	4,000	116 / 127 / 145	116 / 127 / 145	116 / 127 / 145	117 / 128 / 145	121 / 130 / 145	
	2,000	*118 / 125 / 144	118 / 125 / 144	118 / 125 / 144	118 / 126 / 144	118 / 128 / 144	122 / 131 / 144
	0	*121 / 125 / 145	*121 / 125 / 145	*121 / 125 / 145	*121 / 125 / 145	*117 / 126 / 144	119 / 129 / 144

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

Speeds marked with an asterisk (*) are limited by V_{mcg}. Do not reduce below the V_{mcg} speed.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO / 20
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
540,000	10,000	117 / 127 / 143	117 / 127 / 143	119 / 128 / 143	121 / 129 / 143		
	8,000	117 / 127 / 143	117 / 127 / 143	119 / 128 / 143	121 / 129 / 143		
	6,000	115 / 125 / 142	115 / 125 / 142	115 / 125 / 142	118 / 127 / 142	121 / 129 / 142	
	4,000	*115 / 124 / 142	*115 / 124 / 142	*115 / 124 / 142	*114 / 125 / 142	118 / 127 / 142	
	2,000	*118 / 122 / 141	*118 / 122 / 141	*118 / 122 / 141	*118 / 122 / 141	114 / 125 / 141	119 / 128 / 141
	0	*121 / 124 / 145	*121 / 124 / 145	*121 / 124 / 145	*121 / 124 / 145	*117 / 122 / 141	116 / 125 / 141
520,000	10,000	114 / 123 / 140	114 / 123 / 140	115 / 124 / 140	118 / 126 / 140		
	8,000	114 / 123 / 140	114 / 123 / 140	115 / 124 / 140	118 / 126 / 140		
	6,000	*113 / 122 / 139	*113 / 122 / 139	*113 / 122 / 139	114 / 124 / 139	117 / 126 / 139	
	4,000	*115 / 120 / 139	*115 / 120 / 139	*115 / 120 / 139	*114 / 121 / 139	114 / 124 / 139	
	2,000	*118 / 121 / 141	*118 / 121 / 141	*118 / 121 / 141	*118 / 121 / 141	*113 / 121 / 139	115 / 124 / 139
	0	*121 / 124 / 145	*121 / 124 / 145	*121 / 124 / 145	*121 / 124 / 145	*117 / 121 / 141	112 / 122 / 139
500,000	10,000	*110 / 120 / 137	*110 / 120 / 137	111 / 121 / 137	114 / 122 / 137		
	8,000	*110 / 120 / 137	*110 / 120 / 137	111 / 121 / 137	114 / 122 / 137		
	6,000	*113 / 118 / 137	*113 / 118 / 137	*113 / 118 / 137	111 / 120 / 136	114 / 122 / 136	
	4,000	*115 / 118 / 137	*115 / 118 / 137	*115 / 118 / 137	*114 / 118 / 136	110 / 120 / 136	
	2,000	*118 / 121 / 141	*118 / 121 / 141	*118 / 121 / 141	*118 / 121 / 141	*113 / 118 / 137	111 / 121 / 136
	0	*121 / 124 / 145	*121 / 124 / 145	*121 / 124 / 145	*121 / 124 / 145	*117 / 121 / 140	*111 / 119 / 136
480,000	10,000	*110 / 116 / 134	*110 / 116 / 134	*109 / 117 / 134	110 / 119 / 134		
	8,000	*110 / 116 / 134	*110 / 116 / 134	*109 / 117 / 134	110 / 119 / 134		
	6,000	*113 / 116 / 135	*113 / 116 / 135	*113 / 116 / 135	*109 / 116 / 134	110 / 119 / 134	
	4,000	*115 / 118 / 137	*115 / 118 / 137	*115 / 118 / 137	*114 / 117 / 135	*109 / 117 / 134	
	2,000	*118 / 121 / 141	*118 / 121 / 141	*118 / 121 / 141	*118 / 121 / 141	*113 / 117 / 135	108 / 117 / 133
	0	*121 / 124 / 144	*121 / 124 / 144	*121 / 124 / 144	*121 / 124 / 144	*117 / 121 / 140	*111 / 116 / 134
460,000	10,000	*110 / 113 / 131	*110 / 113 / 131	*109 / 113 / 131	106 / 115 / 131		
	8,000	*110 / 113 / 131	*110 / 113 / 131	*109 / 113 / 131	106 / 115 / 131		
	6,000	*113 / 116 / 135	*113 / 116 / 135	*113 / 116 / 135	*109 / 113 / 131	106 / 115 / 131	
	4,000	*115 / 118 / 137	*115 / 118 / 137	*115 / 118 / 137	*114 / 117 / 135	*109 / 113 / 131	
	2,000	*118 / 121 / 141	*118 / 121 / 141	*118 / 121 / 141	*118 / 121 / 140	*113 / 117 / 135	*107 / 114 / 131
	0	*121 / 124 / 144	*121 / 124 / 144	*121 / 124 / 144	*121 / 124 / 144	*117 / 121 / 140	*111 / 114 / 132
420,000	10,000	*110 / 113 / 131	*110 / 113 / 131	*109 / 111 / 128	*105 / 111 / 128		
	8,000	*110 / 113 / 131	*110 / 113 / 131	*109 / 111 / 128	*105 / 111 / 128		
	6,000	*113 / 116 / 134	*113 / 116 / 134	*113 / 116 / 134	*109 / 112 / 129	*105 / 111 / 128	
	4,000	*115 / 118 / 137	*115 / 118 / 137	*115 / 118 / 137	*114 / 117 / 135	*109 / 112 / 129	
	2,000	*118 / 121 / 140	*118 / 121 / 140	*118 / 121 / 140	*118 / 121 / 140	*113 / 117 / 135	*107 / 111 / 128
	0	*121 / 124 / 144	*121 / 124 / 144	*121 / 124 / 144	*121 / 124 / 144	*117 / 121 / 140	*111 / 114 / 132

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

Speeds marked with an asterisk (*) are limited by V_{mcg}. Do not reduce below the V_{mcg} speed.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO1 / 10
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
880,000	10,000						
	8,000						
	6,000	168 / 187 / 192					
	4,000	170 / 184 / 191	170 / 184 / 191	169 / 184 / 191	165 / 186 / 192		
	2,000	166 / 180 / 188	164 / 180 / 188	164 / 180 / 188	164 / 180 / 188	169 / 186 / 191	
	0	164 / 179 / 188	164 / 179 / 188	163 / 179 / 188	163 / 179 / 188	167 / 182 / 189	172 / 186 / 191
870,000	10,000						
	8,000						
	6,000	170 / 186 / 191					
	4,000	168 / 183 / 190	168 / 183 / 190	168 / 183 / 190	166 / 185 / 191		
	2,000	166 / 180 / 188	164 / 180 / 188	164 / 180 / 188	164 / 180 / 187	170 / 185 / 190	165 / 188 / 191
	0	163 / 178 / 187	163 / 178 / 187	163 / 178 / 187	163 / 178 / 187	166 / 180 / 188	173 / 185 / 190
860,000	10,000	163 / 186 / 191					
	8,000	163 / 186 / 191					
	6,000	171 / 184 / 190					
	4,000	167 / 182 / 189	167 / 182 / 189	167 / 182 / 189	168 / 183 / 189		
	2,000	165 / 179 / 187	163 / 179 / 187	163 / 179 / 187	163 / 179 / 187	170 / 183 / 189	166 / 186 / 189
	0	163 / 178 / 187	162 / 178 / 187	162 / 177 / 187	162 / 177 / 187	165 / 179 / 187	172 / 183 / 188
840,000	10,000	166 / 183 / 189					
	8,000	166 / 183 / 189					
	6,000	168 / 181 / 188	168 / 181 / 188				
	4,000	165 / 179 / 187	165 / 179 / 187	165 / 179 / 187	166 / 180 / 187		
	2,000	164 / 177 / 186	162 / 177 / 186	162 / 177 / 186	162 / 177 / 186	167 / 180 / 186	170 / 183 / 187
	0	161 / 176 / 185	161 / 176 / 185	161 / 176 / 185	161 / 176 / 185	163 / 177 / 185	169 / 180 / 186
820,000	10,000	167 / 180 / 186					
	8,000	167 / 180 / 186					
	6,000	165 / 178 / 185	165 / 178 / 185	166 / 178 / 185			
	4,000	163 / 176 / 184	162 / 176 / 184	162 / 176 / 184	163 / 177 / 185	168 / 180 / 185	
	2,000	161 / 175 / 184	160 / 175 / 184	160 / 175 / 184	160 / 175 / 184	165 / 177 / 184	170 / 180 / 184
	0	159 / 173 / 183	159 / 173 / 183	158 / 173 / 183	158 / 173 / 183	161 / 175 / 183	166 / 178 / 183
800,000	10,000	164 / 177 / 184					
	8,000	164 / 177 / 184					
	6,000	163 / 175 / 183	163 / 175 / 183	163 / 175 / 183	165 / 177 / 183		
	4,000	160 / 174 / 182	160 / 174 / 182	160 / 174 / 182	160 / 174 / 182	165 / 177 / 182	
	2,000	159 / 172 / 182	157 / 172 / 182	157 / 172 / 182	157 / 172 / 182	162 / 174 / 182	167 / 177 / 182
	0	157 / 170 / 181	156 / 170 / 181	156 / 170 / 181	156 / 170 / 181	159 / 172 / 181	164 / 175 / 181

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO1 / 10
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
780,000	10,000	162 / 174 / 181	162 / 174 / 181				
	8,000	162 / 174 / 181	162 / 174 / 181				
	6,000	160 / 172 / 180	160 / 172 / 180	160 / 172 / 180	162 / 174 / 180		
	4,000	158 / 171 / 180	158 / 171 / 180	157 / 171 / 180	158 / 172 / 180	162 / 174 / 180	
	2,000	157 / 169 / 179	155 / 169 / 179	155 / 169 / 179	155 / 169 / 179	159 / 171 / 179	164 / 174 / 179
	0	154 / 167 / 179	154 / 167 / 179	154 / 167 / 179	154 / 167 / 179	156 / 169 / 179	161 / 172 / 179
760,000	10,000	159 / 171 / 179	159 / 171 / 179				
	8,000	159 / 171 / 179	159 / 171 / 179				
	6,000	158 / 169 / 178	158 / 169 / 178	158 / 169 / 178	160 / 171 / 178	163 / 173 / 178	
	4,000	155 / 168 / 177	155 / 168 / 177	155 / 168 / 177	155 / 169 / 177	159 / 171 / 177	
	2,000	154 / 166 / 177	153 / 166 / 177	152 / 166 / 177	152 / 166 / 177	157 / 168 / 177	162 / 171 / 177
	0	152 / 164 / 176	152 / 164 / 176	151 / 164 / 176	151 / 164 / 176	154 / 166 / 176	158 / 169 / 176
740,000	10,000	156 / 168 / 176	156 / 168 / 176	158 / 169 / 176	161 / 170 / 176		
	8,000	156 / 168 / 176	156 / 168 / 176	158 / 169 / 176	161 / 170 / 176		
	6,000	155 / 166 / 175	155 / 166 / 175	155 / 166 / 175	157 / 168 / 175	160 / 170 / 175	
	4,000	153 / 165 / 175	153 / 165 / 175	152 / 165 / 175	153 / 166 / 175	157 / 168 / 175	
	2,000	152 / 163 / 174	150 / 163 / 174	150 / 163 / 174	150 / 163 / 174	154 / 165 / 174	159 / 168 / 174
	0	149 / 161 / 174	149 / 161 / 174	149 / 161 / 174	149 / 161 / 174	151 / 163 / 174	155 / 166 / 174
720,000	10,000	154 / 165 / 174	154 / 165 / 174	155 / 166 / 174	158 / 167 / 174		
	8,000	154 / 165 / 174	154 / 165 / 174	155 / 166 / 174	158 / 167 / 174		
	6,000	152 / 163 / 173	152 / 163 / 173	152 / 163 / 173	154 / 165 / 173	157 / 167 / 173	
	4,000	150 / 162 / 172	150 / 162 / 172	150 / 162 / 172	150 / 162 / 172	154 / 165 / 172	
	2,000	149 / 160 / 172	147 / 160 / 172	147 / 160 / 172	147 / 160 / 172	152 / 162 / 172	156 / 165 / 172
	0	146 / 158 / 171	146 / 158 / 171	146 / 158 / 171	146 / 158 / 171	149 / 160 / 171	153 / 163 / 171
700,000	10,000	151 / 162 / 171	151 / 162 / 171	152 / 163 / 171	155 / 164 / 171		
	8,000	151 / 162 / 171	151 / 162 / 171	152 / 163 / 171	155 / 164 / 171		
	6,000	150 / 160 / 170	150 / 160 / 170	150 / 160 / 170	151 / 162 / 170	154 / 164 / 170	
	4,000	147 / 159 / 170	147 / 159 / 170	147 / 159 / 170	148 / 159 / 170	151 / 161 / 170	
	2,000	146 / 157 / 169	145 / 157 / 169	145 / 157 / 169	145 / 157 / 169	149 / 159 / 169	153 / 162 / 169
	0	144 / 155 / 169	144 / 155 / 169	144 / 155 / 169	144 / 155 / 169	146 / 157 / 169	150 / 160 / 169
680,000	10,000	148 / 159 / 168	148 / 159 / 168	149 / 159 / 168	152 / 161 / 168		
	8,000	148 / 159 / 168	148 / 159 / 168	149 / 159 / 168	152 / 161 / 168		
	6,000	147 / 157 / 168	147 / 157 / 168	147 / 157 / 168	149 / 159 / 168	151 / 161 / 168	
	4,000	145 / 155 / 167	145 / 155 / 167	145 / 155 / 167	145 / 156 / 167	149 / 158 / 167	
	2,000	143 / 154 / 167	142 / 154 / 167	142 / 154 / 167	142 / 154 / 167	146 / 156 / 167	150 / 159 / 167
	0	141 / 152 / 166	141 / 152 / 166	141 / 152 / 166	141 / 152 / 166	143 / 154 / 166	147 / 157 / 166

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO1 / 10

V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
660,000	10,000	146 / 156 / 166	145 / 156 / 166	147 / 156 / 166	149 / 158 / 166		
	8,000	146 / 156 / 166	145 / 156 / 166	147 / 156 / 166	149 / 158 / 166		
	6,000	144 / 154 / 165	144 / 154 / 165	144 / 154 / 165	146 / 155 / 165	149 / 157 / 165	
	4,000	142 / 152 / 164	142 / 152 / 164	142 / 152 / 164	142 / 153 / 164	146 / 155 / 164	
	2,000	141 / 150 / 164	139 / 150 / 164	139 / 150 / 164	139 / 151 / 164	144 / 153 / 164	147 / 156 / 164
	0	138 / 149 / 163	138 / 149 / 163	138 / 149 / 163	138 / 149 / 163	141 / 151 / 163	145 / 154 / 163
640,000	10,000	143 / 152 / 163	143 / 152 / 163	144 / 153 / 163	146 / 155 / 163		
	8,000	143 / 152 / 163	143 / 152 / 163	144 / 153 / 163	146 / 155 / 163		
	6,000	141 / 150 / 135	141 / 150 / 135	141 / 151 / 135	143 / 152 / 137	146 / 154 / 140	
	4,000	139 / 149 / 162	139 / 149 / 162	139 / 149 / 162	140 / 150 / 162	143 / 152 / 162	
	2,000	137 / 147 / 161	136 / 147 / 161	136 / 147 / 161	136 / 147 / 161	141 / 150 / 161	145 / 153 / 161
	0	135 / 146 / 161	135 / 146 / 161	135 / 146 / 161	135 / 146 / 161	138 / 147 / 161	142 / 150 / 161
620,000	10,000	140 / 149 / 160	140 / 149 / 160	141 / 150 / 160	143 / 151 / 160		
	8,000	140 / 149 / 160	140 / 149 / 160	141 / 150 / 160	143 / 151 / 160		
	6,000	138 / 147 / 160	138 / 147 / 160	138 / 147 / 160	140 / 149 / 160	143 / 151 / 160	
	4,000	136 / 146 / 159	136 / 146 / 159	136 / 146 / 159	137 / 146 / 159	140 / 149 / 159	
	2,000	134 / 144 / 159	133 / 144 / 159	133 / 144 / 159	133 / 144 / 159	138 / 146 / 159	142 / 149 / 159
	0	132 / 142 / 158	132 / 142 / 158	132 / 142 / 158	132 / 142 / 158	135 / 144 / 158	139 / 147 / 158
600,000	10,000	137 / 145 / 157	137 / 146 / 157	138 / 146 / 157	140 / 148 / 157		
	8,000	137 / 145 / 157	137 / 146 / 157	138 / 146 / 157	140 / 148 / 157		
	6,000	135 / 144 / 157	135 / 144 / 157	135 / 144 / 157	137 / 145 / 157	140 / 148 / 157	
	4,000	133 / 142 / 156	133 / 142 / 156	133 / 142 / 156	134 / 143 / 156	137 / 145 / 156	
	2,000	131 / 140 / 156	130 / 140 / 156	130 / 140 / 156	130 / 141 / 156	135 / 143 / 156	138 / 146 / 156
	0	128 / 139 / 156	128 / 139 / 156	128 / 139 / 156	128 / 139 / 156	131 / 141 / 155	136 / 144 / 155
580,000	10,000	133 / 142 / 154	133 / 142 / 154	134 / 142 / 154	136 / 144 / 154		
	8,000	133 / 142 / 154	133 / 142 / 154	134 / 142 / 154	136 / 144 / 154		
	6,000	131 / 140 / 154	131 / 140 / 154	132 / 140 / 154	134 / 142 / 154	136 / 144 / 154	
	4,000	129 / 138 / 153	129 / 138 / 153	129 / 138 / 153	130 / 139 / 153	133 / 142 / 153	
	2,000	127 / 137 / 153	127 / 137 / 153	127 / 137 / 153	127 / 137 / 153	131 / 139 / 153	135 / 142 / 153
	0	125 / 136 / 154	125 / 136 / 154	125 / 136 / 154	125 / 136 / 154	128 / 137 / 153	132 / 140 / 153
560,000	10,000	129 / 138 / 151	130 / 138 / 151	131 / 138 / 151	133 / 140 / 151		
	8,000	129 / 138 / 151	130 / 138 / 151	131 / 138 / 151	133 / 140 / 151		
	6,000	128 / 136 / 150	128 / 136 / 150	128 / 136 / 150	130 / 138 / 150	133 / 140 / 150	
	4,000	126 / 135 / 151	126 / 135 / 151	126 / 135 / 151	127 / 136 / 151	130 / 138 / 150	
	2,000	124 / 134 / 151	123 / 134 / 151	123 / 134 / 151	124 / 134 / 151	128 / 136 / 150	132 / 139 / 150
	0	122 / 132 / 151	122 / 132 / 151	122 / 132 / 151	122 / 133 / 151	125 / 134 / 151	129 / 137 / 150

 Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO1 / 10
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
540,000	10,000	126 / 134 / 148	126 / 134 / 148	127 / 135 / 148	130 / 137 / 148		
	8,000	126 / 134 / 148	126 / 134 / 148	127 / 135 / 148	130 / 137 / 148		
	6,000	124 / 133 / 148	124 / 133 / 148	125 / 133 / 148	126 / 134 / 148	130 / 137 / 148	
	4,000	122 / 132 / 148	122 / 132 / 148	123 / 132 / 148	123 / 132 / 148	127 / 135 / 148	
	2,000	121 / 130 / 148	120 / 130 / 148	120 / 130 / 148	121 / 131 / 148	124 / 133 / 148	128 / 136 / 148
	0	119 / 129 / 149	119 / 129 / 149	119 / 129 / 149	119 / 129 / 149	122 / 131 / 148	125 / 134 / 148
520,000	10,000	122 / 131 / 145	123 / 131 / 145	123 / 131 / 145	126 / 133 / 145		
	8,000	122 / 131 / 145	123 / 131 / 145	123 / 131 / 145	126 / 133 / 145		
	6,000	121 / 129 / 145	121 / 129 / 145	121 / 129 / 145	123 / 131 / 145	126 / 133 / 145	
	4,000	119 / 128 / 146	119 / 128 / 146	119 / 128 / 146	120 / 129 / 145	123 / 131 / 145	
	2,000	118 / 127 / 146	117 / 127 / 146	117 / 127 / 146	117 / 127 / 146	121 / 129 / 145	125 / 132 / 145
	0	*116 / 126 / 146	*116 / 126 / 146	*116 / 126 / 146	*116 / 126 / 146	118 / 128 / 146	122 / 130 / 145
500,000	10,000	119 / 127 / 143	119 / 127 / 143	120 / 128 / 142	122 / 129 / 142		
	8,000	119 / 127 / 143	119 / 127 / 143	120 / 128 / 142	122 / 129 / 142		
	6,000	118 / 126 / 143	118 / 126 / 143	118 / 126 / 143	120 / 128 / 142	123 / 129 / 142	
	4,000	116 / 125 / 143	116 / 125 / 143	116 / 125 / 143	117 / 126 / 143	120 / 128 / 142	
	2,000	114 / 124 / 144	*114 / 124 / 144	*114 / 124 / 144	114 / 124 / 143	118 / 126 / 143	121 / 129 / 142
	0	*116 / 123 / 144	*116 / 123 / 144	*116 / 123 / 144	*116 / 123 / 144	115 / 124 / 143	119 / 127 / 143
480,000	10,000	116 / 124 / 140	116 / 124 / 140	117 / 124 / 140	119 / 126 / 139		
	8,000	116 / 124 / 140	116 / 124 / 140	117 / 124 / 140	119 / 126 / 139		
	6,000	114 / 123 / 140	114 / 123 / 140	114 / 123 / 140	116 / 124 / 140	119 / 126 / 139	
	4,000	112 / 122 / 141	113 / 122 / 141	113 / 122 / 141	113 / 122 / 140	116 / 124 / 140	
	2,000	*113 / 120 / 141	*114 / 120 / 141	*114 / 120 / 141	*113 / 121 / 141	114 / 123 / 140	118 / 125 / 140
	0	*116 / 120 / 141	*116 / 120 / 141	*116 / 119 / 141	*116 / 119 / 141	*113 / 121 / 141	115 / 124 / 140
460,000	10,000	112 / 120 / 137	112 / 120 / 137	113 / 121 / 137	115 / 122 / 137		
	8,000	112 / 120 / 137	112 / 120 / 137	113 / 121 / 137	115 / 122 / 137		
	6,000	111 / 119 / 138	111 / 119 / 138	111 / 119 / 138	113 / 121 / 137	115 / 122 / 137	
	4,000	*111 / 118 / 138	*111 / 118 / 138	*111 / 118 / 138	110 / 119 / 138	113 / 121 / 137	
	2,000	*113 / 117 / 138	*114 / 117 / 138	*114 / 117 / 138	*113 / 117 / 138	111 / 119 / 138	114 / 122 / 137
	0	*116 / 119 / 140	*116 / 119 / 140	*116 / 119 / 140	*116 / 119 / 140	*113 / 118 / 138	112 / 120 / 137
420,000	10,000	109 / 117 / 135	109 / 117 / 135	110 / 117 / 134	111 / 119 / 134		
	8,000	109 / 117 / 135	109 / 117 / 135	110 / 117 / 134	111 / 119 / 134		
	6,000	*108 / 116 / 135	109 / 116 / 135	109 / 116 / 135	109 / 117 / 135	112 / 119 / 134	
	4,000	*111 / 115 / 135	*111 / 115 / 135	*111 / 115 / 135	*109 / 115 / 135	109 / 117 / 134	
	2,000	*113 / 116 / 137	*114 / 116 / 137	*114 / 116 / 137	*113 / 116 / 136	*109 / 116 / 135	110 / 118 / 134
	0	*116 / 119 / 140	*116 / 119 / 140	*116 / 119 / 140	*116 / 119 / 140	*113 / 116 / 136	108 / 117 / 135

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

Speeds marked with an asterisk (*) are limited by V_{mcg}. Do not reduce below the V_{mcg} speed.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO1 / 20

V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
880,000	10,000	161 / 183 / 187	158 / 183 / 187	153 / 183 / 187	147 / 185 / 188		
	8,000	161 / 183 / 187	158 / 183 / 187	153 / 183 / 187	147 / 185 / 188		
	6,000	169 / 181 / 186	165 / 181 / 186	162 / 181 / 186	157 / 183 / 186	148 / 186 / 187	
	4,000	165 / 178 / 185	165 / 179 / 185	165 / 179 / 185	166 / 180 / 185	161 / 182 / 186	
	2,000	163 / 176 / 183	161 / 176 / 183	161 / 176 / 183	161 / 176 / 183	167 / 179 / 184	161 / 183 / 185
	0	158 / 172 / 181	158 / 172 / 181	158 / 172 / 181	158 / 172 / 181	162 / 176 / 183	169 / 180 / 184
870,000	10,000	163 / 181 / 186	159 / 181 / 186	155 / 182 / 186	149 / 184 / 186		
	8,000	163 / 181 / 186	159 / 181 / 186	155 / 182 / 186	149 / 184 / 186		
	6,000	167 / 179 / 185	167 / 179 / 185	164 / 179 / 185	158 / 181 / 185	150 / 185 / 186	
	4,000	164 / 177 / 184	164 / 177 / 184	164 / 177 / 184	165 / 178 / 184	162 / 180 / 184	
	2,000	161 / 174 / 182	160 / 174 / 182	160 / 174 / 182	160 / 175 / 182	166 / 178 / 183	163 / 181 / 184
	0	157 / 171 / 180	157 / 171 / 180	157 / 171 / 180	157 / 171 / 180	161 / 174 / 182	168 / 179 / 183
860,000	10,000	164 / 180 / 184	161 / 180 / 185	156 / 181 / 185	150 / 182 / 185		
	8,000	164 / 180 / 184	161 / 180 / 185	156 / 181 / 185	150 / 182 / 185		
	6,000	166 / 178 / 183	166 / 178 / 184	165 / 178 / 184	160 / 180 / 184	152 / 183 / 185	
	4,000	162 / 176 / 182	163 / 176 / 183	163 / 176 / 183	163 / 177 / 183	164 / 179 / 183	
	2,000	160 / 173 / 181	158 / 173 / 181	158 / 173 / 181	158 / 173 / 181	165 / 176 / 182	165 / 180 / 183
	0	157 / 171 / 180	157 / 171 / 180	157 / 171 / 180	157 / 171 / 180	160 / 173 / 181	166 / 177 / 182
840,000	10,000	165 / 177 / 182	164 / 177 / 182	159 / 178 / 182	154 / 179 / 183		
	8,000	165 / 177 / 182	164 / 177 / 182	159 / 178 / 182	154 / 179 / 183		
	6,000	163 / 175 / 181	163 / 175 / 181	163 / 175 / 181	163 / 177 / 181	156 / 180 / 182	
	4,000	160 / 173 / 180	160 / 173 / 180	160 / 173 / 180	161 / 174 / 180	165 / 176 / 181	
	2,000	158 / 171 / 179	156 / 171 / 179	156 / 171 / 179	156 / 171 / 179	162 / 174 / 180	167 / 177 / 180
	0	156 / 169 / 179	155 / 169 / 179	155 / 169 / 179	155 / 169 / 179	158 / 171 / 179	164 / 174 / 179
820,000	10,000	162 / 174 / 180	162 / 174 / 180	162 / 175 / 180	157 / 176 / 180		
	8,000	162 / 174 / 180	162 / 174 / 180	162 / 175 / 180	157 / 176 / 180		
	6,000	160 / 172 / 179	160 / 172 / 179	160 / 172 / 179	163 / 174 / 179	159 / 177 / 180	
	4,000	157 / 170 / 178	157 / 170 / 178	157 / 170 / 178	158 / 171 / 178	163 / 173 / 178	
	2,000	156 / 168 / 177	154 / 168 / 177	154 / 168 / 177	154 / 168 / 177	159 / 171 / 177	165 / 174 / 178
	0	153 / 167 / 177	153 / 167 / 177	153 / 167 / 177	153 / 167 / 177	156 / 168 / 177	161 / 171 / 177
800,000	10,000	159 / 171 / 177	159 / 171 / 177	161 / 172 / 177	161 / 173 / 177		
	8,000	159 / 171 / 177	159 / 171 / 177	161 / 172 / 177	161 / 173 / 177		
	6,000	158 / 169 / 176	158 / 169 / 176	158 / 169 / 176	160 / 171 / 176	163 / 174 / 177	
	4,000	155 / 167 / 176	155 / 167 / 176	155 / 167 / 176	155 / 168 / 176	160 / 170 / 176	
	2,000	154 / 166 / 175	152 / 166 / 175	152 / 166 / 175	152 / 166 / 175	157 / 168 / 175	162 / 171 / 175
	0	151 / 164 / 174	151 / 164 / 174	151 / 164 / 174	151 / 164 / 174	153 / 166 / 174	158 / 168 / 175

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO1 / 20
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
780,000	10,000	157 / 168 / 175	156 / 168 / 175	158 / 169 / 175	161 / 170 / 175		
	8,000	157 / 168 / 175	156 / 168 / 175	158 / 169 / 175	161 / 170 / 175		
	6,000	155 / 166 / 174	155 / 166 / 174	155 / 166 / 174	157 / 168 / 174	161 / 171 / 174	
	4,000	152 / 164 / 173	152 / 164 / 173	152 / 165 / 173	153 / 165 / 173	157 / 167 / 173	
	2,000	151 / 163 / 173	150 / 163 / 173	150 / 163 / 173	149 / 163 / 173	154 / 165 / 173	159 / 168 / 173
	0	149 / 161 / 172	149 / 161 / 172	149 / 161 / 172	149 / 161 / 172	151 / 163 / 172	156 / 166 / 172
760,000	10,000	154 / 165 / 172	154 / 165 / 172	155 / 166 / 172	158 / 167 / 172		
	8,000	154 / 165 / 172	154 / 165 / 172	155 / 166 / 172	158 / 167 / 172		
	6,000	152 / 163 / 171	152 / 163 / 171	152 / 163 / 171	155 / 165 / 172	158 / 167 / 172	
	4,000	150 / 162 / 171	150 / 162 / 171	150 / 162 / 171	150 / 162 / 171	154 / 164 / 171	
	2,000	149 / 160 / 170	147 / 160 / 170	147 / 160 / 170	147 / 160 / 170	151 / 162 / 170	156 / 165 / 170
	0	146 / 158 / 170	146 / 158 / 170	146 / 158 / 170	146 / 158 / 170	149 / 160 / 170	153 / 163 / 170
740,000	10,000	151 / 162 / 170	151 / 162 / 170	152 / 163 / 170	155 / 164 / 170		
	8,000	151 / 162 / 170	151 / 162 / 170	152 / 163 / 170	155 / 164 / 170		
	6,000	150 / 160 / 169	150 / 160 / 169	150 / 160 / 169	152 / 162 / 169	155 / 164 / 169	
	4,000	148 / 159 / 168	147 / 159 / 168	147 / 159 / 168	148 / 159 / 168	152 / 161 / 168	
	2,000	147 / 157 / 168	145 / 157 / 168	145 / 157 / 168	145 / 157 / 168	149 / 159 / 168	153 / 162 / 168
	0	144 / 155 / 167	144 / 155 / 167	144 / 155 / 167	144 / 155 / 167	146 / 157 / 167	150 / 160 / 167
720,000	10,000	148 / 159 / 167	148 / 159 / 167	150 / 160 / 167	152 / 161 / 167		
	8,000	148 / 159 / 167	148 / 159 / 167	150 / 160 / 167	152 / 161 / 167		
	6,000	147 / 157 / 167	147 / 157 / 167	147 / 157 / 167	149 / 159 / 167	153 / 161 / 167	
	4,000	145 / 156 / 166	145 / 156 / 166	145 / 156 / 166	145 / 157 / 166	149 / 159 / 166	
	2,000	144 / 154 / 165	142 / 154 / 165	142 / 154 / 165	142 / 154 / 165	147 / 156 / 165	151 / 159 / 166
	0	141 / 153 / 165	141 / 153 / 165	141 / 153 / 165	141 / 153 / 165	144 / 154 / 165	148 / 157 / 165
700,000	10,000	146 / 156 / 165	146 / 156 / 165	147 / 157 / 165	149 / 158 / 165		
	8,000	146 / 156 / 165	146 / 156 / 165	147 / 157 / 165	149 / 158 / 165		
	6,000	145 / 154 / 164	145 / 154 / 164	145 / 154 / 164	146 / 156 / 164	150 / 158 / 164	
	4,000	143 / 153 / 164	142 / 153 / 164	142 / 153 / 164	143 / 154 / 164	146 / 156 / 164	
	2,000	141 / 151 / 163	140 / 151 / 163	140 / 151 / 163	140 / 151 / 163	144 / 153 / 163	148 / 156 / 163
	0	139 / 149 / 163	139 / 149 / 163	138 / 150 / 163	138 / 150 / 163	141 / 151 / 163	145 / 154 / 163
680,000	10,000	143 / 153 / 162	143 / 153 / 162	144 / 154 / 162	147 / 155 / 162		
	8,000	143 / 153 / 162	143 / 153 / 162	144 / 154 / 162	147 / 155 / 162		
	6,000	142 / 151 / 162	142 / 151 / 162	142 / 151 / 162	144 / 153 / 162	147 / 155 / 162	
	4,000	140 / 150 / 161	140 / 150 / 161	140 / 150 / 161	140 / 151 / 161	144 / 153 / 161	
	2,000	138 / 148 / 161	137 / 148 / 161	137 / 148 / 161	137 / 148 / 161	141 / 150 / 161	145 / 153 / 161
	0	136 / 146 / 160	136 / 146 / 160	136 / 146 / 160	136 / 146 / 160	138 / 148 / 160	142 / 151 / 160

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO1 / 20

V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
660,000	10,000	141 / 150 / 160	140 / 150 / 160	142 / 151 / 160	144 / 152 / 160		
	8,000	141 / 150 / 160	140 / 150 / 160	142 / 151 / 160	144 / 152 / 160		
	6,000	139 / 148 / 159	139 / 148 / 159	139 / 148 / 159	141 / 150 / 159	144 / 152 / 159	
	4,000	137 / 147 / 159	137 / 147 / 159	137 / 147 / 159	138 / 147 / 158	141 / 150 / 158	
	2,000	135 / 145 / 158	134 / 145 / 158	134 / 145 / 158	134 / 145 / 158	139 / 147 / 158	142 / 150 / 158
	0	133 / 143 / 158	133 / 143 / 158	133 / 143 / 158	133 / 143 / 158	136 / 145 / 158	140 / 148 / 158
640,000	10,000	138 / 147 / 157	138 / 147 / 157	139 / 147 / 157	141 / 149 / 157		
	8,000	138 / 147 / 157	138 / 147 / 157	139 / 147 / 157	141 / 149 / 157		
	6,000	136 / 145 / 130	136 / 145 / 130	136 / 145 / 130	138 / 147 / 132	141 / 149 / 135	
	4,000	134 / 144 / 156	134 / 144 / 156	134 / 144 / 156	135 / 144 / 156	138 / 146 / 156	
	2,000	132 / 142 / 155	131 / 142 / 155	131 / 142 / 155	132 / 142 / 155	136 / 144 / 155	139 / 147 / 155
	0	130 / 140 / 155	130 / 140 / 155	130 / 140 / 155	130 / 140 / 155	133 / 142 / 155	137 / 145 / 155
620,000	10,000	135 / 144 / 154	135 / 144 / 154	136 / 144 / 154	138 / 146 / 154		
	8,000	135 / 144 / 154	135 / 144 / 154	136 / 144 / 154	138 / 146 / 154		
	6,000	134 / 142 / 154	134 / 142 / 154	134 / 142 / 154	135 / 144 / 154	138 / 146 / 154	
	4,000	131 / 140 / 153	131 / 140 / 153	131 / 140 / 153	132 / 141 / 153	135 / 143 / 153	
	2,000	129 / 139 / 153	128 / 139 / 153	128 / 139 / 153	129 / 139 / 153	133 / 141 / 153	137 / 144 / 153
	0	127 / 137 / 153	127 / 137 / 153	127 / 137 / 153	127 / 137 / 153	130 / 139 / 153	134 / 142 / 153
600,000	10,000	132 / 140 / 152	132 / 140 / 152	133 / 141 / 152	135 / 143 / 152		
	8,000	132 / 140 / 152	132 / 140 / 152	133 / 141 / 152	135 / 143 / 152		
	6,000	130 / 139 / 151	130 / 139 / 151	130 / 139 / 151	132 / 140 / 151	135 / 142 / 151	
	4,000	128 / 137 / 151	128 / 137 / 151	128 / 137 / 151	129 / 138 / 151	132 / 140 / 151	
	2,000	126 / 135 / 150	125 / 135 / 150	125 / 135 / 150	125 / 135 / 150	130 / 138 / 150	134 / 141 / 150
	0	123 / 134 / 150	123 / 134 / 150	123 / 134 / 150	123 / 134 / 150	126 / 135 / 150	131 / 139 / 150
580,000	10,000	128 / 137 / 148	128 / 137 / 148	130 / 137 / 148	132 / 139 / 148		
	8,000	128 / 137 / 148	128 / 137 / 148	130 / 137 / 148	132 / 139 / 148		
	6,000	127 / 135 / 148	127 / 135 / 148	127 / 135 / 148	129 / 136 / 148	132 / 139 / 148	
	4,000	124 / 133 / 148	124 / 133 / 148	124 / 133 / 148	125 / 134 / 148	129 / 136 / 148	
	2,000	122 / 131 / 147	121 / 131 / 147	121 / 131 / 147	122 / 132 / 147	126 / 134 / 147	130 / 137 / 147
	0	120 / 130 / 147	120 / 130 / 147	120 / 130 / 147	120 / 130 / 147	123 / 132 / 147	127 / 135 / 147
560,000	10,000	125 / 133 / 145	125 / 133 / 145	126 / 133 / 145	128 / 135 / 145		
	8,000	125 / 133 / 145	125 / 133 / 145	126 / 133 / 145	128 / 135 / 145		
	6,000	123 / 131 / 145	123 / 131 / 145	123 / 131 / 145	125 / 133 / 145	128 / 135 / 145	
	4,000	120 / 129 / 145	121 / 129 / 145	121 / 129 / 145	122 / 130 / 145	125 / 133 / 144	
	2,000	118 / 128 / 144	118 / 128 / 144	118 / 128 / 144	118 / 128 / 144	122 / 130 / 144	126 / 133 / 144
	0	117 / 127 / 145	117 / 127 / 145	117 / 127 / 145	117 / 127 / 145	119 / 128 / 144	123 / 131 / 144

Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

TAKEOFF SPEEDS

DRY RUNWAY
KIAS

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO1 / 20
V₁ / V_R / V₂

TAKEOFF WEIGHT LBS	AIRPORT PRESS ALT FT	AMBIENT TEMPERATURE - °C					
		0 & BELOW	10	20	30	40	50
540,000	10,000	121 / 129 / 143	121 / 129 / 143	122 / 130 / 143	125 / 132 / 143		
	8,000	121 / 129 / 143	121 / 129 / 143	122 / 130 / 143	125 / 132 / 143		
	6,000	119 / 128 / 142	119 / 128 / 142	120 / 128 / 142	122 / 129 / 142	125 / 131 / 142	
	4,000	117 / 126 / 142	117 / 126 / 142	117 / 126 / 142	118 / 127 / 142	122 / 129 / 142	
	2,000	115 / 125 / 142	115 / 125 / 142	115 / 125 / 142	115 / 125 / 142	119 / 127 / 141	123 / 130 / 141
	0	*116 / 124 / 142	*116 / 124 / 142	*116 / 124 / 142	*116 / 124 / 142	116 / 125 / 142	120 / 128 / 141
520,000	10,000	118 / 126 / 140	118 / 126 / 140	119 / 127 / 140	122 / 128 / 140		
	8,000	118 / 126 / 140	118 / 126 / 140	119 / 127 / 140	122 / 128 / 140		
	6,000	116 / 124 / 139	116 / 124 / 139	116 / 124 / 139	118 / 126 / 139	121 / 128 / 139	
	4,000	114 / 123 / 139	114 / 123 / 139	114 / 123 / 139	115 / 124 / 139	118 / 126 / 139	
	2,000	*113 / 122 / 140	*114 / 122 / 140	*114 / 122 / 140	*113 / 122 / 140	115 / 124 / 139	119 / 126 / 139
	0	*116 / 121 / 140	*116 / 121 / 140	*116 / 121 / 140	*116 / 121 / 140	*113 / 122 / 140	116 / 125 / 139
500,000	10,000	114 / 122 / 137	114 / 122 / 137	115 / 123 / 137	118 / 125 / 137		
	8,000	114 / 122 / 137	114 / 122 / 137	115 / 123 / 137	118 / 125 / 137		
	6,000	112 / 121 / 137	112 / 121 / 137	113 / 121 / 137	114 / 122 / 136	118 / 124 / 136	
	4,000	*111 / 120 / 137	*111 / 120 / 137	*111 / 120 / 137	112 / 120 / 137	114 / 122 / 136	
	2,000	*113 / 119 / 137	*114 / 119 / 137	*114 / 119 / 137	*113 / 119 / 137	112 / 121 / 137	115 / 123 / 136
	0	*116 / 119 / 139	*116 / 119 / 139	*116 / 119 / 139	*116 / 119 / 139	*113 / 119 / 137	113 / 121 / 136
480,000	10,000	110 / 119 / 134	111 / 119 / 134	112 / 119 / 134	114 / 121 / 134		
	8,000	110 / 119 / 134	111 / 119 / 134	112 / 119 / 134	114 / 121 / 134		
	6,000	109 / 117 / 134	109 / 117 / 134	109 / 117 / 134	111 / 119 / 134	114 / 121 / 134	
	4,000	*111 / 116 / 134	*111 / 116 / 134	*111 / 116 / 134	*109 / 117 / 134	111 / 119 / 134	
	2,000	*113 / 116 / 135	*114 / 116 / 135	*114 / 116 / 135	*113 / 116 / 135	110 / 117 / 134	112 / 120 / 133
	0	*116 / 119 / 138	*116 / 119 / 138	*116 / 119 / 138	*116 / 119 / 138	*113 / 116 / 134	110 / 118 / 134
460,000	10,000	107 / 115 / 131	107 / 115 / 131	108 / 116 / 131	110 / 117 / 131		
	8,000	107 / 115 / 131	107 / 115 / 131	108 / 116 / 131	110 / 117 / 131		
	6,000	*108 / 114 / 132	*108 / 114 / 132	*108 / 114 / 132	108 / 115 / 131	110 / 117 / 131	
	4,000	*111 / 114 / 131	*111 / 114 / 131	*111 / 114 / 131	*109 / 114 / 132	108 / 116 / 131	
	2,000	*113 / 116 / 135	*114 / 116 / 135	*114 / 116 / 135	*113 / 116 / 135	*109 / 114 / 132	108 / 116 / 131
	0	*116 / 119 / 138	*116 / 119 / 138	*116 / 119 / 138	*116 / 119 / 138	*113 / 116 / 134	*107 / 115 / 131
420,000	10,000	*106 / 112 / 129	*106 / 112 / 129	*104 / 112 / 129	106 / 114 / 128		
	8,000	*106 / 112 / 129	*106 / 112 / 129	*104 / 112 / 129	106 / 114 / 128		
	6,000	*108 / 112 / 129	*108 / 112 / 129	*108 / 112 / 129	*105 / 112 / 129	106 / 114 / 128	
	4,000	*111 / 114 / 131	*111 / 114 / 131	*111 / 114 / 131	*109 / 112 / 130	*105 / 112 / 129	
	2,000	*113 / 116 / 135	*114 / 116 / 135	*114 / 116 / 135	*113 / 116 / 135	*109 / 112 / 130	105 / 113 / 128
	0	*116 / 119 / 138	*116 / 119 / 138	*116 / 119 / 138	*116 / 119 / 138	*113 / 116 / 134	*107 / 112 / 129

 Limited by either Maximum Brake Energy, Tire Limit Speed, and/or Environmental Envelope.

Speeds marked with an asterisk (*) are limited by V_{mcg}.

TAKEOFF STABILIZER SETTINGS

UNITS AIRPLANE NOSE UP

CAUTION: Crews are not authorized to perform manual weight and balance computations without coordination and approval from Flight Control and the LCC. Refer to FOM Ch 5, Manual WDR.

TO

All Flaps

GROSS WEIGHT LBS	CENTER OF GRAVITY PERCENT M.A.C.						
	9	13	17	21	25	29	33
900,000	9.5	9	8	7	6	5	4
800,000	9.5	9	8	6.5	5.5	4.5	3.5
700,000	9.5	8.5	7.5	6.5	5	4	3
650,000	9	8	7	6	5	4	3
600,000	8.5	7.5	6.5	5.5	4.5	3.5	2.5
550,000	7.5	6.5	5.5	5	4	3	2
500,000		5.5	4.5	4	3	2	2
450,000		4	3.5	3	2.5	2	2
400,000		3.5	2.5	2.5	2	2	2

TO1

All Flaps

GROSS WEIGHT LBS	CENTER OF GRAVITY PERCENT M.A.C.						
	9	13	17	21	25	29	33
900,000	9.5	9	8	7	6	5	4
800,000	9.5	9	8	6.5	5.5	4.5	3.5
700,000	9.5	8.5	7.5	6.5	5	4	3
650,000	9	8	7	6	5	4	3
600,000	8.5	7.5	6.5	5.5	4.5	3.5	2.5
550,000	7.5	6.5	5.5	5	4	3	2
500,000		5.5	4.5	4	3	2	2
450,000		4	3.5	3	2.5	2	2
400,000		3.5	3.0	2.5	2	2	2

End of Section

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DEFINITIONS AND ASSUMPTIONS

APPROACH CLIMB LIMIT WEIGHT	Approach Climb Limit Weight is defined in FAR 25.121 as the maximum weight at which a missed approach climb meets the FAR prescribed climb gradient (2.1% for a two engine aircraft). This gradient is determined with the critical engine inoperative, remaining engine at takeoff thrust, landing gear retracted, and approach flap setting (as defined in the FAA Approved Flight Manual). This weight takes into account an air conditioning pack ON and operated from engine bleed air.
F.A.R. LANDING FIELD LENGTH	This is the landing field length as defined in the Federal Air Regulations Part 121, and is the actual landing distance plus an additional safety margin of 67%. Dispatch is based on F.A.R. Landing Field Length at the destination airport.
LANDING CLIMB LIMIT WEIGHT	Landing Climb Limit Weight is defined in FAR 25.119 as the maximum weight at which the aircraft meets the FAR prescribed climb gradient (3.2%). This gradient is determined with all engines operating, landing gear extended, and landing flap setting.
OPERATIONAL LANDING DISTANCE	The distance required to land starting at 50 feet above the runway (usually at the threshold) to a complete stop on the runway for a given landing weight, runway condition, and brake setting. This distance is based on a speed of V_{REF} at 50 feet and assumes all reversers are operating. These distances are based upon advisory data from the manufacturers and include an air distance (from threshold to touchdown) of 1,500 feet and a safety margin of 15%.
V_S	Indicated stall speed for the aircraft weight and configuration. $1.3 V_S$ is 1.3 times the stall speed, or an increase of 30% above stall speed.

INTENTIONALLY BLANK

F.A.R. DRY LANDING FIELD LENGTH**FEET****PW 4056****FLAPS 25**

AIRCRAFT WEIGHT LBS (1,000 LBS)	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
880	12,630	13,150	13,700	14,290	14,930						
860	11,980	12,480	12,980	13,510	14,100	14,730	15,420				
840	11,470	11,790	12,280	12,790	13,330	13,910	14,540	15,210			
820	11,050	11,360	11,700	12,080	12,590	13,130	13,700	14,310	14,970		
800	10,640	10,940	11,250	11,550	11,910	12,380	12,910	13,470	14,080	14,720	15,420
780	10,230	10,520	10,810	11,110	11,430	11,760	12,160	12,680	13,240	13,830	14,460
760	9,830	10,110	10,380	10,680	10,990	11,300	11,640	11,990	12,460	13,000	13,580
740	9,450	9,700	9,960	10,250	10,540	10,840	11,150	11,480	11,830	12,230	12,750
720	9,070	9,310	9,560	9,830	10,100	10,390	10,700	11,010	11,340	11,690	12,040
700	8,690	8,920	9,170	9,410	9,680	9,960	10,240	10,540	10,860	11,170	11,520
680	8,320	8,540	8,770	9,010	9,270	9,530	9,800	10,090	10,380	10,680	11,010
660	7,960	8,170	8,390	8,620	8,860	9,120	9,370	9,640	9,920	10,220	10,520
640	7,600	7,810	8,020	8,230	8,470	8,700	8,940	9,200	9,470	9,750	10,040
630	7,430	7,630	7,840	8,040	8,270	8,500	8,740	8,990	9,250	9,520	9,800
620	7,260	7,450	7,650	7,850	8,080	8,300	8,530	8,770	9,040	9,300	9,570
600	6,920	7,100	7,290	7,480	7,680	7,900	8,120	8,350	8,590	8,840	9,110
580	6,650	6,820	7,010	7,190	7,380	7,590	7,800	8,030	8,250	8,490	8,750
560	6,450	6,620	6,800	6,980	7,160	7,370	7,580	7,790	8,010	8,240	8,490
540	6,250	6,410	6,580	6,760	6,950	7,130	7,330	7,540	7,750	7,970	8,210
520	6,050	6,210	6,370	6,540	6,720	6,900	7,100	7,300	7,500	7,720	7,940
500	5,840	6,010	6,150	6,320	6,490	6,670	6,850	7,040	7,240	7,460	7,670
480	5,650	5,800	5,940	6,110	6,260	6,440	6,610	6,800	6,990	7,190	7,390
460	5,450	5,590	5,730	5,880	6,050	6,200	6,380	6,550	6,740	6,930	7,120
440	5,250	5,390	5,530	5,670	5,820	5,980	6,140	6,310	6,480	6,670	6,870

NOTE:

Actual Landing Distance is:

- 60 percent of the F.A.R. Landing Field Lengths above.
- The distance to a complete stop from 50 feet above the runway threshold at VREF.
- Based on Maximum Manual Braking, Speed Brakes Extended and No Reverse Thrust.

CORRECTIONS:

CONDITION	CORRECTION
Headwind	- 55 ft. per knot
Tailwind	+ 150 ft. per knot
Manual Spoilers	Refer to ODM Abnormal section
Wet runway and/or Low Minima	increase distance by 15%

F.A.R. DRY LANDING FIELD LENGTH**FEET****PW 4056****FLAPS 30**

AIRCRAFT WEIGHT LBS (1,000 LBS)	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
880	11,100	11,430	11,880	12,360	12,860	13,400	14,000	14,630	15,310		
860	10,720	11,010	11,320	11,750	12,220	12,720	13,260	13,850	14,470	15,160	
840	10,350	10,640	10,930	11,240	11,600	12,060	12,570	13,110	13,680	14,300	14,960
820	9,980	10,260	10,530	10,830	11,140	11,470	11,900	12,390	12,930	13,500	14,090
800	9,620	9,890	10,150	10,440	10,730	11,040	11,360	11,720	12,230	12,740	13,300
780	9,270	9,510	9,790	10,050	10,330	10,620	10,940	11,250	11,590	12,040	12,550
760	8,910	9,160	9,410	9,660	9,940	10,210	10,510	10,820	11,140	11,470	11,850
740	8,580	8,810	9,040	9,290	9,550	9,810	10,090	10,390	10,700	11,020	11,340
720	8,240	8,450	8,690	8,920	9,170	9,430	9,690	9,970	10,260	10,560	10,880
700	7,900	8,120	8,340	8,560	8,790	9,040	9,300	9,570	9,840	10,130	10,430
680	7,580	7,780	7,990	8,200	8,430	8,670	8,920	9,170	9,420	9,700	9,980
660	7,260	7,450	7,650	7,860	8,080	8,300	8,540	8,770	9,020	9,280	9,550
640	6,940	7,130	7,320	7,510	7,710	7,930	8,160	8,380	8,610	8,870	9,130
630	6,810	6,990	7,180	7,370	7,570	7,780	8,000	8,220	8,460	8,700	8,960
620	6,670	6,860	7,030	7,220	7,420	7,630	7,840	8,060	8,300	8,540	8,780
600	6,480	6,660	6,830	7,020	7,210	7,410	7,610	7,830	8,050	8,290	8,530
580	6,290	6,460	6,630	6,820	7,000	7,180	7,390	7,600	7,820	8,040	8,280
560	6,120	6,270	6,440	6,610	6,790	6,970	7,160	7,360	7,570	7,790	8,010
540	5,930	6,080	6,230	6,400	6,580	6,750	6,940	7,140	7,340	7,550	7,770
520	5,740	5,880	6,040	6,200	6,360	6,540	6,720	6,900	7,100	7,300	7,520
500	5,550	5,700	5,840	5,990	6,150	6,310	6,480	6,670	6,850	7,050	7,260
480	5,360	5,500	5,640	5,790	5,940	6,090	6,270	6,440	6,620	6,810	7,000
460	5,170	5,300	5,440	5,580	5,730	5,880	6,040	6,210	6,380	6,560	6,740
440	4,990	5,120	5,250	5,390	5,520	5,670	5,820	5,980	6,150	6,320	6,500

NOTE:

Actual Landing Distance is:

- 60 percent of the F.A.R. Landing Field Lengths above.
- The distance to a complete stop from 50 feet above the runway threshold at VREF.
- Based on Maximum Manual Braking, Speed Brakes Extended and No Reverse Thrust.

CORRECTIONS:

CONDITION	CORRECTION
Headwind	- 65 ft. per knot
Tailwind	+ 180 ft. per knot
Manual Spoilers	Refer to ODM Abnormal section
Wet runway and/or Low Minima	increase distance by 15%

APPROACH AND LANDING CLIMB LIMITS

POUNDS

PW 4056

**APPROACH FLAPS 20
LANDING FLAPS 25**

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
50	830,200	803,000	775,200	745,800							
45	881,800	850,400	819,900	791,000	760,200	732,700	705,200				
40	929,700	898,300	865,100	833,400	803,400	771,800	743,200	714,600	686,500		
35	975,500	941,600	909,400	875,600	842,900	811,000	780,400	750,200	721,000	693,800	667,400
32	991,700	967,300	932,300	899,900	863,300	830,800	800,300	768,700	741,400	711,400	683,400
30	992,100	972,200	945,600	912,300	878,200	844,900	813,500	782,400	751,600	723,800	696,100
28	992,100	972,300	951,900	925,500	893,100	858,400	824,800	793,200	762,900	733,500	704,900
26	992,100	972,300	952,000	931,100	904,600	870,500	837,000	805,100	774,300	744,600	715,400
24	992,400	972,600	952,000	931,400	909,400	881,600	848,600	816,100	785,300	754,200	725,300
22	992,500	972,900	952,300	931,700	909,400	886,600	859,100	825,800	795,500	763,600	734,200
20	992,800	973,000	952,600	931,700	909,700	886,600	870,100	835,200	804,100	771,600	742,500
18	992,800	973,000	952,700	931,700	909,700	887,200	871,500	845,400	812,400	781,300	750,700
16	992,800	973,000	952,700	931,800	909,800	887,200	871,800	848,700	820,400	789,300	757,900
14	992,900	973,100	952,800	931,800	909,800	887,300	871,900	848,700	825,600	797,600	765,900
12	992,900	973,100	953,000	931,900	910,400	887,300	871,900	848,800	825,700	803,100	773,700
10	993,000	973,100	953,300	931,900	910,400	887,500	872,500	848,800	826,300	803,700	780,300
8	993,000	973,700	953,400	932,200	910,500	887,600	872,500	849,400	826,300	803,700	780,600
6	993,000	973,800	953,400	932,200	910,500	887,900	872,800	849,400	826,600	803,800	780,900
4	993,100	973,800	953,400	932,300	910,500	888,000	872,900	849,500	826,900	804,400	781,200
2	993,100	973,800	953,500	932,300	910,600	888,000	873,200	849,500	826,900	804,400	781,300
≤0	993,100	973,900	953,800	932,600	910,600	888,100	873,200	849,800	827,000	804,400	781,900

NOTES:

- AFM Maximum Structural Landing Weight should not be exceeded (unless overweight landing is deemed necessary in flight).
- Weights are for 2 or 3 packs on.
- Reduce Limit Weight by 47,200 pounds when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10 degrees C.

Bleed Adjustment

1 PACK ON	+8,600 lbs
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BASIS:

The limit weights shown are the more restrictive of:

APPROACH

- Flaps at approach setting.
- Landing gear retracted.
- 3 Engines operating.

LANDING

- Flaps at landing setting.
- Landing gear extended.
- All engines operating.

APPROACH AND LANDING CLIMB LIMITS

POUNDS

PW 4056

APPROACH FLAPS 20
LANDING FLAPS 30

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
50	824,000	791,200	763,800	737,800							
45	873,900	841,100	812,300	782,200	751,800	726,600					
40	920,700	887,600	858,100	824,700	792,400	764,200	696,500	703,100	675,500		
35	963,200	928,400	897,800	864,900	831,000	800,100	732,200	736,300	705,900	675,500	648,700
32	977,500	952,300	918,600	885,800	852,600	821,400	785,900	753,300	723,500	692,300	664,300
30	978,000	957,200	931,800	899,700	867,200	834,600	799,300	764,800	734,700	702,400	674,200
28	978,000	957,200	936,700	911,200	877,900	845,600	811,300	776,600	745,700	713,400	683,500
26	978,300	957,800	936,700	917,000	892,100	857,600	822,600	787,500	755,000	723,200	692,300
24	978,600	957,800	936,700	917,000	895,700	869,100	833,000	798,200	765,700	733,900	702,200
22	978,600	958,100	937,000	917,000	896,000	873,000	843,100	807,800	775,300	741,900	711,200
20	978,600	958,100	937,000	917,300	896,000	873,500	852,200	816,600	782,900	749,500	719,200
18	978,700	958,100	937,000	917,300	896,000	873,500	854,900	826,500	791,700	758,300	726,800
16	978,700	958,400	937,600	917,600	896,000	873,600	854,900	829,500	799,900	766,000	734,800
14	978,900	958,400	937,600	917,900	896,300	873,800	855,000	829,500	805,100	773,400	741,900
12	979,000	958,400	937,600	917,900	896,300	874,100	855,500	829,800	805,400	780,300	749,000
10	979,000	958,400	937,600	917,900	896,300	874,100	855,500	829,800	805,400	780,300	754,800
8	979,000	958,700	937,900	918,200	896,300	874,200	855,500	829,800	805,700	780,300	755,400
6	979,000	958,700	937,900	918,200	896,600	874,200	855,600	829,800	805,700	780,600	755,700
4	979,000	958,800	938,000	918,300	896,900	874,700	855,800	829,800	806,000	780,600	755,900
2	979,000	958,800	938,000	918,300	896,900	874,700	856,100	830,400	806,300	780,900	756,000
≤0	979,000	958,800	938,500	918,300	896,900	874,800	856,200	830,400	806,300	781,200	756,200

NOTES:

- AFM Maximum Structural Landing Weight should not be exceeded (unless overweight landing is deemed necessary in flight).
- Weights are for 2 or 3 packs on.
- Reduce Limit Weight by 37,700 pounds when operating in icing conditions during any part of the flight when the forecast landing temperature is below 10 degrees C.

Bleed Adjustment

1 PACK ON	+6,300 lbs
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BASIS:

The limit weights shown are the more restrictive of:

APPROACH

- Flaps at approach setting.
- Landing gear retracted.
- 3 Engines operating.

LANDING

- Flaps at landing setting.
- Landing gear extended.
- All engines operating

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NORMAL LANDING SPEEDS

	VZF	V _{MA1}	V _{MA5}	V _{MA10}	V _{MA20}	V _{REF}	V _{REF}	Opt. Desc. Speed
Flaps	0	1	5	10	20	25	30	0
Gear	UP	UP	UP	UP	DN	DN	DN	UP
Wt	IAS							
630	236	216	196	176	166	162	156	297
610	234	214	194	174	164	160	154	296
590	231	211	191	171	161	157	151	295
570	228	208	188	168	156	154	148	294
550	225	205	185	165	155	151	145	293
530	222	202	182	162	152	148	142	292
510	219	199	179	159	149	145	139	291
490	216	196	176	156	146	142	136	290
470	213	193	173	153	143	139	133	289
450	210	190	170	150	140	134	130	287

For three or four engines operating.

Note:

For Flaps 0 through 20 approach speed selections, set the command speed indicator at the charted values.

For flaps 25 and 30 approach speed selections, set the command speed indicator to $V_{REF25} + 5$ or $V_{REF30} + 5$.

For weights above 630,000 lb., refer to "Overweight Landing Speeds" in the Abnormal section of this ODM.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).									
	DRY (6)						GOOD (5)			
	AB 1	AB 2	AB 3	AB 4	Max AB	Max Manual	AB 3	AB 4	Max AB	Max Manual
860,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
840,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
820,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
800,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
780,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
760,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
740,000	12,900	11,500	10,100	8,800	7,200	6,400	10,100	8,900	8,100	7,900
720,000	12,600	11,200	9,900	8,600	7,100	6,200	9,900	8,700	8,000	7,800
700,000	12,200	11,000	9,700	8,400	6,900	6,000	9,700	8,400	7,800	7,600
680,000	11,900	10,700	9,500	8,200	6,700	5,900	9,500	8,200	7,600	7,400
660,000	11,600	10,400	9,200	8,000	6,600	5,700	9,200	8,000	7,400	7,200
640,000	11,300	10,100	9,000	7,800	6,400	5,600	9,000	7,800	7,200	7,000
620,000	11,000	9,900	8,800	7,600	6,300	5,400	8,800	7,600	7,000	6,800
600,000	10,600	9,600	8,500	7,400	6,100	5,200	8,500	7,400	6,800	6,700
580,000	10,300	9,300	8,300	7,200	5,900	5,100	8,300	7,200	6,700	6,500
560,000	10,000	9,000	8,100	6,900	5,800	4,900	8,100	7,000	6,500	6,300
540,000	9,700	8,800	7,800	6,700	5,600	4,800	7,800	6,800	6,300	6,100
520,000	9,300	8,500	7,600	6,500	5,500	4,700	7,600	6,600	6,100	5,900
500,000	9,000	8,200	7,400	6,300	5,300	4,500	7,400	6,400	5,900	5,700
480,000	8,700	7,900	7,200	6,100	5,100	4,400	7,200	6,200	5,700	5,500
460,000	8,400	7,700	6,900	5,900	5,000	4,300	6,900	6,000	5,600	5,400

BASIS: Zero wind • Four Engine Reverse Thrust • Touchdown Speed = VREF30 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

NOTE: Flaps 30 Landing may not be possible for weights greater than 750,000 lb. due to V_{FE} limitations.

Shaded areas could correspond to Caution or Melt Zone in Brake Cooling charts. Refer to Abnormal section.

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)						GOOD (5)			
0	-600	-500	-500	-400	-300	-200	-500	-400	-300	-300
2,000	0	0	0	0	0	0	0	0	0	0
4,000	600	500	500	400	300	200	500	400	300	300
6,000	1,200	1,100	900	700	600	500	900	700	700	700
8,000	1,900	1,600	1,400	1,100	800	700	1,400	1,100	1,000	1,000

CORRECTIONS

	DRY (6)						GOOD (5)			
PER 1 KT HEADWIND	-50	-50	-50	-50	0	0	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	100	100	50	150	100	100	100
PER 5 KTS ADD'L SPD	350	350	400	350	300	200	400	350	300	250
PER 10°C ABOVE ISA	300	250	200	150	150	100	200	200	150	150
PER 10°C BELOW ISA	-250	-250	-200	-150	-150	-100	-200	-200	-150	-150
PER 1% UP SLOPE	-250	-150	-50	0	0	-50	-50	0	-100	-150
PER 1% DOWN SLOPE	250	100	50	0	0	50	50	50	150	150
2 REVERSERS INOP	600	200	100	0	0	100	100	100	300	300
4 REVERSERS INOP	900	200	100	0	0	300	100	300	700	700
MANUAL SPOILERS	0	0	0	0	0	300	0	0	0	300

Note: Do not operate when Braking Action is Nil.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 30

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	MEDIUM (3)				POOR(1)			
	AB 3	AB 4	Max AB	Max Manual	AB 3	AB 4	Max AB	Max Manual
860,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
840,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
820,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
800,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
780,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
760,000	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}	V _{FE}
740,000	11,000	10,500	10,500	10,500	13,600	13,600	13,600	13,600
720,000	10,700	10,300	10,300	10,300	13,300	13,300	13,300	13,300
700,000	10,400	10,000	10,000	10,000	12,900	12,900	12,900	12,900
680,000	10,200	9,800	9,800	9,800	12,600	12,600	12,600	12,600
660,000	9,900	9,500	9,500	9,500	12,300	12,300	12,300	12,300
640,000	9,700	9,300	9,300	9,300	11,900	11,900	11,900	11,900
620,000	9,400	9,000	9,000	9,000	11,600	11,600	11,600	11,600
600,000	9,200	8,800	8,800	8,800	11,200	11,200	11,200	11,200
580,000	8,900	8,500	8,500	8,500	10,900	10,900	10,900	10,900
560,000	8,700	8,300	8,300	8,300	10,500	10,500	10,500	10,500
540,000	8,400	8,000	8,000	8,000	10,200	10,200	10,200	10,200
520,000	8,200	7,800	7,800	7,800	9,900	9,900	9,900	9,900
500,000	7,900	7,500	7,500	7,500	9,500	9,500	9,500	9,500
480,000	7,700	7,200	7,200	7,200	9,200	9,200	9,200	9,200
460,000	7,400	7,000	7,000	7,000	8,900	8,900	8,900	8,900

BASIS: Zero wind • Four Engine Reverse Thrust • Touchdown Speed = VREF30 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

NOTE: Flaps 30 Landing may not be possible for weights greater than 750,000 lb. due to V_{FE} limitations.

Shaded areas could correspond to Caution or Melt Zone in Brake Cooling charts. Refer to Abnormal section.

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)				POOR (1)			
0	-500	-500	-500	-500	-600	-600	-600	-600
2,000	0	0	0	0	0	0	0	0
4,000	500	500	500	500	600	600	600	600
6,000	1,000	1,000	1,000	1,000	1,300	1,300	1,300	1,300
8,000	1,500	1,400	1,400	1,400	1,900	1,900	1,900	1,900

CORRECTIONS	MEDIUM (3)				POOR (1)			
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	150	250	250	250	250
PER 5 KTS ADD'L SPD	400	350	350	300	400	350	350	350
PER 10°C ABOVE ISA	250	250	250	250	350	350	350	350
PER 10°C BELOW ISA	-250	-200	-200	-200	-250	-250	-250	-250
PER 1% UP SLOPE	-200	-250	-250	-300	-500	-500	-500	-550
PER 1% DOWN SLOPE	300	350	350	350	900	900	900	900
2 REVERSERS INOP	500	800	800	800	1,600	1,600	1,600	1,600
4 REVERSERS INOP	1,500	1,800	1,800	1,800	4,100	4,000	4,100	4,000
MANUAL SPOILERS	0	0	0	300	0	0	0	300

Note: Do not operate when Braking Action is Nil.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 25

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).									
	DRY (6)						GOOD (5)			
	AB 1	AB 2	AB 3	AB 4	Max AB	Max Manual	AB 3	AB 4	Max AB	Max Manual
860,000	16,400	14,300	12,500	10,500	8,500	8,000	12,500	10,600	9,900	9,400
840,000	16,000	14,000	12,200	10,300	8,400	7,800	12,200	10,400	9,700	9,200
820,000	15,700	13,700	12,000	10,100	8,200	7,600	12,000	10,200	9,500	9,000
800,000	15,300	13,400	11,700	9,900	8,100	7,400	11,700	10,000	9,300	8,800
780,000	14,900	13,100	11,500	9,700	7,900	7,200	11,500	9,700	9,100	8,700
760,000	14,600	12,800	11,200	9,500	7,700	7,000	11,200	9,500	8,900	8,500
740,000	14,200	12,500	11,000	9,300	7,600	6,800	11,000	9,300	8,700	8,300
720,000	13,800	12,200	10,700	9,100	7,400	6,700	10,700	9,100	8,500	8,100
700,000	13,500	11,900	10,500	8,900	7,200	6,500	10,500	8,900	8,300	7,900
680,000	13,100	11,600	10,200	8,700	7,100	6,300	10,200	8,700	8,100	7,700
660,000	12,700	11,300	10,000	8,500	6,900	6,100	10,000	8,500	7,900	7,600
640,000	12,400	11,000	9,700	8,200	6,800	5,900	9,700	8,300	7,700	7,400
620,000	12,000	10,700	9,500	8,000	6,600	5,700	9,500	8,100	7,500	7,200
600,000	11,600	10,400	9,200	7,800	6,400	5,600	9,200	7,900	7,200	7,000
580,000	11,300	10,100	9,000	7,600	6,300	5,400	9,000	7,700	7,000	6,800
560,000	10,900	9,800	8,700	7,400	6,100	5,200	8,700	7,500	6,800	6,600
540,000	10,500	9,500	8,400	7,200	6,000	5,000	8,400	7,300	6,600	6,500
520,000	10,200	9,200	8,200	7,000	5,800	4,900	8,200	7,100	6,500	6,300
500,000	9,800	8,900	7,900	6,800	5,600	4,800	7,900	6,800	6,300	6,100
480,000	9,500	8,600	7,700	6,600	5,500	4,700	7,700	6,600	6,100	5,900
460,000	9,100	8,300	7,400	6,400	5,300	4,600	7,400	6,400	5,900	5,700

BASIS: Zero wind • Four Engine Reverse Thrust • Touchdown Speed = VREF25 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded areas could correspond to Caution or Melt Zone in Brake Cooling charts. Refer to Abnormal section.

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	DRY (6)						GOOD (5)			
0	-700	-600	-500	-400	-300	-300	-500	-400	-400	-400
2,000	0	0	0	0	0	0	0	0	0	0
4,000	700	600	500	400	300	300	500	400	400	400
6,000	1,400	1,200	1,000	800	600	500	1,000	800	700	700
8,000	2,100	1,700	1,400	1,200	900	800	1,400	1,200	1,100	1,100

CORRECTIONS

	DRY (6)						GOOD (5)			
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	0	-50	-50	-50	-50
PER 1 KT TAILWIND	200	150	150	100	100	50	150	100	100	100
PER 5 KTS ADD'L SPD	400	400	400	400	300	200	400	400	300	250
PER 10°C ABOVE ISA	350	300	250	200	150	100	250	200	200	150
PER 10°C BELOW ISA	-300	-250	-250	-200	-150	-100	-250	-200	-150	-150
PER 1% UP SLOPE	-300	-150	-50	0	0	-50	-50	0	-100	-150
PER 1% DOWN SLOPE	250	50	0	0	0	50	0	50	150	150
2 REVERSERS INOP	700	100	100	0	0	200	100	100	400	400
4 REVERSERS INOP	900	200	100	0	0	300	100	300	800	800
MANUAL SPOILERS	0	0	0	0	0	300	0	0	0	300

Note: Do not operate when Braking Action is Nil.

OPERATIONAL LANDING DISTANCES FEET

FLAPS 25

Landing Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
	MEDIUM (3)				POOR(1)			
	AB 3	AB 4	Max AB	Max Manual	AB 3	AB 4	Max AB	Max Manual
860,000	13,500	13,000	13,000	13,000	16,900	16,900	16,900	16,900
840,000	13,200	12,700	12,700	12,700	16,500	16,500	16,500	16,500
820,000	12,900	12,400	12,400	12,400	16,100	16,100	16,100	16,100
800,000	12,600	12,100	12,100	12,100	15,700	15,700	15,700	15,700
780,000	12,400	11,900	11,900	11,900	15,400	15,400	15,400	15,400
760,000	12,100	11,600	11,600	11,600	15,000	15,000	15,000	15,000
740,000	11,800	11,300	11,300	11,300	14,600	14,600	14,600	14,600
720,000	11,500	11,000	11,000	11,000	14,300	14,300	14,300	14,300
700,000	11,300	10,800	10,800	10,800	13,900	13,900	13,900	13,900
680,000	11,000	10,500	10,500	10,500	13,500	13,500	13,500	13,500
660,000	10,700	10,200	10,200	10,200	13,200	13,200	13,200	13,200
640,000	10,400	9,900	9,900	9,900	12,800	12,800	12,800	12,800
620,000	10,200	9,700	9,700	9,700	12,400	12,400	12,400	12,400
600,000	9,900	9,400	9,400	9,400	12,100	12,100	12,100	12,100
580,000	9,600	9,100	9,100	9,100	11,700	11,700	11,700	11,700
560,000	9,300	8,800	8,800	8,800	11,300	11,300	11,300	11,300
540,000	9,100	8,600	8,600	8,600	11,000	11,000	11,000	11,000
520,000	8,800	8,300	8,300	8,300	10,600	10,600	10,600	10,600
500,000	8,500	8,000	8,000	8,000	10,200	10,200	10,200	10,200
480,000	8,200	7,700	7,700	7,700	9,900	9,900	9,900	9,900
460,000	8,000	7,500	7,500	7,500	9,500	9,500	9,500	9,500

BASIS: Zero wind • Four Engine Reverse Thrust • Touchdown Speed = VREF25 - 5 •

Data is advisory and includes 15% safety margin and 1,500 ft. air distance from threshold to touchdown.

REFERENCE DISTANCES BASED UPON PRESSURE ALTITUDE OF 2,000 FEET AND ARE CONSERVATIVE FOR ALL LOWER ALTITUDES.

Shaded areas could correspond to Caution or Melt Zone in Brake Cooling charts. Refer to Abnormal section.

ALTITUDE ADJUSTMENT

ALTITUDE (FEET)	MEDIUM (3)				POOR (1)			
0	-600	-500	-500	-500	-700	-700	-700	-700
2,000	0	0	0	0	0	0	0	0
4,000	600	500	500	500	700	700	700	700
6,000	1,100	1,100	1,100	1,100	1,400	1,400	1,400	1,400
8,000	1,700	1,600	1,600	1,600	2,100	2,100	2,100	2,100

CORRECTIONS	MEDIUM (3)				POOR (1)			
PER 1 KT HEADWIND	-50	-50	-50	-50	-50	-50	-50	-50
PER 1 KT TAILWIND	150	150	150	150	250	250	250	250
PER 5 KTS ADD'L SPD	400	350	350	350	400	350	350	350
PER 10°C ABOVE ISA	250	250	250	250	350	350	350	350
PER 10°C BELOW ISA	-250	-200	-200	-200	-300	-300	-300	-300
PER 1% UP SLOPE	-200	-250	-250	-300	-500	-550	-550	-600
PER 1% DOWN SLOPE	250	350	350	400	950	950	1,000	950
2 REVERSERS INOP	600	900	900	900	1,900	1,900	1,900	1,900
4 REVERSERS INOP	1,900	2,200	2,200	2,200	5,200	5,100	5,100	5,100
MANUAL SPOILERS	0	0	0	300	0	0	0	300

Note: Do not operate when Braking Action is Nil.

END OF SECTION

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DEFINITIONS AND ASSUMPTIONS

BTMS	Brake Temperature Monitoring System.
CONTAMINATED RUNWAY	Runway contaminated with ice, snow, slush or standing water. The associated table also includes slippery/wet performance.
GROSS LEVEL OFF ALTITUDE	Altitude at which the aircraft is expected to level off after the loss of one engine. No conservatism is built into this value. For use during flight, not for flight planning.
LONG RANGE CRUISE	The speed of the aircraft that will result in 99% of the maximum range of the aircraft in no wind conditions for a given weight and altitude.
MAXIMUM CONTINUOUS THRUST (MCT)	The maximum thrust level for which the engine is rated with no time constraint.
SPECIFIC AIR RANGE (SAR)	The gas mileage range an aircraft can fly per 1,000 lbs of fuel for a given weight, altitude, Mach number, and temperature. The SAR changes as the weight of the aircraft changes, all other parameters remaining constant. Fuel burn required for a given flight segment is the segment length divided by the average SAR for the leg.
STATIC AIR TEMPERATURE (SAT)	The static air temperature outside of the aircraft. Also referred to as the Outside Air Temperature or OAT.
TOTAL AIR TEMPERATURE (TAT)	The sum of both the ambient air temperature plus the total increase in temperature due to compression heating.
VMCG	Minimum control speed on the ground.

MEL RELATED PERFORMANCE ABBREVIATIONS DISPLAYED ON WDR

ASI	AWABS has automatically corrected the allowable weights and V1 speeds due to a completely inoperative anti-skid braking system.
BKI	AWABS has automatically corrected the allowable weights and V1 speeds due to an inoperative brake or one anti-skid channel inoperative.
EEC	AWABS has automatically corrected the allowable weights and V1 speeds due to EEC Normal Mode Inoperative or EPR Indicating System Inoperative.
GRD	AWABS has automatically corrected the allowable weights and V1 speeds due to gear down dispatch. Used when an MEL item requires delayed gear retraction or gear down flight.

THRUST SETTINGS – ALL ENGINE**TAKEOFF EPR**

TO									
PW 4056									
OAT °C	AIRPORT PRESSURE ALTITUDE - FEET								
	0	1,000	2,000	3,000	4,000	5,000	6,000	8,000	10,000
60	1.32	1.32	1.32	1.32	1.32	1.32			
55	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	
50	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39
45	1.43	1.43	1.43	1.43	1.43	1.43	1.42	1.42	1.42
40	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46
35	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.49	1.49
30	1.51	1.52	1.53	1.53	1.53	1.53	1.53	1.53	1.53
25	1.51	1.52	1.54	1.55	1.56	1.56	1.56	1.56	1.56
20	1.51	1.52	1.54	1.55	1.56	1.57	1.59	1.59	1.59
15	1.51	1.52	1.54	1.55	1.56	1.57	1.60	1.62	1.62
10 & below	1.51	1.52	1.54	1.55	1.56	1.57	1.60	1.62	1.65

Based on Normal Bleed - 2 or 3 Packs on
Anti-Ice On or OFF

Engine Bleed Adjustment

1 Pack ON	0.01
Packs OFF	0.02

THRUST SETTINGS – ALL ENGINE

TAKEOFF EPR

TO1

PW 4056

OAT °C	AIRPORT PRESSURE ALTITUDE - FEET								
	0	1,000	2,000	3,000	4,000	5,000	6,000	8000	10,000
60	1.29	1.29	1.29	1.29	1.29	1.29			
55	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	
50	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
45	1.38	1.38	1.38	1.38	1.38	1.38	1.37	1.37	1.37
40	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
35	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.43	1.43
30	1.45	1.45	1.46	1.46	1.46	1.46	1.46	1.46	1.46
25	1.45	1.45	1.47	1.48	1.49	1.49	1.49	1.49	1.49
20	1.45	1.45	1.47	1.48	1.49	1.49	1.51	1.51	1.51
15	1.45	1.45	1.47	1.48	1.49	1.49	1.52	1.53	1.53
10 & below	1.45	1.45	1.47	1.48	1.49	1.49	1.52	1.53	1.56

Based on Normal Bleed - 2 or 3 Packs on
Anti-Ice On or OFF

Engine Bleed Adjustment

1 Pack ON	0.01
Packs OFF	0.02

THRUST SETTINGS – ALL ENGINE**TAKEOFF N1****TO****PW 4056**

OAT °C	AIRPORT PRESSURE ALTITUDE - FEET				
	0	1,000	2,000	3,000	4,000
50	89.9	90.2	90.5	90.8	91.1
45	91.6	92.0	92.3	92.6	92.9
40	93.1	93.4	93.7	94.1	94.4
35	94.6	94.9	94.3	95.6	95.9
30	94.9	95.6	96.5	96.8	97.2
25	94.4	95.7	96.4	97.1	97.9
20	93.9	94.6	95.9	96.6	97.4
15	93.4	94.1	95.4	96.1	96.9
10	92.9	93.6	94.9	95.6	96.4
5	92.4	93.1	94.4	95.1	95.9
0	91.9	92.6	93.9	94.6	95.3
-5	91.4	92.1	93.4	94.1	94.8
-10	90.9	91.6	92.8	93.6	94.3
-15	90.4	91.1	92.3	93.0	93.8
-20	89.9	90.6	91.8	92.5	93.2
-25	89.4	90.1	91.3	92.0	92.1
-30	88.9	89.6	90.8	91.5	92.2
-35	88.4	89.0	90.2	90.9	91.6
-40	87.8	88.5	89.7	90.4	91.1
-45	87.3	88.0	89.2	89.9	90.6
-50	86.8	87.5	88.6	89.3	90.0

THRUST SETTINGS – ALL ENGINE

TAKEOFF N1

TO1

PW 4056

OAT °C	AIRPORT PRESSURE ALTITUDE - FEET				
	0	1,000	2,000	3,000	4,000
50	87.4	87.7	88.0	88.3	88.6
45	88.9	89.2	89.5	89.8	90.1
40	90.1	90.4	90.7	91.0	91.4
35	91.4	91.7	92.0	92.4	92.7
30	91.5	91.8	92.8	93.1	93.5
25	91.0	91.3	92.9	93.7	94.6
20	90.5	90.9	92.4	94.1	94.1
15	90.1	90.4	91.9	92.8	93.6
10	89.6	89.9	91.4	92.3	93.1
5	89.1	89.4	90.9	91.8	92.6
0	88.6	89.0	90.4	91.3	92.1
-5	88.2	88.5	90.0	90.8	91.6
-10	87.7	88.0	89.5	90.3	91.1
-15	87.2	87.5	89.0	89.8	90.6
-20	86.7	87.0	88.5	89.3	90.1
-25	86.2	86.5	88.0	88.8	89.6
-30	85.7	86.0	87.5	88.3	89.1
-35	85.2	85.5	86.9	87.8	88.6
-40	84.7	85.0	86.4	87.2	88.1
-45	84.2	84.5	85.9	86.7	87.5
-50	83.7	84.0	85.4	86.2	87.0

THRUST SETTINGS – ALL ENGINE

CLIMB EPR

CLIMB

Based on 250/340/.84 schedule

PW 4056

TAT °C	PRESSURE ALTITUDE - FEET								
	SL	5000	10,000	15,000	20,000	25,000	30,000	35,000	40,000
60	1.19	1.19	1.18						
50	1.23	1.23	1.22	1.21					
40	1.25	1.29	1.28	1.27	1.25				
30	1.25	1.30	1.35	1.35	1.33	1.32			
20	1.25	1.30	1.35	1.39	1.42	1.42	1.42		
10	1.25	1.30	1.35	1.39	1.43	1.48	1.52	1.44	1.41
0	1.25	1.30	1.35	1.39	1.43	1.48	1.57	1.54	1.51
-10	1.25	1.30	1.35	1.39	1.43	1.48	1.57	1.61	1.58
-20 & below	1.25	1.30	1.35	1.39	1.43	1.48	1.57	1.61	1.58

Based on Normal Bleed - 2 or 3 Packs on
Anti-Ice OFF

Engine Bleed Adjustments

Eng AI on	-0.01	-0.02	-0.03	-0.04	-0.05
Eng & Wing AI on	-0.03	-0.04	-0.06	-0.07	-0.08

THRUST SETTINGS – ALL ENGINE

GO-AROUND EPR

PW 4056

OAT - °C	PRESSURE ALTITUDE - FEET							
	0	1,000	2,000	3,000	4,000	6,000	8,000	10,000
50	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38
45	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.46
40	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.50
35	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
30	1.51	1.53	1.53	1.53	1.54	1.54	1.53	1.53
25	1.51	1.53	1.54	1.55	1.57	1.57	1.57	1.57
20	1.51	1.53	1.54	1.55	1.57	1.61	1.61	1.61
15	1.51	1.53	1.54	1.55	1.57	1.61	1.64	1.64
10	1.51	1.53	1.54	1.55	1.57	1.61	1.64	1.67

Based on Normal Bleed – 2 or 3 Packs on
Anti-Ice OFF

Bleed Adjustments:

1 Pack ON	0.01
Packs OFF	0.02
Anti-ice on	No adj. available

ONE ENGINE INOPERATIVE**MAXIMUM CONTINUOUS THRUST EPR**

BASED ON 250 KIAS / 340 KIAS / 0.84 MACH SPEED SCHEDULE

PW4056

TAT °C	PRESSURE ALTITUDE – FEET					
	5,000	10,000	15,000	20,000	25,000	30,000
50	1.25	1.14	1.11			
45	1.28	1.16	1.13	1.14		
40	1.30	1.18	1.16	1.14		
35	1.33	1.21	1.18	1.16		
30	1.37	1.24	1.22	1.19	1.16	
25	1.37	1.24	1.25	1.23	1.20	
20	1.37	1.24	1.25	1.26	1.24	
15	1.37	1.24	1.25	1.28	1.29	
10	1.37	1.24	1.25	1.28	1.30	
5	1.37	1.24	1.25	1.28	1.30	1.41
0	1.37	1.24	1.25	1.28	1.30	1.41
-5	1.37	1.24	1.25	1.28	1.30	1.41
-10	1.37	1.24	1.25	1.28	1.30	1.41
-15	1.37	1.24	1.25	1.28	1.30	1.41
-20	1.37	1.24	1.25	1.28	1.30	1.41

Based on Normal Bleed – 3 Packs on
Anti-Ice OFF

CORRECTIONS:

Engine AI ON	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03
Engine & Wing AI ON	-0.02	-0.02	-0.03	-0.03	-0.03	-0.04
1 Pack ON	0.01	0.01	0.01	0.01	0.01	0.01
2 Packs ON	0.02	0.02	0.02	0.02	0.02	0.02

ONE ENGINE INOPERATIVE

DRIFTDOWN SPEED AND GROSS LEVEL OFF ALTITUDE

ENGINE ANTI-ICE OFF

GROSS WEIGHT – POUNDS		APPROX GROSS LEVEL OFF ALTITUDE – FEET		
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)	OPTIMUM DRIFTDOWN SPEED - KIAS	ISA + 15°C & COLDER	ISA + 20°C
900,000	876,900	310	24,100	22,800
850,000	830,900	301	26,000	24,900
800,000	783,100	294	27,900	26,800
750,000	735,100	285	29,800	28,800
700,000	687,900	275	31,700	30,800
650,000	639,300	265	33,500	32,700
600,000	600,000	254	35,000	34,600
550,000	550,000	NA	35,000	35,000
500,000	500,000	NA	35,000	35,000
450,000	450,000	NA	35,000	35,000

Indicates positive rate of climb achievable.

ONE ENGINE INOPERATIVE

LONG RANGE CRUISE ALTITUDE CAPABILITY

WEIGHT (LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
880,000	21,700	21,500	19,400
860,000	22,600	22,500	20,400
840,000	23,600	23,500	21,400
820,000	24,500	24,400	22,500
800,000	25,400	25,300	23,500
780,000	26,400	26,200	24,500
760,000	27,300	27,200	25,500
740,000	28,200	28,100	26,500
720,000	29,100	29,000	27,500
700,000	30,100	30,000	28,500
680,000	31,000	30,900	29,500
660,000	31,800	31,700	30,400
640,000	32,700	32,600	31,300
620,000	33,500	33,400	32,300
600,000	34,200	34,100	33,200
580,000	35,000	34,900	34,000
560,000	35,700	35,700	34,800
540,000	36,400	36,300	35,600
520,000	37,000	37,000	36,300
500,000	37,700	37,600	36,900
480,000	38,400	38,400	37,600
460,000	39,200	39,100	38,400
440,000	39,900	39,900	39,100

BASIS:

- Max continuous thrust.
- Long range cruise speed.
- 100ft/mn residual rate of climb.

ONE ENGINE INOPERATIVE LONG RANGE CRUISE SPEEDS

FL ISA		GROSS WEIGHT – 1,000 LB											
		880	860	840	820	800	780	760	740	720	700	680	660
370	MN IAS TAS												
360	MN IAS TAS												
350	MN IAS TAS												
340	MN IAS TAS												
330 -19	MN IAS TAS												.841 301 489
320 -17	MN IAS TAS											.836 305 488	.827 302 483
310 -16	MN IAS TAS										.831 310 487	.822 306 482	.814 303 478
300 -14	MN IAS TAS									.826 315 487	.818 311 482	.810 308 477	.802 305 472
290 (-13)	MN IAS TAS								.820 319 486	.813 316 481	.805 313 477	.798 310 472	.790 306 468
280 (-11)	MN IAS TAS							.815 324 485	.808 321 480	.801 318 476	.794 314 472	.786 311 467	.779 308 463
270 (-9)	MN IAS TAS					.817 332 488	.810 328 484	.803 325 480	.796 322 475	.789 319 471	.782 316 467	.775 313 463	.768 310 458
260 (-7)	MN IAS TAS				.812 336 487	.805 333 483	.799 330 479	.792 327 475	.785 324 471	.778 321 467	.772 318 462	.764 315 458	.756 311 453
250 -6	MN IAS TAS			.807 341 485	.8 338 482	.794 335 478	.787 332 474	.781 329 470	.774 326 466	.768 323 462	.760 319 458	.752 316 453	.742 311 447

Definitions:

FL: Flight level / altitude (feet).

ISA: Standard Day temperature in °C.

IAS: Indicated airspeed in knots.

MN: Mach number.

TAS: True airspeed in knots.

ONE ENGINE INOPERATIVE LONG RANGE CRUISE SPEEDS

FL ISA		GROSS WEIGHT – 1,000 LB											
		660	640	620	600	580	560	540	520	500	480	460	440
370 -28	MN							.838	.826	.815	.804	.793	.782
	IAS							273	269	265	261	257	253
	TAS							480	474	468	461	455	449
360 -28	MN					.844	.834	.824	.813	.802	.792	.781	.77
	IAS					282	278	274	271	267	263	259	255
	TAS					484	479	473	466	460	454	448	442
350 -26	MN				.840	.830	.82	.810	.800	.790	.780	.769	.758
	IAS				287	283	280	276	272	268	264	260	256
	TAS				484	479	473	467	461	455	450	444	437
340 -25	MN			.836	.826	.817	.807	.798	.788	.778	.768	.757	.743
	IAS			292	288	285	281	277	274	270	266	262	257
	TAS			484	479	473	467	462	456	451	445	438	430
330 -23	MN	.841	.832	.822	.813	.804	.795	.786	.776	.767	.756	.743	.727
	IAS	301	297	293	290	286	283	279	275	271	267	262	256
	TAS	489	484	478	473	468	462	457	452	446	439	432	423
320 -21	MN	.827	.818	.809	.801	.792	.783	.774	.765	.754	.741	.726	.709
	IAS	302	298	295	291	288	284	281	277	273	268	262	255
	TAS	483	478	473	468	463	458	452	447	440	433	424	414
310 -20	MN	.814	.806	.797	.789	.781	.772	.763	.752	.739	.725	.709	.692
	IAS	303	300	296	293	289	286	282	278	273	267	261	254
	TAS	478	473	468	463	458	453	447	441	434	425	416	406
300 -19	MN	.802	.794	.786	.778	.769	.76	.75	.737	.723	.708	.692	.675
	IAS	305	301	298	295	291	287	283	278	272	266	259	253
	TAS	472	468	463	458	453	448	442	434	426	417	408	398
290 -18	MN	.79	.782	.775	.766	.757	.747	.735	.721	.706	.691	.675	.660
	IAS	306	303	300	296	292	288	283	277	271	265	258	252
	TAS	468	463	458	454	448	442	435	427	418	409	400	390
280 -16	MN	.779	.771	.763	.754	.744	.731	.718	.704	.689	.674	.659	.645
	IAS	308	305	301	297	293	288	282	276	270	264	257	251
	TAS	463	458	454	448	442	435	427	418	410	401	392	383
270 -15	MN	.768	.76	.751	.740	.728	.715	.701	.687	.673	.659	.644	.630
	IAS	310	306	302	298	293	287	281	275	269	263	257	251
	TAS	458	453	448	442	435	427	419	410	402	393	385	376
260 -14	MN	.756	.747	.736	.724	.711	.698	.685	.671	.658	.644	.63	.617
	IAS	311	307	302	297	291	286	280	274	268	262	256	250
	TAS	453	448	441	434	426	419	410	402	394	386	378	370
250 -13	MN	.742	.732	.72	.708	.695	.682	.669	.656	.643	.630	.617	.604
	IAS	311	307	301	296	290	284	279	273	267	261	256	250
	TAS	447	441	434	426	418	411	403	395	387	379	371	363

FL: Flight level / altitude (feet).
 ISA: Standard Day temperature in °C.
 IAS: Indicated airspeed in knots.

MN: Mach number.
 TAS: True airspeed in knots.

ONE ENGINE INOPERATIVE LONG RANGE CRUISE SPEEDS

FL ISA		GROSS WEIGHT – 1,000 LB											
		880	860	840	820	800	780	760	740	720	700	680	660
240 (-4)	MN		.801	.795	.789	.783	.777	.770	.763	.756	.747	.738	.727
	IAS		345	342	340	337	334	331	328	324	320	316	311
	TAS		484	481	477	473	469	466	461	457	452	446	440
230 (-3)	MN	.796	.79	.784	.778	.772	.766	.759	.751	.743	.733	.722	.711
	IAS	350	347	344	341	339	336	332	329	325	320	315	310
	TAS	483	480	476	472	469	465	461	456	451	445	438	432
220 -1	MN	.785	.780	.774	.768	.761	.754	.746	.737	.728	.717	.706	.695
	IAS	352	349	346	343	340	337	333	329	324	319	314	309
	TAS	479	475	472	468	464	460	455	449	443	437	430	423
200 (-1)	MN	.764	.758	.751	.744	.735	.726	.716	.706	.696	.685	.675	.664
	IAS	355	352	349	345	341	336	332	327	322	317	311	306
	TAS	469	466	461	457	452	446	440	434	427	421	415	408
180 (-3)	MN	.739	.731	.723	.714	.704	.695	.685	.675	.666	.656	.646	.637
	IAS	357	352	348	343	339	334	329	324	319	315	310	305
	TAS	458	453	447	442	436	430	424	418	412	406	400	394
160 (-6)	MN	.709	.701	.692	.683	.674	.665	.656	.647	.638	.629	.620	.611
	IAS	355	350	345	341	336	332	327	322	318	313	308	304
	TAS	443	437	432	426	421	415	410	404	398	393	387	382
140 (-8)	MN	.679	.671	.663	.655	.646	.638	.63	.622	.613	.605	.597	.588
	IAS	352	348	343	339	334	330	326	321	317	312	308	303
	TAS	427	422	417	412	407	401	396	391	386	381	375	370
120 (-11)	MN	.652	.644	.637	.629	.621	.614	.606	.598	.591	.583	.575	.568
	IAS	350	346	342	337	333	329	325	320	316	312	308	304
	TAS	413	408	403	398	394	389	384	379	374	369	364	360
100 (-14)	MN	.627	.619	.612	.605	.598	.591	.584	.577	.57	.563	.555	.548
	IAS	349	345	340	336	332	328	324	320	316	312	308	304
	TAS	400	395	391	386	382	377	373	368	364	359	355	350
80 (-17)	MN	.603	.597	.590	.584	.577	.571	.564	.557	.551	.544	.538	.531
	IAS	348	344	340	336	332	328	325	321	317	313	309	305
	TAS	388	384	380	375	371	367	363	358	354	350	346	341
60 -20	MN	.582	.576	.570	.564	.558	.552	.546	.539	.533	.527	.521	.515
	IAS	347	344	340	336	333	329	325	322	318	314	311	307
	TAS	377	373	369	365	361	357	353	349	345	342	338	334

FL: Flight level / altitude (feet).
 ISA: Standard Day temperature in °C.
 IAS: Indicated airspeed in knots.

MN: Mach number.
 TAS: True airspeed in knots.

ONE ENGINE INOPERATIVE LONG RANGE CRUISE SPEEDS

FL ISA		GROSS WEIGHT – 1,000 LB											
		660	640	620	600	580	560	540	520	500	480	460	440
240 -11	MN	.727	.716	.704	.691	.679	.667	.654	.642	.629	.617	.604	.591
	IAS	311	306	300	295	289	283	278	272	267	261	255	250
	TAS	440	433	425	418	410	403	395	388	380	373	365	357
230 -10	MN	.711	.699	.688	.676	.664	.652	.640	.628	.616	.604	.592	.580
	IAS	310	304	299	294	288	283	277	272	266	261	255	250
	TAS	432	424	417	410	403	396	388	381	374	366	359	352
220 -9	MN	.695	.684	.672	.661	.649	.638	.626	.615	.603	.592	.580	.569
	IAS	309	303	298	293	287	282	277	271	266	261	255	250
	TAS	423	417	410	403	396	389	382	375	368	361	354	346
200 -6	MN	.664	.654	.643	.633	.622	.612	.601	.590	.580	.569	.558	.548
	IAS	306	301	296	291	286	281	276	271	266	261	256	250
	TAS	408	402	395	389	382	376	369	363	356	350	343	337
180 -3	MN	.637	.627	.617	.608	.598	.588	.578	.568	.559	.549	.539	.529
	IAS	305	300	295	290	285	281	276	271	266	261	256	252
	TAS	394	388	382	376	370	364	358	352	346	340	334	328
160 0	MN	.611	.602	.593	.584	.575	.566	.557	.548	.539	.53	.521	.512
	IAS	304	299	295	290	285	281	276	271	267	262	258	253
	TAS	382	376	370	365	359	353	348	342	337	331	325	320
140 -3	MN	.588	.580	.572	.563	.555	.547	.538	.530	.522	.513	.505	.496
	IAS	303	299	295	290	286	281	277	272	268	264	259	255
	TAS	370	365	360	354	349	344	339	333	328	323	318	312
120 -6	MN	.568	.560	.552	.544	.537	.529	.521	.514	.506	.498	.49	.482
	IAS	304	299	295	291	287	282	278	274	270	265	261	257
	TAS	360	355	350	345	340	335	330	325	320	315	310	305
100 -9	MN	.548	.541	.534	.527	.52	.513	.506	.498	.491	.483	.476	.468
	IAS	304	300	296	292	288	284	280	276	272	267	263	259
	TAS	350	345	341	336	332	327	323	318	313	309	304	298
80 -12	MN	.531	.524	.518	.511	.504	.498	.491	.484	.477	.469	.462	.454
	IAS	305	301	298	294	290	286	282	278	274	269	265	260
	TAS	341	337	333	329	324	320	316	311	307	302	297	292
60 -16	MN	.515	.509	.503	.496	.490	.484	.477	.470	.463	.456	.448	.440
	IAS	307	303	299	296	292	288	284	280	276	271	266	262
	TAS	334	330	326	322	317	313	309	304	300	295	290	285

FL: Flight level / altitude (feet).

ISA: Standard Day temperature in °C.

IAS: Indicated airspeed in knots.

MN: Mach number.

TAS: True airspeed in knots.

TWO ENGINES INOPERATIVE

DRIFTDOWN SPEED AND GROSS LEVEL OFF ALTITUDE

ENGINE ANTI-ICE OFF

GROSS WEIGHT – POUNDS		APPROX GROSS LEVEL OFF ALTITUDE – FEET		
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)	OPTIMUM DRIFTDOWN SPEED - KIAS	ISA + 15°C & COLDER	ISA + 20°C
900,000	869,700	305	9,400	7,200
850,000	822,600	297	11,900	10,000
800,000	775,200	289	14,400	12,700
750,000	727,600	280	16,800	15,400
700,000	679,800	271	19,200	17,900
650,000	631,800	261	21,600	20,500
600,000	584,700	251	24,100	23,100
550,000	536,300	240	26,600	25,800
500,000	488,600	229	29,300	28,600
450,000	441,100	216	31,800	31,400

BASIS:

- Maximum Continuous Thrust Limits
- 100 ft/min residual rate of climb
- 35,000 ft initial altitude

TWO ENGINES INOPERATIVE

LONG RANGE CRUISE ALTITUDE CAPABILITY

WEIGHT (LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
880,000	3,300	3,200	
860,000	4,800	4,700	1,100
840,000	6,200	6,100	2,800
820,000	7,600	7,500	4,300
800,000	8,900	8,800	5,900
780,000	10,100	10,000	7,400
760,000	11,300	11,200	8,800
740,000	12,500	12,400	10,200
720,000	13,600	13,600	11,500
700,000	14,800	14,700	12,800
680,000	15,900	15,800	14,100
660,000	17,000	16,900	15,300
640,000	18,100	18,000	16,500
620,000	19,200	19,100	17,700
600,000	20,300	20,300	18,900
580,000	21,500	21,400	20,100
560,000	22,600	22,600	21,400
540,000	23,800	23,800	22,600
520,000	25,000	25,000	23,900
500,000	26,200	26,200	25,200
480,000	27,400	27,400	26,400
460,000	28,700	28,600	27,700
440,000	29,900	29,900	29,000

BASIS:

- Max continuous thrust.
- Long range cruise speed.
- 100ft/mn residual rate of climb.

RAPID DESCENT TO 10,000 FEET

DIVERSION FUEL BURN

(1,000 LB)

ALL ENGINES OPERATING

INITIAL GROSS WT LBS.	DISTANCE TO ALTERNATE - NAUTICAL GROUND MILES								
	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500
800,000	43.4	85.1	124.4	161.9	197.8	229.5	259.9		
750,000	38.8	76.5	112.8	148.0	181.7	212.0	241.2	270.8	
700,000	35.0	69.7	103.1	136.2	168.1	197.0	225.3	254.0	281.9
650,000	32.1	64.2	95.1	126.1	156.2	183.5	210.7	238.5	265.7
600,000	30.0	60.0	89.0	118.0	146.5	172.5	198.5	225.0	251.0
550,000	29.4	58.0	86.0	114.0	141.2	166.4	191.1	217.1	241.8
500,000	28.4	55.9	82.4	109.3	135.5	159.8	183.7	208.5	233.0
450,000	27.8	53.5	79.4	105.3	130.2	153.6	177.0	200.8	224.5
400,000	26.8	51.8	76.5	101.6	125.6	148.7	171.0	194.3	217.2

FLYING TIME (hr:min)	1:25	2:48	4:18	5:42	7:12	8:45	10:18	12:00	13:40
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BASIS:

- 0.84 / 290 / 250 descent speed schedule
- Long Range Cruise at 10,000 feet

ONE ENGINE INOPERATIVE

INITIAL GROSS WT LBS.	DISTANCE TO ALTERNATE - NAUTICAL GROUND MILES							
	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000
800,000	58.0	102.0	146.6	185.0	221.7			
750,000	47.5	87.1	127.5	162.3	196.6	228.8	259.3	286.1
700,000	39.0	74.6	110.7	142.7	174.9	205.0	234.0	260.4
650,000	33.5	64.8	97.6	126.6	156.4	184.7	212.4	238.2
600,000	29.0	58.0	87.5	114.5	142.0	168.5	195.0	219.5
550,000	28.0	55.7	84.2	110.0	136.1	162.0	187.0	210.2
500,000	27.0	53.3	80.7	105.0	130.1	154.6	178.5	200.5
450,000	25.0	51.0	76.8	100.3	124.1	146.9	169.6	190.9
400,000	23.0	48.3	73.1	95.1	117.8	139.6	161.1	180.8

FLYING TIME (hr:min)	1:36	3:10	4:40	6:17	7:51	9:32	11:16	13:00
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BASIS:

- One Engine Inoperative
- 0.84 / 290 / 250 descent speed schedule
- Maximum Continuous Thrust limits at 10,000 feet

OVERWEIGHT LANDING SPEEDS

	VZF	V _{MA1}	V _{MA5}	V _{MA10}	V _{MA20}	V _{REF}	V _{REF}
Flaps	0	1	5	10	20	25	30
Gear	UP	UP	UP	UP	DN	DN	DN
Wt (1,000lbs)	IAS						
870	286	246	226	206	196	191	186
850	284	244	224	204	194	192	184
830	282	242	222	202	192	190	182
810	279	239	219	199	189	188	179
790	277	237	217	197	187	183	177
770	274	234	214	194	184	180	174
750	272	232	212	192	182	178	172
730	269	229	209	189	179	175	169
710	267	227	207	187	177	172	167
690	264	224	204	184	174	169	164
670	241	221	201	181	171	166	161
650	239	219	199	179	169	164	159
630	236	216	196	176	166	162	156

For three or four engines operating.

Note:

For Flaps 0 through 20 approach speed selections, set the command speed indicator at the charted values. For flaps 25 and 30 approach speed selections, set the command speed indicator to $V_{REF25} + 5$ or $V_{REF30} + 5$.

For weights below 630,000 lb., refer to "Normal Landing Speeds" in the Approach/Landing section of this ODM.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

APPLICABILITY

The tables on the following pages provide landing distances and approach speeds to be used in the event of in-flight system failures. **The values in this section are not to be used for dispatch purposes.**

Refer to the “MEL Support” pages at the end of this section of the ODM for dispatch landing distances with the following MELs applied:

- Anti-skid Inoperative
- Manual Speed Brakes
- Two Wheel Brakes Deactivated

The landing distances provided in this section are classified by runway braking action. These classifications include “DRY,” “GOOD,” “MEDIUM,” or “POOR.” Refer to the Airway Manual – Section 4 (Weather) to find the relationship between these terms, the current environmental conditions, and runway friction values.

ASSUMPTIONS

The data within this section was generated based on a set of assumed conditions:

- Maximum manual braking (more aggressive than Max Autobrakes)
- Includes distance from 50 feet above threshold to stop (1,500 feet of air distance)
- Based on demonstrated landing performance produced by the manufacturer during certification process
- Does not include any other safety factors or margins

In addition, the data within this section were also calculated with certain baseline conditions. There are corrections provided for each abnormal configuration accounting for any variances from the following:

- Sea level altitude
- Standard Day Outside Air Temperature (OAT = ISA)
- No wind
- No slope
- Operating engines at maximum reverse thrust, except for hydraulic system failures
- Each abnormal configuration landing distance table is based on the approach speed stated within each table.

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

FEET

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-21 for all assumed conditions.

AIR-GROUND LOGIC IN AIR MODE (FLAPS 30)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	6,750	6,400	6,050	5,700	5,350	5,000	4,650	4,350
GOOD	9,030	8,580	8,130	7,680	7,230	6,780	6,330	5,880
MEDIUM	13,420	12,720	12,020	11,320	10,620	9,920	9,220	8,520
POOR	19,520	18,520	17,520	16,520	15,520	14,520	13,520	12,570
VREF30	181	175	169	162	156	150	143	136

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+140	+210	+320	+450
Wind	Per 1 kt. headwind	-22	-34	-56	-95
	Per 1 kt. tailwind	+73	+114	+195	+347
Slope	Per 1% downhill	+110	+290	+880	+3040
	Per 1% uphill	-90	-230	-610	-1470
Temperature	Per 1°C above ISA	+13	+20	+31	+47
	Per 1°C below ISA	-13	-20	-30	-43
Approach Speed	Per 10 kt. Above VREF	+580	+760	+950	+1100
Reverse Thrust	Two Reversers	N/A	N/A	N/A	N/A
	No Reversers	N/A	N/A	N/A	N/A

ANTI-SKID INOP (FLAPS 30) - (For Inflight Failure ONLY, see MEL SUPPORT for dispatch with Anti-skid Inop)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	10,060	9,510	8,960	8,410	7,860	7,310	6,760	6,210
GOOD	10,060	9,510	8,960	8,410	7,860	7,310	6,760	6,210
MEDIUM	13,030	12,280	11,530	10,780	10,030	9,280	8,530	7,830
POOR	17,530	16,530	15,530	14,530	13,530	12,530	11,530	10,580
VREF30	181	175	169	162	156	150	143	136

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+250	+250	+340	+450
Wind	Per 1 kt. headwind	-42	-42	-61	-105
	Per 1 kt. tailwind	+149	+149	+234	+514
Slope	Per 1% downhill	+370	+370	+900	+4380
	Per 1% uphill	-290	-290	-560	-1350
Temperature	Per 1°C above ISA	+24	+24	+34	+49
	Per 1°C below ISA	-22	-22	-28	-32
Approach Speed	Per 10 kt. Above VREF	+600	+600	+660	+710
Reverse Thrust	Two Reversers	+670	+670	+1400	+3550
	No Reversers	+1590	+1590	+3600	+11450

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

FEET

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-21 for all assumed conditions.

ASYMMETRIC/SPLIT TRAILING EDGE FLAPS (FLAPS 25)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	7,140	6,790	6,440	6,090	5,740	5,390	5,040	4,740
GOOD	9,050	8,600	8,150	7,700	7,250	6,800	6,350	5,900
MEDIUM	11,660	11,060	10,460	9,860	9,260	8,660	8,060	7,460
POOR	14,690	13,890	13,090	12,290	11,490	10,690	9,890	9,090
VREF30+25	206	200	194	187	181	175	168	161

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+160	+220	+310	+400
Wind	Per 1 kt. headwind	-21	-30	-44	-64
	Per 1 kt. tailwind	+70	+102	+157	+243
Slope	Per 1% downhill	+90	+190	+410	+930
	Per 1% uphill	-80	-160	-320	-600
Temperature	Per 1°C above ISA	+15	+22	+31	+41
	Per 1°C below ISA	-15	-20	-27	-34
Approach Speed	Per 10 kt. Above VREF	+460	+530	+580	+620
Reverse Thrust	Two Reversers	+160	+410	+910	+1710
	No Reversers	+350	+920	+2190	+4450

FLAPS UP

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	13,480	12,380	11,280	10,180	9,080	7,980	6,880	6,380
GOOD	12,270	11,670	11,070	10,470	9,870	9,270	8,670	8,120
MEDIUM	16,840	15,990	15,140	14,290	13,440	12,590	11,740	10,890
POOR	22,280	21,080	19,880	18,680	17,480	16,280	15,080	13,880
VREF30+70	251	245	239	232	226	220	213	206

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+390	+310	+470	+660
Wind	Per 1 kt. headwind	-33	-35	-54	-79
	Per 1 kt. tailwind	+135	+116	+185	+290
Slope	Per 1% downhill	+150	+240	+590	+1400
	Per 1% uphill	-140	-210	-470	-930
Temperature	Per 1°C above ISA	+35	+31	+48	+69
	Per 1°C below ISA	-31	-28	-40	-53
Approach Speed	Per 10 kt. Above VREF	+750	+550	+700	+820
Reverse Thrust	Two Reversers	+380	+630	+1660	+3450
	No Reversers	+1020	+1670	+4260	+9630

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

FEET

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-21 for all assumed conditions.

JAMMED STABILIZER (FLAPS 25)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	7,350	6,900	6,450	6,000	5,550	5,100	4,650	4,350
GOOD	8,400	8,000	7,600	7,200	6,800	6,400	6,000	5,600
MEDIUM	11,460	10,860	10,260	9,660	9,060	8,460	7,860	7,260
POOR	15,020	14,170	13,320	12,470	11,620	10,770	9,920	9,120
VREF30+20	201	195	189	182	176	170	163	156

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+150	+210	+300	+410
Wind	Per 1 kt. headwind	-21	-29	-44	-65
	Per 1 kt. tailwind	+69	+100	+157	+247
Slope	Per 1% downhill	+80	+180	+430	+1010
	Per 1% uphill	-70	-150	-330	-640
Temperature	Per 1°C above ISA	+14	+20	+30	+42
	Per 1°C below ISA	-14	-19	-26	-34
Approach Speed	Per 10 kt. Above VREF	+380	+520	+610	+680
Reverse Thrust	Two Reversers	+140	+380	+940	+1890
	No Reversers	+310	+850	+2280	+5030

LEADING EDGE FLAPS INOP (FLAPS 25)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	7,640	7,190	6,740	6,290	5,840	5,390	4,940	4,640
GOOD	9,020	8,570	8,120	7,670	7,220	6,770	6,320	5,870
MEDIUM	12,150	11,500	10,850	10,200	9,550	8,900	8,250	7,600
POOR	15,470	14,620	13,770	12,920	12,070	11,220	10,370	9,520
VREF30+25	206	200	194	187	181	175	168	161

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+150	+220	+320	+430
Wind	Per 1 kt. headwind	-21	-30	-46	-66
	Per 1 kt. tailwind	+69	+102	+161	+252
Slope	Per 1% downhill	+80	+190	+450	+1040
	Per 1% uphill	-80	-160	-350	-670
Temperature	Per 1°C above ISA	+15	+22	+32	+44
	Per 1°C below ISA	-14	-20	-27	-36
Approach Speed	Per 10 kt. Above VREF	+400	+540	+630	+690
Reverse Thrust	Two Reversers	+160	+420	+1020	+2020
	No Reversers	+340	+950	+2480	+5390

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

FEET

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-21 for all assumed conditions.

ONE BODY GEAR UP (FLAPS 30)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	7,210	6,710	6,210	5,710	5,210	4,710	4,210	3,810
GOOD	7,460	7,060	6,660	6,260	5,860	5,460	5,060	4,660
MEDIUM	9,930	9,380	8,830	8,280	7,730	7,180	6,630	6,080
POOR	12,920	12,170	11,420	10,670	9,920	9,170	8,420	7,720
VREF30	181	175	169	162	156	150	143	136

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+140	+170	+250	+340
Wind	Per 1 kt. headwind	-23	-27	-41	-61
	Per 1 kt. tailwind	+76	+93	+148	+234
Slope	Per 1% downhill	+100	+150	+380	+920
	Per 1% uphill	-90	-130	-290	-570
Temperature	Per 1°C above ISA	+14	+16	+24	+34
	Per 1°C below ISA	-13	-15	-22	-28
Approach Speed	Per 10 kt. Above VREF	+390	+500	+590	+650
Reverse Thrust	Two Reversers	+160	+270	+690	+1430
	No Reversers	+350	+600	+1640	+3690

ONE WING GEAR UP (FLAPS 30)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	7,680	7,130	6,580	6,030	5,480	4,930	4,380	4,080
GOOD	8,410	7,960	7,510	7,060	6,610	6,160	5,710	5,260
MEDIUM	11,650	11,000	10,350	9,700	9,050	8,400	7,750	7,150
POOR	15,370	14,520	13,670	12,820	11,970	11,120	10,270	9,420
VREF30	181	175	169	162	156	150	143	136

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+150	+200	+290	+400
Wind	Per 1 kt. headwind	-23	-31	-48	-74
	Per 1 kt. tailwind	+76	+104	+169	+278
Slope	Per 1% downhill	+120	+230	+570	+1530
	Per 1% uphill	-100	-190	-430	-870
Temperature	Per 1°C above ISA	+14	+19	+28	+40
	Per 1°C below ISA	-14	-18	-26	-35
Approach Speed	Per 10 kt. Above VREF	+430	+660	+760	+830
Reverse Thrust	Two Reversers	N/A	N/A	N/A	N/A
	No Reversers	+200	+430	+1160	+2630

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

FEET

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-21 for all assumed conditions.

TWO WING GEAR UP (FLAPS 30)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	10,360	9,510	8,660	7,810	6,960	6,110	5,260	4,660
GOOD	10,430	9,580	8,730	7,880	7,030	6,180	5,330	4,930
MEDIUM	10,940	10,340	9,740	9,140	8,540	7,940	7,340	6,740
POOR	14,990	14,140	13,290	12,440	11,590	10,740	9,890	9,090
VREF30	181	175	169	162	156	150	143	136

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+280	+280	+270	+380
Wind	Per 1 kt. headwind	-31	-31	-46	-72
	Per 1 kt. tailwind	+148	+148	+162	+271
Slope	Per 1% downhill	+220	+220	+510	+1420
	Per 1% uphill	-180	-180	-380	-810
Temperature	Per 1°C above ISA	+23	+23	+26	+38
	Per 1°C below ISA	-17	-17	-24	-33
Approach Speed	Per 10 kt. Above VREF	+680	+680	+670	+770
Reverse Thrust	Two Reversers	N/A	N/A	N/A	N/A
	No Reversers	+400	+400	+980	+2350

TWO HYDRAULIC SYSTEMS INOP (FLAPS 25)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	8,930	8,530	8,130	7,730	7,330	6,930	6,530	6,130
GOOD	12,090	11,490	10,890	10,290	9,690	9,090	8,490	7,940
MEDIUM	17,570	16,720	15,870	15,020	14,170	13,320	12,470	11,620
POOR	25,400	24,200	23,000	21,800	20,600	19,400	18,200	17,050
VREF30+20	201	195	189	182	176	170	163	156

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+220	+290	+440	+610
Wind	Per 1 kt. headwind	-29	-41	-67	-114
	Per 1 kt. tailwind	+93	+134	+228	+402
Slope	Per 1% downhill	+240	+490	+1380	+4430
	Per 1% uphill	-200	-390	-930	-2120
Temperature	Per 1°C above ISA	+20	+28	+43	+64
	Per 1°C below ISA	-20	-28	-42	-59
Approach Speed	Per 10 kt. Above VREF	+920	+1080	+1260	+1390
Reverse Thrust	Two Reversers	N/A	N/A	N/A	N/A
	No Reversers	N/A	N/A	N/A	N/A

ABNORMAL CONFIGURATION ACTUAL LANDING DISTANCES AND APPROACH SPEEDS

FEET

NOTE: Data below assumes Max Manual Braking and does NOT include 15% safety margin. Refer to Page 4-21 for all assumed conditions.

REVERSER UNLOCKED (FLAPS 25)

RWY COND. APPCH SPD	LANDING WEIGHT - POUNDS							
	850,000	800,000	750,000	700,000	650,000	600,000	550,000	500,000
DRY	7,470	7,020	6,570	6,120	5,670	5,220	4,770	4,470
GOOD	9,050	8,600	8,150	7,700	7,250	6,800	6,350	5,900
MEDIUM	12,630	11,980	11,330	10,680	10,030	9,380	8,730	8,080
POOR	17,370	16,420	15,470	14,520	13,570	12,620	11,670	10,770
VREF30+20	201	195	189	182	176	170	163	156

CORRECTION (FEET)		DRY	GOOD	MEDIUM	POOR
Altitude	Per 1,000 ft	+150	+220	+320	+450
Wind	Per 1 kt. headwind	-22	-31	-50	-77
	Per 1 kt. tailwind	+71	+106	+174	+288
Slope	Per 1% downhill	+90	+210	+570	+1570
	Per 1% uphill	-80	-180	-430	-920
Temperature	Per 1°C above ISA	+14	+21	+32	+47
	Per 1°C below ISA	-14	-20	-29	-40
Approach Speed	Per 10 kt. Above VREF	+390	+570	+690	+790
Reverse Thrust	Two Reversers	N/A	N/A	N/A	N/A
	No Reversers	+170	+470	+1340	+3140

EMERGENCY LANDING DISTANCES

FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES.

FLAPS 30

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

NOTE: Flaps 30 Landing may not be possible for weights greater than 750,000 lb. due to V_{FE} limitations.

Elev (ft)	Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
		DRY		GOOD		MEDIUM		POOR	
		Max AutoBrake	Max Manual	Max AutoBrake	Max Manual	Max AutoBrake	Max Manual	Max AutoBrake	Max Manual
0	850,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	800,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	750,000	6,320	5,550	7,070	6,880	9,120	9,090	11,720	11,700
	700,000	5,970	5,200	6,670	6,480	8,570	8,540	10,970	10,950
	650,000	5,620	4,850	6,270	6,080	8,020	7,990	10,220	10,200
	600,000	5,270	4,500	5,870	5,680	7,470	7,440	9,470	9,450
	550,000	4,920	4,150	5,470	5,280	6,920	6,890	8,720	8,700
	500,000	4,570	3,900	5,070	4,880	6,370	6,340	8,020	8,000
	450,000	4,220	3,650	4,670	4,480	5,820	5,790	7,320	7,300
1,000	850,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	800,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	750,000	6,440	5,650	7,220	7,030	9,330	9,300	12,000	11,980
	700,000	6,090	5,300	6,820	6,630	8,780	8,750	11,250	11,230
	650,000	5,740	4,950	6,420	6,230	8,230	8,200	10,500	10,480
	600,000	5,390	4,600	6,020	5,830	7,680	7,650	9,750	9,730
	550,000	5,040	4,250	5,620	5,430	7,130	7,100	9,000	8,980
	500,000	4,690	4,000	5,220	5,030	6,580	6,550	8,300	8,280
	450,000	4,340	3,750	4,820	4,630	6,030	6,000	7,600	7,580
2,000	850,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	800,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	750,000	6,560	5,750	7,370	7,180	9,540	9,510	12,280	12,260
	700,000	6,210	5,400	6,970	6,780	8,990	8,960	11,530	11,510
	650,000	5,860	5,050	6,570	6,380	8,440	8,410	10,780	10,760
	600,000	5,510	4,700	6,170	5,980	7,890	7,860	10,030	10,010
	550,000	5,160	4,350	5,770	5,580	7,340	7,310	9,280	9,260
	500,000	4,810	4,100	5,370	5,180	6,790	6,760	8,580	8,560
	450,000	4,460	3,850	4,970	4,780	6,240	6,210	7,880	7,860

LANDING DISTANCES INCLUDE 1,500 FT. FOR AIR DISTANCE BETWEEN LANDING THRESHOLD AND TOUCHDOWN.

BASIS:

- Zero wind and runway slope
- 4 Engines at full reverse thrust
- Approach speed = $V_{REF30} + 5$ kts.

Shaded weights/brake settings could correspond to Caution or Melt Zone in Brake Cooling charts. Reference Abnormal section for further details.

CORRECTIONS	DRY		GOOD		MEDIUM		POOR	
PER 1 KT HEADWIND	-20	-10	-20	-20	-30	-30	-50	-50
PER 1 KT TAILWIND	70	60	90	90	140	140	230	230
PER 5 KTS ABOVE APPROACH SPEED	250	190	260	240	310	280	320	300
PER 1% UP SLOPE	0	-50	-90	-110	-210	-240	-450	-470
PER 1% DWN SLOPE	0	60	110	130	300	320	800	790
1 REVERSER INOP	0	80	250	240	610	630	1,320	1,310
2 REVERSERS INOP	0	180	570	550	1,480	1,520	3,490	3,450
MANUAL SPOILERS	0	240	0	240	0	240	0	240

EMERGENCY LANDING DISTANCES

FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES.

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

FLAPS 30

NOTE: Flaps 30 Landing may not be possible for weights greater than 750,000 lb. due to V_{FE} limitations.

Elev (ft)	Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
		DRY		GOOD		MEDIUM		POOR	
		Max AutoBrake	Max Manual	Max AutoBrake	Max Manual	Max AutoBrake	Max Manual	Max AutoBrake	Max Manual
3,000	850,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	800,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	750,000	6,680	5,850	7,520	7,330	9,750	9,720	12,560	12,540
	700,000	6,330	5,500	7,120	6,930	9,200	9,170	11,810	11,790
	650,000	5,980	5,150	6,720	6,530	8,650	8,620	11,060	11,040
	600,000	5,630	4,800	6,320	6,130	8,100	8,070	10,310	10,290
	550,000	5,280	4,450	5,920	5,730	7,550	7,520	9,560	9,540
	500,000	4,930	4,200	5,520	5,330	7,000	6,970	8,860	8,840
	450,000	4,580	3,950	5,120	4,930	6,450	6,420	8,160	8,140
4,000	850,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	800,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	750,000	6,800	5,950	7,670	7,480	9,960	9,930	12,840	12,820
	700,000	6,450	5,600	7,270	7,080	9,410	9,380	12,090	12,070
	650,000	6,100	5,250	6,870	6,680	8,860	8,830	11,340	11,320
	600,000	5,750	4,900	6,470	6,280	8,310	8,280	10,590	10,570
	550,000	5,400	4,550	6,070	5,880	7,760	7,730	9,840	9,820
	500,000	5,050	4,300	5,670	5,480	7,210	7,180	9,140	9,120
	450,000	4,700	4,050	5,270	5,080	6,660	6,630	8,440	8,420
6,000	850,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	800,000	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}	V_{FE}
	750,000	7,040	6,150	7,970	7,780	10,380	10,350	13,400	13,380
	700,000	6,690	5,800	7,570	7,380	9,830	9,800	12,650	12,630
	650,000	6,340	5,450	7,170	6,980	9,280	9,250	11,900	11,880
	600,000	5,990	5,100	6,770	6,580	8,730	8,700	11,150	11,130
	550,000	5,640	4,750	6,370	6,180	8,180	8,150	10,400	10,380
	500,000	5,290	4,500	5,970	5,780	7,630	7,600	9,700	9,680
	450,000	4,940	4,250	5,570	5,380	7,080	7,050	9,000	8,980

LANDING DISTANCES INCLUDE 1,500 FT. FOR AIR DISTANCE BETWEEN LANDING THRESHOLD AND TOUCHDOWN.

BASIS:

- Zero wind and runway slope
- 4 Engines at full reverse thrust
- Approach speed = $V_{REF30} + 5$ kts.



Shaded weights/brake settings could correspond to Caution or Melt Zone in Brake Cooling charts. Reference Abnormal section for further details.

CORRECTIONS	DRY		GOOD		MEDIUM		POOR	
PER 1 KT HEADWIND	-20	-10	-20	-20	-30	-30	-50	-50
PER 1 KT TAILWIND	70	60	90	90	140	140	230	230
PER 5 KTS ABOVE APPROACH SPEED	250	190	260	240	310	280	320	300
PER 1% UP SLOPE	0	-50	-90	-110	-210	-240	-450	-470
PER 1% DWN SLOPE	0	60	110	130	300	320	800	790
1 REVERSER INOP	0	80	250	240	610	630	1,320	1,310
2 REVERSERS INOP	0	180	570	550	1,480	1,520	3,490	3,450
MANUAL SPOILERS	0	240	0	240	0	240	0	240

EMERGENCY LANDING DISTANCES

FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES.

FLAPS 25

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

Elev (ft)	Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
		DRY		GOOD		MEDIUM		POOR	
		Max AutoBrake	Max Manual	Max AutoBrake	Max Manual	Max AutoBrake	Max Manual	Max AutoBrake	Max Manual
0	850,000	7,300	6,760	8,450	7,970	10,970	10,950	14,150	14,150
	800,000	6,950	6,360	8,000	7,570	10,370	10,350	13,350	13,350
	750,000	6,600	5,960	7,550	7,170	9,770	9,750	12,550	12,550
	700,000	6,250	5,560	7,100	6,770	9,170	9,150	11,750	11,750
	650,000	5,900	5,160	6,650	6,370	8,570	8,550	10,950	10,950
	600,000	5,550	4,760	6,200	5,970	7,970	7,950	10,150	10,150
	550,000	5,200	4,360	5,750	5,570	7,370	7,350	9,350	9,350
	500,000	4,850	4,110	5,350	5,170	6,770	6,750	8,550	8,550
	450,000	4,500	3,860	4,950	4,770	6,170	6,150	7,750	7,750
1,000	850,000	7,430	6,870	8,610	8,130	11,200	11,180	14,460	14,460
	800,000	7,080	6,470	8,160	7,730	10,600	10,580	13,660	13,660
	750,000	6,730	6,070	7,710	7,330	10,000	9,980	12,860	12,860
	700,000	6,380	5,670	7,260	6,930	9,400	9,380	12,060	12,060
	650,000	6,030	5,270	6,810	6,530	8,800	8,780	11,260	11,260
	600,000	5,680	4,870	6,360	6,130	8,200	8,180	10,460	10,460
	550,000	5,330	4,470	5,910	5,730	7,600	7,580	9,660	9,660
	500,000	4,980	4,220	5,510	5,330	7,000	6,980	8,860	8,860
	450,000	4,630	3,970	5,110	4,930	6,400	6,380	8,060	8,060
2,000	850,000	7,560	6,980	8,770	8,290	11,430	11,410	14,770	14,770
	800,000	7,210	6,580	8,320	7,890	10,830	10,810	13,970	13,970
	750,000	6,860	6,180	7,870	7,490	10,230	10,210	13,170	13,170
	700,000	6,510	5,780	7,420	7,090	9,630	9,610	12,370	12,370
	650,000	6,160	5,380	6,970	6,690	9,030	9,010	11,570	11,570
	600,000	5,810	4,980	6,520	6,290	8,430	8,410	10,770	10,770
	550,000	5,460	4,580	6,070	5,890	7,830	7,810	9,970	9,970
	500,000	5,110	4,330	5,670	5,490	7,230	7,210	9,170	9,170
	450,000	4,760	4,080	5,270	5,090	6,630	6,610	8,370	8,370

LANDING DISTANCES INCLUDE 1,500 FT. FOR AIR DISTANCE BETWEEN LANDING THRESHOLD AND TOUCHDOWN.

BASIS:

- Zero wind and runway slope
- 4 Engines at full reverse thrust
- Approach speed = $V_{REF25} + 5$ kts.

Shaded weights/brake settings could correspond to Caution or Melt Zone in Brake Cooling charts. Reference Abnormal section for further details.

CORRECTIONS	DRY		GOOD		MEDIUM		POOR	
PER 1 KT HEADWIND	-20	-10	-20	-20	-30	-30	-50	-50
PER 1 KT TAILWIND	80	60	100	90	150	150	230	230
PER 5 KTS ABOVE APPROACH SPEED	250	190	260	240	310	290	320	320
PER 1% UP SLOPE	0	-50	-90	-120	-220	-260	-490	-500
PER 1% DWN SLOPE	0	60	110	140	320	340	850	840
1 REVERSER INOP	0	90	300	290	730	760	1,610	1,590
2 REVERSERS INOP	0	210	680	660	1,840	1,870	4,410	4,370
MANUAL SPOILERS	0	240	0	240	0	240	0	240

EMERGENCY LANDING DISTANCES

FEET

NOTE: TO BE USED ONLY UNDER CAPTAIN'S EMERGENCY AUTHORITY. PROVIDES ACTUAL LANDING DISTANCES.

DATA IS ADVISORY AND DOES NOT INCLUDE 15% SAFETY MARGIN.

FLAPS 25

Elev (ft)	Weight (lb)	NOTE: Interpolate for GOOD-TO-MEDIUM (4) or MEDIUM-TO-POOR (2).							
		DRY		GOOD		MEDIUM		POOR	
		Max AutoBrake	Max Manual	Max AutoBrake	Max Manual	Max AutoBrake	Max Manual	Max AutoBrake	Max Manual
3,000	850,000	7,690	7,090	8,930	8,450	11,660	11,640	15,080	15,080
	800,000	7,340	6,690	8,480	8,050	11,060	11,040	14,280	14,280
	750,000	6,990	6,290	8,030	7,650	10,460	10,440	13,480	13,480
	700,000	6,640	5,890	7,580	7,250	9,860	9,840	12,680	12,680
	650,000	6,290	5,490	7,130	6,850	9,260	9,240	11,880	11,880
	600,000	5,940	5,090	6,680	6,450	8,660	8,640	11,080	11,080
	550,000	5,590	4,690	6,230	6,050	8,060	8,040	10,280	10,280
	500,000	5,240	4,440	5,830	5,650	7,460	7,440	9,480	9,480
	450,000	4,890	4,190	5,430	5,250	6,860	6,840	8,680	8,680
4,000	850,000	7,820	7,200	9,090	8,610	11,890	11,870	15,390	15,390
	800,000	7,470	6,800	8,640	8,210	11,290	11,270	14,590	14,590
	750,000	7,120	6,400	8,190	7,810	10,690	10,670	13,790	13,790
	700,000	6,770	6,000	7,740	7,410	10,090	10,070	12,990	12,990
	650,000	6,420	5,600	7,290	7,010	9,490	9,470	12,190	12,190
	600,000	6,070	5,200	6,840	6,610	8,890	8,870	11,390	11,390
	550,000	5,720	4,800	6,390	6,210	8,290	8,270	10,590	10,590
	500,000	5,370	4,550	5,990	5,810	7,690	7,670	9,790	9,790
	450,000	5,020	4,300	5,590	5,410	7,090	7,070	8,990	8,990
6,000	850,000	8,080	7,420	9,410	8,930	12,350	12,330	16,010	16,010
	800,000	7,730	7,020	8,960	8,530	11,750	11,730	15,210	15,210
	750,000	7,380	6,620	8,510	8,130	11,150	11,130	14,410	14,410
	700,000	7,030	6,220	8,060	7,730	10,550	10,530	13,610	13,610
	650,000	6,680	5,820	7,610	7,330	9,950	9,930	12,810	12,810
	600,000	6,330	5,420	7,160	6,930	9,350	9,330	12,010	12,010
	550,000	5,980	5,020	6,710	6,530	8,750	8,730	11,210	11,210
	500,000	5,630	4,770	6,310	6,130	8,150	8,130	10,410	10,410
	450,000	5,280	4,520	5,910	5,730	7,550	7,530	9,610	9,610

LANDING DISTANCES INCLUDE 1,500 FT. FOR AIR DISTANCE BETWEEN LANDING THRESHOLD AND TOUCHDOWN.

BASIS:

- Zero wind and runway slope
- 4 Engines at full reverse thrust
- Approach speed = $V_{REF25} + 5$ kts.



Shaded weights/brake settings could correspond to Caution or Melt Zone in Brake Cooling charts. Reference Abnormal section for further details.

CORRECTIONS	DRY		GOOD		MEDIUM		POOR	
PER 1 KT HEADWIND	-20	-10	-20	-20	-30	-30	-50	-50
PER 1 KT TAILWIND	80	60	100	90	150	150	230	230
PER 5 KTS ABOVE APPROACH SPEED	250	190	260	240	310	290	320	320
PER 1% UP SLOPE	0	-50	-90	-120	-220	-260	-490	-500
PER 1% DWN SLOPE	0	60	110	140	320	340	850	840
1 REVERSER INOP	0	90	300	290	730	760	1,610	1,590
2 REVERSERS INOP	0	210	680	660	1,840	1,870	4,410	4,370
MANUAL SPOILERS	0	240	0	240	0	240	0	240

BRAKE COOLING FOLLOWING LANDING

GOVERNING CONDITIONS

NOTE: Maximum Quick Turnaround Landing Weight (QTLW) is not limiting for most normal operations.

If any of the following conditions apply, accomplish the procedures below to determine QTLW and Brake Cooling requirements.

- “QTLW Warning Remark” appears on the WDR **or**
- Landing above MLW **or**
- Landing using NO reversers **or**
- Landing using reversers with autobrake 4 or higher **or**
- Landing with non-standard aircraft configurations (flaps inoperative, brake deactivated,...etc.)

PROCEDURES

- A) Determine if the Maximum Quick Turn Landing Weight has been exceeded.
- B) Obtain a Landing Brake Cooling time.
- C) **Wait the longer of the two times** once the aircraft is parked at the gate or other designated area.

QUICK TURNAROUND LANDING WEIGHT

1. BTMS OPERATIVE

Check the BTMS display on EICAS no sooner than 10 minutes and no later than 15 minutes after parking.

If any brake temperature value is 5 or higher **or** BRAKE TEMP light is on then:

A **70 minute** ground cooling period is required.

NOTE: If any brake temperature display is blank or indicates 0, the BTMS INOPERATIVE Method must be used.

2. BTMS INOPERATIVE

Determine the Maximum Quick Turnaround Landing Weight from Page 4-33.

If the Actual Landing Weight is greater than the Maximum Quick Turnaround Landing Weight then:

A **70 minute** ground cooling period is required.

NOTE: Check that wheel thermal plugs have not melted before executing a takeoff.

LANDING BRAKE COOLING

1. BTMS OPERATIVE

- a) Check the BTMS display on EICAS no sooner than 10 minutes and no later than 15 minutes after parking.
- b) Use the highest value to enter the BTMS Operative Brake Cooling table for ground from Page 4-34.
- c) Wait the specified time associated with the value from the BTMS indicator.

NOTE: If any brake temperature display is blank or indicates 0, the BTMS INOPERATIVE Method must be used.

2. BTMS INOPERATIVE

Determine the Cooling Time and associated action if applicable from the Brake Cooling Time and AutoBrake Adjustment tables on Page 4-35. Comply with the specified procedures for the Caution Zone and Fuse Plug Melt Zone.

BRAKE COOLING FOLLOWING LANDING
MAXIMUM QUICK TURN-AROUND LANDING WEIGHT
(1,000 POUNDS)

FLAPS 25

AIRPORT PRESSURE ALTITUDE FEET	AMBIENT TEMPERATURE – °C							
	-20	-10	0	10	20	30	40	49
-1000	720	708	698	684	671	658	647	637
0	707	695	684	670	658	645	634	624
1,000	693	683	670	655	645	632	621	612
2,000	679	668	656	644	631	620	609	600
3,000	666	655	644	629	620	607	597	588
4,000	653	642	630	617	606	595		
5,000	641	629	617	604	594	583		
6,000	628	616	604	592	582	572		
7,000	615	603	592	579	571	561		
8,000	602	591	580	567	559	550		
9,000	590	579	567	556	548	539		
10,000	578	566	556	545	537			

FLAPS 30

AIRPORT PRESSURE ALTITUDE FEET	AMBIENT TEMPERATURE – °C							
	-20	-10	0	10	20	30	40	49
-1000	769	754	743	729	714	701	687	676
0	754	741	728	713	700	687	673	663
1,000	738	727	714	698	686	672	661	650
2,000	725	712	699	684	672	659	647	637
3,000	709	698	685	669	659	646	634	625
4,000	695	685	671	657	645	632		
5,000	681	671	657	642	631	620		
6,000	668	657	644	629	619	608		
7,000	654	642	631	616	606	596		
8,000	641	629	617	604	594	584		
9,000	628	616	604	592	582	572		
10,000	615	605	591	578	571			

CONDITION		CORRECTION – POUNDS
Wind	per 1 kt. of headwind	+ 1,200
	per 1 kt. of tailwind	- 9,400
Runway slope	per 0.1% uphill slope	+ 600
	per 0.1% downhill slope	- 1,600
2 Brakes deactivated		-50,900

BRAKE COOLING FOLLOWING LANDING

BTMS OPERATIVE BRAKE COOLING

(minutes)

	BTMS Indication						
	1	2	3	4	5	6	7+
Ground	0	35	55	70	86	100	Fuse Plug
In-Flight Gear Down *	0	4.0	7.0	9.0	11.5	13.0	Melt Zone

NOTE: 1) A BTMS indication of 5 or higher will cause the EICAS message "BRAKE TEMP" to appear. Message extinguishes when the temperature decreases to 4.

2) The shaded region indicates values in the Caution Zone.

- The In-Flight Gear Down cooling times are for use **ONLY** after waiting the duration of the ground cooling time and BTMS indicates overheating on the subsequent takeoff.
- The values above also apply to Rejected Takeoff.

BRAKE COOLING FOLLOWING LANDING

LANDING BRAKE COOLING

LANDING USING MAX MANUAL BRAKING:

Obtain a brake cooling time from the following table. A quick assessment can be made by using the next highest weight and speed. If the resulting wait time has the potential of causing a delay or is in the Caution or Fuse Plug Melt Zones, interpolation may be used to determine a more precise wait time with the associated zone action. Zones are indicated in the table for quicker identification. Refer to the time ranges for Caution and Fuse Plug Melt Zones below.

NOTE: Wait time begins once the aircraft is parked at the gate (or other designated location).

BRAKE COOLING TIME (h:mm)

WEIGHT (1,000 lbs)	Brakes on Speed (Ground Speed KTS)					
	80	100	120	140	160	180
Reverse	0 Eng / 4 Eng	0 Eng / 4 Eng	0 Eng / 4 Eng	0 Eng / 4 Eng	0 Eng / 4 Eng	0 Eng / 4 Eng
880	0:00 / 0:00	0:33 / 0:28	1:04 / 0:57	1:30C / 1:22C	1:47F / 1:36F	1:57F / 1:46F
800	0:00 / 0:00	0:23 / 0:21	0:56 / 0:50	1:21C / 1:14C	1:35C / 1:26C	1:43F / 1:33F
700	0:00 / 0:00	0:16 / 0:10	0:45 / 0:39	1:09 / 1:03	1:21C / 1:13C	1:39F / 1:29C
600	0:00 / 0:00	0:00 / 0:00	0:33 / 0:27	0:57 / 0:51	1:11C / 1:04	1:29C / 1:21C
500	0:00 / 0:00	0:00 / 0:00	0:20 / 0:33	0:43 / 0:37	1:02 / 0:56	1:19C / 1:12C

C - CAUTION ZONE (1:10 – 1:35) – Fuse plugs may melt. Wait the specified time. After the landing gear assembly has cooled, visually inspect for tire damage and seal leakage.

F - FUSE PLUG MELT ZONE (Shaded Region, ≥ 1:36) – Under these conditions, consider that fuse plugs will likely melt and deflate the tires. Unless required, do not set parking brake. The possibility of tire, grease or hydraulic fluid fires should also be considered. Maintenance inspection of tires, wheels and brakes is recommended.

LANDING USING AUTOBRAKES:

- 1) Determine the time from the table above. This is the reference time.
- 2) Subtract the time in the adjustment table below from the reference time in the table above to get proper cooling time for the respective brake setting. **Any resulting wait time of 1:36 or above is in the Fuse Plug Melt Zone.**

AUTOBRAKE ADJUSTMENT

NW INDICATES NO WAITING REQUIRED

	Brakes on Speed (Ground Speed KTS)					
	80	100	120	140	160	180
Reverse	0 Eng / 4 Eng	0 Eng / 4 Eng	0 Eng / 4 Eng	0 Eng / 4 Eng	0 Eng / 4 Eng	0 Eng / 4 Eng
MaxAuto	NW / NW	0:05 / NW	0:04 / 0:14	0:04 / 0:11	0:05 / 0:09	0:05 / 0:08
Auto 4	NW / NW	0:10 / NW	0:10 / 0:30	0:10 / 0:26	0:13 / 0:25	0:13 / 0:25
Auto 3	NW / NW	0:14 / NW	0:14 / NW	0:15 / 0:42	0:17 / 0:40	0:18 / 0:40
Auto 2	NW / NW	NW / NW	0:19 / NW	0:21 / 1:03	0:23 / 1:01	0:27 / 1:01
Auto 1	NW / NW	NW / NW	0:28 / NW	0:30 / NW	0:33 / NW	0:38 / NW

BRAKE COOLING FOLLOWING REJECTED TAKEOFF

REJECTED TAKEOFF BRAKE COOLING

PROCEDURES

Use the table below. A quick assessment can be made by using the next highest weight and speed. If the resulting wait time has the potential of causing a delay or is in the Caution or Fuse Plug Melt Zones, interpolation may be used to determine a more precise wait time with the associated zone action. Zones are indicated in the table for quicker identification. Refer to the time ranges for Caution and Fuse Plug Melt Zones below.

NOTE: Wait time begins once the aircraft is parked at the gate (or other designated location).

BRAKE COOLING TIME (h:mm)

WEIGHT (1,000 lbs)	Brakes on Speed (Ground Speed KTS)					
	80	100	120	140	160	180
880	0:30	1:00	1:27C	1:57F	2:15F	2:14F
800	0:25	0:54	1:19C	1:46F	2:02F	2:11F
700	0:17	0:45	1:10C	1:33C	1:46F	2:06F
600	0:00	0:36	1:00	1:20C	1:36F	1:55F
500	0:00	0:26	0:48	1:07	1:25C	1:44F

C - CAUTION ZONE (1:10 – 1:35) – Fuse plugs may melt. Wait the specified time. After the landing gear assembly has cooled, visually inspect for tire damage and seal leakage.

F - FUSE PLUG MELT ZONE (Shaded Region, ≥ 1:36) – Under these conditions, consider that fuse plugs will likely melt and deflate the tires. Unless required, do not set parking brake. The possibility of tire, grease or hydraulic fluid fires should also be considered. Maintenance inspection of tires, wheels and brakes is recommended.

OPERATION WITHOUT AIRSPEED INDICATION

Use the following pitch attitude and thrust setting data to estimate airspeed and rate of climb/descent, if the airspeed system becomes unreliable or unusable enroute. ***If the damage to the airspeed indication system is detected during early stages of the flight (takeoff or initial climb), return to departure airport.***

CLIMB							
SPEED: 290/0.84				THRUST: MAX CLIMB FLAPS: UP			
PRESSURE ALTITUDE FEET		GROSS WEIGHT – POUNDS					
		870,000	850,000	750,000	650,000	550,000	450,000
40,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)					+3.5 700	+3.5 1,500
35,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)			+4.0 600	+4.0 1,300	+4.0 1,900	+4.5 2,800
30,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	+5.0 500	+5.0 600	+4.5 1,000	+4.5 1,400	+4.5 2,000	+4.5 2,700
20,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	+6.5 1,400	+6.5 1,500	+6.5 1,900	+6.5 2,400	+7.0 3,100	+7.5 4,000
10,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	+8.5 2,100	+8.5 2,200	+8.5 2,700	+9.0 3,300	+9.5 4,100	+10.5 5,200
0	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	+10.0 2,500	+10.0 2,600	+10.5 3,200	+10.5 3,800	+11.5 4,700	13.0 5,900

CRUISE							
SPEED: 0.84/290				THRUST: EPR FOR LEVEL FLIGHT FLAPS: UP			
PRESSURE ALTITUDE FEET		GROSS WEIGHT - POUNDS					
		870,000	850,000	750,000	650,000	550,000	450,000
40,000	PITCH ATTITUDE EPR (Alt Mode %N1)					+3.0 1.31 (87.9)	+2.0 1.17 (83.5)
35,000	PITCH ATTITUDE EPR (Alt Mode %N1)			+3.0 1.39 (90.8)	+2.5 1.23 (85.9)	+2.0 1.14 (83.0)	+1.0 1.09 (80.8)
30,000	PITCH ATTITUDE EPR (Alt Mode %N1)	+4.0 1.34 (89.9)	+4.0 1.31 (88.9)	+3.5 1.19 (85.0)	+3.0 1.12 (82.3)	+2.0 1.07 (79.8)	+1.0 1.02 (77.5)
25,000	PITCH ATTITUDE EPR (Alt Mode %N1)	+4.5 1.12 (81.2)	+4.5 1.11 (80.5)	+4.0 1.06 (77.5)	+3.0 1.02 (75.0)	+2.5 0.99 (72.6)	+1.5 0.97 (70.7)
20,000	PITCH ATTITUDE EPR (Alt Mode %N1)	+5.0 1.04 (73.6)	+5.0 1.03 (73.0)	+4.0 1.01 (70.6)	+3.0 0.99 (68.5)	+2.5 0.98 (66.3)	+1.5 0.97 (64.4)
15,000	PITCH ATTITUDE EPR (Alt Mode %N1)	+5.0 1.01 (66.0)	+5.0 1.01 (65.4)	+4.0 1.00 (62.5)	+3.5 0.99 (60.1)	+2.5 0.98 (57.7)	+1.5 0.97 (55.7)

OPERATION WITHOUT AIRSPEED INDICATION

Use the following pitch attitude and thrust setting data to estimate airspeed and rate of climb/descent, if the airspeed system becomes unreliable or unusable enroute. ***If the damage to the airspeed indication system is detected during early stages of the flight (takeoff or initial climb), return to departure airport.***

DESCENT							
SPEED: 0.84/290				THRUST: IDLE FLAPS: UP			
PRESSURE ALTITUDE FEET		GROSS WEIGHT – POUNDS					
		870,000	850,000	750,000	650,000	550,000	450,000
40,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)					-0.5 -2,700	-1.5 -2,800
35,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)			-1.0 -3,300	-1.5 -3,200	-2.0 -3,400	-3.0 -3,700
30,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	1.5 -2,200	1.5 -2,200	1.0 -2,100	0.5 -2,200	-0.5 -2,300	-2.0 -2,600
20,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	2.0 -2,000	1.5 -2,000	1.0 -2,000	0.0 -2,100	-1.0 -2,200	-2.0 -2,500
10,000	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	2.0 -1,700	2.0 -1,700	1.0 -1,700	0.0 -1,800	-1.0 -1,900	-2.0 -2,200
0	PITCH ATTITUDE RATE OF CLIMB (FT/MIN)	2.5 -1,500	2.0 -1,500	1.0 -1,500	0.0 -1,600	-1.0 -1,700	-2.0 -1,900

HOLDING							
SPEED: $V_{\text{Ref25}} + 70$				THRUST: EPR FOR LEVEL FLIGHT FLAPS: UP			
PRESSURE ALTITUDE FEET		GROSS WEIGHT – POUNDS					
		870,000	850,000	750,000	650,000	550,000	450,000
10,000	PITCH ATTITUDE	5.5	5.5	5.5	6.0	6.0	5.5
	EPR	1.04	1.04	1.04	1.04	1.02	1.01
	(Alt Mode %N1)	(73.6)	(73.0)	(69.8)	(66.1)	(61.3)	(56.4)
	KIAS	284	282	261	240	224	209

OPERATION WITHOUT AIRSPEED INDICATION

Use the following pitch attitude and thrust setting data to estimate airspeed and rate of climb/descent, if the airspeed system becomes unreliable or unusable enroute. ***If the damage to the airspeed indication system is detected during early stages of the flight (takeoff or initial climb), return to departure airport.***

TERMINAL AREA								
SPEED: see below			THRUST: EPR FOR LEVEL FLIGHT FLAPS: AS REQ'D					
PRESSURE ALTITUDE FEET	FLAPS, SPEED		GROSS WEIGHT – POUNDS					
			900,000	800,000	700,000	600,000	500,000	400,000
5,000	Up(GEAR UP) VREF30 + 80	PITCH ATT	6.5	6.0	6.0	5.5	5.0	4.5
		EPR	1.08	1.06	1.05	1.03	1.02	1.01
		(Alt Mode %N1)	(71.4)	(68.1)	(64.2)	(59.8)	(54.9)	(49.1)
		KIAS	268	256	244	231	217	2.2
5,000	1 (GEAR UP) VREF30 + 60	PITCH ATT	7.5	7.5	7.0	7.0	6.5	6.0
		EPR	1.10	1.09	1.07	1.06	1.04	1.03
		(Alt Mode %N1)	(73.2)	(69.9)	(66.2)	(62.2)	(57.4)	(51.3)
		KIAS	248	236	224	211	197	182
5,000	5 (GEAR UP) VREF30 + 40	PITCH ATT	8.0	8.0	8.0	8.0	7.5	7.0
		EPR	1.15	1.13	1.11	1.09	1.07	1.05
		(Alt Mode %N1)	(77.1)	(73.8)	(70.1)	(65.8)	(61.1)	(54.9)
		KIAS	228	216	204	191	177	162
5,000	10 (GEAR UP) VREF30 + 20	PITCH ATT	9.0	9.0	8.5	8.5	8.5	8.5
		EPR	1.17	1.14	1.12	1.10	1.08	1.06
		(Alt Mode %N1)	(77.6)	(74.2)	(70.4)	(66.2)	(61.1)	(55.1)
		KIAS	208	196	184	171	157	142
5,000	20 (GEAR DOWN) VREF30 + 10	PITCH ATT	7.5	7.5	7.5	7.5	7.5	7.5
		EPR	1.25	1.22	1.18	1.15	1.12	1.09
		(Alt Mode %N1)	(84.3)	(80.9)	(76.9)	(72.4)	(67.3)	(61.1)
		KIAS	198	186	174	161	147	132

FINAL APPROACH								
SPEED: see below			THRUST: EPR FOR 3° GLIDESLOPE FLAPS: AS REQ'D					
PRESSURE ALTITUDE – FEET	FLAPS, SPEED		GROSS WEIGHT – POUNDS					
			900,000	800,000	700,000	600,000	500,000	400,000
1,500	25 (GEAR DOWN) VREF25+10	PITCH ATT	2.0	2.0	2.0	2.0	2.0	2.04
		EPR	1.10	1.09	1.07	1.06	1.05	1.04
		(Alt Mode %N1)	(67.7)	(64.6)	(61.1)	(57.3)	(52.2)	(46.1)
		KIAS	205	193	180	166	152	136
1,500	30 (GEAR DOWN) VREF30+10	PITCH ATT			1.0	1.0	0.5	0.5
		EPR			1.12	1.10	1.08	1.06
		(Alt Mode %N1)			(68.3)	(64.3)	(59.1)	(53.2)
		KIAS			173	160	146	131

MEL SUPPORT

73-21-02A: EEC NORMAL MODE INOPERATIVE 77-11-01: ENGINE PRESSURE RATIO INDICATING SYSTEM INOPERATIVE

RESTRICTIONS

The following restrictions apply to all MEL items presented on this page:

- Set takeoff thrust manually. Autothrottle is not available in the ALTN mode. Use of Reduced Thrust for takeoff is NOT authorized.

73-21-02A

77-11-01

EEC ALTERNATE MODE

MEL 73-21-02A allows dispatch with one Electronic Engine Control inoperative and MEL 77-11-01 allows dispatch with one EPR Indicating System inoperative, provided all engines are operated in the ALTERNATE EEC mode. The following power settings must be used in lieu of the NORMAL thrust setting charts. Refer to the chart below for the EPR takeoff power setting chart for EEC ALT mode.

NOTE:

For takeoff with all EEC's in the alternate mode, the following conditions must be satisfied:

- All EECs must be in the alternate (ALTN) mode
- TO thrust is required
- Assumed Temperature thrust is not authorized
- Minimum runway length - 6,000 feet
- The anti-skid system must be operative
- N1, N2, and fuel flow indications must operate normally on the engine with the inoperative EPR indication
- All packs selected OFF for takeoff
- (PF) As the thrust is advanced during takeoff, press the TO/GA switch to initialize the FMC.
- (PM) After takeoff, select one pack ON passing 1,000 feet HAA. Select the remaining packs ON in conjunction with the After Takeoff procedure (refer to Operations Manual Volume 1, Supplementary Procedures, SP.2, packs Off Takeoff).

EEC ALTERNATE MODE TAKEOFF THRUST

EPR

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET										
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	10,000
54	1.33	1.33	1.33	1.33	1.33						
50	1.37	1.37	1.37	1.37	1.37	1.37	1.37				
45	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	
40	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45
35	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48
30	1.50	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51
25	1.50	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53
20	1.50	1.53	1.54	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56
15	1.50	1.53	1.54	1.56	1.57	1.58	1.58	1.58	1.58	1.58	1.58
10	1.50	1.53	1.54	1.56	1.57	1.58	1.59	1.61	1.61	1.61	1.61
5	1.50	1.53	1.54	1.56	1.57	1.58	1.59	1.61	1.63	1.64	1.64
0 & below	1.50	1.53	1.54	1.56	1.57	1.58	1.59	1.61	1.63	1.64	1.65

Bleed Adjustments:

2 Packs OFF	- .01
Anti-Ice ON	No adj. available

The EICAS advisory message ENG____LIM PROT may be displayed on takeoff as thrust levers approach the full forward position, a normal condition since the EEC's are in the alternate (ALT) mode.

MEL SUPPORT

ALTERNATE TAKEOFF THRUST SETTING PROCEDURE

When the EPR from one engine is not available, advance all thrust levers together to set takeoff EPR on the three engines with EPR. Adjust the N_1 on the engine which does not have EPR available to match the N_1 indication of the other engines. After takeoff thrust is set, make only minor adjustments to N_1 and make no adjustments after 80 knots.

V Speed Adjustments

- 1) Note the FMC generated V_1 , V_R and V_2 speeds from the TAKEOFF REF page.
- 2) Add the adjustments to V_1 and V_R from the following tables.

V1 ADJUSTMENT

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET										
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	10,000
54	9	9	9	9	9						
50	9	9	9	9	9	9					
45	9	9	9	9	9	9	9	9	9		
40	7	8	8	8	8	8	8	8	8	8	8
35	5	7	8	8	8	8	8	8	8	8	8
30	3	5	6	7	8	8	8	8	8	8	8
25	3	3	4	5	6	6	7	7	7	7	7
20	3	3	3	3	3	5	5	7	7	7	7
15	3	3	3	3	3	3	3	5	6	6	6
10	3	3	3	3	3	3	3	3	4	5	6
5	3	3	3	3	3	3	3	3	3	3	4
0 & below	3	3	3	3	3	3	3	3	3	3	2

VR ADJUSTMENT

OAT °C	AIRPORT PRESSURE ALTITUDE – FEET										
	-1,000	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	10,000
54	4	4	4	4							
50	4	4	4	4	4	4					
45	4	4	4	4	4	4	4	4	4		
40	4	4	4	4	4	4	4	4	4	4	4
35	2	3	3	3	3	3	3	3	3	3	3
30	2	2	3	3	3	3	3	3	3	3	3
25	2	2	2	2	3	3	3	3	3	3	3
20	2	2	2	2	2	2	2	3	3	3	3
15	2	2	2	2	1	1	2	2	2	3	3
10	2	2	2	2	1	1	1	1	2	2	3
5	2	2	2	2	1	1	1	1	1	1	2
0 & below	2	2	2	2	1	1	1	1	1	1	1

MEL SUPPORT

ALTERNATE TAKEOFF THRUST SETTING PROCEDURE

3) Determine V_{MCG} and $V_{R MIN}$ from the following chart.

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)											
		-2,000		0		2,000		4,000		6,000		8,000	
°F	°C	V_{MCG}	$V_{R MIN}$	V_{MCG}	$V_{R MIN}$	V_{MCG}	$V_{R MIN}$	V_{MCG}	$V_{R MIN}$	V_{MCG}	$V_{R MIN}$	V_{MCG}	$V_{R MIN}$
140	60	108	111	104	107	101	103	97	100	93	96	90	93
131	55	112	115	108	111	104	107	100	103	97	99	93	96
122	50	115	118	111	114	107	110	103	106	100	102	96	99
113	45	119	122	114	118	110	113	106	109	102	105	99	101
104	40	123	126	117	120	113	116	109	112	105	108	101	104
103	39	124	127	118	121	113	117	109	112	105	108	102	104
99	37	125	128	119	122	114	117	110	113	106	109	102	105
95	35	125	128	120	123	115	119	111	114	107	110	103	106
92	33	125	129	122	125	116	119	112	115	108	111	104	107
86	30	126	129	123	126	118	122	113	116	109	112	105	108
85	29	126	129	123	126	118	122	114	117	109	112	105	108
77	25	126	129	124	127	120	123	115	118	111	114	107	110
73	23	126	129	124	127	120	123	115	118	112	115	107	110
68	20	126	129	124	127	121	124	116	119	113	116	108	111
59	15	126	129	124	127	121	124	117	120	113	116	110	113
50	10	126	129	124	127	121	124	117	120	115	118	110	114
41	5	126	129	124	127	121	124	117	120	115	118	111	114
32	0	126	129	124	127	121	124	117	120	115	118	111	114
-67	-55	126	129	124	127	121	124	117	120	115	118	111	114

4) Revise the V speed numbers on the TAKEOFF REF page as follows:

V_1 = the greater of the adjusted V_1 and V_{MCG}

V_R = the greater of the adjusted V_R and $V_{R MIN}$

5) If V_R has been adjusted for $V_{R MIN}$ in step 4, adjust V_2 as follows:

Enter the table below with actual gross weight and $V_{R MIN}$ to obtain V_2 . Use the greater of this resultant V_2 or the FMC generated V_2 .

V_2 for $V_{R MIN}$

Weight 1,000 lbs	$V_{R MIN}$ (KIAS)					
	100	105	110	115	120	125
650	117	121	127	133	139	145
600	117	121	127	133	139	145
550	116	121	127	133	139	145
500	116	121	127	133	140	146
450	117	121	128	134	140	147
400	117	121	128	134	141	147

MEL SUPPORT**V_{MCG} – MINIMUM CONTROL SPEED, GROUND****KIAS**

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE - FEET							
°F	°C	-2,000	0	2,000	4,000	5,000	6,000	8,000	10,000
-67	-55	122	121	118	115	114	113	110	107
0	-18	122	121	118	115	114	113	110	107
10	-12	122	121	118	115	114	113	110	107
20	-7	122	121	118	115	114	113	110	107
30	-1	122	121	118	115	114	113	110	107
40	4	122	121	118	115	114	113	110	107
50	10	122	121	118	115	114	113	110	107
51	11	122	121	118	115	114	113	110	107
60	16	122	121	118	115	114	113	110	105
68	20	122	121	118	115	114	113	108	104
70	21	122	121	118	115	114	112	108	104
74	23	122	121	118	115	114	111	107	103
78	25	122	121	118	115	113	111	107	103
80	27	122	121	118	115	112	110	106	102
85	29	122	121	118	114	111	109	105	101
90	32	122	121	117	112	109	108	104	100
92	33	122	121	116	112	109	108	104	100
99	37	122	119	114	110	107	106	102	98
100	38	122	118	114	110	106	106	102	98
103	39	122	118	113	109	106	105	102	98
110	43	120	115	111	107	104	103	99	96
120	49	116	112	108	104	101	100	97	93
130	54	112	108	104	101	98	97	93	90
140	60	108	104	101	97	95	93	90	87

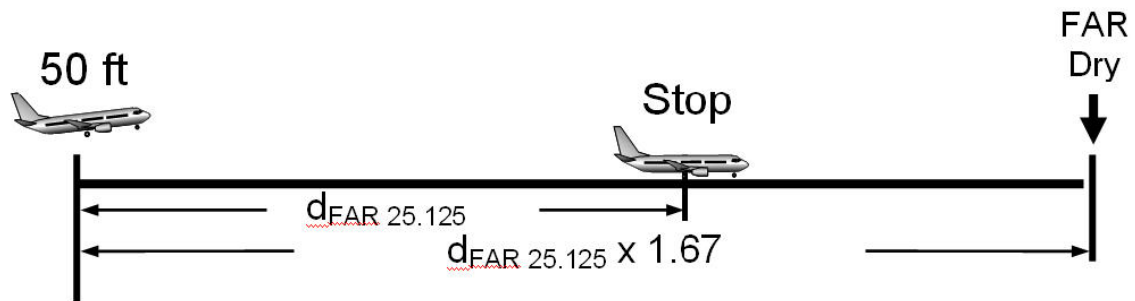
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MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

DEFINITION

All given distances in this section are FAR (Factored) Landing Distances. These distances represent the actual (or demonstrated) landing distances – designated as d_{FAR} in the diagram below – multiplied by a factor of 1.67.



FAR Landing Distance Diagram

This is in accordance with FAR 121.195, requiring the aircraft to be able to come to a complete stop within 60% of the effective length of the runway.

APPLICABILITY

The tables on the following pages provide landing distances and approach speeds to be used for dispatch with the given conditions and the associated MEL applied. For landing distances in the event of an in-flight system failure or abnormality not detected at or prior to dispatch, please refer to the “Abnormal Configuration Actual Landing Distances and Approach Speeds” pages in this section of the ODM.

ASSUMPTIONS

The data within this section was generated based on a set of assumed conditions:

- Standard day conditions
- No wind
- No slope
- No reverse thrust credit factored in FAR Landing Distances
- Maximum manual braking
- Includes distance from 50 feet above threshold to stop (1,000 feet of air distance)

MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

FLAPS 25

Actual (unfactored) landing distances are 60% of the distances indicated.

ANTI-SKID INOP – DRY RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870											
840											
810											
780											
750											
720											
690											
660											
630	16,810										
610	16,010	16,460	16,890								
590	15,250	15,670	16,080	16,510	16,960						
570	14,780	15,180	15,570	16,000	16,440	16,920					
550	14,320	14,700	15,080	15,510	15,930	16,390	16,860				
530	13,840	14,220	14,590	15,000	15,410	15,850	16,300	16,760			
510	13,380	13,750	14,110	14,500	14,890	15,310	15,740	16,190	16,660		
490	12,930	13,280	13,630	14,000	14,360	14,770	15,190	15,620	16,060	16,540	
470	12,470	12,800	13,130	13,490	13,850	14,230	14,640	15,050	15,480	15,940	16,410

ANTI-SKID INOP - WET RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870											
840											
810											
780											
750											
720											
690											
660											
630	19,330										
610	18,420	18,920	19,420								
590	17,530	18,020	18,490	18,980	19,500						
570	17,000	17,450	17,900	18,400	18,910	19,460					
550	16,460	16,900	17,340	17,830	18,320	18,850	19,390				
530	15,920	16,360	16,780	17,250	17,720	18,230	18,750	19,280			
510	15,390	15,810	16,230	16,680	17,120	17,600	18,100	18,620	19,160		
490	14,860	15,270	15,670	16,100	16,520	16,980	17,460	17,960	18,470	19,020	
470	14,340	14,720	15,100	15,520	15,920	16,370	16,830	17,310	17,800	18,330	18,870

CORRECTIONS:

Headwind per kt	-65 ft
Tailwind per kt	+210 ft

MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

Actual (unfactored) landing distances are 60% of the distances indicated.

FLAPS 30

ANTI-SKID INOP – DRY RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870											
840											
810											
780											
750											
720											
690	16,660										
660	15,610	16,020	16,450	16,890							
630	14,570	14,940	15,340	15,770	16,190	16,620					
610	14,100	14,480	14,870	15,280	15,690	16,130	16,580				
590	13,690	14,060	14,430	14,840	15,240	15,670	16,110	16,580			
570	13,280	13,630	13,990	14,390	14,780	15,200	15,610	16,070	16,510	16,990	
550	12,870	13,210	13,550	13,930	14,320	14,720	15,120	15,560	15,990	16,460	16,940
530	12,470	12,790	13,130	13,480	13,860	14,250	14,640	15,060	15,480	15,930	16,390
510	12,060	12,370	12,690	13,030	13,400	13,770	14,150	14,550	14,960	15,400	15,830
490	11,640	11,940	12,250	12,590	12,930	13,280	13,650	14,050	14,430	14,860	15,280
470	11,230	11,530	11,830	12,150	12,470	12,820	13,170	13,540	13,920	14,330	14,730

ANTI-SKID INOP - WET RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870											
840											
810											
780											
750											
720											
690	19,160										
660	17,950	18,420	18,920	19,430							
630	16,760	17,190	17,640	18,140	18,620	19,110					
610	16,210	16,650	17,100	17,570	18,050	18,550	19,070				
590	15,740	16,160	16,600	17,060	17,530	18,020	18,520	19,060			
570	15,270	15,680	16,090	16,540	17,000	17,470	17,950	18,480	18,990	19,540	
550	14,800	15,190	15,590	16,020	16,470	16,930	17,390	17,900	18,390	18,930	19,480
530	14,340	14,710	15,100	15,510	15,940	16,380	16,840	17,320	17,810	18,320	18,840
510	13,860	14,220	14,600	14,990	15,410	15,830	16,270	16,740	17,210	17,710	18,210
490	13,390	13,740	14,090	14,480	14,870	15,270	15,700	16,150	16,600	17,090	17,570
470	12,920	13,260	13,600	13,970	14,350	14,740	15,140	15,570	16,000	16,480	16,940

CORRECTIONS:

Headwind per kt	-75 ft
Tailwind per kt	+240 ft

MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

FLAPS 25

Actual (unfactored) landing distances are 60% of the distances indicated.

MANUAL SPEED BRAKES – DRY RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870	12,770	13,250	13,780	14,340	14,960	15,680					
840	11,930	12,250	12,730	13,230	13,760	14,340	14,970	15,630			
810	11,310	11,610	11,920	12,260	12,700	13,200	13,750	14,340	15,000	15,670	
780	10,700	10,980	11,270	11,580	11,900	12,230	12,630	13,170	13,710	14,300	14,970
750	10,110	10,360	10,640	10,930	11,220	11,530	11,860	12,190	12,550	13,060	13,620
720	9,530	9,780	10,030	10,290	10,570	10,850	11,160	11,470	11,800	12,140	12,500
690	8,970	9,200	9,440	9,680	9,940	10,200	10,490	10,780	11,070	11,390	11,720
660	8,430	8,640	8,870	9,090	9,330	9,580	9,840	10,110	10,380	10,680	10,980
630	7,900	8,100	8,300	8,510	8,740	8,970	9,210	9,460	9,710	10,000	10,270
610	7,550	7,740	7,930	8,140	8,340	8,570	8,800	9,030	9,280	9,540	9,800
590	7,220	7,400	7,580	7,770	7,960	8,180	8,380	8,610	8,850	9,090	9,360
570	7,020	7,190	7,360	7,550	7,740	7,950	8,150	8,370	8,590	8,830	9,090
550	6,820	6,980	7,150	7,330	7,520	7,720	7,920	8,130	8,340	8,570	8,820
530	6,610	6,780	6,940	7,110	7,290	7,480	7,680	7,880	8,090	8,310	8,540
510	6,410	6,570	6,720	6,900	7,060	7,250	7,440	7,630	7,830	8,040	8,270
490	6,210	6,360	6,510	6,680	6,830	7,010	7,190	7,380	7,570	7,780	7,990
470	6,010	6,160	6,300	6,460	6,610	6,780	6,950	7,140	7,320	7,520	7,720

MANUAL SPEED BRAKES - WET RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870	14,680	15,240	15,850	16,490	17,200	18,030					
840	13,720	14,090	14,640	15,220	15,820	16,490	17,210	17,980			
810	13,000	13,350	13,710	14,100	14,600	15,180	15,810	16,490	17,250	18,020	
780	12,310	12,620	12,960	13,310	13,680	14,060	14,530	15,150	15,770	16,440	17,210
750	11,630	11,920	12,240	12,570	12,900	13,250	13,630	14,020	14,440	15,020	15,660
720	10,960	11,250	11,540	11,840	12,150	12,480	12,830	13,190	13,570	13,960	14,370
690	10,310	10,580	10,860	11,130	11,440	11,730	12,070	12,400	12,730	13,100	13,470
660	9,690	9,940	10,200	10,450	10,730	11,010	11,320	11,630	11,940	12,280	12,630
630	9,080	9,310	9,550	9,790	10,050	10,310	10,590	10,880	11,160	11,490	11,810
610	8,690	8,910	9,120	9,360	9,600	9,860	10,110	10,390	10,670	10,970	11,270
590	8,300	8,510	8,720	8,930	9,160	9,410	9,640	9,910	10,170	10,450	10,760
570	8,070	8,270	8,460	8,680	8,900	9,140	9,380	9,630	9,880	10,160	10,450
550	7,840	8,030	8,220	8,430	8,640	8,870	9,110	9,350	9,590	9,860	10,140
530	7,600	7,790	7,980	8,180	8,380	8,600	8,830	9,060	9,300	9,550	9,820
510	7,370	7,550	7,730	7,930	8,120	8,330	8,550	8,770	9,010	9,250	9,510
490	7,140	7,320	7,490	7,680	7,860	8,060	8,270	8,490	8,710	8,950	9,190
470	6,910	7,080	7,250	7,430	7,600	7,790	8,000	8,210	8,420	8,650	8,880

CORRECTIONS:

Headwind per kt	-55 ft
Tailwind per kt	+150 ft

MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

Actual (unfactored) landing distances are 60% of the distances indicated.

FLAPS 30

MANUAL SPEED BRAKES – DRY RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870	11,350	11,680	12,020	12,490	12,990	13,510	14,090	14,700	15,350	15,920	
840	10,790	11,080	11,380	11,680	12,030	12,500	13,010	13,540	14,120	14,750	15,410
810	10,240	10,510	10,790	11,070	11,380	11,710	12,040	12,510	13,030	13,580	14,160
780	9,710	9,960	10,220	10,490	10,770	11,070	11,380	11,720	12,030	12,500	13,010
750	9,190	9,420	9,670	9,920	10,180	10,460	10,740	11,050	11,350	11,680	12,020
720	8,670	8,880	9,120	9,350	9,600	9,850	10,120	10,410	10,700	10,990	11,310
690	8,180	8,380	8,600	8,820	9,050	9,290	9,540	9,800	10,070	10,350	10,640
660	7,700	7,890	8,090	8,290	8,500	8,730	8,960	9,200	9,450	9,710	9,980
630	7,220	7,390	7,570	7,770	7,970	8,170	8,370	8,590	8,850	9,080	9,330
610	7,000	7,180	7,360	7,550	7,740	7,940	8,150	8,370	8,600	8,830	9,080
590	6,810	6,980	7,160	7,340	7,530	7,720	7,930	8,140	8,360	8,580	8,820
570	6,630	6,790	6,950	7,130	7,320	7,510	7,700	7,910	8,110	8,340	8,560
550	6,440	6,600	6,750	6,930	7,110	7,290	7,470	7,680	7,880	8,090	8,310
530	6,250	6,400	6,560	6,720	6,890	7,070	7,250	7,440	7,640	7,850	8,060
510	6,060	6,210	6,360	6,510	6,680	6,850	7,030	7,210	7,400	7,600	7,800
490	5,870	6,010	6,150	6,310	6,460	6,630	6,800	6,980	7,160	7,350	7,550
470	5,690	5,820	5,960	6,110	6,260	6,410	6,570	6,740	6,920	7,110	7,290

MANUAL SPEED BRAKES - WET RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870	13,060	13,430	13,830	14,360	14,930	15,540	16,200	16,900	17,650	18,310	
840	12,410	12,740	13,080	13,440	13,830	14,380	14,960	15,570	16,240	16,960	17,730
810	11,770	12,080	12,410	12,740	13,090	13,460	13,850	14,380	14,980	15,620	16,280
780	11,160	11,450	11,750	12,060	12,390	12,730	13,090	13,480	13,840	14,380	14,970
750	10,570	10,830	11,120	11,410	11,710	12,020	12,350	12,700	13,050	13,430	13,820
720	9,970	10,220	10,490	10,760	11,040	11,330	11,640	11,970	12,300	12,640	13,000
690	9,410	9,640	9,890	10,140	10,400	10,680	10,970	11,270	11,580	11,900	12,230
660	8,850	9,070	9,300	9,530	9,780	10,040	10,300	10,580	10,870	11,160	11,470
630	8,300	8,500	8,710	8,940	9,160	9,390	9,630	9,880	10,180	10,440	10,730
610	8,050	8,250	8,460	8,680	8,900	9,130	9,370	9,630	9,890	10,150	10,440
590	7,840	8,030	8,230	8,440	8,660	8,880	9,120	9,370	9,610	9,870	10,140
570	7,620	7,810	8,000	8,200	8,410	8,630	8,850	9,100	9,330	9,590	9,850
550	7,410	7,580	7,770	7,970	8,170	8,380	8,600	8,830	9,060	9,310	9,560
530	7,190	7,360	7,540	7,730	7,930	8,130	8,340	8,560	8,790	9,020	9,270
510	6,970	7,140	7,310	7,490	7,680	7,880	8,080	8,290	8,510	8,740	8,970
490	6,750	6,910	7,080	7,250	7,430	7,620	7,820	8,030	8,230	8,460	8,680
470	6,540	6,690	6,850	7,020	7,190	7,370	7,560	7,760	7,960	8,180	8,390

CORRECTIONS:

Headwind per kt	-65 ft
Tailwind per kt	+180 ft

MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

FLAPS 25

Actual (unfactored) landing distances are 60% of the distances indicated.

TWO WHEEL BRAKES DEACTIVATED – DRY RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870	14,100	14,730									
840	13,010	13,430	14,050	14,700							
810	12,200	12,590	13,000	13,440	14,010	14,660					
780	11,430	11,780	12,150	12,550	12,970	13,400	13,920	14,620			
750	10,680	11,000	11,350	11,720	12,090	12,490	12,910	13,350	13,820	14,490	
720	9,940	10,260	10,580	10,910	11,260	11,620	12,010	12,410	12,840	13,290	13,750
690	9,260	9,540	9,830	10,130	10,460	10,790	11,160	11,530	11,910	12,310	12,730
660	8,610	8,870	9,140	9,400	9,700	10,000	10,340	10,680	11,020	11,400	11,780
630	8,040	8,250	8,480	8,720	8,980	9,260	9,550	9,850	10,170	10,530	10,870
610	7,660	7,870	8,080	8,300	8,520	8,780	9,050	9,340	9,630	9,950	10,280
590	7,300	7,500	7,690	7,900	8,110	8,340	8,560	8,840	9,110	9,410	9,730
570	7,070	7,260	7,450	7,660	7,860	8,090	8,320	8,550	8,810	9,100	9,410
550	6,850	7,030	7,220	7,420	7,620	7,840	8,060	8,290	8,520	8,780	9,080
530	6,620	6,810	6,980	7,180	7,370	7,580	7,800	8,020	8,250	8,480	8,750
510	6,400	6,580	6,750	6,940	7,120	7,320	7,530	7,750	7,970	8,200	8,440
490	6,200	6,360	6,520	6,700	6,870	7,070	7,270	7,470	7,690	7,910	8,140
470	5,990	6,140	6,290	6,460	6,630	6,810	7,000	7,200	7,410	7,630	7,850

TWO WHEEL BRAKES DEACTIVATED - WET RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870	16,210	16,940									
840	14,960	15,450	16,160	16,910							
810	14,030	14,480	14,950	15,450	16,110	16,860					
780	13,140	13,550	13,970	14,430	14,910	15,410	16,010	16,820			
750	12,280	12,650	13,050	13,480	13,900	14,360	14,850	15,350	15,890	16,660	
720	11,430	11,800	12,160	12,550	12,940	13,360	13,810	14,270	14,760	15,280	15,810
690	10,650	10,970	11,300	11,650	12,030	12,410	12,830	13,260	13,690	14,160	14,640
660	9,910	10,200	10,510	10,810	11,150	11,500	11,890	12,280	12,670	13,110	13,550
630	9,240	9,490	9,750	10,020	10,330	10,650	10,980	11,330	11,690	12,110	12,510
610	8,810	9,050	9,290	9,540	9,800	10,100	10,410	10,740	11,070	11,440	11,820
590	8,390	8,620	8,850	9,080	9,320	9,600	9,850	10,160	10,480	10,820	11,190
570	8,130	8,350	8,570	8,800	9,040	9,310	9,570	9,840	10,130	10,460	10,820
550	7,880	8,090	8,300	8,530	8,770	9,020	9,270	9,530	9,800	10,100	10,440
530	7,620	7,830	8,030	8,260	8,480	8,720	8,970	9,220	9,480	9,760	10,060
510	7,360	7,570	7,760	7,980	8,190	8,420	8,660	8,910	9,160	9,430	9,710
490	7,120	7,310	7,500	7,700	7,900	8,130	8,360	8,600	8,840	9,100	9,360
470	6,880	7,060	7,240	7,430	7,620	7,830	8,060	8,280	8,520	8,770	9,030

CORRECTIONS:

Headwind per kt	-55 ft
Tailwind per kt	+150 ft

MEL SUPPORT

FAR LANDING DISTANCES (FACTORED)

Actual (unfactored) landing distances are 60% of the distances indicated.

FLAPS 30

TWO WHEEL BRAKES DEACTIVATED – DRY RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870	12,290	12,710	13,160	13,770	14,410						
840	11,550	11,930	12,320	12,720	13,160	13,780	14,440				
810	10,850	11,190	11,560	11,930	12,330	12,750	13,180	13,790	14,460		
780	10,180	10,500	10,830	11,170	11,530	11,920	12,320	12,760	13,170	13,780	14,450
750	9,550	9,830	10,130	10,450	10,770	11,120	11,490	11,890	12,280	12,710	13,150
720	8,930	9,180	9,470	9,750	10,050	10,370	10,700	11,060	11,440	11,820	12,230
690	8,370	8,590	8,840	9,110	9,380	9,670	9,970	10,300	10,640	10,980	11,360
660	7,850	8,050	8,270	8,490	8,730	9,000	9,270	9,570	9,870	10,180	10,520
630	7,330	7,520	7,720	7,930	8,140	8,350	8,580	8,830	9,140	9,410	9,720
610	7,090	7,280	7,480	7,690	7,890	8,110	8,330	8,580	8,840	9,120	9,410
590	6,880	7,070	7,260	7,460	7,660	7,880	8,100	8,330	8,560	8,820	9,110
570	6,680	6,850	7,030	7,230	7,430	7,640	7,850	8,080	8,300	8,540	8,800
550	6,470	6,640	6,810	7,010	7,200	7,400	7,610	7,830	8,040	8,270	8,510
530	6,270	6,430	6,600	6,780	6,970	7,160	7,360	7,580	7,790	8,010	8,240
510	6,060	6,220	6,380	6,550	6,740	6,920	7,120	7,320	7,530	7,740	7,960
490	5,850	6,000	6,160	6,330	6,500	6,680	6,860	7,060	7,260	7,480	7,680
470	5,650	5,800	5,950	6,110	6,270	6,440	6,620	6,810	7,000	7,210	7,410

TWO WHEEL BRAKES DEACTIVATED - WET RUNWAY

AIRCRAFT WEIGHT 1,000 LBS	AIRPORT PRESSURE ALTITUDE - FEET										
	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
870	14,130	14,610	15,130	15,830	16,570						
840	13,290	13,720	14,170	14,620	15,140	15,850	16,600				
810	12,470	12,870	13,290	13,710	14,180	14,660	15,160	15,860	16,630		
780	11,710	12,070	12,450	12,840	13,270	13,710	14,170	14,680	15,140	15,850	16,610
750	10,980	11,300	11,650	12,020	12,390	12,790	13,220	13,670	14,130	14,620	15,130
720	10,270	10,560	10,890	11,210	11,550	11,920	12,310	12,720	13,150	13,590	14,060
690	9,630	9,880	10,160	10,470	10,790	11,120	11,470	11,850	12,230	12,630	13,060
660	9,030	9,260	9,510	9,760	10,040	10,350	10,660	11,000	11,340	11,710	12,100
630	8,430	8,640	8,870	9,120	9,360	9,610	9,870	10,160	10,520	10,820	11,180
610	8,150	8,370	8,600	8,840	9,070	9,330	9,580	9,860	10,170	10,480	10,820
590	7,910	8,130	8,350	8,580	8,810	9,060	9,310	9,580	9,840	10,140	10,470
570	7,680	7,880	8,090	8,320	8,550	8,790	9,030	9,290	9,540	9,820	10,120
550	7,440	7,640	7,840	8,060	8,280	8,510	8,750	9,000	9,250	9,520	9,790
530	7,210	7,390	7,590	7,790	8,020	8,240	8,470	8,710	8,950	9,210	9,470
510	6,970	7,150	7,340	7,530	7,750	7,960	8,180	8,420	8,660	8,900	9,150
490	6,730	6,900	7,080	7,270	7,470	7,680	7,890	8,120	8,350	8,600	8,840
470	6,490	6,670	6,840	7,020	7,210	7,410	7,610	7,830	8,050	8,290	8,520

CORRECTIONS:

Headwind per kt	-65 ft
Tailwind per kt	+180 ft

END OF SECTION

FERRY FLIGHT PLANNING AND OPERATION

AUTHORIZATION AND FLIGHT PLANNING	5-2
LANDING GEAR EXTENDED.....	5-3

AUTHORIZATION AND FLIGHT PLANNING

Authorization, procedures, and applicability of data for ferry operations is described in Technical Operations Policies and Procedures (TOPP). Procedures outlined in TOPP must be strictly adhered to.

Ferry operational data is available for the following configuration:

- Landing Gear Extended

The following method should be used for ferry flight planning and certain revenue flight planning (as noted) and operations:

1. Obtain a normal aircraft configuration (computerized or manual) unfilled flight plan using Long Range Cruise (LRC) at the proposed cruise altitude.
2. Calculate the trip time and fuel load based on the values displayed under the appropriate ferry configuration. Enter this data either in the Dispatcher Remarks section of the Computerized Flight Plan or on the Standby Flight Plan form (NS80172).
3. Add remarks containing the ferry speed, speed limit, altitude limit, total time, leg times if appropriate, and engine-out altitude capability.
Note: Suggested cruise altitudes are for reference, and reasonable adjustments may be made to accommodate ATC and direction of flight.
4. Assure adequate terrain clearance by referring to the Engine Out Altitude Limit table, if available. (See FERRY, ENROUTE heading)
5. Adjust the Runway Allowable and Climb Limit Takeoff Weights, and the Landing Climb Limit Weight as follows:
Go to the appropriate ferry configuration page and subtract the weight decrements indicated under headings for TAKEOFF and LANDING from the NORMAL Thrust takeoff weight and the Landing Climb weight, respectively, obtained from the ARM (Airport Sections).

The following limitations should be applied to all ferry flights:

1. Do not combine two or more ferry configurations.
2. All ferry flight takeoffs will be made using full (NORMAL) thrust (TMC TO) and climb out will be made using Maximum Climb thrust (TMC CLB) unless otherwise specified on ferry configuration data page.
3. Observe additional limitations and restrictions as listed for each ferry configuration on the following data pages.

LANDING GEAR EXTENDED

OPERATIONAL LIMITATIONS:

The following are the FAA Airplane Flight Manual mandated limitations for gear down operations. Limitations are unchanged from normal except as listed below.

1. All components required for a landing gear extended operation must be functional in accordance with the appropriate maintenance manual.
2. The use of speed increase for improved climb performance in order to increase maximum takeoff weight is prohibited.
3. Dispatch into known icing conditions is prohibited.
4. The airplane is not eligible for extended over-water operations when landing gear down lock pins are installed. "Extended over-water operation" includes any operation over water at a horizontal distance of more than 50 nautical miles from the nearest shoreline.
5. Use of reduced thrust takeoff is prohibited.
6. Limitations relating to engine-out drift down are contained in the ABNORMAL section of this Operational Data Manual (ODM).
7. Takeoff is limited to Flaps 10 and 20.
8. V_{MO} and M_{MO} are reduced to 270 KIAS and .73 Mach.
9. The airspeed indicator and Mach-airspeed warning switch must be reprogrammed for V_{MO} and M_{MO} .
10. The EPR indication system must be operational.
11. Emergency procedures are unchanged, except **emergency descent target speed is 270 KIAS**.
12. Severe turbulent air penetration recommended airspeed is 260 KCAS/0.66 Mach when gross weight is 700,000 pounds or higher, 250 KCAS/0.66 Mach when gross weight is 600,000 pounds or higher but less than 700,000 pounds, and 240 KCAS/0.66 Mach when gross weight is below 600,000 pounds.
13. The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn and thrust-limited maximum altitude, and compute an overly shallow descent path. Use of VNAV during descent is not recommended.

FLIGHT PLANNING

Fuel Required / Trip Time (1,000 lb / hours):

PRESSURE ALTITUDE - FEET	RANGE - NAUTICAL GROUND MILES						
	500	1,000	1,500	2,000	2,500	3,000	3,500
10,000	48.0 / 2.2	96.0 / 4.2	148.0 / 5.9	202.0 / 7.7	260.0 / 9.4	320.0 / 11.1	
14,000	45.0 / 2.0	91.0 / 3.8	138.0 / 5.6	187.0 / 7.3	239.0 / 9.0	295.0 / 10.6	
18,000	42.0 / 1.9	84.0 / 3.6	127.0 / 5.4	172.0 / 7.0	222.0 / 8.5	271.0 / 10.2	325.0 / 11.7
22,000 and above	40.5 / 1.8	79.0 / 3.5	119.0 / 5.2	161.0 / 6.6	205.0 / 8.2	252.0 / 9.6	304.0 / 11.2

NOTE: Based on Long Range Cruise, 240/0.60 climb, 0.66/240 descent, standard day conditions, zero winds, reference landing weight of 400,000 lb.

TAKEOFF

RATOW & Takeoff climb limit weight:

Use GRD TPI in AWABS

Takeoff V Speeds:

Use GRD TPI in AWABS

Takeoff Thrust Settings:

Use NORMAL only, ALTERNATE thrust NOT approved.

Takeoff Flap Settings:

Flaps 10 or 20 only.

Operation from Contaminated Runway:

Permitted, use GRD TPI.

LANDING GEAR EXTENDED

ENROUTE

Long Range Cruise Table – All Engine

GROSS WEIGHT - POUNDS	PRESSURE ALTITUDE - 1,000 FEET											
	CRUISE SPEED - KIAS TARGET EPR FUEL FLOW / ENGINE - LB/HR											
	10	15	17	19	21	23	25	27	29	31	33	35
880,000	270 1.25 11083	270 1.35 11219										
840,000	270 1.23 10693	270 1.32 10793	270 1.38 10889									
800,000	270 1.21 10349	270 1.30 10423	270 1.35 10497									
760,000	270 1.20 10047	270 1.28 10094	270 1.33 10158	270 1.38 10245								
720,000	268 1.19 9676	264 1.26 9515	263 1.30 9537	263 1.35 9611	265 1.41 9749							
680,000	262 1.17 9124	258 1.24 8943	257 1.27 8945	256 1.31 8983	257 1.36 9074	258 1.43 9220						
640,000	256 1.16 8578	252 1.22 8412	250 1.24 8381	249 1.28 8397	248 1.33 8423	249 1.38 8516	251 1.45 8669					
600,000	249 1.14 8066	245 1.19 7873	244 1.22 7840	242 1.25 7827	241 1.29 7827	241 1.34 7857	242 1.40 7974	244 1.48 8135				
560,000	241 1.13 7542	239 1.17 7340	237 1.20 7308	235 1.23 7277	234 1.26 7254	233 1.30 7246	233 1.35 7306	235 1.42 7433	237 1.50 7610	239 1.59 7801		
520,000	233 1.11 7025	231 1.15 6820	230 1.18 6781	228 1.20 6754	227 1.23 6707	226 1.26 6674	225 1.31 6678	225 1.36 6759	227 1.43 6891	229 1.51 7068	231 1.61 7247	
480,000	225 1.10 6502	224 1.14 6324	222 1.16 6262	221 1.18 6232	220 1.20 6189	218 1.23 6134	217 1.27 6104	216 1.31 6124	217 1.37 6210	218 1.44 6345	220 1.53 6509	223 1.63 6689
440,000	215 1.09 5970	215 1.12 5819	214 1.14 5768	213 1.15 5716	212 1.18 5673	211 1.20 5616	209 1.23 5571	208 1.27 5550	207 1.31 5575	208 1.37 5668	209 1.45 5796	211 1.54 5936

LANDING GEAR EXTENDED (cont'd)

ENROUTE (cont'd.)

Long Range Cruise Table – One Engine Inoperative

GROSS WEIGHT - POUNDS	PRESSURE ALTITUDE - 1,000 FEET CRUISE SPEED - KIAS TARGET EPR FUEL FLOW / ENGINE - LB/HR										
	9	11	13	15	17	19	21	23	25	27	29
840,000	270 1.40 14890										
800,000	270 1.37 14334										
760,000	270 1.35 13828	270 1.40 14007									
720,000	265 1.32 13071	264 1.37 13183	264 1.42 13361								
680,000	259 1.29 12247	258 1.33 12322	257 1.38 12444	257 1.44 12497							
640,000	252 1.26 11400	251 1.30 11498	250 1.34 11591	249 1.40 11515	250 1.46 11759						
600,000	245 1.24 10603	244 1.27 10669	243 1.31 10775	242 1.35 10636	242 1.41 10772	242 1.48 11015					
560,000	238 1.21 9838	237 1.24 9867	236 1.27 9957	235 1.31 9815	234 1.36 9883	234 1.42 10040	235 1.50 10266	237 1.60 10617			
520,000	230 1.19 9084	229 1.22 9107	228 1.24 9151	227 1.28 9019	227 1.32 9057	226 1.37 9141	226 1.43 9287	227 1.51 9509	229 1.62 9881		
480,000	221 1.17 8355	221 1.19 8359	220 1.22 8391	219 1.24 8244	219 1.28 8269	218 1.32 8316	217 1.37 8385	217 1.44 8526	218 1.52 8738	220 1.63 9101	
440,000	212 1.15 7645	212 1.17 7633	212 1.19 7647	211 1.21 7522	210 1.24 7506	210 1.28 7536	209 1.32 7563	208 1.37 7621	208 1.44 7759	209 1.52 7961	211 1.63 8292

LANDING GEAR EXTENDED (cont'd)

ENROUTE (cont'd.)

Driftdown Performance

GROSS WEIGHT - POUNDS		OPTIMUM DRIFTDOWN SPEED - KIAS	LEVEL OFF ALTITUDE - FEET		
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)		ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
880,000	844,000	266	8,500	8,500	6,300
860,000	826,000	264	9,500	9,500	7,400
840,000	808,000	261	10,400	10,400	8,500
820,000	789,000	259	11,400	11,300	9,500
800,000	770,000	257	12,300	12,300	10,500
780,000	752,000	254	13,300	13,200	11,500
760,000	734,000	252	14,200	14,200	12,500
740,000	715,000	250	15,100	15,100	13,500
720,000	697,000	247	16,100	16,000	14,500
700,000	678,000	245	17,000	16,900	15,500
680,000	660,000	242	17,900	17,800	16,500
660,000	640,000	240	18,900	18,900	17,600
640,000	621,000	237	19,800	19,800	18,600
620,000	601,000	234	20,800	20,800	19,700
600,000	582,000	232	21,700	21,700	20,700
580,000	562,000	229	22,800	22,700	21,700
560,000	542,000	226	23,800	23,800	22,800
540,000	524,000	223	24,700	24,700	23,900
520,000	504,000	221	25,700	25,700	24,900
500,000	485,000	218	26,700	26,700	26,000
480,000	466,000	215	27,700	27,700	27,000
460,000	448,000	212	28,700	28,600	28,100
440,000	430,000	209	29,500	29,500	29,000

BASIS: One engine inoperative, Max Continuous Thrust, engine bleed for 3 packs on, altitude reduced by 1,000 feet for additional margin.

LANDING GEAR EXTENDED (cont'd)

ENROUTE (cont'd.)

Altitude Capability – One Engine Inoperative

GROSS WEIGHT - POUNDS	ISA + 10°C & COLDER	ISA + 15°C	ISA + 20°C
880,000	6,300	6,200	3200
860,000	7,200	7,100	4200
840,000	8,000	8,000	5200
820,000	8,800	8,800	6,200
800,000	9,500	9,500	7,100
780,000	10,200	10,200	7,900
760,000	11,000	10,900	8,700
740,000	11,900	11,900	9,700
720,000	13,100	13,100	11,000
700,000	14,300	14,200	12,300
680,000	15,400	15,300	13,500
660,000	16,500	16,400	14,800
640,000	17,600	17,500	16,000
620,000	18,700	18,600	17,300
600,000	19,800	19,700	18,500
580,000	20,900	20,800	19,700
560,000	22,000	21,900	20,900
540,000	23,100	23,100	22,100
520,000	24,300	24,200	23,300
500,000	25,400	25,300	24,600
480,000	26,500	26,500	25,800
460,000	27,700	27,600	27,000
440,000	28,800	28,800	28,300

CONFIGURATION	CORRECTION - FEET
Engine Bleed for ONE PACK ON	+ 400
Engine Bleed for Packs OFF	+ 600
Engine Anti-Ice ON	- 2,000
Engine and Wing Anti-Ice ON	- 3,800

BASIS: Engine bleed for 3 packs on, Max Continuous Thrust, altitude reduced by an additional 1,000 feet for additional margin.

LANDING

Landing Speed restrictions:

No additional restrictions

Flap Setting Restrictions:

No additional restrictions

Approach & Landing climb limit weights:

Use GRD LPI data if available, otherwise reduce standard landing climb limit by 140,000 lbs

LANDING GEAR EXTENDED (cont'd)

HOLDING SPEED / THRUST (KIAS / EPR)

Weight - Pounds	Flaps Up Altitude - Feet	
	10,000	15,000
880,000	270/1.25	270/1.35
840,000	270/1.23	270/1.32
800,000	270/1.21	270/1.30
760,000	263/1.20	263/1.27
720,000	255/1.18	255/1.25
680,000	246/1.16	246/1.23
640,000	238/1.15	238/1.20
600,000	231/1.13	231/1.18
560,000	226/1.12	226/1.16
520,000	219/1.11	219/1.15
480,000	214/1.10	214/1.13
440,000	207/1.09	207/1.12

NOTE: Chart includes 5% additional fuel for holding in a racetrack pattern.

End of Section