Predicting Performance

Performance

- Speed
- Maneuverability
- Load-carrying capability
- Take-offs
- Landings

Performance Charts

TAKEOFF DISTANCE
MAXIMUM WEIGHT 2400 LB

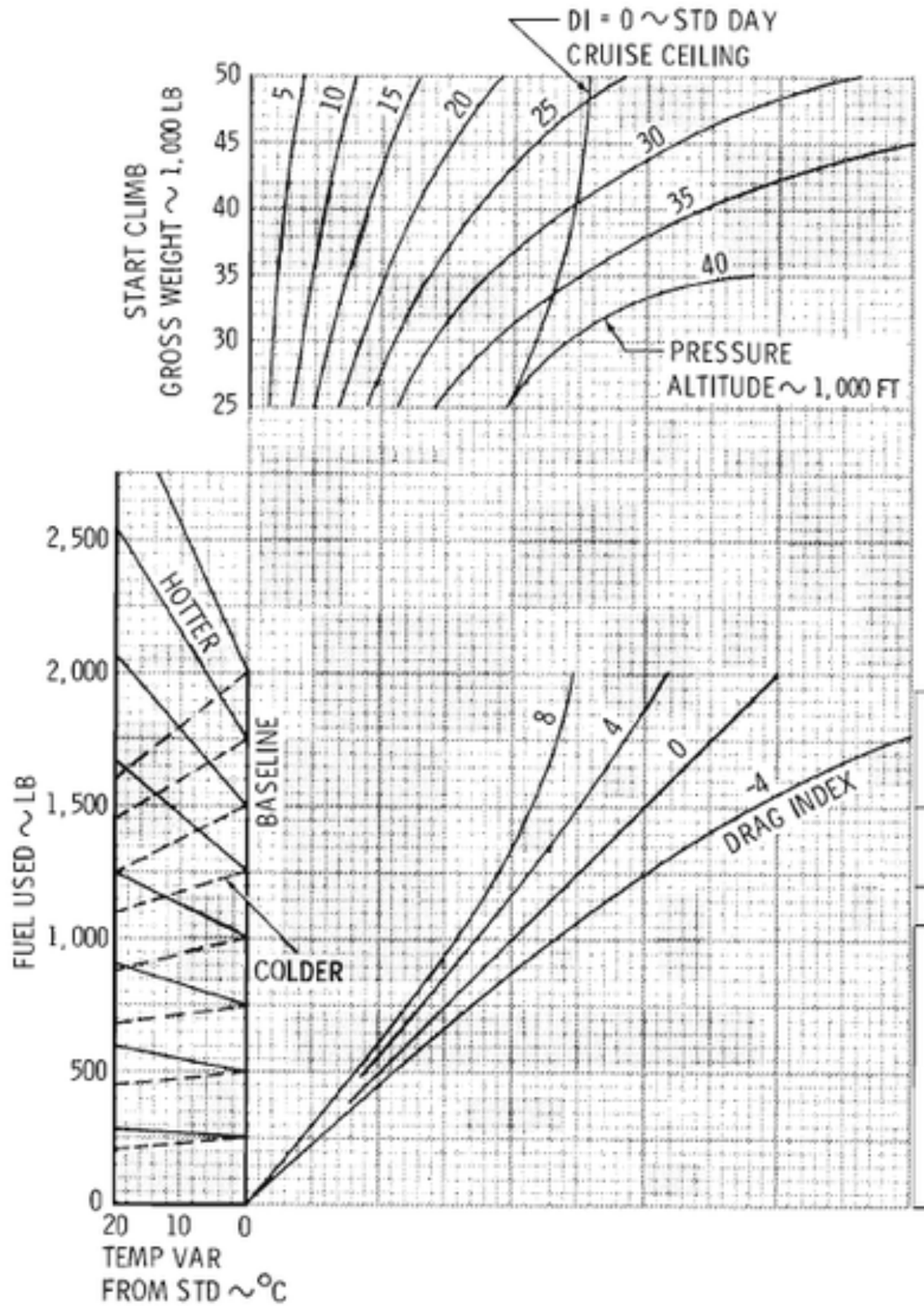
SHORT FIELD

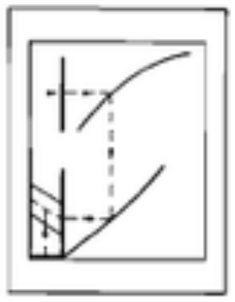
CONDITIONS:
Flaps 10°
Full Throttle Prior to Brake Release
Paved Level Runway
Zero Wind

NOTES:
1. Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.
2. Decrease distances 10% for each 9 knots headwind. For operation with tailwind up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

WEIGHT LB	TAKEOFF SPEED KIAS		PRESS ALT FT	0 °C		10 °C		20 °C		30 °C		40 °C	
	LIFT OFF	AT 50 FT		GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS
2400	51	56	S.L.	795	1460	860	1570	925	1685	995	1810	1065	1945
			1000	875	1605	940	1725	1015	1860	1090	2000	1170	2155
			2000	960	1770	1035	1910	1115	2060	1200	2220	1290	2395
			3000	1055	1960	1140	2120	1230	2295	1325	2480	1425	2685
			4000	1165	2185	1260	2365	1355	2570	1465	2790	1575	3030
			5000	1285	2445	1390	2660	1500	2895	1620	3160	1745	3455
			6000	1425	2755	1540	3015	1665	3300	1800	3620	1940	3990
			7000	1580	3140	1710	3450	1850	3805	2000	4220	---	---
			8000	1755	3615	1905	4015	2060	4480	---	---	---	---
2200	49	54	S.L.	650	1195	700	1280	750	1375	805	1470	865	1575
			1000	710	1310	765	1405	825	1510	885	1615	950	1735
			2000	780	1440	840	1545	905	1660	975	1785	1045	1915
			3000	855	1585	925	1705	995	1835	1070	1975	1150	2130
			4000	945	1750	1020	1890	1100	2040	1180	2200	1270	2375
			5000	1040	1945	1125	2105	1210	2275	1305	2465	1405	2665
			6000	1150	2170	1240	2355	1340	2555	1445	2775	1555	3020
			7000	1270	2440	1375	2655	1485	2890	1605	3155	1730	3450
			8000	1410	2760	1525	3015	1650	3305	1785	3630	1925	4005
2000	46	51	S.L.	525	970	565	1035	605	1110	650	1185	695	1265
			1000	570	1060	615	1135	665	1215	710	1295	765	1385
			2000	625	1160	675	1240	725	1330	780	1425	840	1525
			3000	690	1270	740	1365	800	1465	860	1570	920	1685
			4000	755	1400	815	1500	880	1615	945	1735	1015	1865
			5000	830	1545	900	1660	970	1790	2145	1925	1120	2070
			6000	920	1710	990	1845	1070	1990	2405	2145	1235	2315
			7000	1015	1900	1095	2055	1180	2225	2715	2405	1370	2605
			8000	1125	2125	1215	2305	1310	2500	1410	2715	1520	2950

MAXIMUM THRUST CLIMB
Fuel Used, Speed Schedule





START, TAXI, TAKEOFF, AND ACCELERATE TO CLIMB SPEED PLANNING FACTORS

FUEL USED	500 LB
DISTANCE (BRAKE RELEASE TO CLIMB SPEED)	2 NM
TIME (BRAKE RELEASE TO CLIMB SPEED)	1 MIN

CLIMB SPEED SCHEDULE
ALL GROSS WEIGHTS, DRAG INDEXES

PRESSURE ALTITUDE	INDICATED AIRSPEED
~ 1,000 FT	~ KIAS
SEA LEVEL	200
5	195
10	190
15	185
20	180
25	175
30	170
35	165
40	160

A1-1-10A-3-4

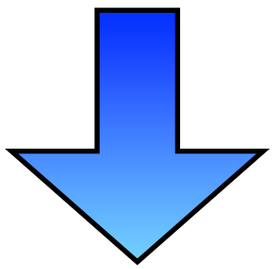
Factors Affecting Performance

- Aircraft Weight
- Winds
- Atmospheric Density
  - Pressure, Temperature, Humidity

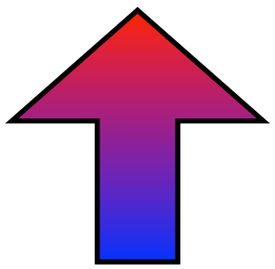
Aero Advantage

Density Altitude

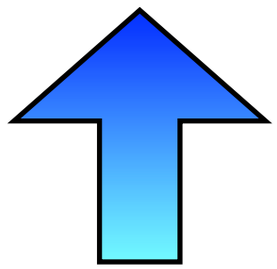
Pressure



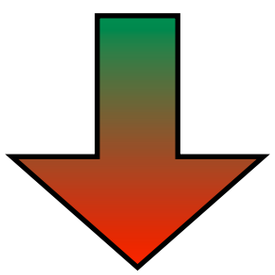
Temperature



Humidity



Aircraft Performance

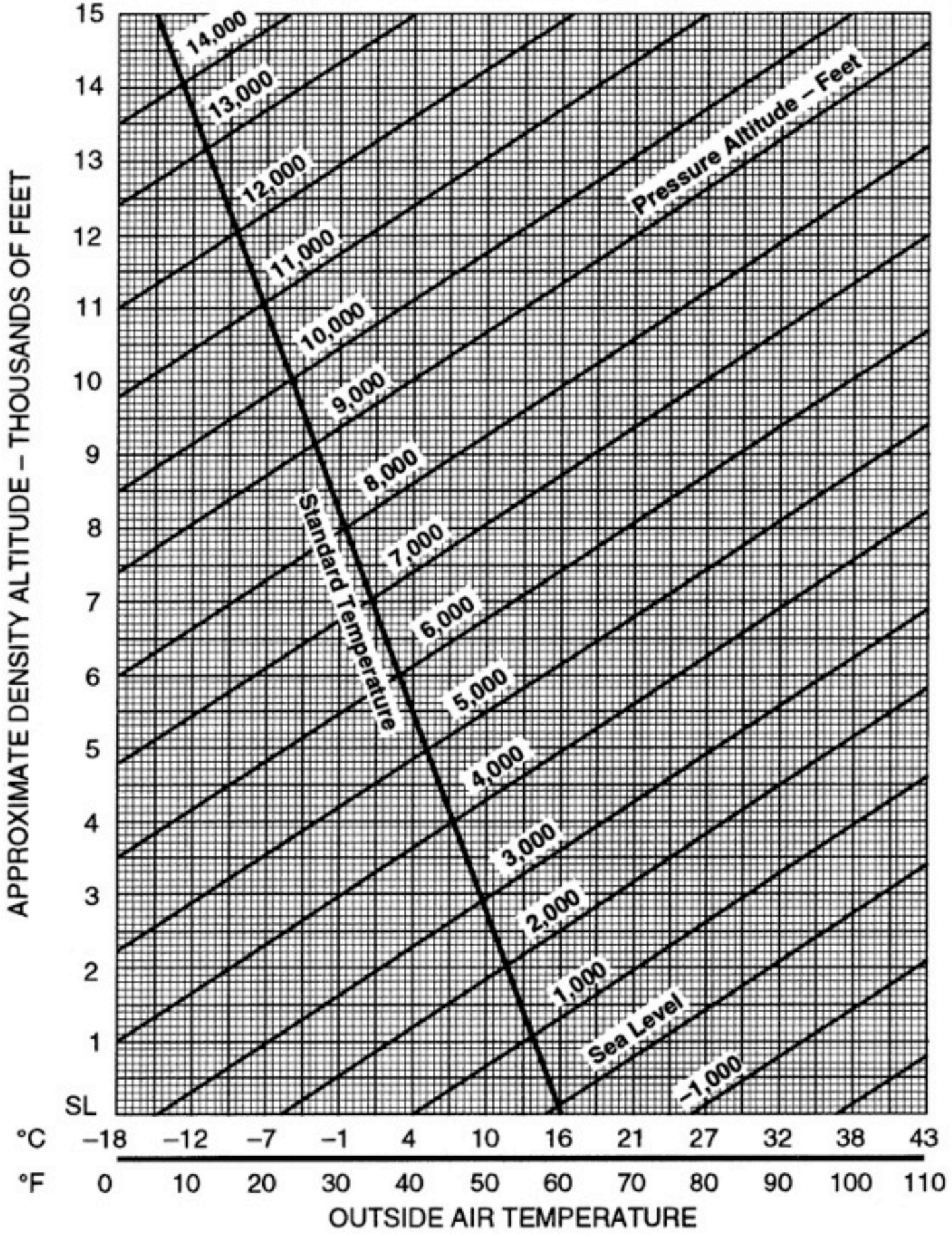


Density Altitude

- Pressure altitude (29.92)
- Pressure altitude adjusted for temperature

Aero Advantage

DENSITY ALTITUDE CHART



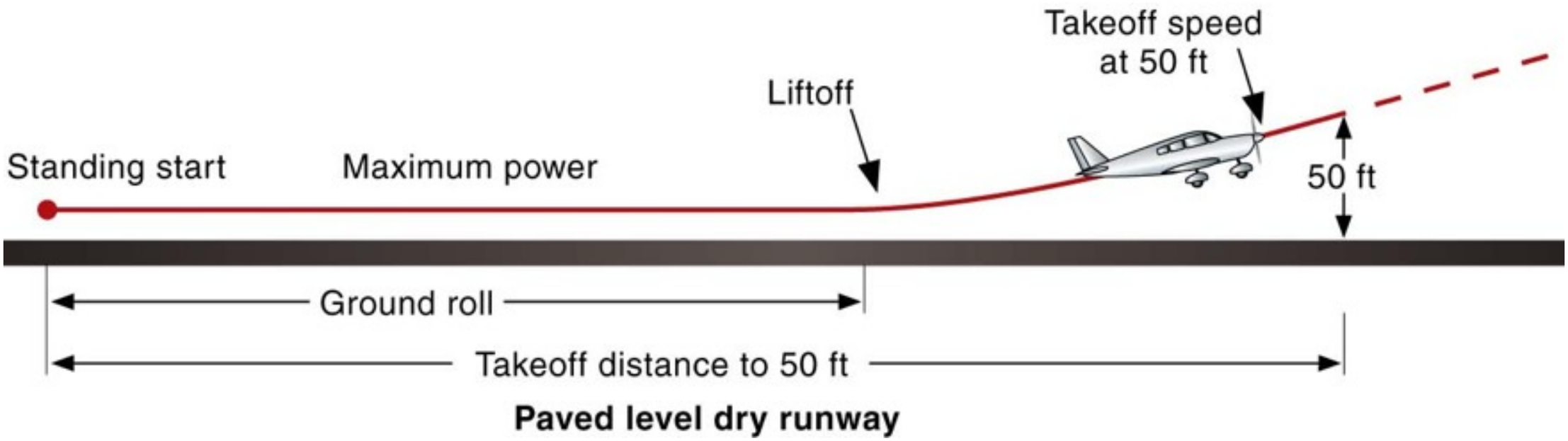
Altimeter Setting (" Hg)	Pressure Altitude Conversion Factor
28.0	1,824
28.1	1,727
28.2	1,630
28.3	1,533
28.4	1,436
28.5	1,340
28.6	1,244
28.7	1,148
28.8	1,053
28.9	957
29.0	863
29.1	768
29.2	673
29.3	579
29.4	485
29.5	392
29.6	298
29.7	205
29.8	112
29.9	20
29.92	0
30.0	–73
30.1	–165
30.2	–257
30.3	–348
30.4	–440
30.5	–531
30.6	–622
30.7	–712
30.8	–803
30.9	–893
31.0	–983

Takeoff and Landing Performance

Factors

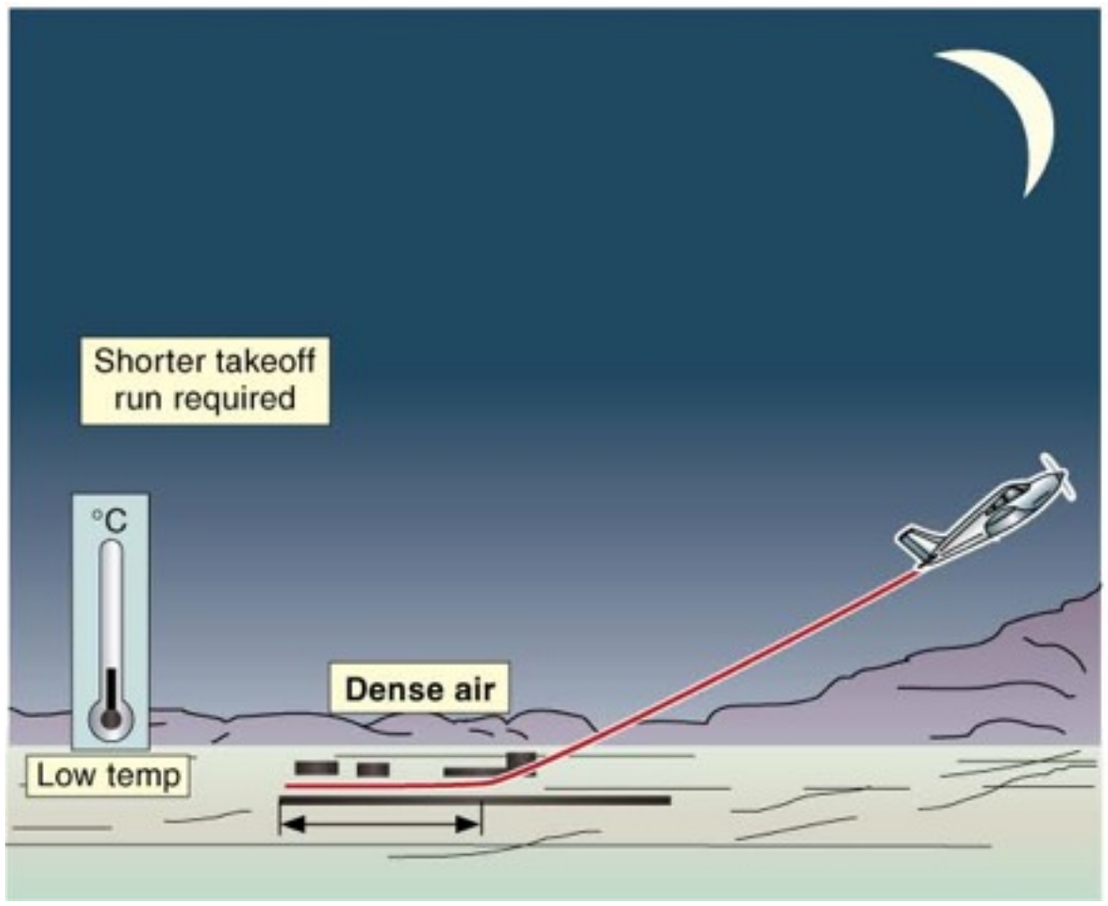
- Density Altitude
- Aircraft Weight
- Aircraft Configuration (Flaps)
- Runway Gradient and Surface
- Surface Winds

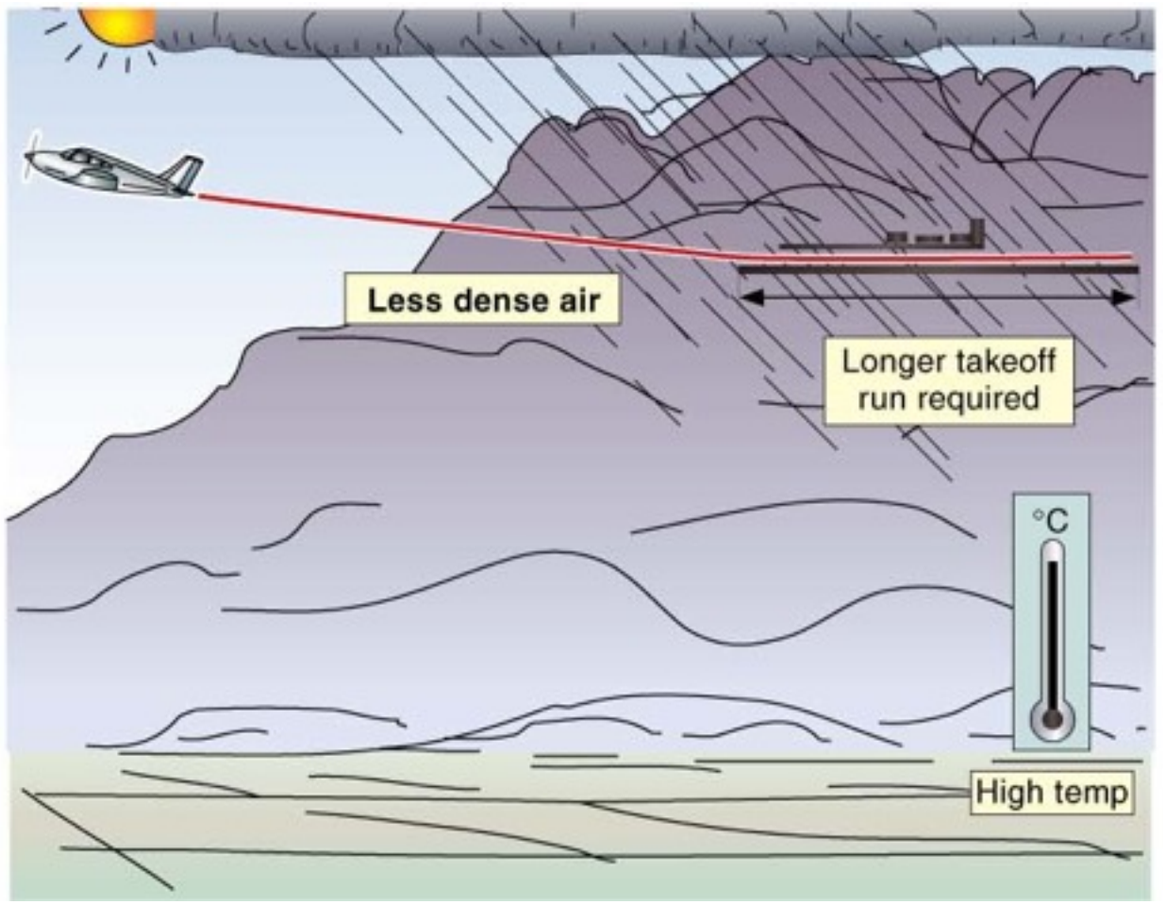
Aero Advantage



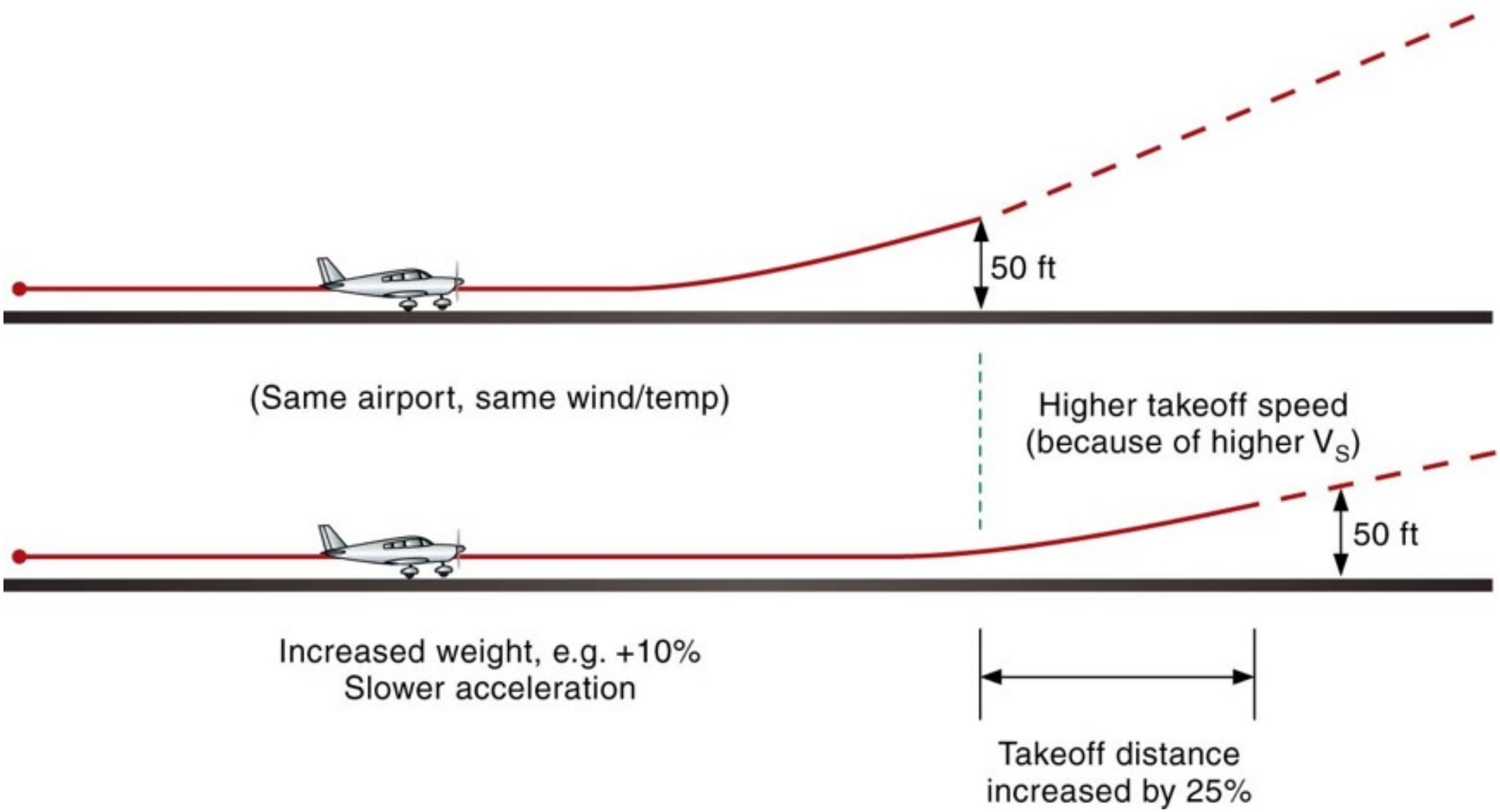
Paved level dry runway

Density Altitude

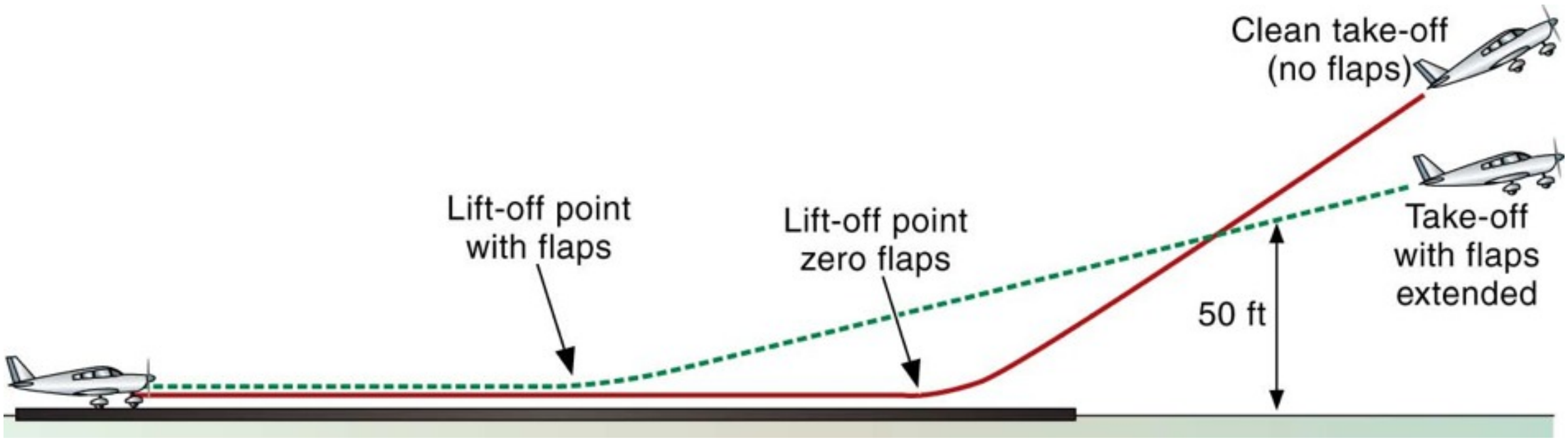




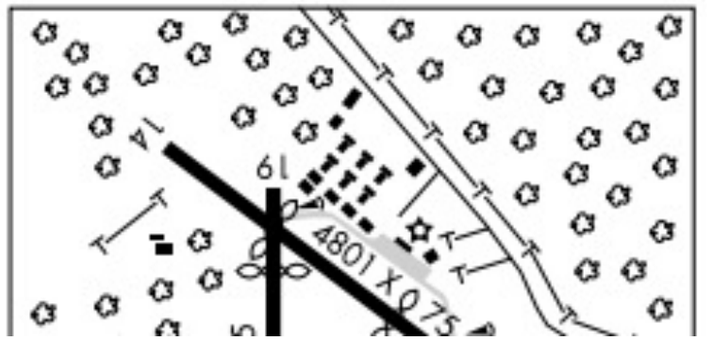
Increased Weight



Flaps


Clean take-off
(no flaps)
Take-off
with flaps
extended
Lift-off point
with flaps
Lift-off point
zero flaps
50 ft

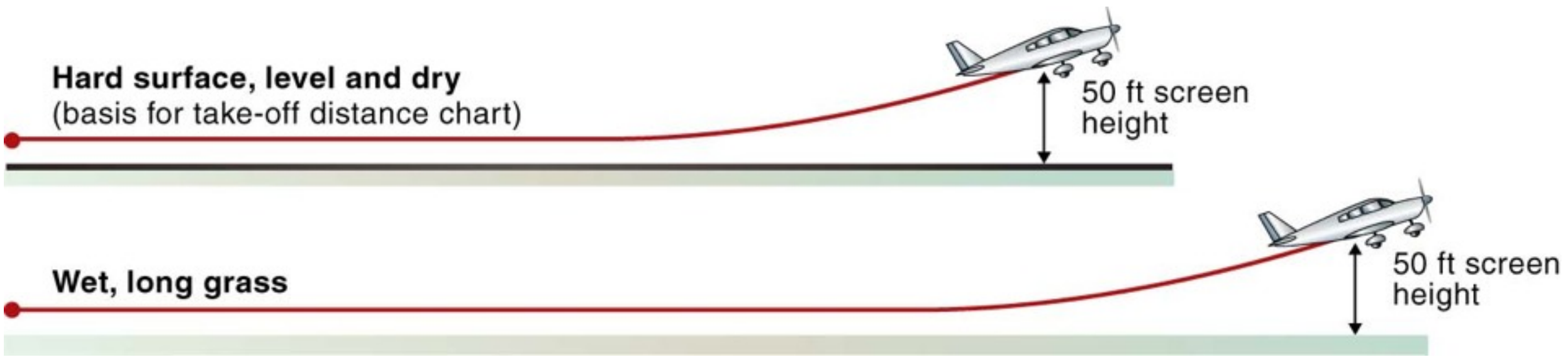
ORANGE MUNI (ORE) 1 SE UTC−5(−4DT) N42°34.20′ W72°17.31′ NEW YORK
555 B S2 **FUEL** 80, 100LL, JET A NOTAM FILE ORE H−10I, 11D, 12K, L−33C, 34J
RWY 01–19: H5000X75 (ASPH) S−25 MIRL 0.4% up S IAP
RWY 01: Thld dsplcd 100′. Trees.
RWY 19: Thld dsplcd 850′. Trees.
RWY 14–32: H4801X75 (ASPH) S−25 MIRL 0.4% up SE
RWY 14: Thld dsplcd 1477′. Trees.
RWY 32: Thld dsplcd 1659′. Trees.
AIRPORT REMARKS: Attended 1300–2200Z‡. Parachute Jumping. Parachute jumping weekends only. ACTIVATE MIRL Rwy 01–19 and Rwy 14–32—CTAF



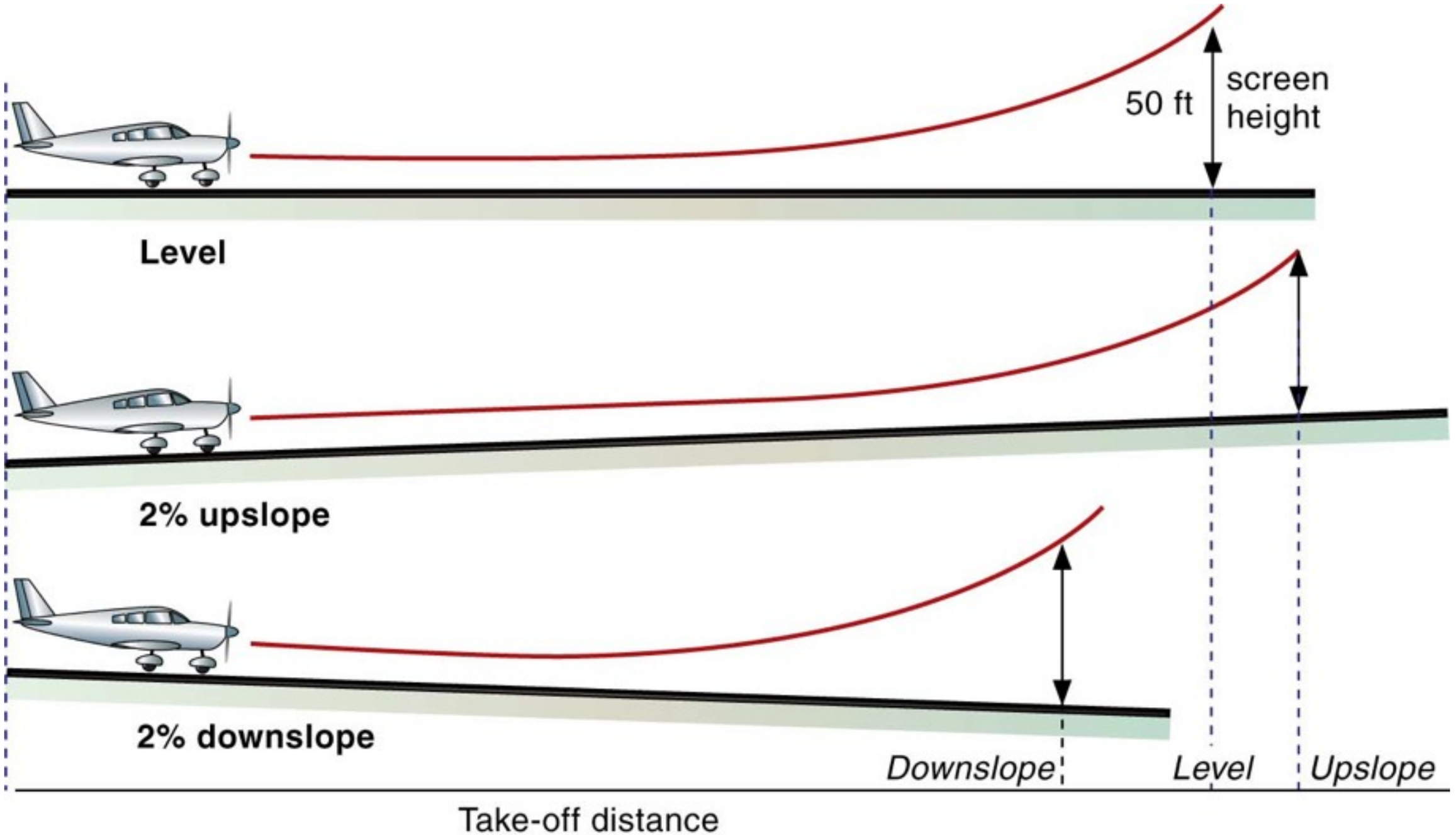
EDGARTOWN

KATAMA AIRPARK (1B2) 2 S UTC−5(−4DT) N41°21.51′ W70°31.47′ NEW YORK
18 S2 **FUEL** 100LL TPA—1018 (1000) NOTAM FILE BDR
RWY 03–21: 3700X50 (TURF)
RWY 03: Thld dsplcd 245′. Road. **RWY 21:** Thld dsplcd 300′. Pole.
RWY 06–24: 2700X50 (TURF)
RWY 06: Thld dsplcd 300′. Road. **RWY 24:** Road.
RWY 17–35: 2600X50 (TURF)
RWY 17: Thld dsplcd 200′. Building.
AIRPORT REMARKS: Attended May 15–Sep 15 dawn–dusk. Be aware of hi-speed military jet and heavy helicopter tfc vicinity of Cape Cod CGAS. Rwy 03 and 21 and 06 and 17 dsplcd thlds marked with flush white paving blocks.
COMMUNICATIONS: CTAF/UNICOM 122.8

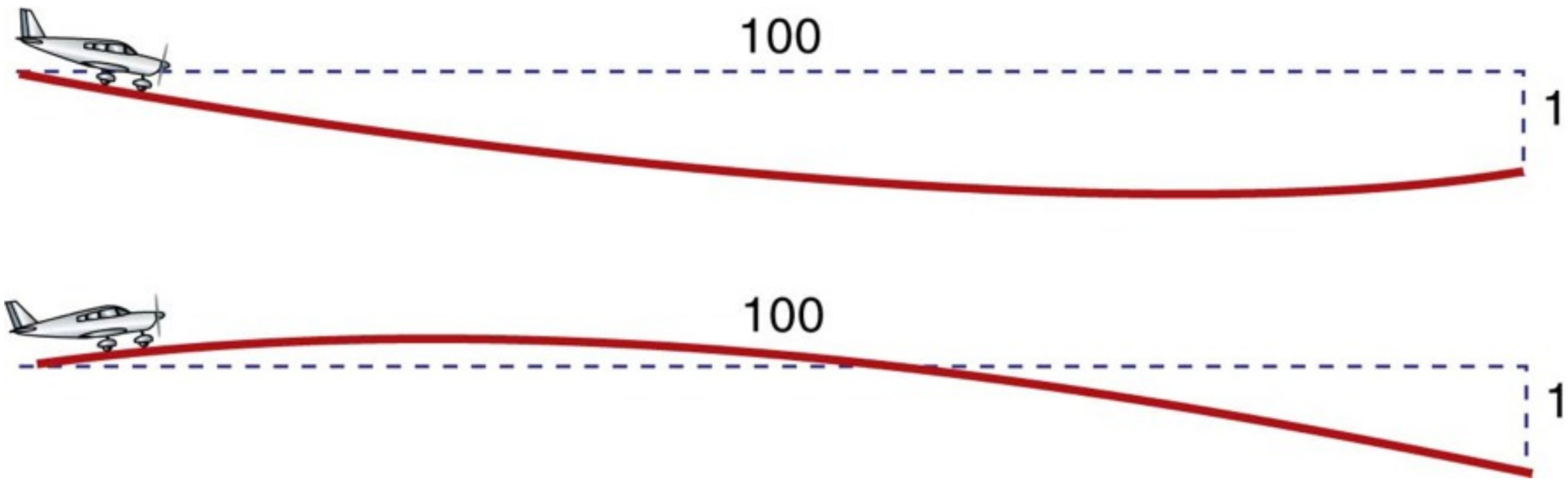
Poor Surface



Slopes

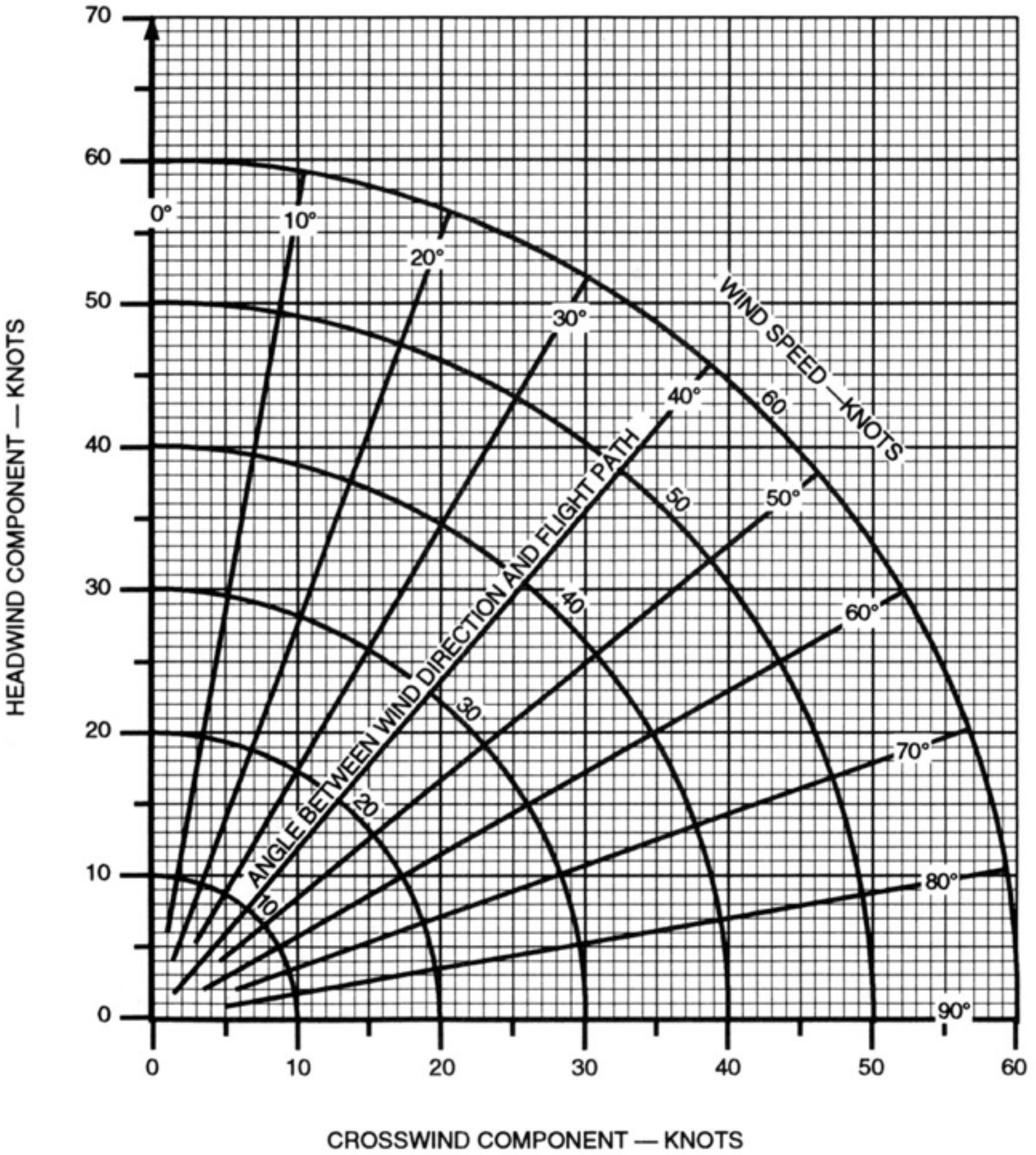

50 ft
screen height
Level
2% upslope
2% downslope
Downslope
Level
Upslope
Take-off distance

Slopes



Same Slopes

WIND COMPONENT



TAKEOFF DISTANCE

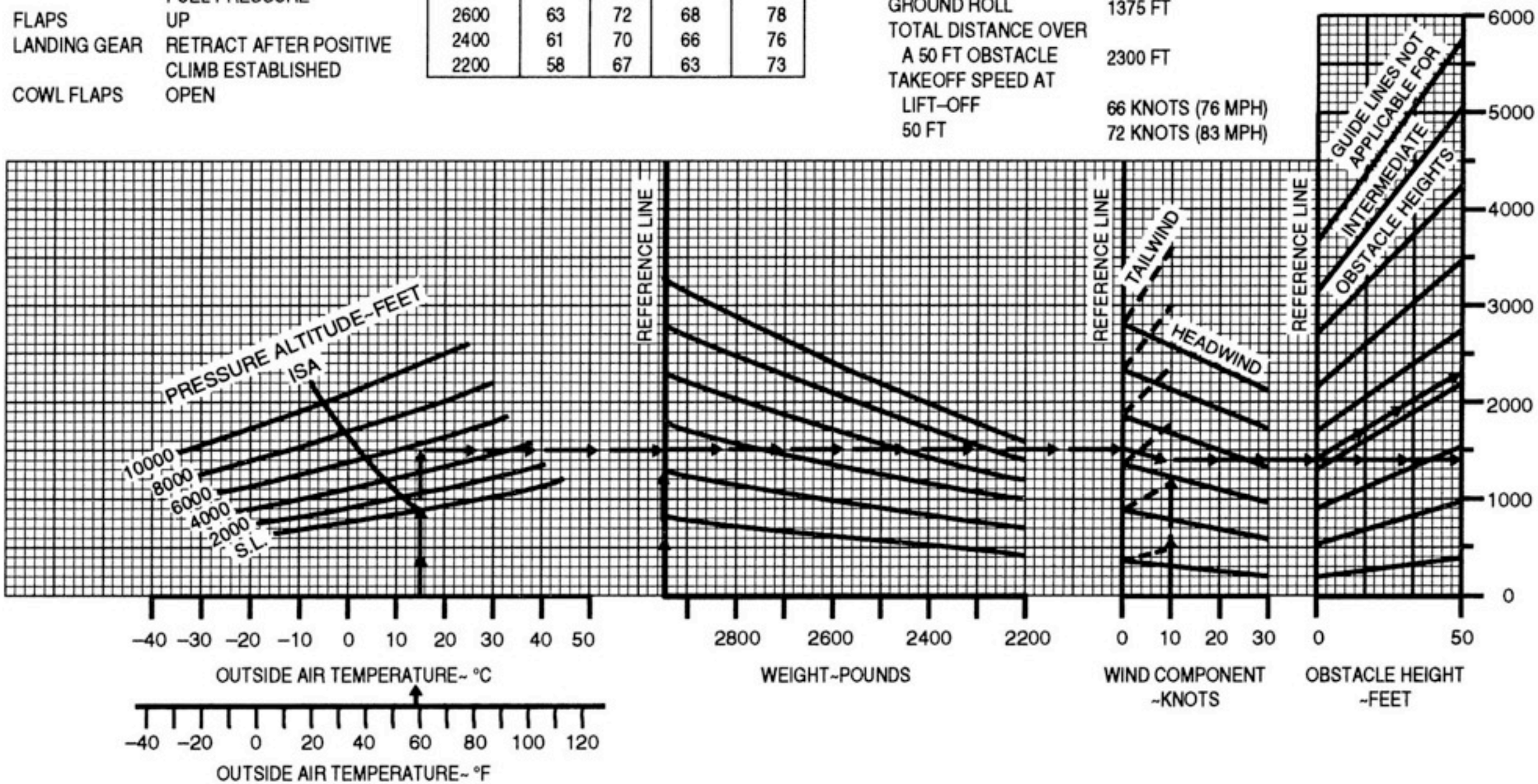
ASSOCIATED CONDITIONS:

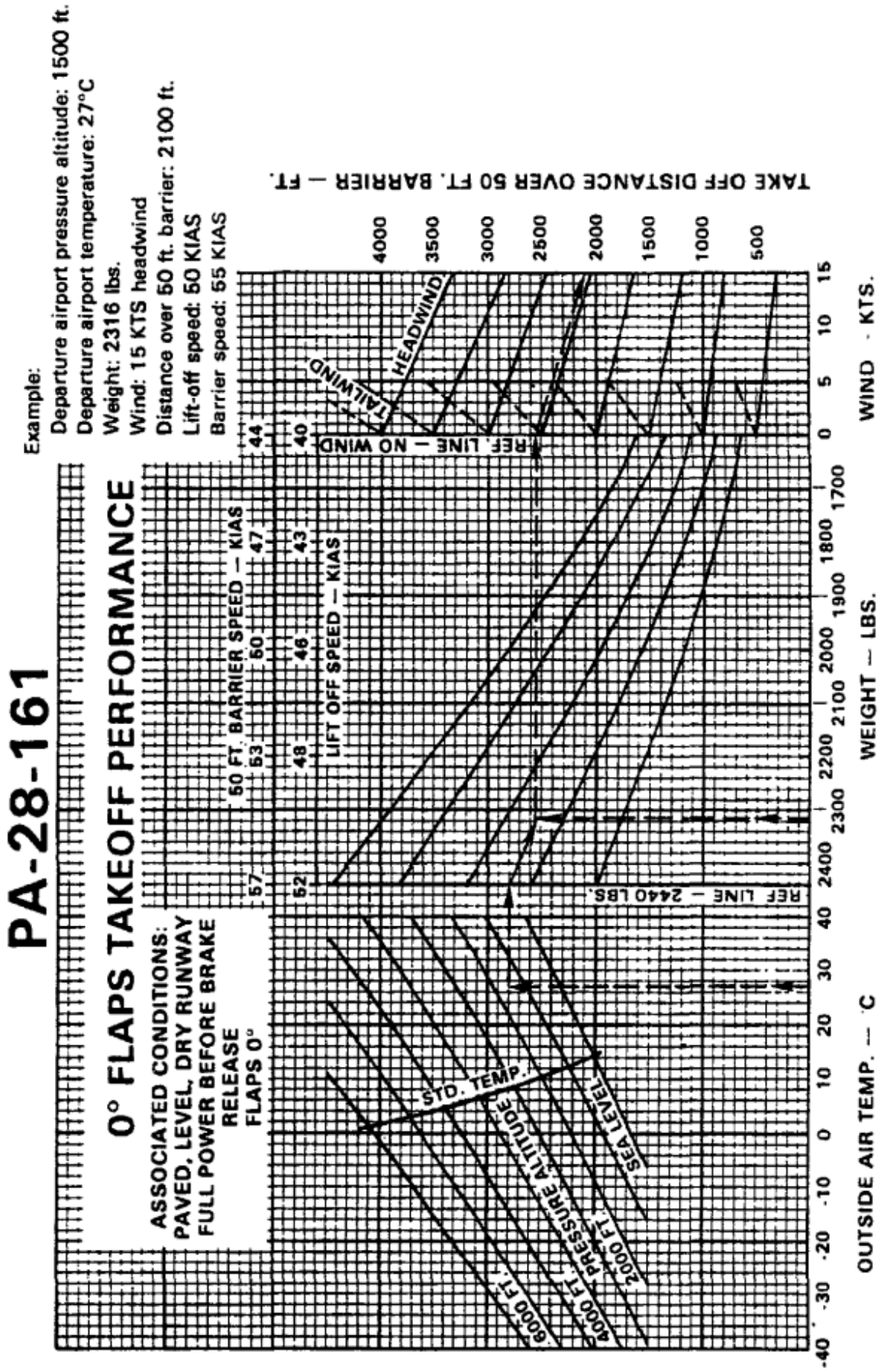
POWER	FULL THROTTLE 2600 RPM
MIXTURE	LEAN TO APPROPRIATE FUEL PRESSURE
FLAPS	UP
LANDING GEAR	RETRACT AFTER POSITIVE CLIMB ESTABLISHED
COWL FLAPS	OPEN

WEIGHT ~ POUNDS	TAKEOFF SPEED			
	LIFT–OFF		50 FT	
	KNOTS	MPH	KNOTS	MPH
2950	66	76	72	83
2800	64	74	70	81
2600	63	72	68	78
2400	61	70	66	76
2200	58	67	63	73

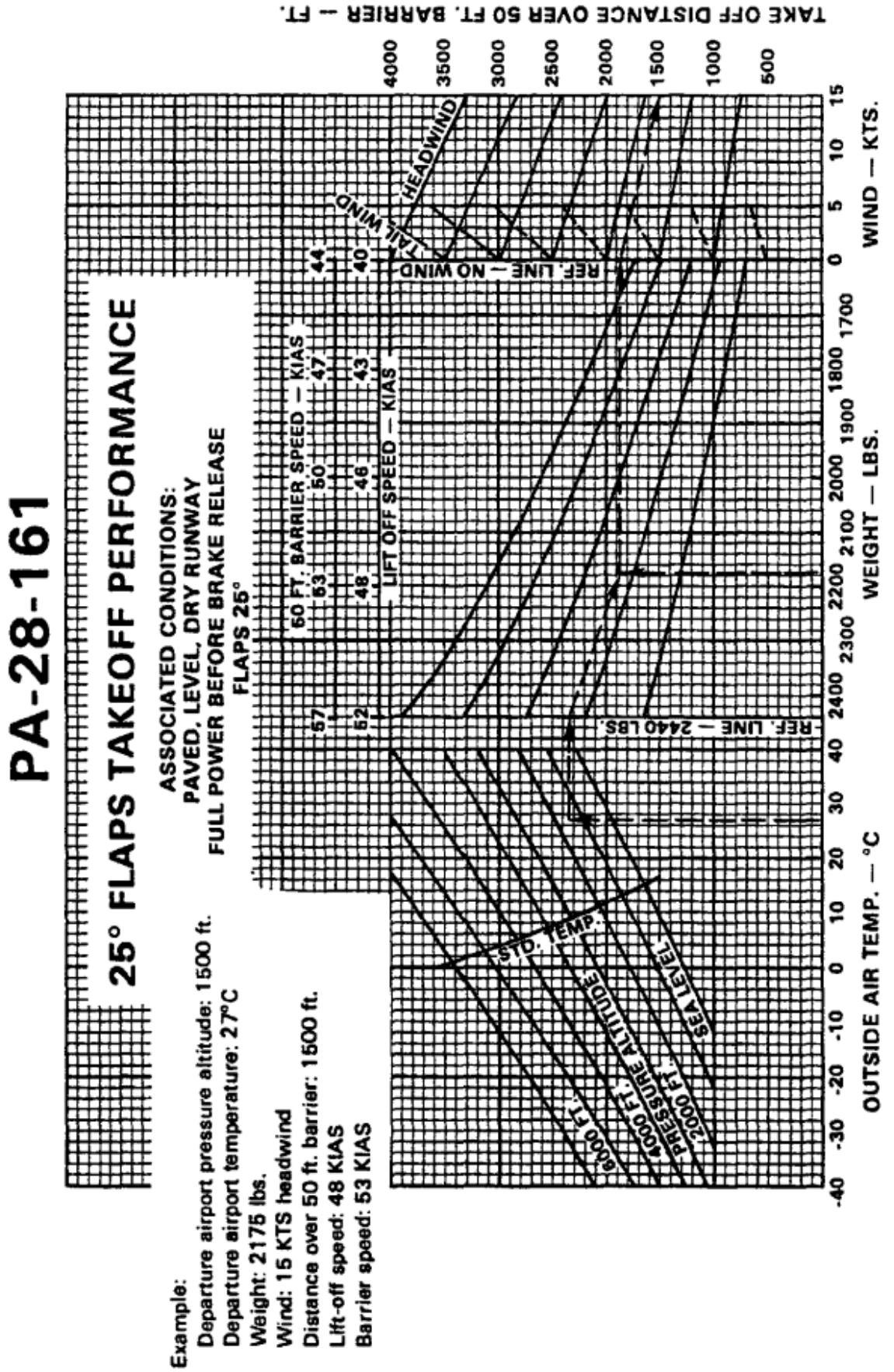
EXAMPLE:

OAT	15 °C (59 °F)
PRESSURE ALTITUDE	5650 FT
TAKEOFF WEIGHT	2950 LB
HEADWIND COMP.	9.0 KNOTS
GROUND ROLL	1375 FT
TOTAL DISTANCE OVER A 50 FT OBSTACLE	2300 FT
TAKEOFF SPEED AT	
LIFT–OFF	66 KNOTS (76 MPH)
50 FT	72 KNOTS (83 MPH)



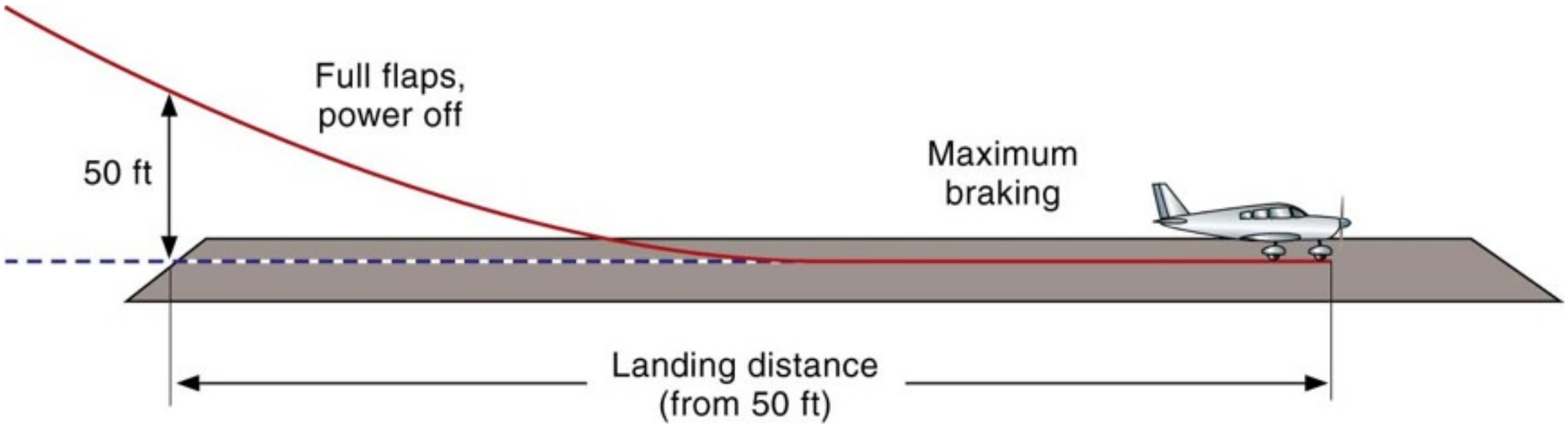


0° FLAPS TAKEOFF PERFORMANCE
Figure 5-9

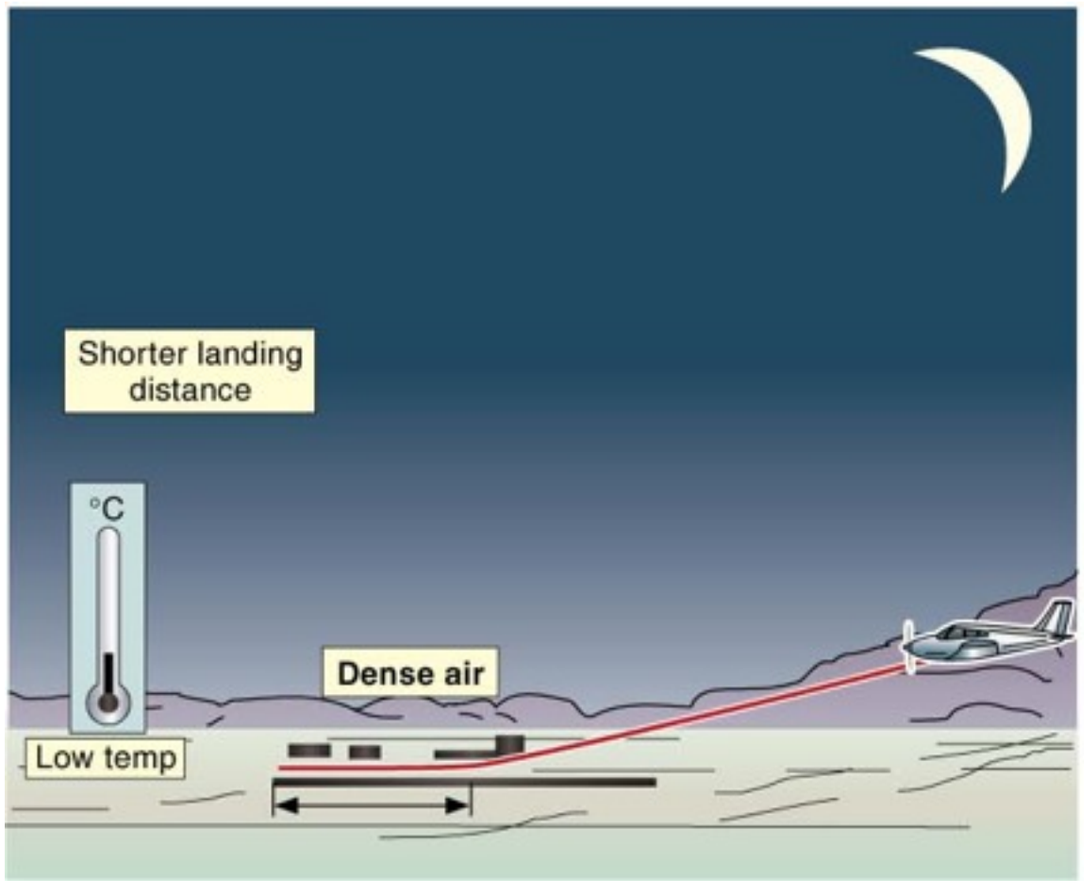


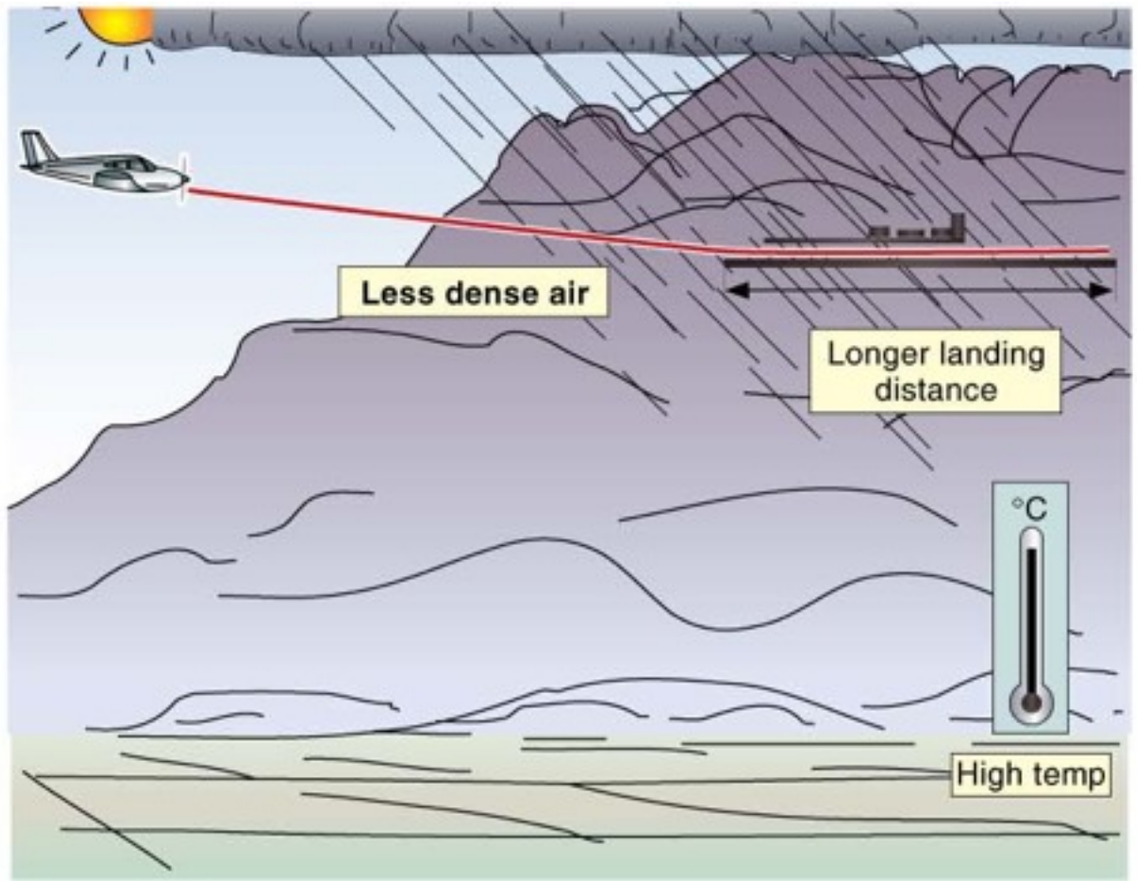
25° FLAPS TAKEOFF PERFORMANCE
Figure 5-13

Landings

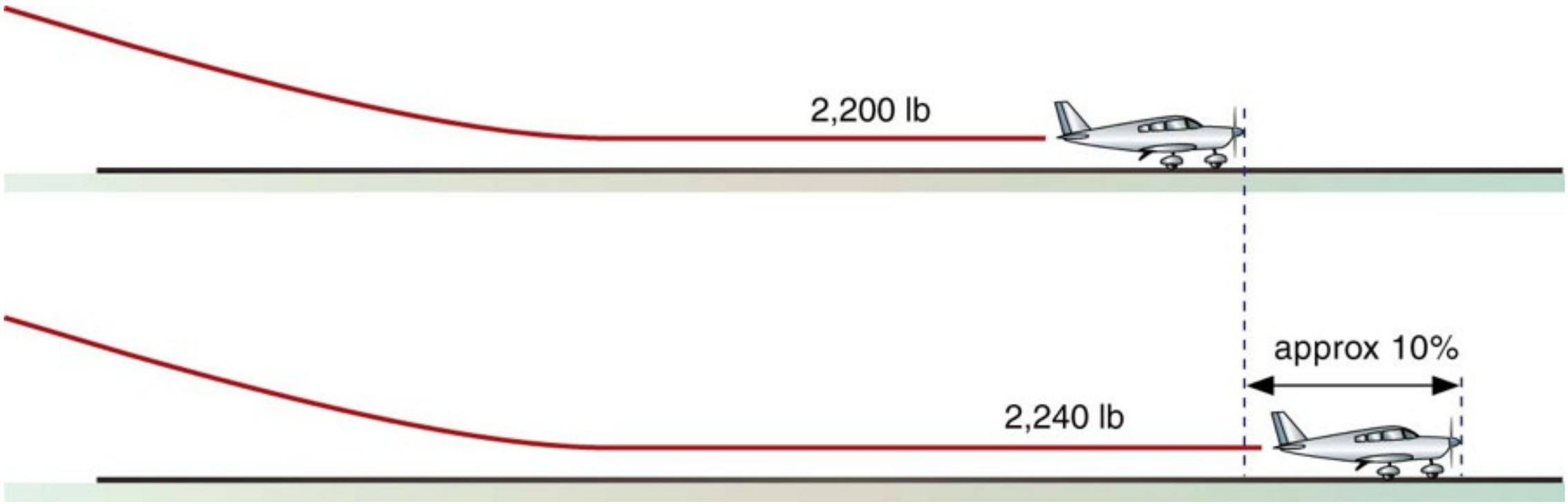

Full flaps,
power off
50 ft
Maximum
braking
Landing distance
(from 50 ft)

Density Altitude

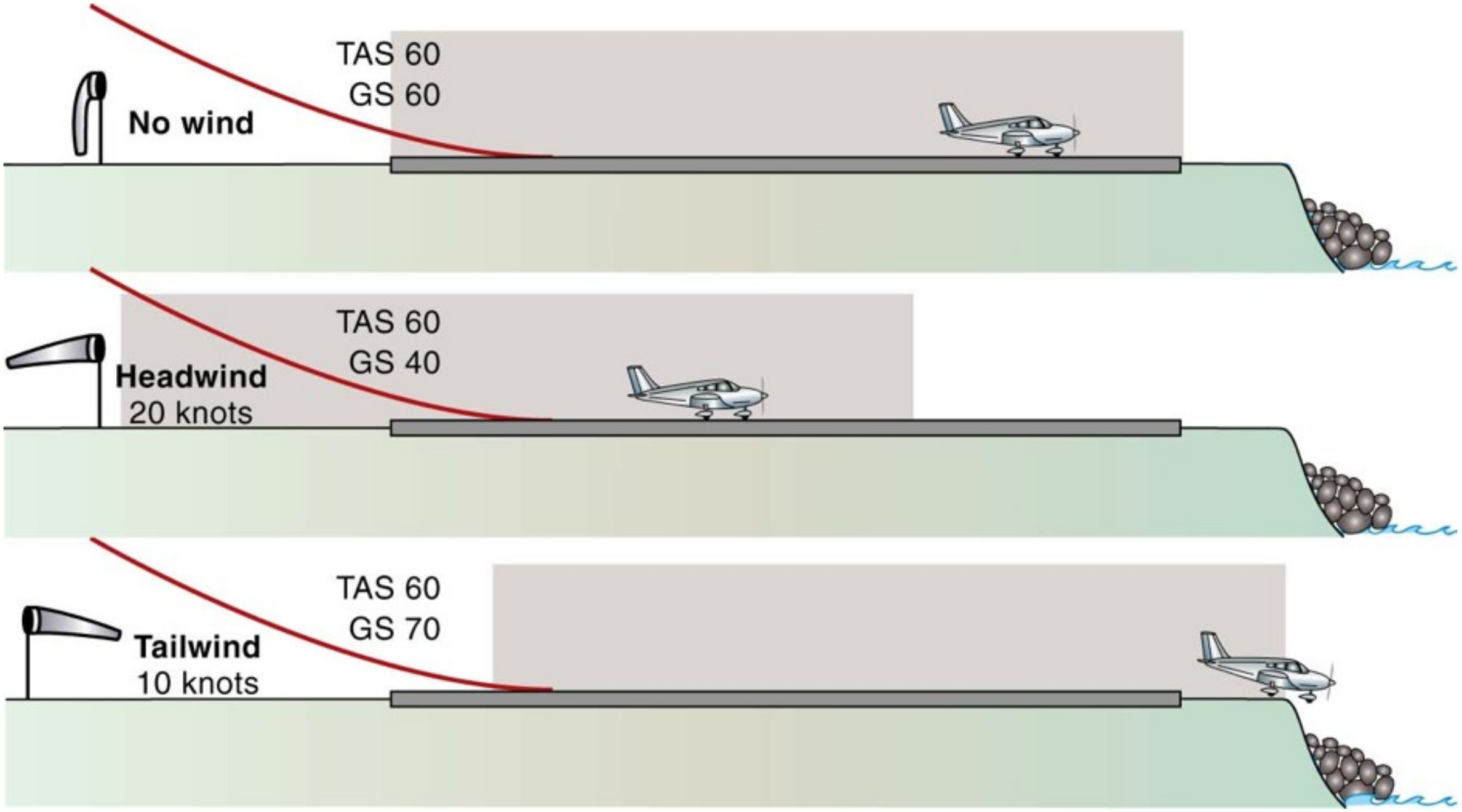




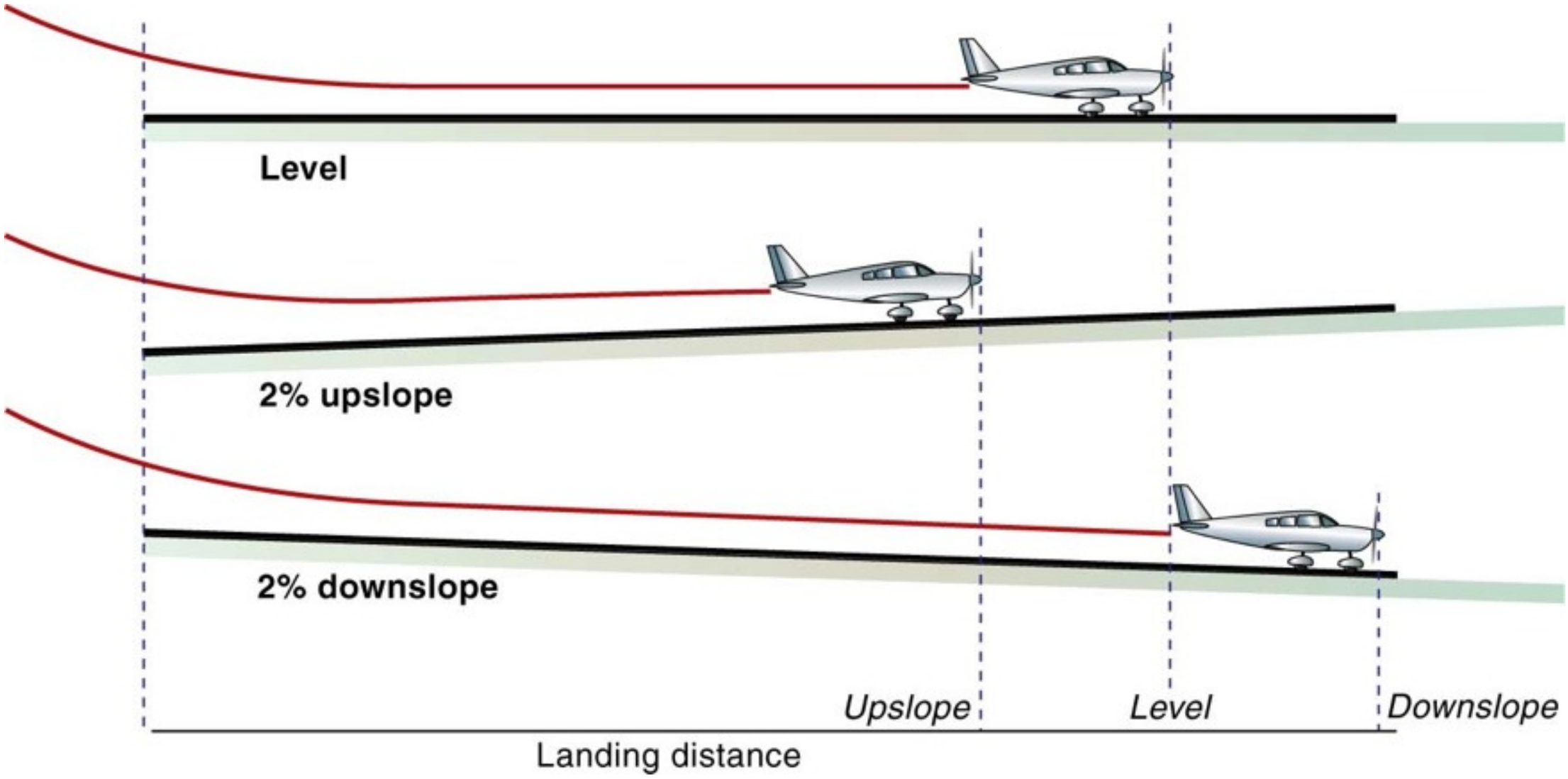
Increase Weight



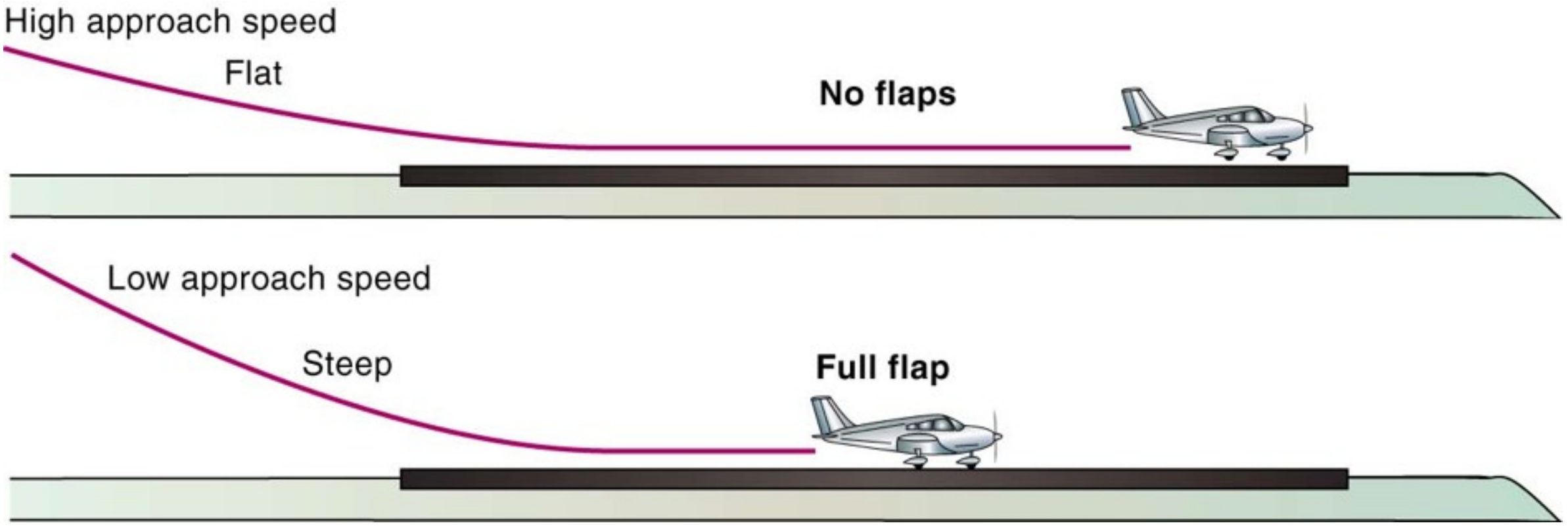
Wind Effects



Slope


Level
2% upslope
2% downslope
Upslope
Level
Downslope
Landing distance

Flaps


High approach speed
Flat
No flaps
Low approach speed
Steep
Full flap

LANDING DISTANCE

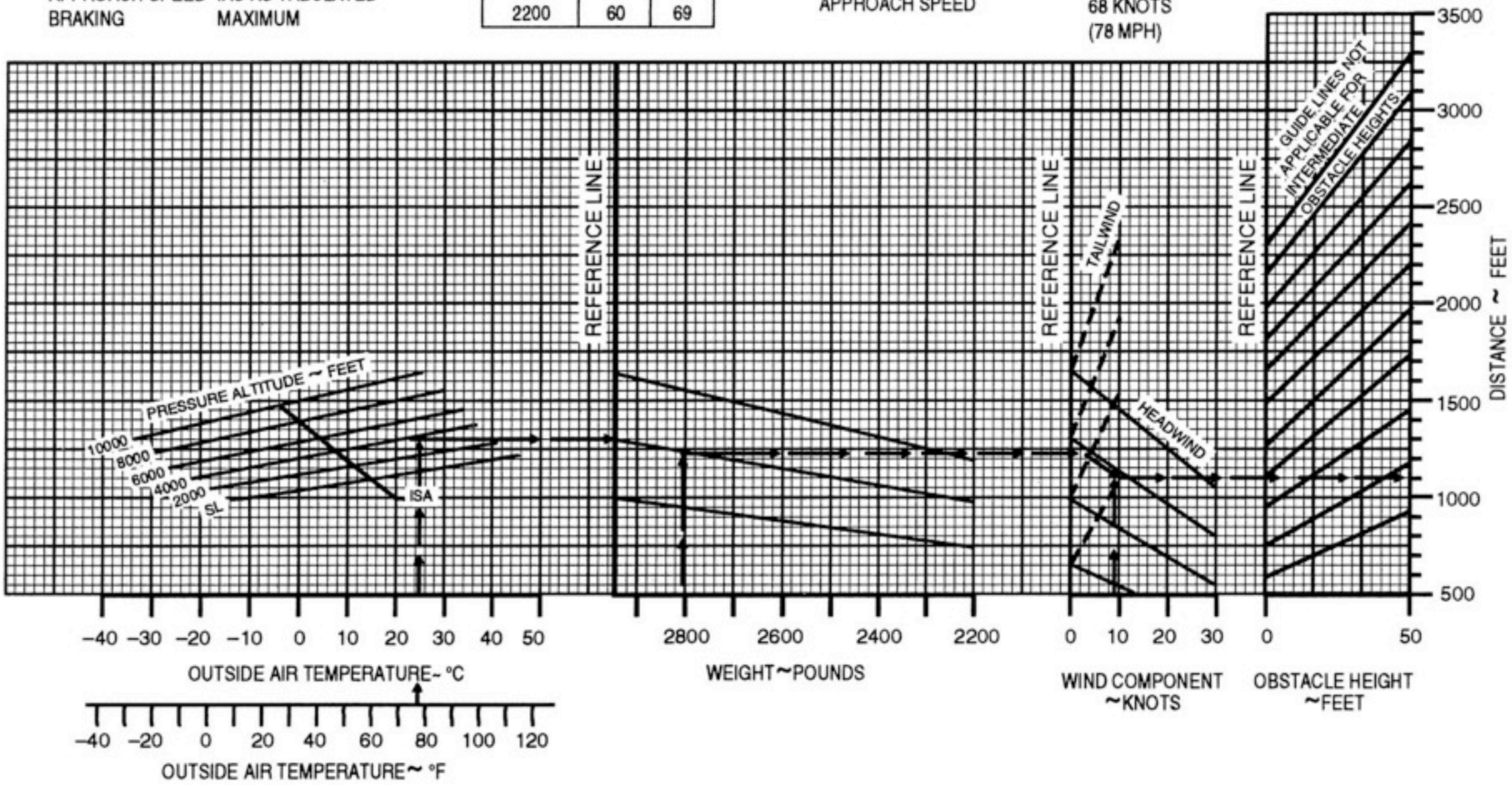
ASSOCIATED CONDITIONS:

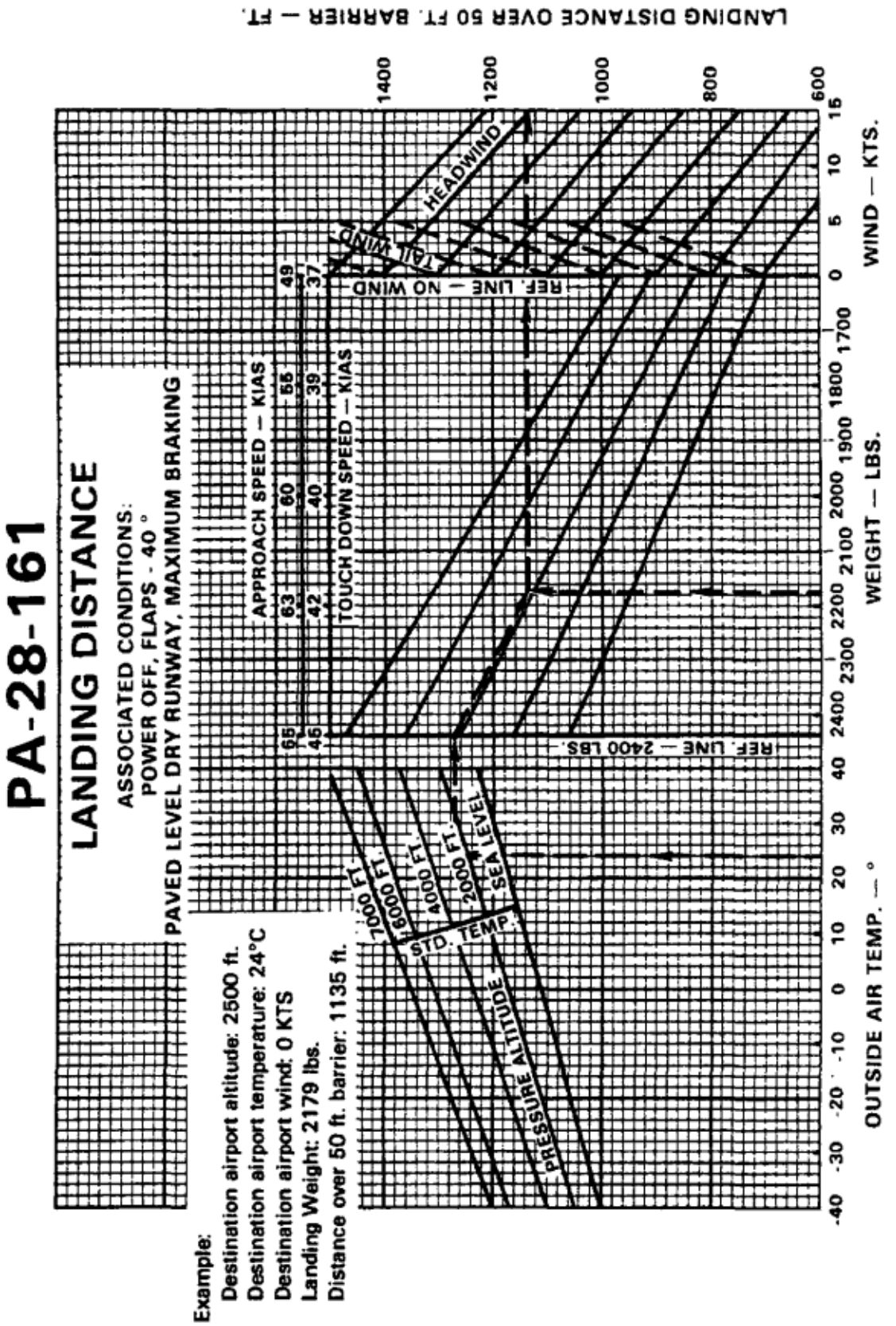
POWER	RETARDED TO MAINTAIN 900 FT/on FINAL APPROACH
FLAPS	DOWN
LANDING GEAR	DOWN
RUNWAY	PAVED, LEVEL, DRY SURFACE
APPROACH SPEED	IAS AS TABULATED
BRAKING	MAXIMUM

WEIGHT ~ POUNDS	SPEED AT 50 FT	
	KNOTS	MPH
2950	70	80
2800	68	78
2600	65	75
2400	63	72
2200	60	69

EXAMPLE:

OAT	25 °C (77 °F)
PRESSURE ALTITUDE	3965 FT
WEIGHT	2814 LB
WIND COMPONENT	9.0 KNOTS (HEADWIND)
GROUND ROLL	1080 FT
TOTAL OVER 50 FT OBSTACLE	1700 FT
APPROACH SPEED	68 KNOTS (78 MPH)





LANDING DISTANCE
Figure 5-35

Table 3-2. Pilot/Operator Runway Condition Assessment Matrix (RCAM)

Assessment Criteria		Control/Braking Assessment Criteria	
Runway Condition Description	**RwyCC**	**Deceleration or Directional Control Observation**	**Reported Braking Action**
• Dry	6	---	---
• Frost • Wet (includes damp and 1/8 inch depth or less of water) ***1/8 Inch (3 mm) Depth or Less of:*** • Slush • Dry Snow • Wet Snow	5	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	Good
-15 ºC and Colder Outside Air Temperature: • Compacted Snow	4	Braking deceleration OR directional control is between Good and Medium.	Good to Medium
• Slippery When Wet (wet runway) • Dry Snow or Wet Snow (any depth) over Compacted Snow ***Greater Than 1/8 Inch (3 mm) Depth of:*** • Dry Snow • Wet Snow ***Warmer Than -15 ºC Outside Air Temperature:*** • Compacted Snow	3	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	Medium
Greater Than 1/8 Inch (3 mm) Depth of: • Water • Slush	2	Braking deceleration OR directional control is between Medium and Poor.	Medium to Poor
• Ice	1	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	Poor
• Wet Ice • Slush over Ice • Water over Compacted Snow • Dry Snow or Wet Snow over Ice	0	Braking deceleration is minimal to nonexistent for the wheel braking effort applied OR directional control is uncertain.	Nil

The following factors are multipliers to the unfactored AFM demonstrated landing distances:

Runway Condition Code	**6**	**5 Grooved/ PFC**	**5 Smooth**	**4**	**3**	**2**	**1**
Braking Action	Dry	Good	Good	Good to Medium	Medium	Medium to Poor	Poor
Turbojet, No Reverse	1.67	2.3	2.6	2.8	3.2	4.0	5.1
Turbojet, With Reverse	1.67	1.92	2.2	2.3	2.5	2.9	3.4
Turboprop (see Note)	1.67	1.92	2.0	2.2	2.4	2.7	2.9
Reciprocating	1.67	2.3	2.6	2.8	3.2	4.0	5.1

Note: These LDFs apply only to turboprops when the AFM provides for a landing distance credit for the use of ground idle power lever position. Turboprops without this credit should use the "Turbojet, No Reverse" LDFs.

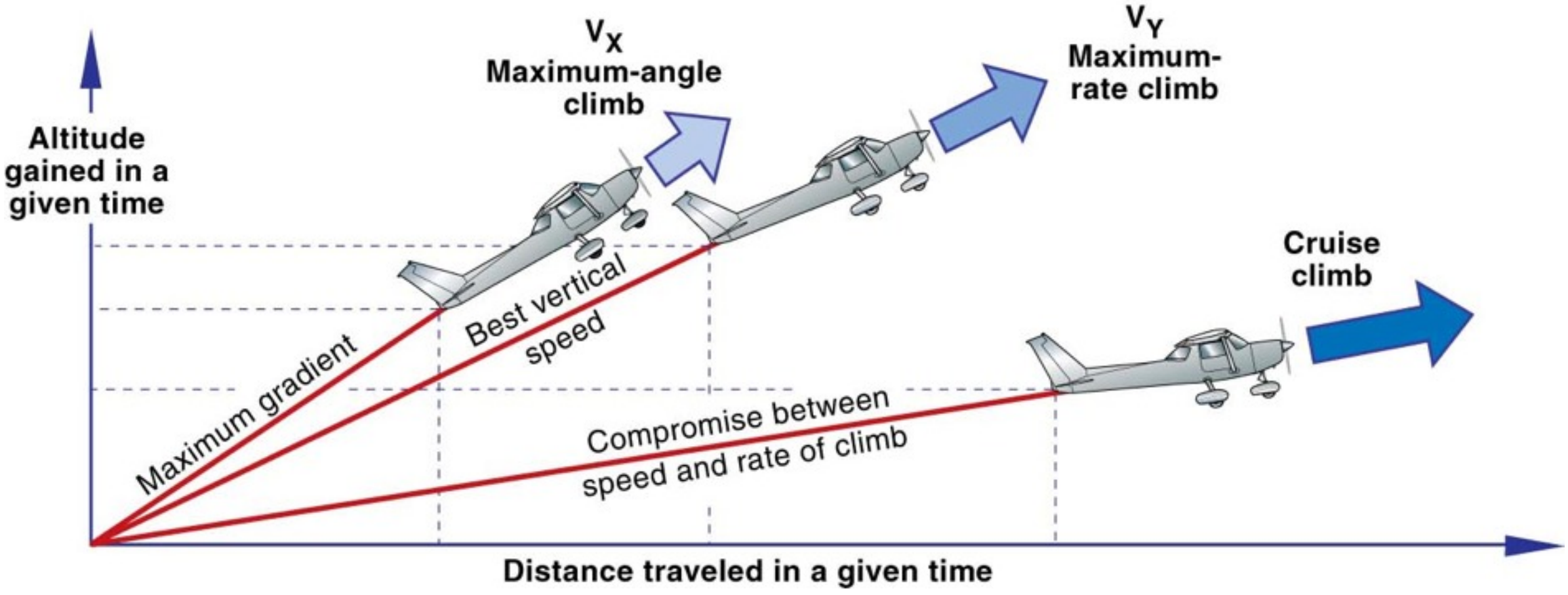
Climb Performance

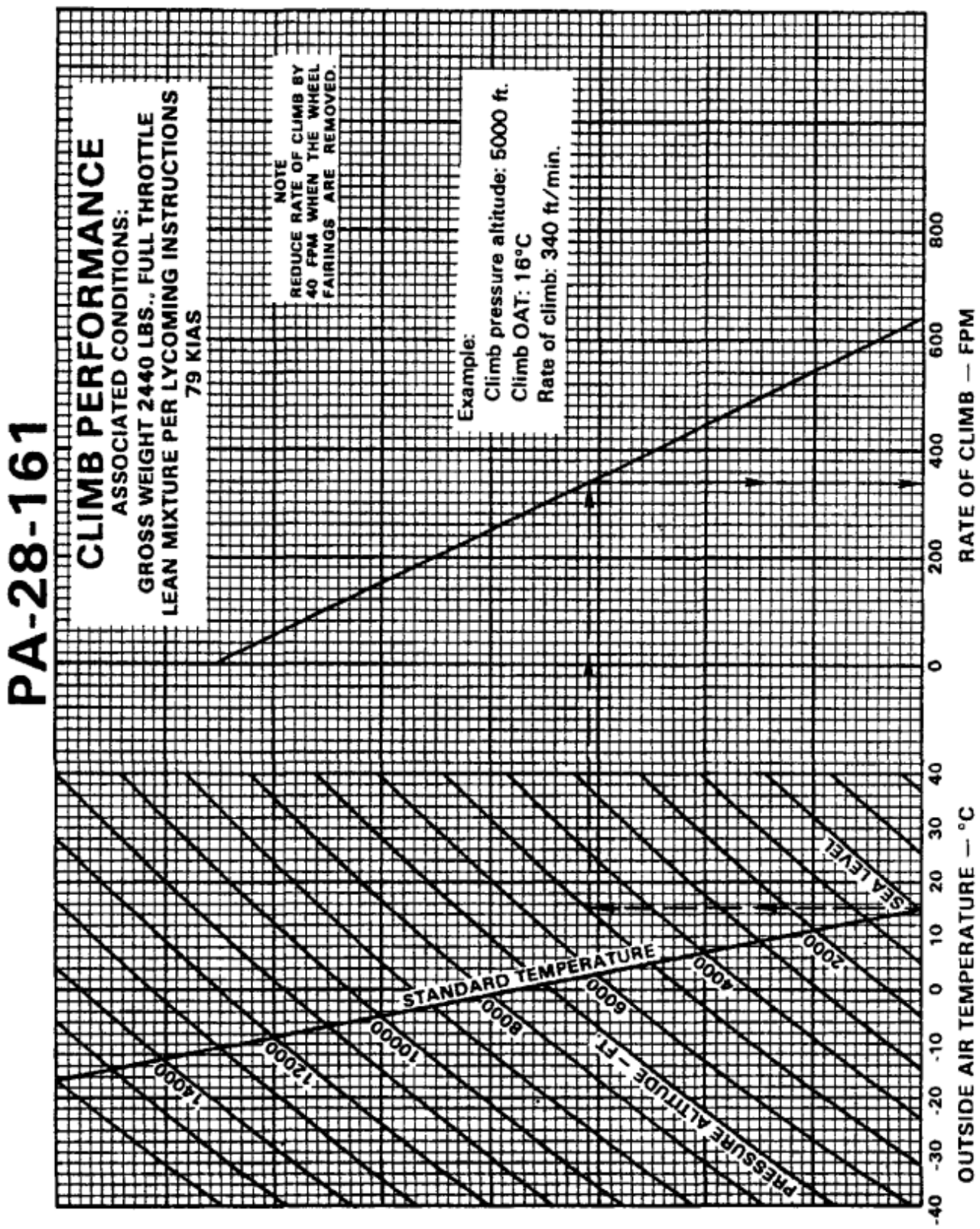
Climbs

- Best Angle of Climb (Vx)
- Best Rate of Climb (Vy)
- En Route Climbs

Aero Advantage

Climbs

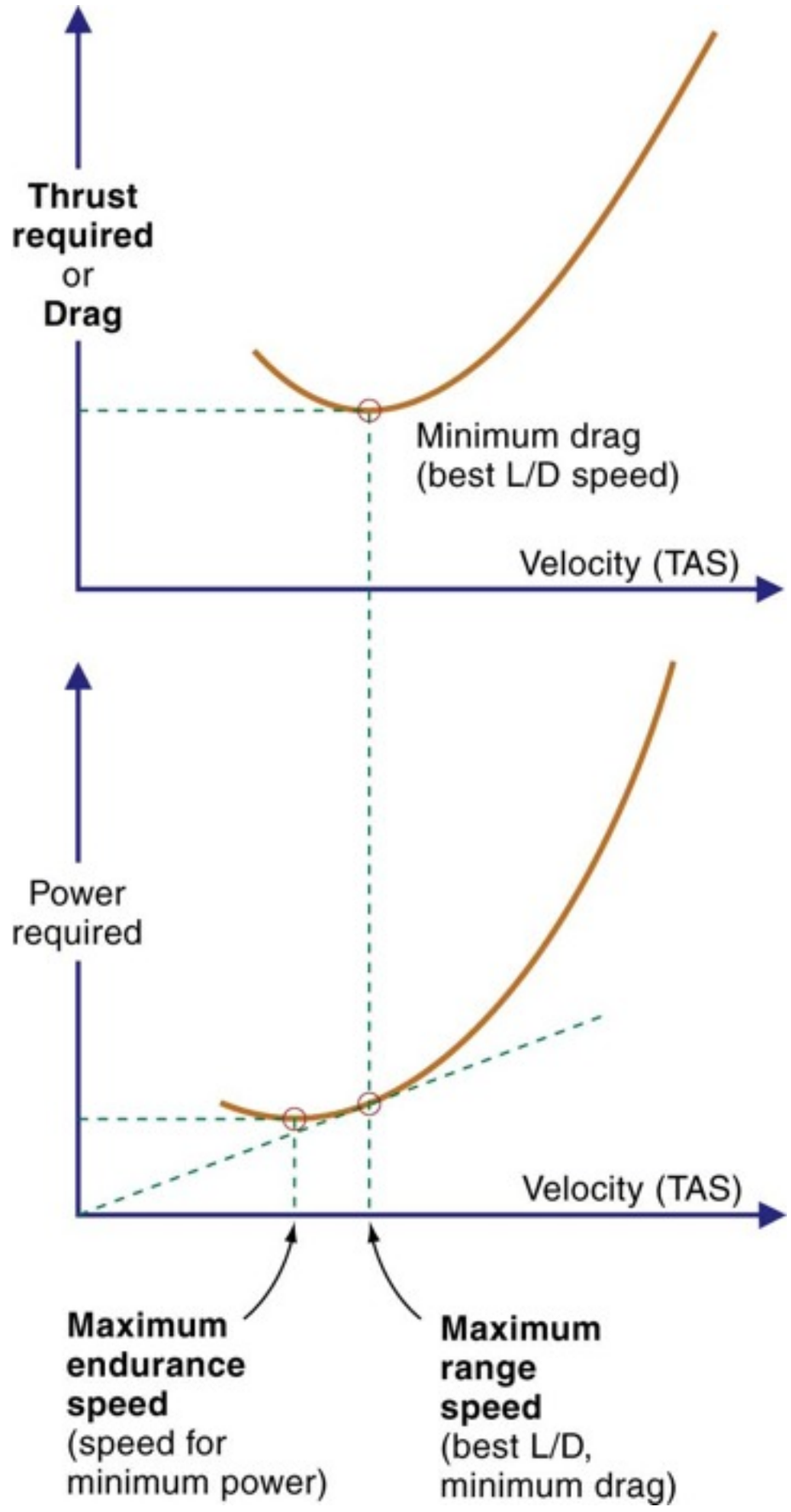

V_X
Maximum-angle climb
V_Y
Maximum-rate climb
Altitude gained in a given time
Cruise climb
Best vertical speed
Maximum gradient
Compromise between speed and rate of climb
Distance traveled in a given time

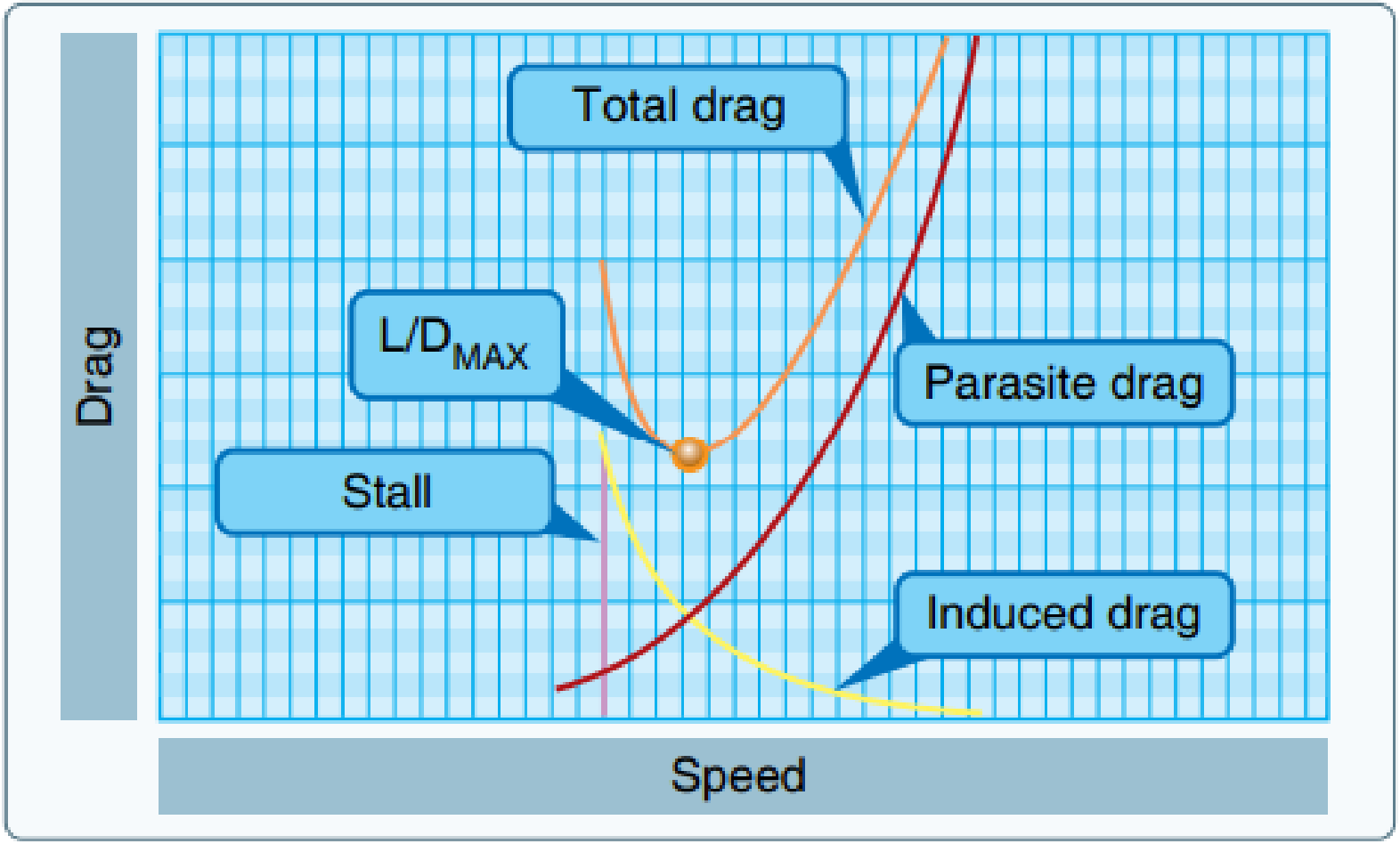


CLIMB PERFORMANCE
Figure 5-17

Cruise Performance

- Maximum Range
- Maximum Endurance


Thrust
required
or
Drag
Minimum drag
(best L/D speed)
Velocity (TAS)
Power
required
Velocity (TAS)
Maximum
endurance
speed
(speed for
minimum power)
Maximum
range
speed
(best L/D,
minimum drag)


Drag
Total drag
L/D$_{MAX}$
Parasite drag
Stall
Induced drag
Speed

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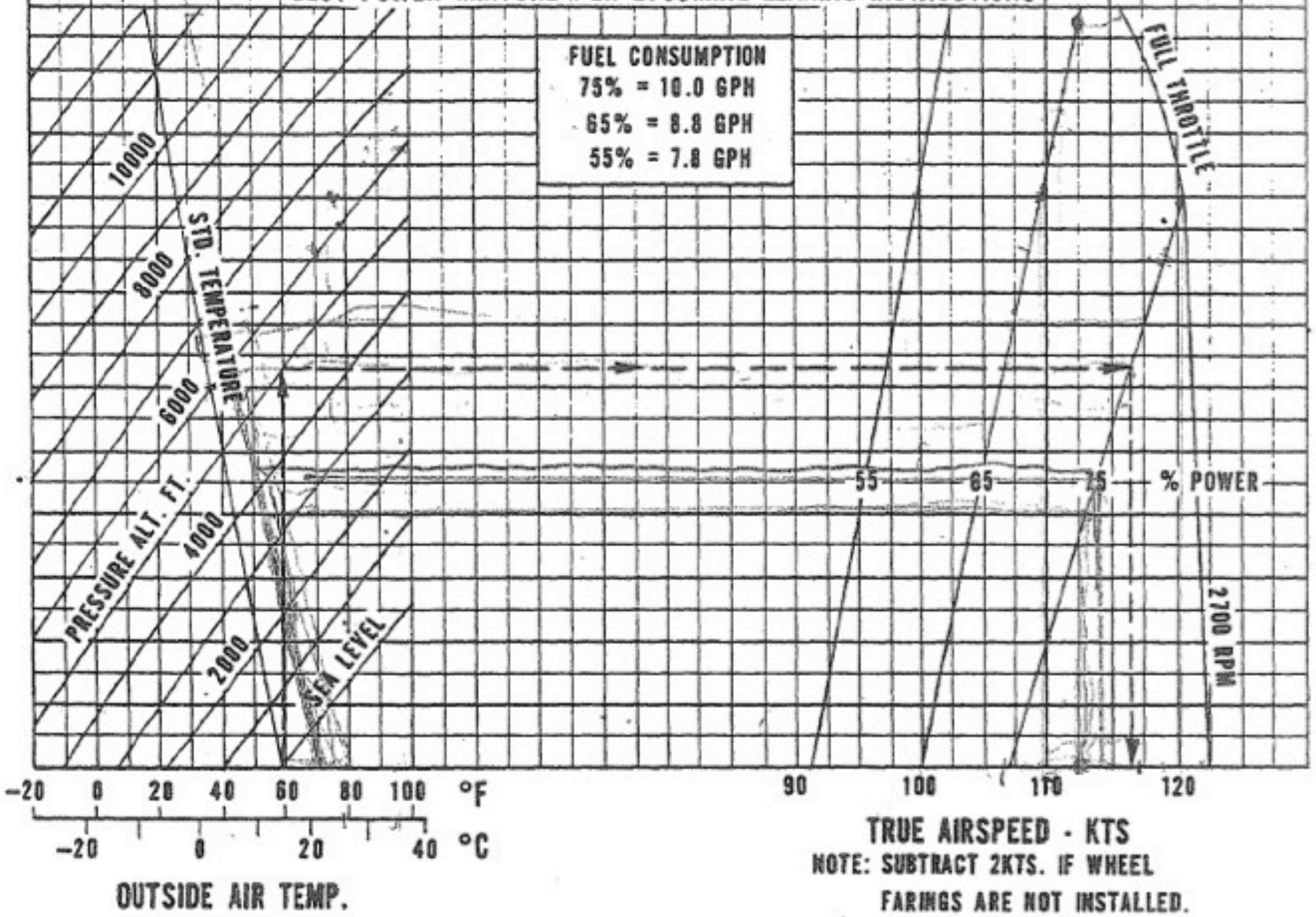
BEST POWER CRUISE PERFORMANCE

GROSS WEIGHT 2325 LBS. WHEEL FAIRINGS INSTALLED

BEST POWER MIXTURE PER LYCOMING LEANING INSTRUCTIONS



NOTE: SUBTRACT 2KTS. IF WHEEL FARINGS ARE NOT INSTALLED.

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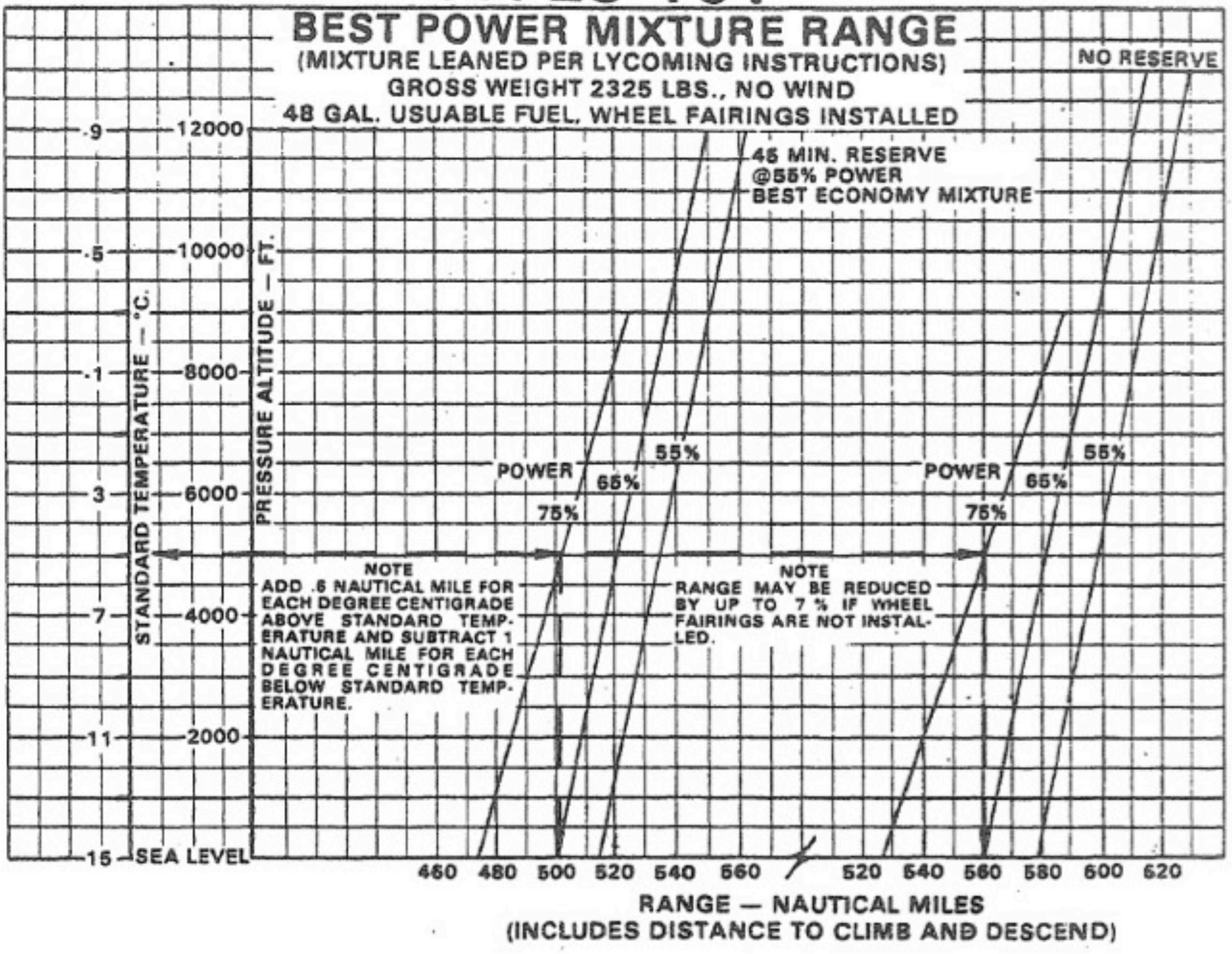
BEST POWER MIXTURE RANGE

(MIXTURE LEANED PER LYCOMING INSTRUCTIONS)
GROSS WEIGHT 2325 LBS., NO WIND
48 GAL. USUABLE FUEL, WHEEL FAIRINGS INSTALLED



RANGE — NAUTICAL MILES
(INCLUDES DISTANCE TO CLIMB AND DESCEND)

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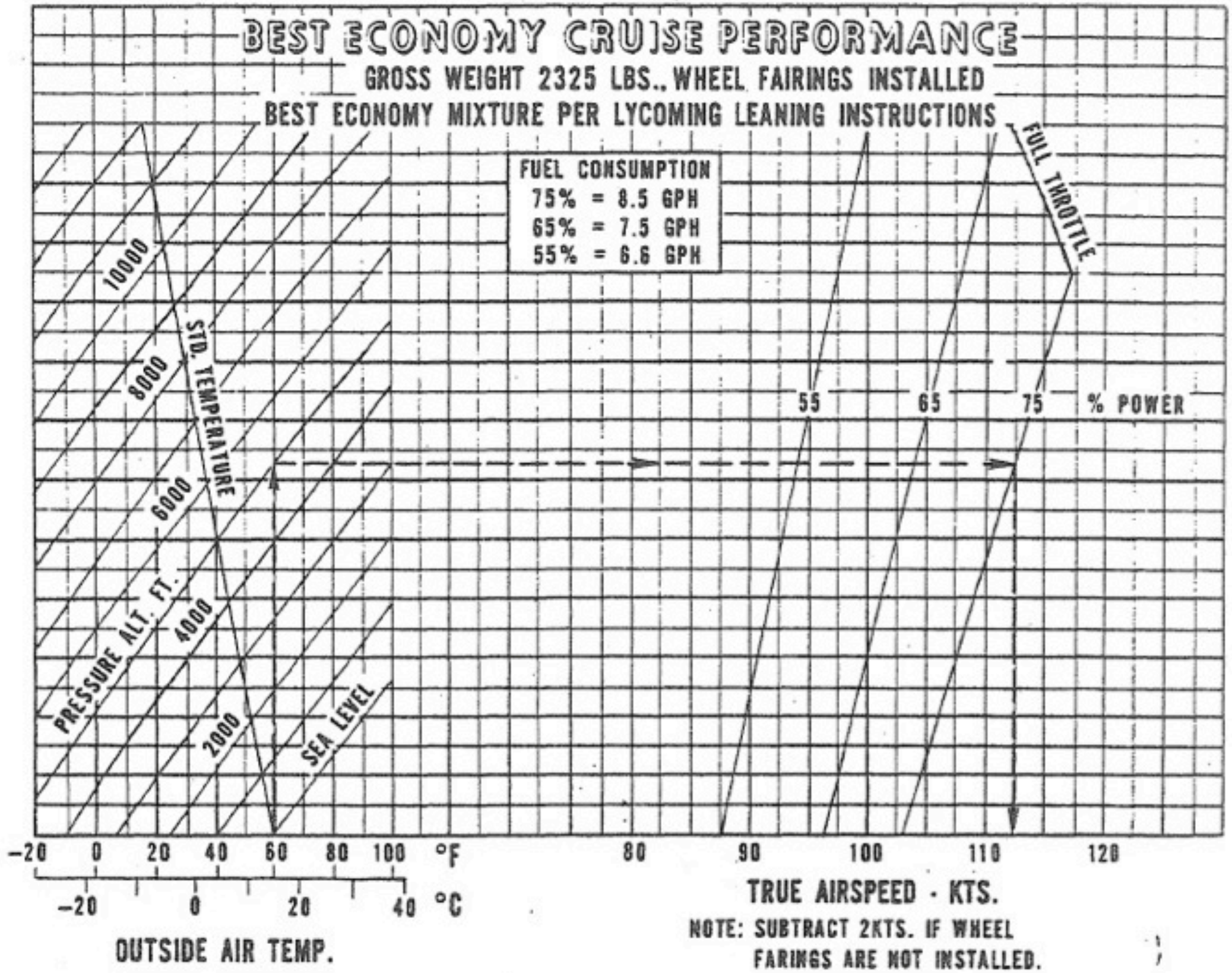
BEST ECONOMY CRUISE PERFORMANCE
GROSS WEIGHT 2325 LBS., WHEEL FAIRINGS INSTALLED
BEST ECONOMY MIXTURE PER LYCOMING LEANING INSTRUCTIONS
FUEL CONSUMPTION
75% = 8.5 GPH
65% = 7.5 GPH
55% = 6.6 GPH
FULL THROTTLE
55
65
75
% POWER
10000
8000
6000
4000
2000
SEA LEVEL
PRESSURE ALT. FT.
STD. TEMPERATURE
-20 0 20 40 60 80 100 °F
-20 0 20 40 °C
OUTSIDE AIR TEMP.
80 90 100 110 120
TRUE AIRSPEED - KTS.
NOTE: SUBTRACT 2KTS. IF WHEEL FAIRINGS ARE NOT INSTALLED.

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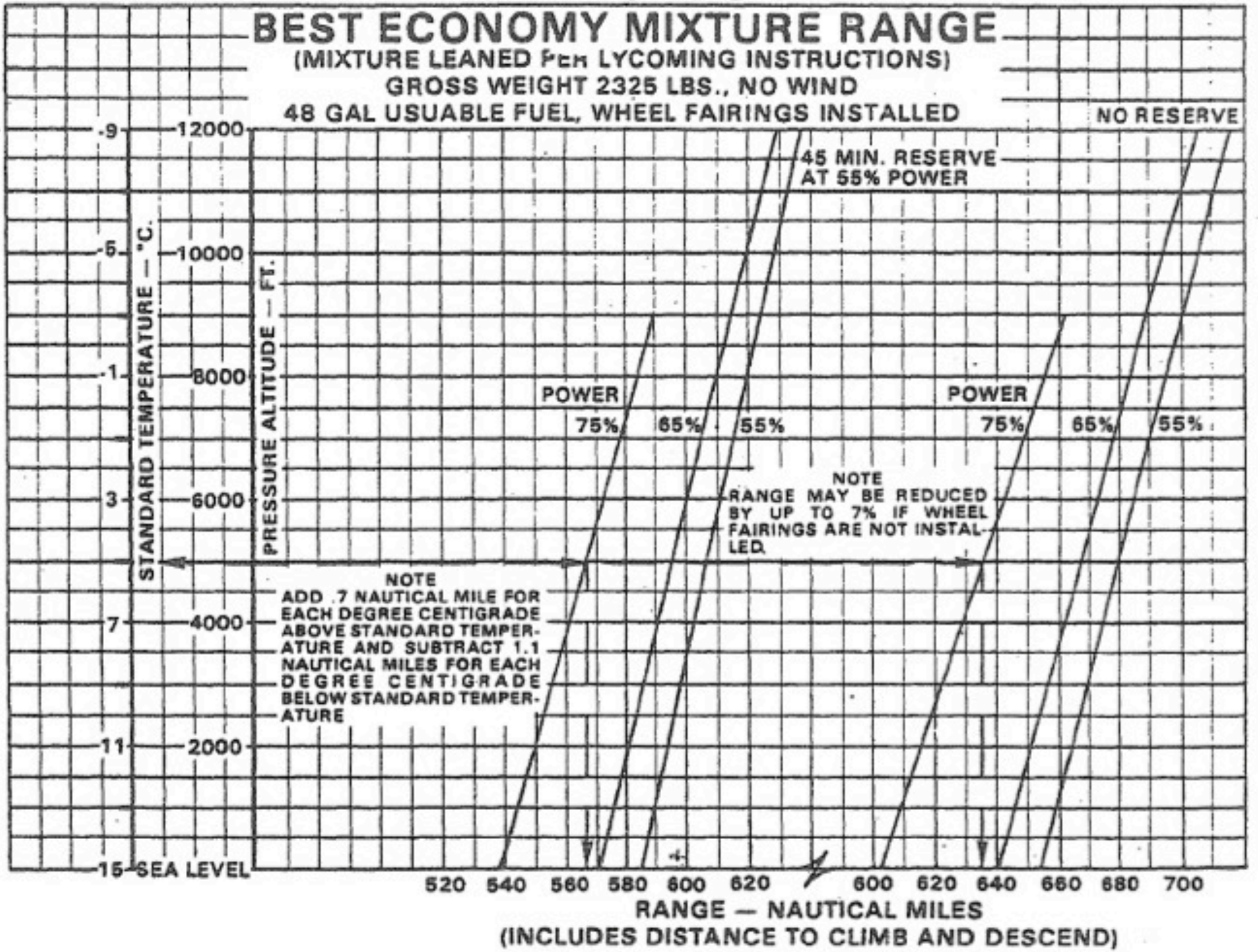
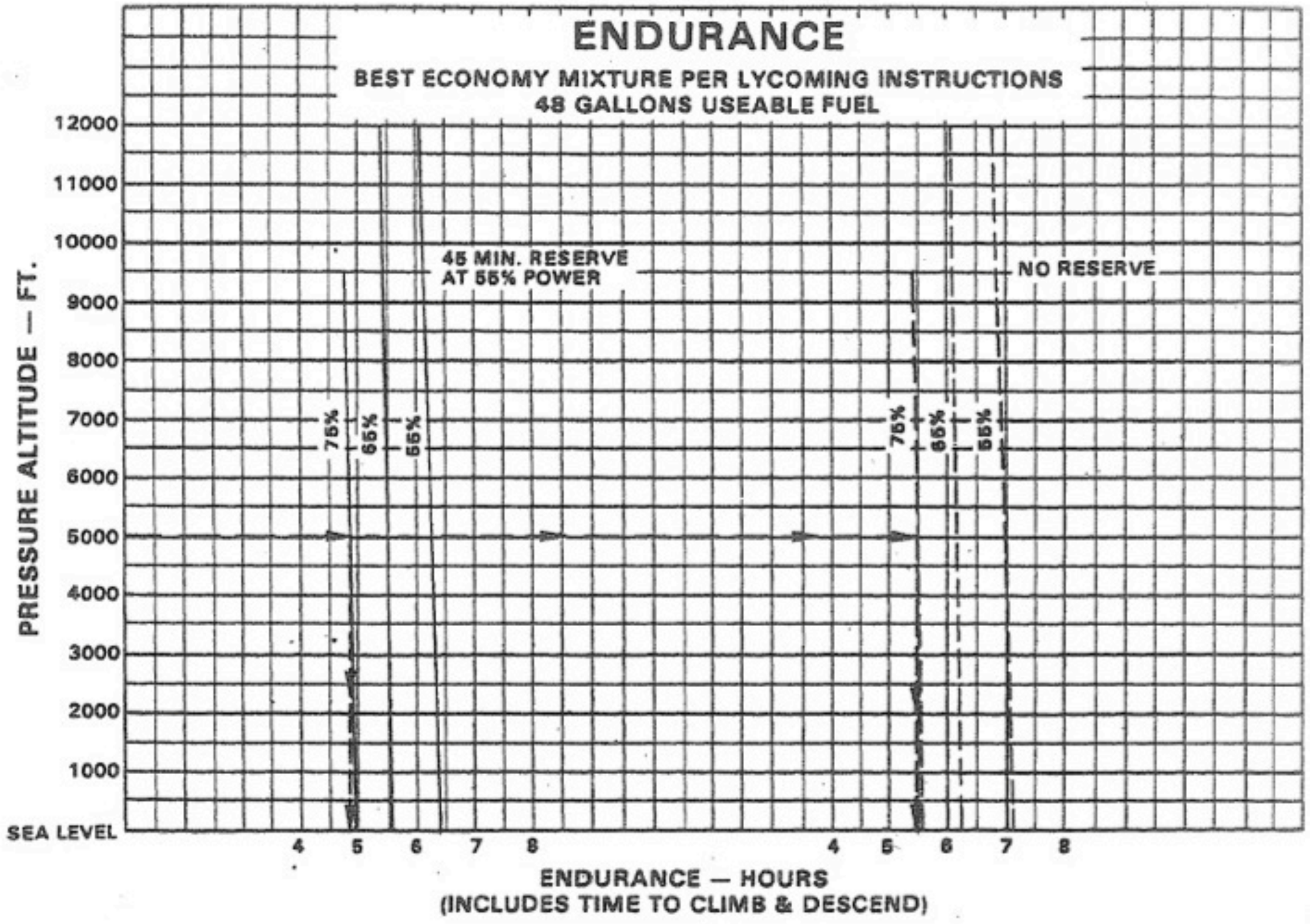
BEST ECONOMY MIXTURE RANGE

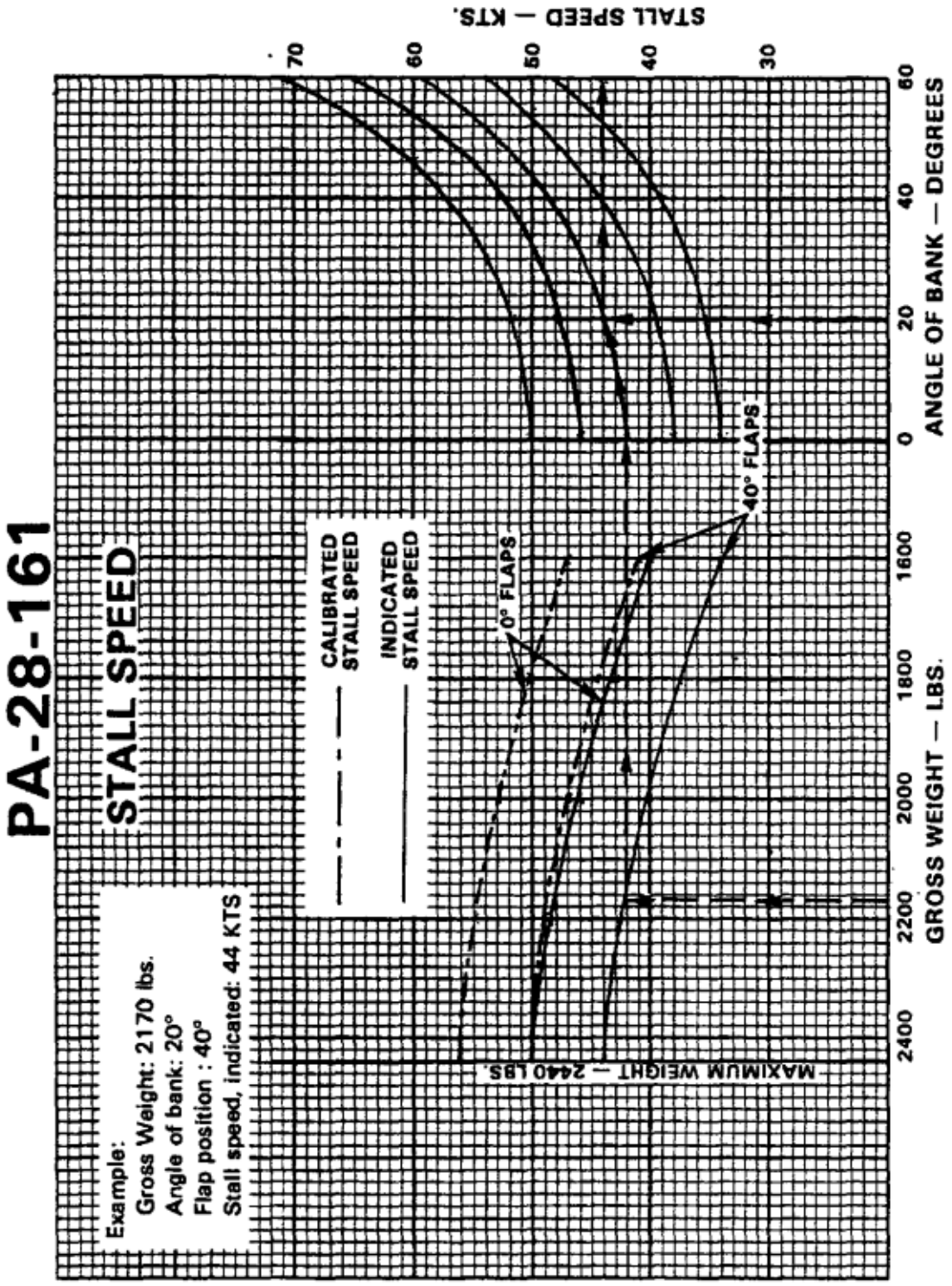
(MIXTURE LEANED PER LYCOMING INSTRUCTIONS)
GROSS WEIGHT 2325 LBS., NO WIND
48 GAL USUABLE FUEL, WHEEL FAIRINGS INSTALLED



PA-28-161

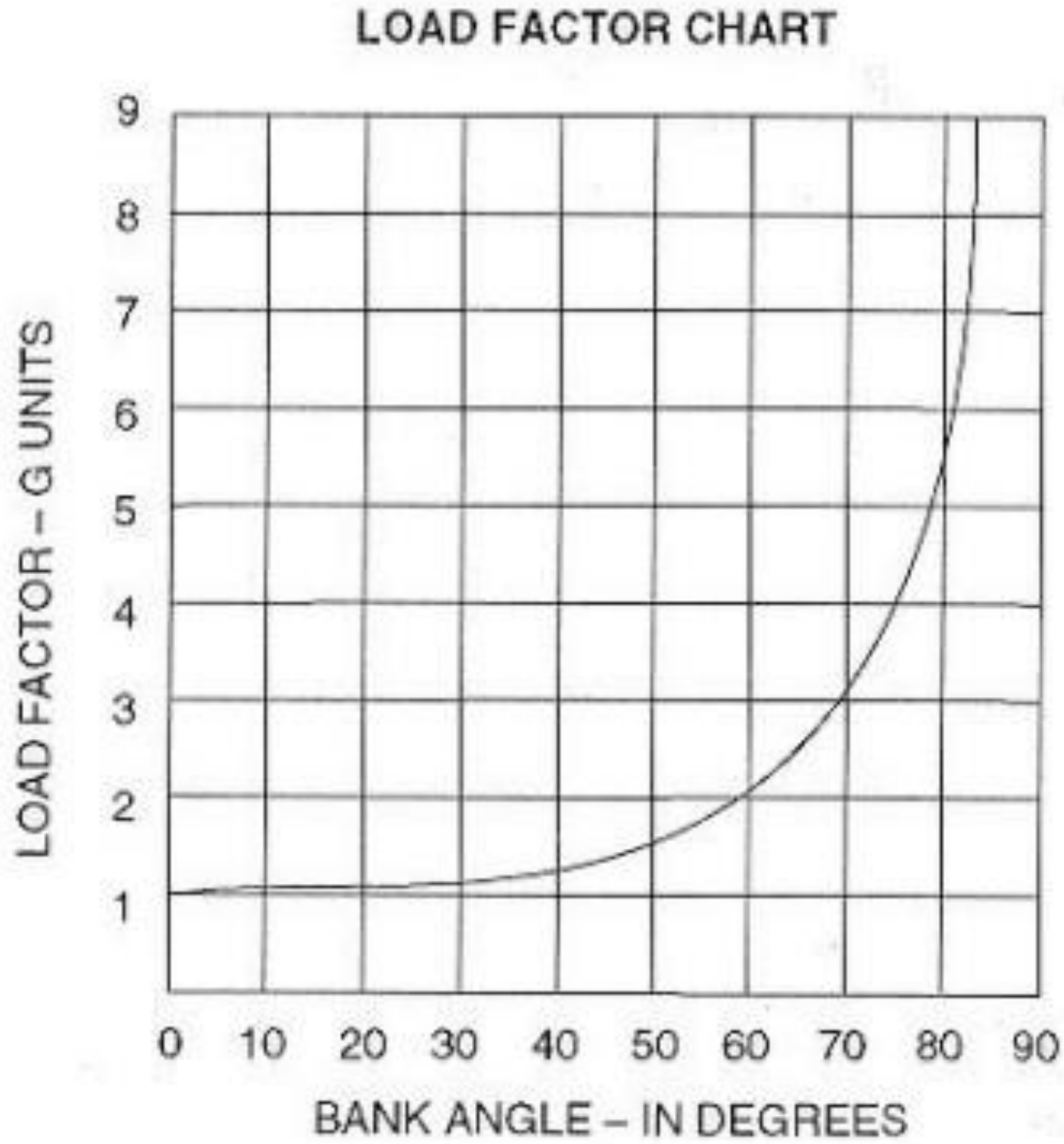

ENDURANCE
BEST ECONOMY MIXTURE PER LYCOMING INSTRUCTIONS
48 GALLONS USEABLE FUEL
45 MIN. RESERVE
AT 55% POWER
NO RESERVE
75%
65%
55%
75%
65%
55%
PRESSURE ALTITUDE — FT.
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
SEA LEVEL
4
5
6
7
8
4
5
6
7
8
ENDURANCE — HOURS
(INCLUDES TIME TO CLIMB & DESCEND)

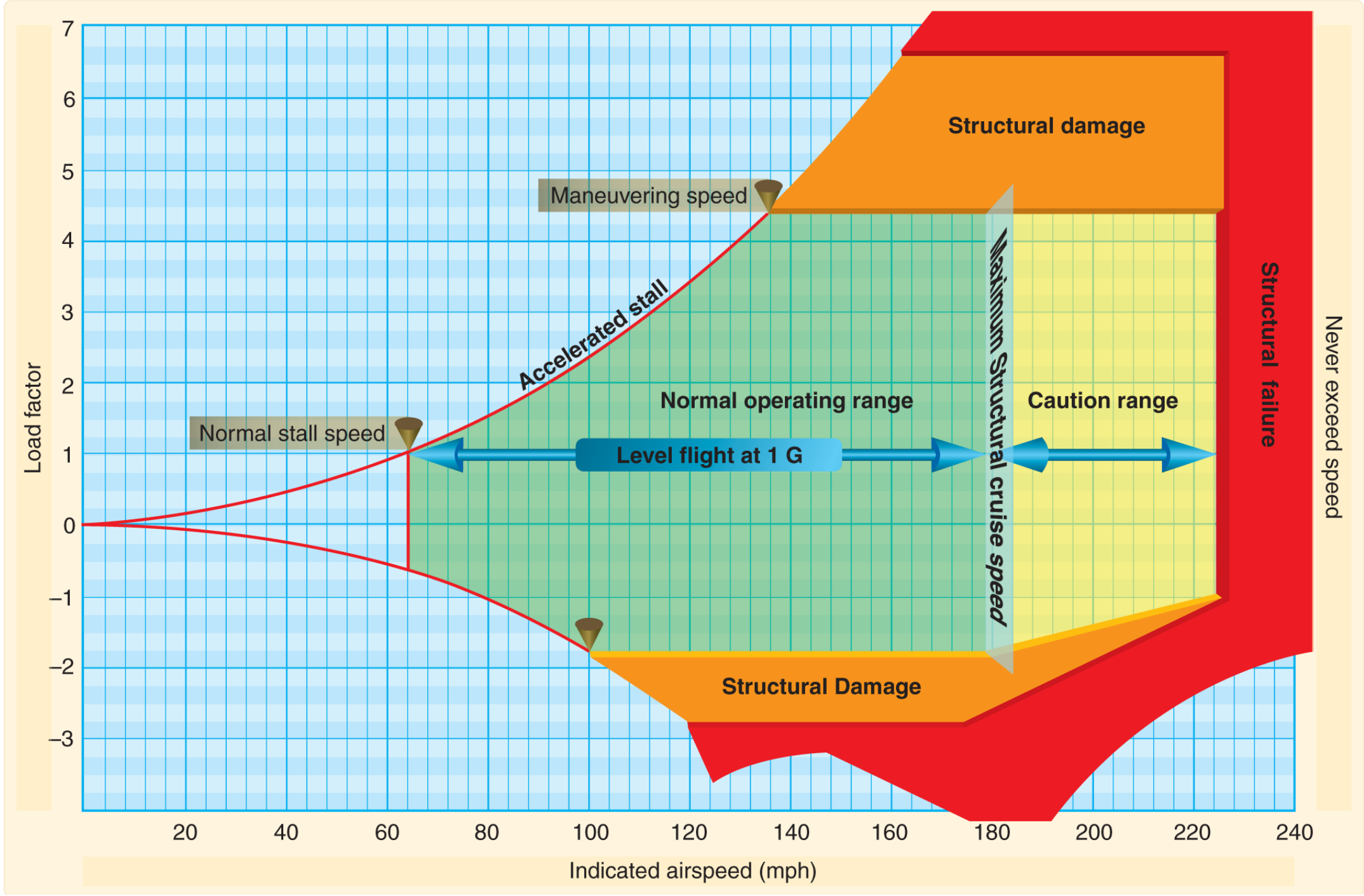
Performance Limitations

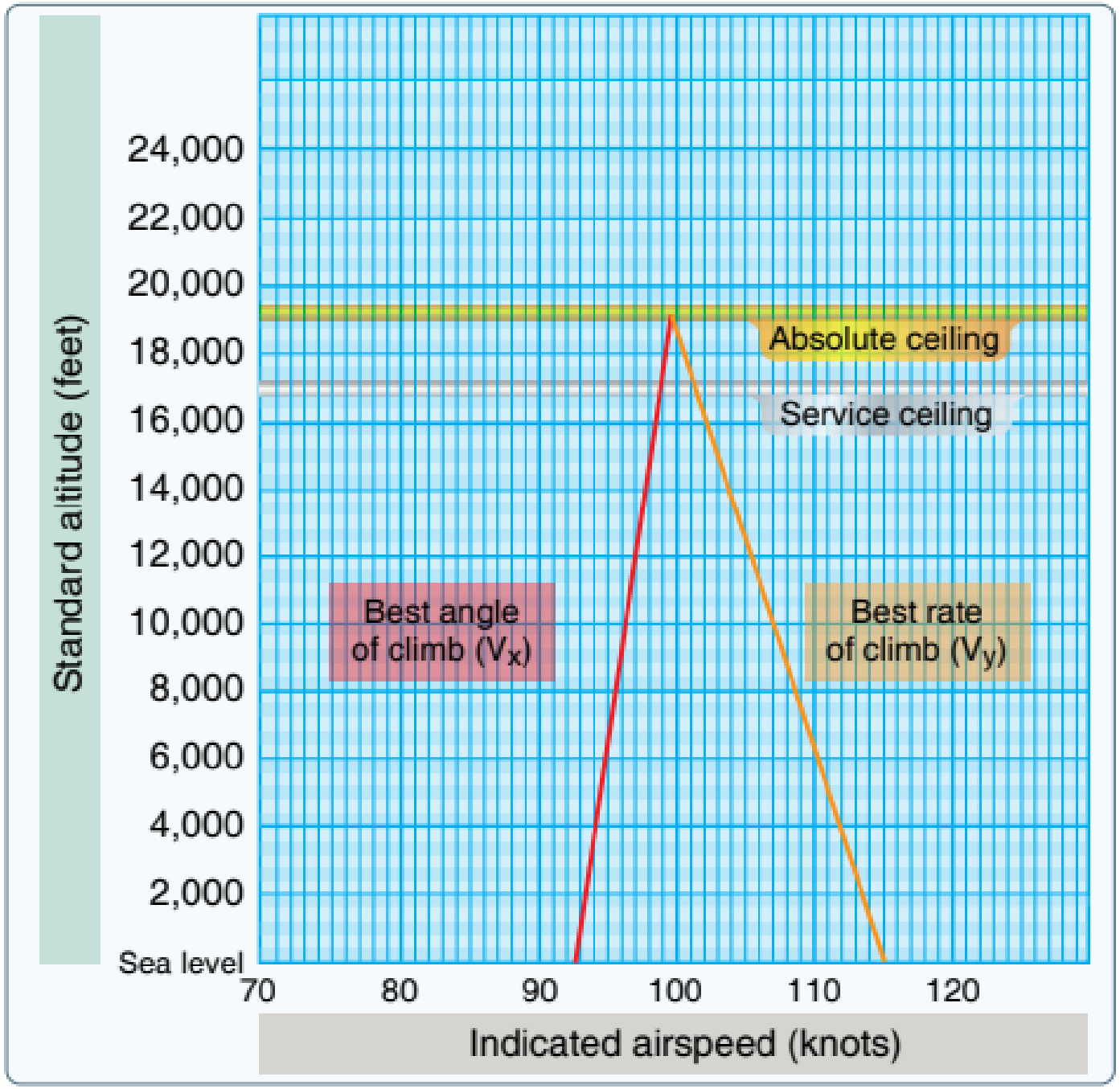


STALL SPEED
Figure 5-5

ANGLE OF BANK ϕ	LOAD FACTOR n
0°	1.0
10°	1.015
30°	1.154
45°	1.414
60°	2.000
70°	2.923
80°	5.747
85°	11.473
90°	∞




Load factor
7
6
5
4
3
2
1
0
–1
–2
–3
Structural damage
Maneuvering speed
Accelerated stall
Normal stall speed
Normal operating range
Level flight at 1 G
Maximum Structural cruise speed
Caution range
Structural failure
Never exceed speed
Structural Damage
20
40
60
80
100
120
140
160
180
200
220
240
Indicated airspeed (mph)


Standard altitude (feet)
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
Sea level
Absolute ceiling
Service ceiling
Best angle of climb (V_X)
Best rate of climb (V_Y)
70
80
90
100
110
120
Indicated airspeed (knots)