
## Performance Characteristics We Want to Predict



Airplanes:

- Takeoff Distance: Ground Roll/Over 50' Obstacle
- Climb Rate
- Time, Distance, Fuel to Climb
- Cruise Speed, Fuel Consumption
- Time, Distance, Fuel to Descend
- Landing Distance Ground Roll
- Landing Distance Over 50 ft Obstacle

- Helicopters
  - Ability to hover in/out of ground effect

# Importance of Performance

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**91.103 — Preflight action.**

- **Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include:**
  - … information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, aircraft gross weight, and wind and temperature.

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# Reminder: Thrust and Drag

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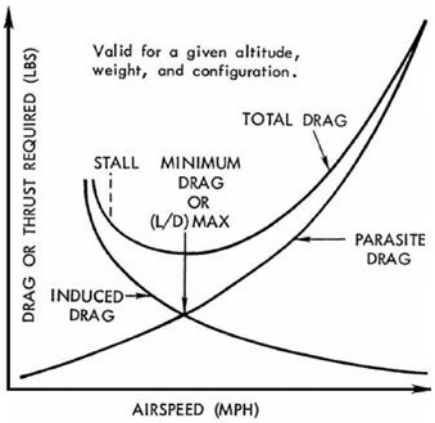
- As the aircraft produces lift, it also creates drag
  - "Induced drag"
  - Decreases as airspeed increases
- As the aircraft moves through the air, there is friction between the air and the skin of the aircraft
  - "Parasitic drag"
  - Increases as airspeed increases
- The sum of the two curves gives total drag of the aircraft
  - In order to maintain airspeed, the thrust provided by the aircraft must equal the total drag
- "Back Side of the Power Curve"
  - A decrease in airspeed requires an increase in power




(Note: To get the power curve, multiply Drag And Thrust by airspeed)

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# Climb Performance

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- Best Angle of Climb ($V_X$):
  - Greatest gain in altitude over the shortest distance
    - Increases with altitude (TAS)
    - Wind changes climb angle, but $V_X$ calculated for calm wind
- Best Rate of Climb ($V_Y$)
  - Greatest gain in altitude over the shortest time
    - Decreases with altitude (TAS)
    - Independent of wind
- Cruise Climb
  - Increases Ground Speed
  - Increases Forward Visibility
  - Better Engine Cooling
  - 87 Knots in Warrior (79 Vy); 105 for Cirrus SR20 (96 Vy); 150 for PC-12 (120 Vy)



# Climb Thrust and Power

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- Thrust is the forward acting force created by the propeller
  - As airspeed increases, the thrust created by the propeller decreases
  - The more excess thrust an aircraft has, the steeper it can climb (i.e. higher angle of climb)
- Power is defined as $thrust \times speed$
  - Roughly constant with airspeed for piston aircraft
  - The more excess power available, the higher the RATE at which an aircraft can climb

# Best Glide Ratio

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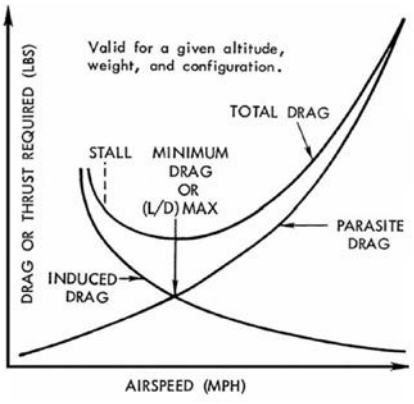
- What airspeed would you fly when you lost your engine? Why?
- $(L/D)_{MAX}$ is the airspeed at which the aircraft covers maximum distance for a given altitude loss






# Effects of Weight on Performance

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- As weight increases…
  - Takeoff distances increase
  - Cruise speeds decrease
  - Fuel Economy is reduced
  - Landing distance increase
- Remember…
  - Any increase in weight results in a needed increase in lift, thus less thrust available

# Effects of Wind on Performance

**Headwind**

- Better takeoff performance
- Better climb angle
- Decreased cruise range (lower ground speed)
- Better landing performance (shorter ground roll)

**Tailwind**

- Worse takeoff performance (need to roll farther to build up required airspeed)
- Worse climb angle (being pushed into trees)
- Better cruise range
- Worse landing performance (higher ground speed requires more time/distance for braking)



# Center of Gravity

MIT AEROASTRO

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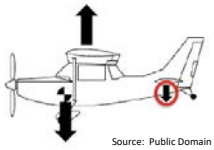
- Forward Center of Gravity
  - Increased Stability
  - Longer Takeoff Distance
  - Decreased Climb Rates
  - Slower Cruise Speeds
  - Decreased Range
    - More tail down force



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- Aft Center of Gravity
  - Decreased Stability
  - Shorter Takeoff Distances
  - Increased Climb Rates
  - Faster Cruise Speeds
  - Increased Range
    - Less tail down force

# Atmospheric Pressure

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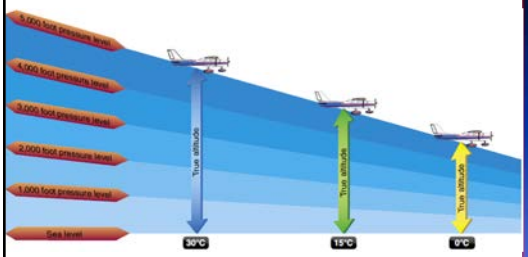
Effect of Temperature on Atmospheric Pressure

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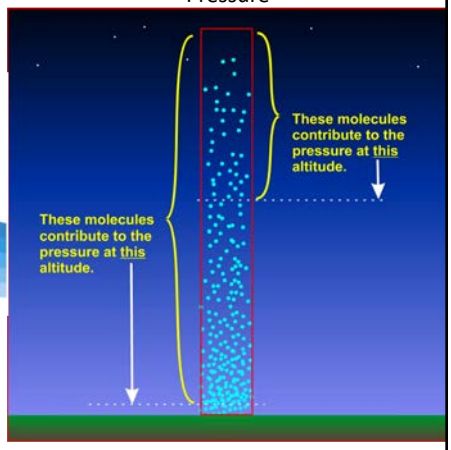
A Simple "Mental Model" of Atmospheric Pressure






# Effect of Atmospheric Pressure

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- Aircraft performance is primarily affected by changes in air density
  - Air density in turn is primarily affected by pressure, temperature and humidity
- For each flight, performance needs to be calculated under the prevailing conditions
  - Conditions are usually referenced to the international standard atmosphere (ISA)
- As air density decreases:
  - The engine cannot take in as much air for combustion
  - The propeller cannot grab as much air for thrust
  - Drag is reduced

**Standard Atmosphere**

| Altitude (ft) | Pressure (Hg) | Temperature (°C) | Temperature (°F) |
|---|---|---|---|
| 0 | 29.92 | 15.0 | 59.0 |
| 1,000 | 28.86 | 13.0 | 55.4 |
| 2,000 | 27.82 | 11.0 | 51.9 |
| 3,000 | 26.82 | 9.1 | 48.3 |
| 4,000 | 25.84 | 7.1 | 44.7 |
| 5,000 | 24.89 | 5.1 | 41.2 |
| 6,000 | 23.98 | 3.1 | 37.6 |
| 7,000 | 23.09 | 1.1 | 34.0 |
| 8,000 | 22.22 | -0.9 | 30.5 |
| 9,000 | 21.38 | -2.8 | 26.9 |
| 10,000 | 20.57 | -4.8 | 23.3 |
| 11,000 | 19.79 | -6.8 | 19.8 |
| 12,000 | 19.02 | -8.8 | 16.2 |
| 13,000 | 18.29 | -10.8 | 12.6 |
| 14,000 | 17.57 | -12.7 | 9.1 |
| 15,000 | 16.88 | -14.7 | 5.5 |
| 16,000 | 16.21 | -16.7 | 1.9 |
| 17,000 | 15.56 | -18.7 | -1.6 |
| 18,000 | 14.94 | -20.7 | -5.2 |
| 19,000 | 14.33 | -22.6 | -8.8 |
| 20,000 | 13.74 | -24.6 | -12.3 |

# Pressure Altitude

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- Pressure Altitude
  - Height above the Standard Datum Plane (29.92 in. Hg)
- To calculate pressure altitude at an airport:
  - Standard Lapse Rate: 1000’ per 1” Hg
  - Standard atmospheric pressure: 29.92” Hg

**(29.92-altimeter setting) x 1000 +**
**Field Elevation =**
**Airport Surface Pressure Altitude**



# Determining Pressure Altitude

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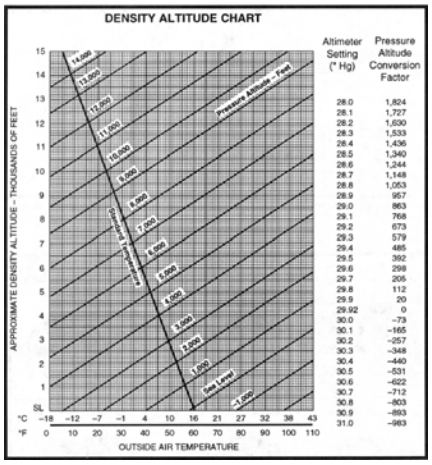
- Elevation **3563’**; Altimeter 29.96
- Interpolate between 29.92 and 30.00
  - -73/2 = 36.5
- 3563 - 36.5 = **3526.5’**
- Or use formula: (29.92-29.96)*1000+3563 = **3523’**

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# Density Altitude

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- Density Altitude
  - Pressure Altitude corrected for non-standard temperature (15° C)
- Big performance impact
- The temperature / density relationship is nonlinear.
  - A simple formula to calculate Density Altitude does not exist
- To calculate Density Altitude:
  - Performance Charts
  - E6B
  - Electronic Flight Computer
  - Web/App



# Determining Density Altitude

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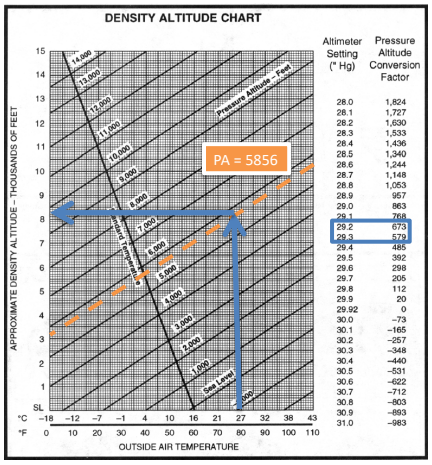
- **Determine density altitude**
  - **Airport elevation 5250 MSL**
  - **Altimeter Setting 29.25**
  - **Temperature 81 F**

1. Interpolate between 29.2 and 29.3 on Conversion Factor chart (+626 ft)
2. Convert airport elevation to pressure altitude (5250+626 = 5876 ft)
3. Use graph to determine density altitude from pressure altitude (8250 ft)
4. Flight Computer demo (if time)

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## Density Altitude (cont'd)

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- When are Density Altitude and Pressure Altitude the same?
- Answer: If the temperature distribution of the atmosphere is the same as that of the standard atmosphere



## Humidity: Another Enemy

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- Relative humidity: ratio of water in the air to the water that the air could hold
- Higher Humidity -> Higher Density Altitude
- Smaller effect than temperature, but very high humidity can reduce engine output by 7 percent.

# pilotfriend.com

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| | | | | |
|---|---|---|---|---|
| Elevation | feet | meters | 5000 | |
| Air Temperature | deg F | deg C | 30 | |
| Altimeter Setting | inches Hg | mb | 30.14 | |
| Dew Point | deg F | deg C | 28 | |

Calculate Reset

| | | | | |
|---|---|---|---|---|
| Density Altitude | 8107 | feet | 2471 | meters |
| Absolute Pressure | 25.086 | inches Hg | 849.49 | mb |
| Relative Density | 78.35 | % | 78.35 | % |



Experiment with Humidity: change dewpoint to 10C -> **7735'**



# Max Convenience: ForeFlight

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# Computing Density Altitude Pilot Operating Manual

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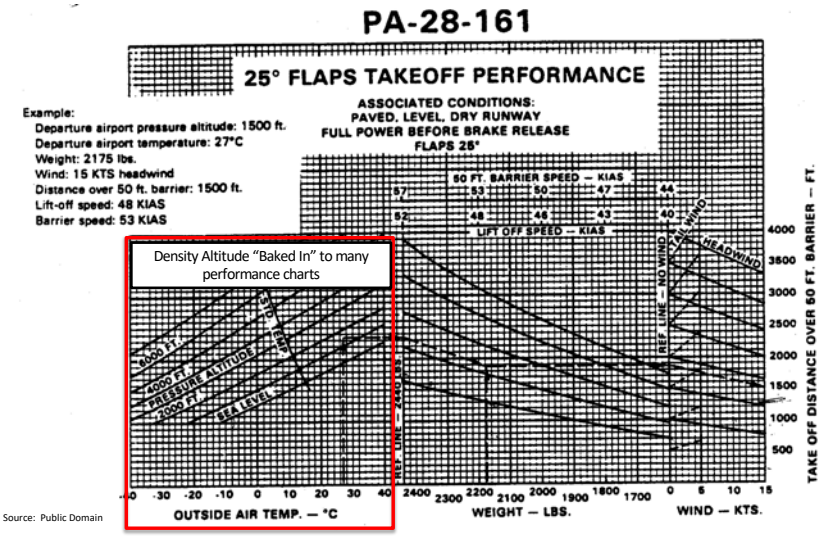


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# Other Factors affecting Performance

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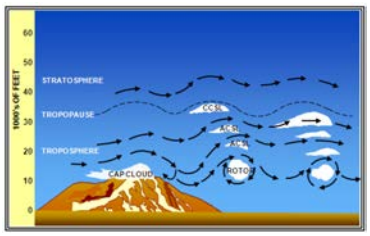
- Turbulence
  - Decreases maneuverability and controllability
  - Requires reduced airspeed
- Pilot technique:
  - Rotation speed
  - Proper/constant pitch attitude
  - Aircraft Configuration: think about a go-around
    - Flaps
    - Landing Gear
    - Cowl Flaps (Beriev Be-103)
    - Spoilers (AA 965)

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# Runway Condition

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- Best numbers: Dry, Paved Runway
- Dry Grass
  - +20% ground roll (Cirrus SR20)
- Wet Grass
  - +30% ground roll takeoff (Cirrus SR20)
  - +60% ground roll landing (SR20)
- Gravel Runways
  - Slight reduction in performance
- Wet *Grooved* Runways
  - Similar to Dry, Paved

Cessna Mustang* numbers for "adverse runway conditions":

- Dry: 3000'
- Wet: 4240'
- 0.2 inches water: 4800'
- 0.2 inches slush or wet snow: 4950'
- 0.1 inches dry snow: 5100'
- Compact snow: 5300'
- Wet ice: off chart (16,600' if dry number is 2200')

*turbojet that lands at Baron speeds.



# Runway Slope and Ground Roll

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- Up
  - Increased takeoff (SR20: 22% at sea level for every 1%; 43% at 10,000')
  - Decreased landing (SR20: 9% for every 1%)
- Down
  - Decreased takeoff (SR20: 7% at sea level for every 1%; 14% at 10,000')
  - Increased landing (SR20: 27% for every 1%)

# Ceiling

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- Absolute Ceiling
  - Altitude where the aircraft will no longer climb
    - Altitude where $V_X$ and $V_Y$ are the same
- Service Ceiling:
  - Where maximum rate of climb is 100 feet per minute (fpm) at max weight and ISA (13,500' for Cessna 172R)
- Determined using the Maximum Rate of Climb Chart

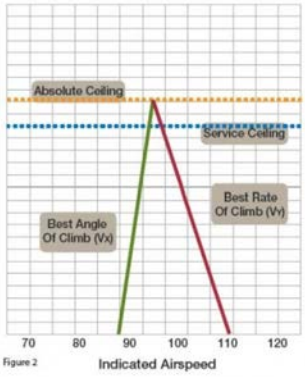

Figure 2
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# Range vs. Endurance

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- Range: greatest distance an aircraft can travel
- Max-range airspeed depends on:
  - Weight
  - Wind
- Endurance: time the aircraft can remain aloft
  - Minimum fuel consumption to maintain altitude
  - Useful if waiting one's turn for Oshkosh, waiting for a runway to reopen, loitering for surveillance, lost
- Robinson R44 helicopter: 100 knots max-range; 55 knots max endurance.

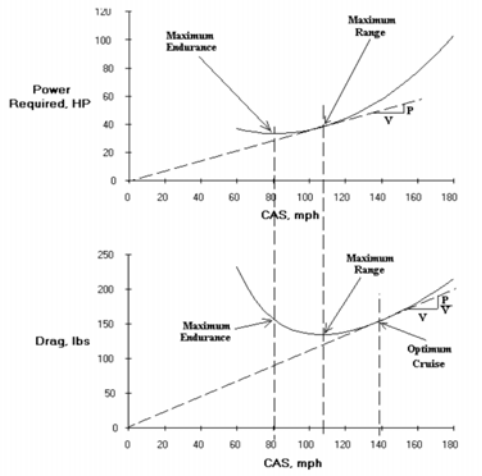
# RV-6a power/drag



Max endurance = minimum fuel consumption per hour.

Max range = minimum fuel consumption per mile.

Power = thrust * velocity

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## PREDICTING PERFORMANCE FOR ALL FLIGHT PHASES

# Landing and Takeoff Performance

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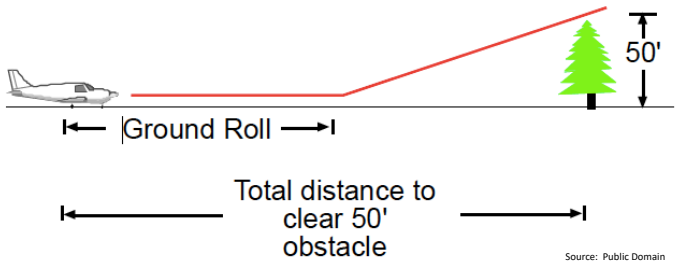
- Terms
  - Ground Roll
  - Distance with 50’ Obstacle: static start to 50’ AGL

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# Landing and Takeoff Performance

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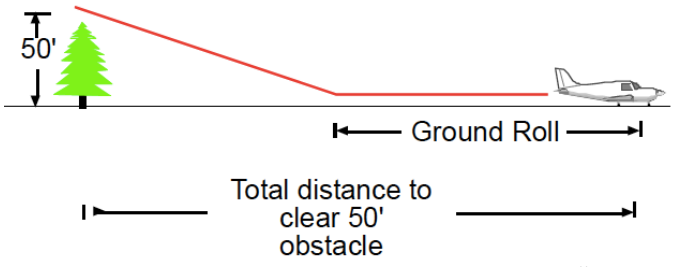


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# Landing Performance Additional Factors

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- Pilot Technique
  - Braking
  - Stabilized Approach
- Turbulence
  - Increase approach speed
  - During gusty conditions, increase approach speed by 1/2 the gust factor (rule of thumb). With METAR wind 35015G25KT
    - Gust Factor: 25 – 15 = 10
    - ½ of Gust Factor: 10/2 = 5
    - Approach at 80 knots instead of 75 (Cirrus SR20)
- Flaps:
  - Approach Speed reduced
  - Approach Angle increased



# Takeoff/Landing Performance Charts

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- Charts differ based on configuration and desired performance value. Piper Warrior POH includes…
  - 0° Flaps Takeoff Ground Roll
    - Used for Normal Takeoff
  - 0° Flaps Takeoff Performance (50’ Standard Obstacle)
  - 25° Flaps Takeoff Ground Roll
    - Used when necessary to leave runway surface sooner
  - 25° Flaps Takeoff Performance (50’ Standard Obstacle)
    - Used when obstacle clearance is necessary
- Flight school renters: remember that they made the charts with a new aircraft and engine!
- Everyone: remember that a professional test pilot demonstrated those numbers. (FAR 121 and 135 add margins)

# Wind Components

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- Note Headwind: shortens takeoff and landing distances
- Check Tailwind: stay within limitations for high-performance aircraft
- Check Crosswind: ensure sufficient rudder authority (increases with airspeed so maybe adjust flap use)

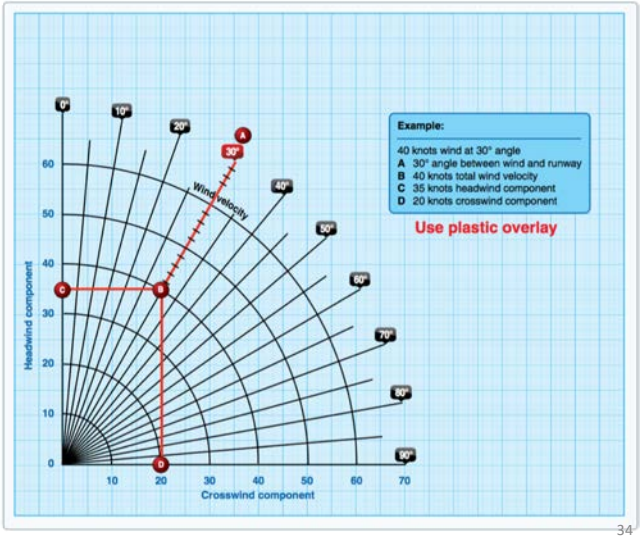


# Wind 26040KT; Rwy 29

16.687

**Heavy Crosswind?**
- Check Limitations
- Check Max Demonstrated
- Consider reduced flaps

**Philip's Anecdote:**
You can get a jet type rating at FlightSafety even if you can't use this chart.



# Takeoff Performance

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| Example: | |
|---|---|
| OAT | 15 °C (59 °F) |
| Pressure altitude | 5,650 feet |
| Takeoff weight | 2,950 lb |
| Headwind comp. | 9.0 knots |
| Ground roll | 1,375 feet |
| Total distance over a 50 feet obstacle | 2,300 feet |
| Takeoff speed at | |
| Lift-off | 66 knots (76 mph) |
| 50 feet | 72 knots (83 mph) |

| Associated conditions | |
|---|---|
| Power | Full throttle 2,600 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 | |
| | kts | MPH | kts | MPH |
| 2,950 | 66 | 76 | 72 | 83 |
| 2,800 | 64 | 74 | 70 | 81 |
| 2,600 | 63 | 72 | 68 | 78 |
| 2,400 | 61 | 70 | 66 | 76 |
| 2,200 | 58 | 67 | 63 | 73 |

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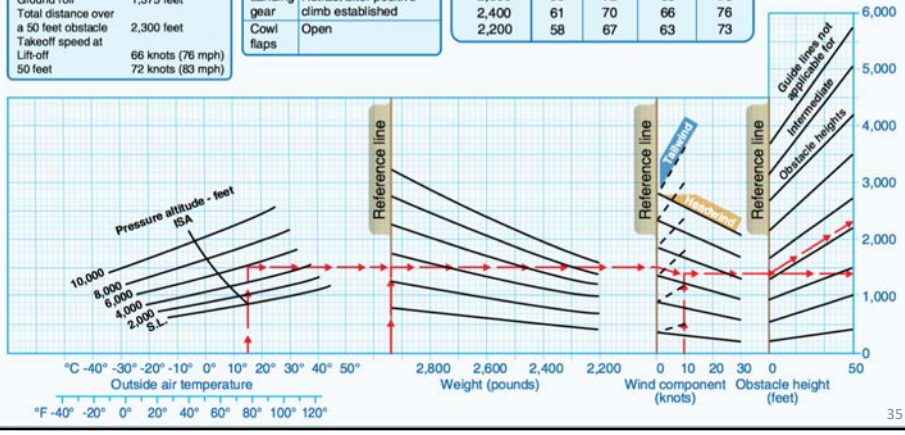





# Pilatus PC-12, Flaps 15

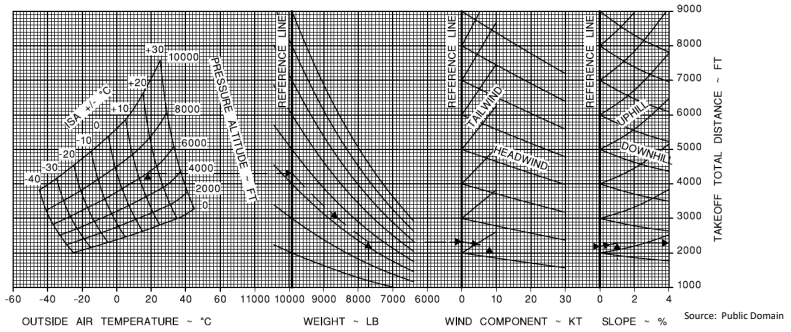
16.687

TAKEOFF TOTAL DISTANCE - FLAPS 15°
OVER 50 FT OBSTACLE; (STANDARD UNITS)

| WEIGHT ~ LB | $V_R$ ~ KIAS | $V_{50FT}$ ~ KIAS |
|---|---|---|
| 6400 | 63 | 78 |
| 7300 | 67 | 83 |
| 8200 | 71 | 88 |
| 9100 | 75 | 93 |
| 10000 | 79 | 98 |
| 10450 | 81 | 100 |

ASSOCIATED CONDITIONS:
LIFT OFF AT 1.1 $V_{S1}$
OBSTACLE AT 1.3 $V_{S1}$
REFER TO THE SPEED SCHEDULE TABLE
RUNWAY SURFACE: TARMAC

| EXAMPLE: | |
|---|---|
| ALTITUDE | 6000 FT |
| OAT | 18 °C |
| WEIGHT | 7716 LB |
| HEADWIND COMPONENT | 8 KT |
| UPHILL COMPONENT | 1 % |
| TAKEOFF TOTAL DISTANCE | 2300 FT |

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# Why Cirrus is the best seller

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## Takeoff Distance: 3000 LB

**WEIGHT: 3000 LB**
**Speed at Liftoff: 68 KIAS**
**Speed over 50 Ft. Obstacle: 75 KIAS**
**Flaps: 50%**
**Power: Takeoff Power**
**Runway: Dry, Paved**

**Headwind:** Subtract 10% for each 12 knots headwind.
**Tailwind:** Add 10% for each 2 knots tailwind up to 10 knots.
**Runway Slope:** Ref. Factors.
**Dry Grass:** Add 20% to Ground Roll.
**Wet Grass:** Add 30% to Ground Roll

| PRESS ALT FT | DISTANCE FT | TEMPERATURE ~ °C 0 | 10 | 20 | 30 | 40 | ISA |
|---|---|---|---|---|---|---|---|
| SL | Grnd Roll | 1287 | 1390 | 1497 | 1608 | 1724 | 1446 |
| | 50 ft | 1848 | 1988 | 2132 | 2282 | 2437 | 2064 |
| 1000 | Grnd Roll | 1412 | 1526 | 1643 | 1766 | 1893 | 1564 |
| | 50 ft | 2022 | 2175 | 2333 | 2497 | 2666 | 2226 |
| 2000 | Grnd Roll | 1552 | 1676 | 1805 | 1940 | 2079 | 1692 |
| | 50 ft | 2214 | 2381 | 2555 | 2734 | 2920 | 2402 |
| 3000 | Grnd Roll | 1706 | 1842 | 1985 | 2132 | 2286 | 1831 |
| | 50 ft | 2426 | 2609 | 2799 | 2996 | 3200 | 2593 |

Source: Public Domain



# Rate of Climb?

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| | |
|---|---|
| **Gross Weight** | 1,670 lbs |
| **Press. Alt at Takeoff** | 2,000 ft |
| **Temperature** | 68° F (20° C) |
| **Rate of Climb?** | |
| **Climb Speed?** | |

# POH Table

16.687

| Weight lbs | Press alt ft | Climb speed kias | Rate of climb - fpm | | | |
|---|---|---|---|---|---|---|
| | | | -20 °C | 0 °C | 20 °C | 40 °C |
| 1670 | S.L. | 67 | 835 | 765 | 700 | 630 |
| | 2000 | 66 | 735 | 670 | 600 | 535 |
| | 4000 | 65 | 635 | 570 | 505 | 445 |
| | 6000 | 63 | 535 | 475 | 415 | 355 |
| | 8000 | 62 | 440 | 380 | 320 | 265 |
| | 10,000 | 61 | 340 | 285 | 230 | 175 |
| | 12,000 | 60 | 245 | 190 | 135 | 85 |

Conditions: Flaps up
Full throttle

Note: Mixture leaned above 3000 feet for maximum rpm.



# Maximum Rate of Climb

16.687

| | |
|---|---|
| **Gross Weight** | 1,670 lbs |
| **Press. Alt at Takeoff** | 2,000 ft |
| **Temperature** | 68° F (20° C) |
| **Rate of Climb?** | **600 fpm** |
| **Climb Speed?** | **66 KIAS** |

CLIMB PERFORMANCE
Figure 5-17

**ASSOCIATED CONDITIONS:**

| | |
|---|---|
| GROSS WEIGHT: | 2440 lb. |
| POWER: | FULL THROTTLE |
| MIXTURE: | FULL RICH |
| FLAPS: | UP |
| AIRSPEED: | 79 KIAS |

## MAXIMUM RATE OF CLIMB

**EXAMPLE**
PRESSURE ALTITUDE: 5000FT
OAT: 16° C (ISA + 11° C)
MAX RATE OF CLIMB: 374 FPM

| PRESSURE ALTITUDE FEET | OUTSIDE AIR TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | ISA - 15° C | ISA | ISA + 10° C | ISA + 20° C | ISA + 30° C |
| S.L. | 677 | 644 | 624 | 604 | 585 |
| 1000 | 628 | 595 | 574 | 554 | 534 |
| 2000 | 578 | 545 | 524 | 504 | 485 |
| 3000 | 528 | 495 | 475 | 455 | 436 |
| 4000 | 478 | 446 | 425 | 405 | 386 |
| 5000 | 429 | 396 | 376 | 356 | 337 |
| 6000 | 379 | 346 | 326 | 306 | 287 |
| 7000 | 330 | 298 | 277 | 257 | 238 |
| 8000 | 280 | 248 | 227 | 207 | 188 |
| 9000 | 231 | 198 | 177 | 157 | 138 |
| 10000 | 181 | 149 | 128 | 108 | 89 |
| 11000 | 132 | 99 | 79 | 59 | 40 |
| 12000 | 83 | 49 | 29 | 9 | -10 |
| 13000 | 33 | 0 | -21 | -41 | -60 |

Source: Public Domain

# Cruise Charts – Tabular Example

16.687

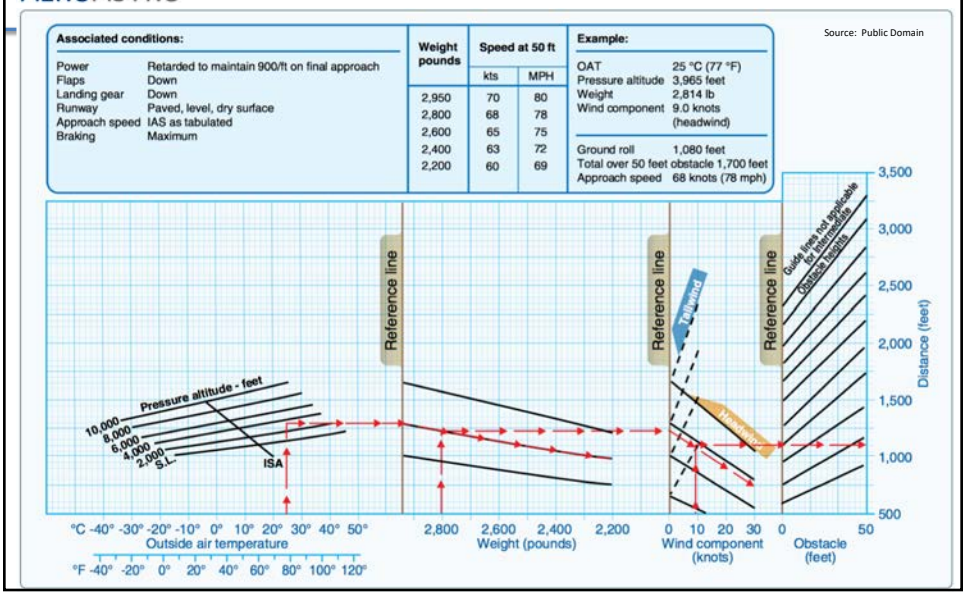
**Cruise power settings**
65% Maximum continuous power (or full throttle 2,800 pounds)

| Press ALT. | ISA -20 °C (-36 °F) | | | | | | | | Standard day (ISA) | | | | | | | | ISA +20 °C (+36 °F) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IOAT | | Engine speed | MAN. press | Fuel flow per engine | | TAS | | IOAT | | Engine speed | MAN. press | Fuel flow per engine | | TAS | | IOAT | | Engine speed | MAN. press | Fuel flow per engine | | TAS | |
| Feet | °F | °C | RMP | IN HG | PSI | GPH | KTS | MPH | °F | °C | RMP | IN HG | PSI | GPH | KTS | MPH | °F | °C | RMP | IN HG | PSI | GPH | KTS | MPH |
| SL | 27 | -3 | 2,450 | 20.7 | 6.6 | 11.5 | 147 | 169 | 63 | 17 | 2,450 | 21.2 | 6.6 | 11.5 | 150 | 173 | 99 | 37 | 2,450 | 21.8 | 6.6 | 11.5 | 153 | 176 |
| 2,000 | 19 | -7 | 2,450 | 20.4 | 6.6 | 11.5 | 149 | 171 | 55 | 13 | 2,450 | 21.0 | 6.6 | 11.5 | 153 | 176 | 91 | 33 | 2,450 | 21.5 | 6.6 | 11.5 | 156 | 180 |
| 4,000 | 12 | -11 | 2,450 | 20.1 | 6.6 | 11.5 | 152 | 175 | 48 | 9 | 2,450 | 20.7 | 6.6 | 11.5 | 156 | 180 | 84 | 29 | 2,450 | 21.3 | 6.6 | 11.5 | 159 | 183 |
| 6,000 | 5 | -15 | 2,450 | 19.8 | 6.6 | 11.5 | 155 | 178 | 41 | 5 | 2,450 | 20.4 | 6.6 | 11.5 | 158 | 182 | 79 | 26 | 2,450 | 21.0 | 6.6 | 11.5 | 161 | 185 |
| 8,000 | -2 | -19 | 2,450 | 19.5 | 6.6 | 11.5 | 157 | 181 | 36 | 2 | 2,450 | 20.2 | 6.6 | 11.5 | 161 | 185 | 72 | 22 | 2,450 | 20.8 | 6.6 | 11.5 | 164 | 189 |
| 10,000 | -8 | -22 | 2,450 | 19.2 | 6.6 | 11.5 | 160 | 184 | 28 | -2 | 2,450 | 19.9 | 6.6 | 11.5 | 163 | 188 | 64 | 18 | 2,450 | 20.3 | 6.5 | 11.4 | 166 | 191 |
| 12,000 | -15 | -26 | 2,450 | 18.8 | 6.4 | 11.5 | 162 | 186 | 21 | -6 | 2,450 | 18.8 | 6.1 | 10.9 | 163 | 188 | 57 | 14 | 2,450 | 18.8 | 5.9 | 10.6 | 163 | 188 |
| 14,000 | -22 | -30 | 2,450 | 17.4 | 5.8 | 10.5 | 159 | 183 | 14 | -10 | 2,450 | 17.4 | 5.6 | 10.1 | 160 | 184 | 50 | 10 | 2,450 | 17.4 | 5.4 | 9.8 | 160 | 184 |
| 16,000 | -29 | -34 | 2,450 | 16.1 | 5.3 | 9.7 | 156 | 180 | 7 | -14 | 2,450 | 16.1 | 5.1 | 9.4 | 156 | 180 | 43 | 6 | 2,450 | 16.1 | 4.9 | 9.1 | 155 | 178 |

Note: 1. Full throttle manifold pressure settings are approximate.
2. Shaded area represents operation with full throttle.

Source: Public Domain

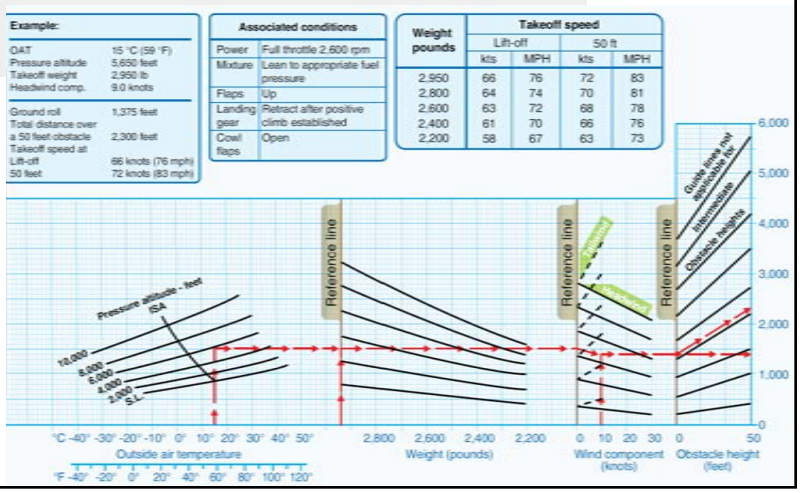
# Landing Performance Example




8. (Refer to Figure 40.) Determine the total distance required for takeoff to clear a 50-foot obstacle.

OAT.....Std
Pressure altitude.....Sea level
Takeoff weight.....2,700 lb
Headwind component.....Calm

- A. 1,000 feet.
- B. 1,400 feet.
- C. 1,700 feet.

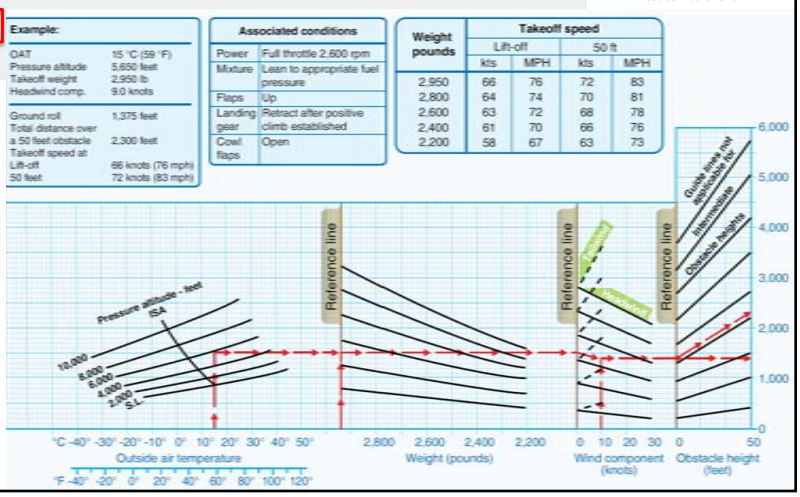


8. (Refer to Figure 40.) Determine the total distance required for takeoff to clear a 50-foot obstacle.

OAT.....Std
Pressure altitude.....Sea level
Takeoff weight.....2,700 lb
Headwind component.....Calm

A. 1,000 feet.
B. 1,400 feet.
C. 1,700 feet.

Source: Public Domain




AERO MIT ASTRO

# The Easy Way

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- Runway numbers for low performance aircraft: using POH remains common
- Apps are available and, in the turbine world, standard.
- Everyone: Web or app for calculating time and fuel requirements.

# Gyronimo (not free)

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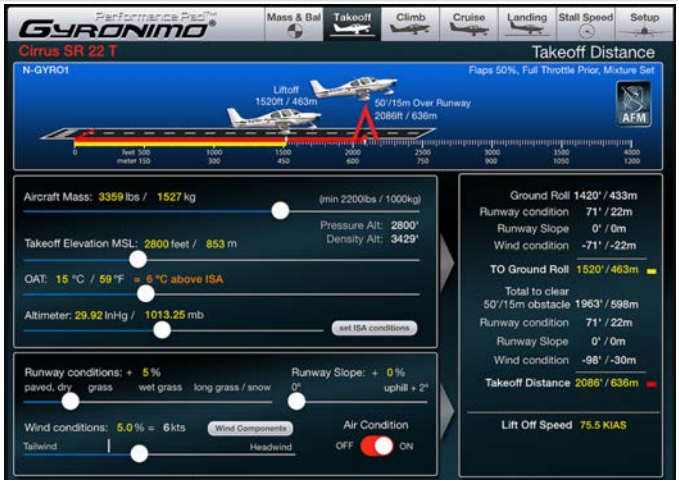
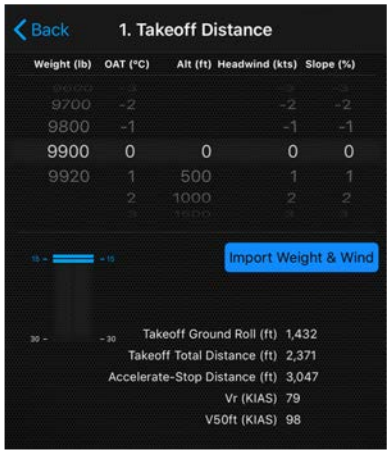


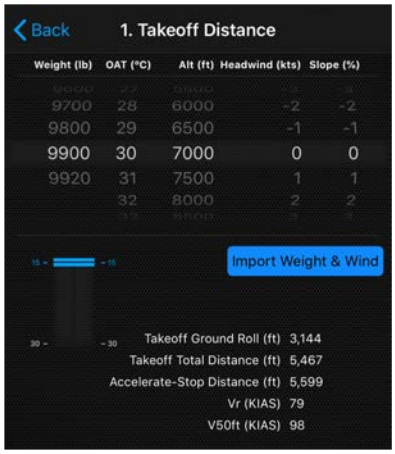





# PC-12 AFM (free/$5 million)

16.687






Note: Accelerate-Stop based on chopping power at roughly 80 knots and pulling condition lever back to Ground Idle (good luck remembering that!).

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# Questions?

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