# The National FAA Safety Team Presents

Federal Aviation Administration

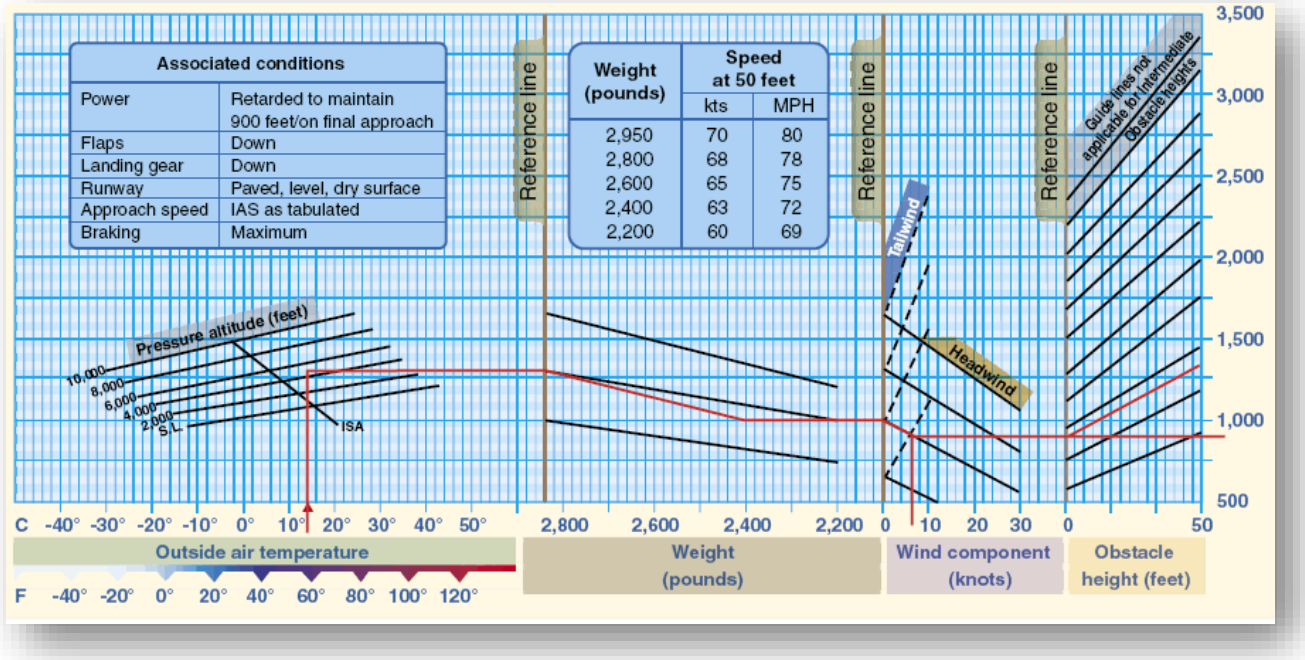
## Topic of the Month December
## Aircraft Performance Monitoring

Presented to: WAFC and Friends

By: Stephen Bateman, CFI

Date: December 14th, 2020

**Produced by AFS-850**
**National FAASTeam**



# Welcome

- **Sponsor Acknowledgment – WAFC, AOPA, FAASTeam, Baltimore FSDO**
- **You know where the restrooms are!**
- **Please - MUTE your microphone**
- **WINGS Credit: Yes…but give me a day or two…**
- **In-and-out…probably no time for questions, but send email:**
  - **steve.bateman@aopa.org**

# Overview

- GAJSC* System/Component Failure Study
- Safety Benefits of Flight Data Monitoring (FDM)
- Present & Future FDM Technologies
- How GA pilots can use FDM today

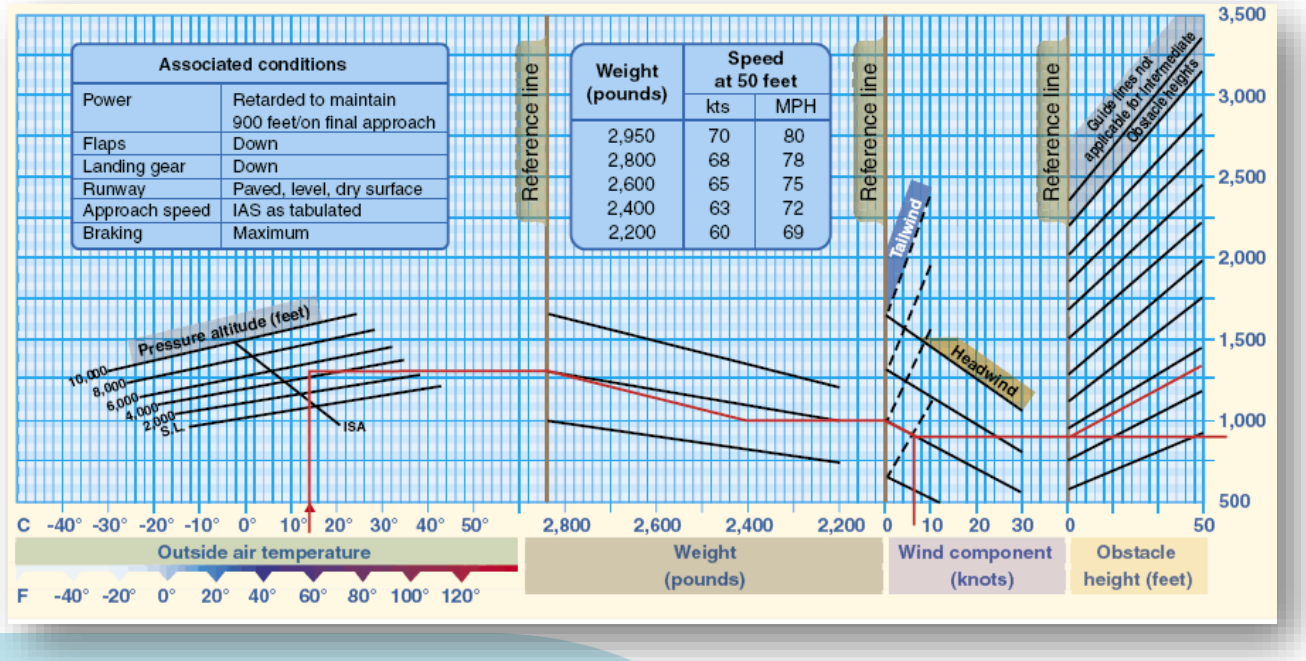

*General Aviation Joint Steering Committee

# Take Aways…

- **Hazards associated with unreasonable performance expectations**
- **Safety benefits of using Flight Data Monitoring (FDM)**
- **Using your EFB to review and debrief flights**
- **Availability of FDM equipment for GA**

# Performance Monitoring Benefits

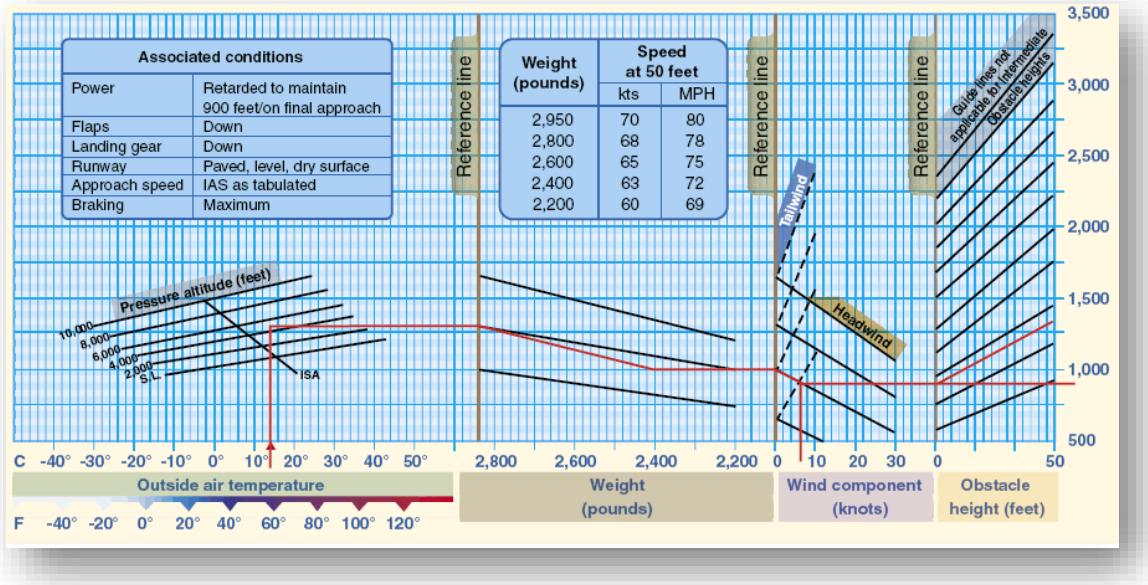
- **Performance predictions**
- **Reasonable performance expectations**
- **Early detection of mechanical issues (preventative maintenance)**
- **Safer flight operations**



# Performance Prediction

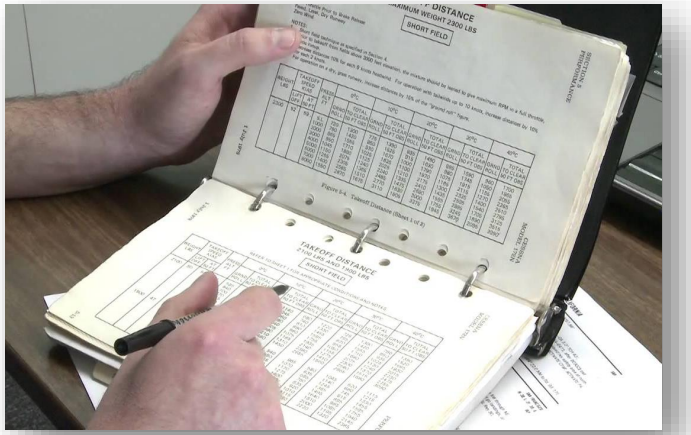
- **Only useful if you actually do it…**

- **Its all to do with:**
  - Density Altitude
  - W&B
- **Use your PoH graphs and tables**
  - Is your aircraft “stock”?
- **What your aircraft could do (we add 50%, right?)**
- **What about you?**
  - Go out and calibrate YOURSELF in YOUR airplane
  - Prepare to be humbled…and learn the lesson!



# How often have you heard….

- She'll haul anything you can fit in the door
- Relax - It flew in here – it'll fly out
- We've got plenty of fuel…(umm…perhaps too much?)

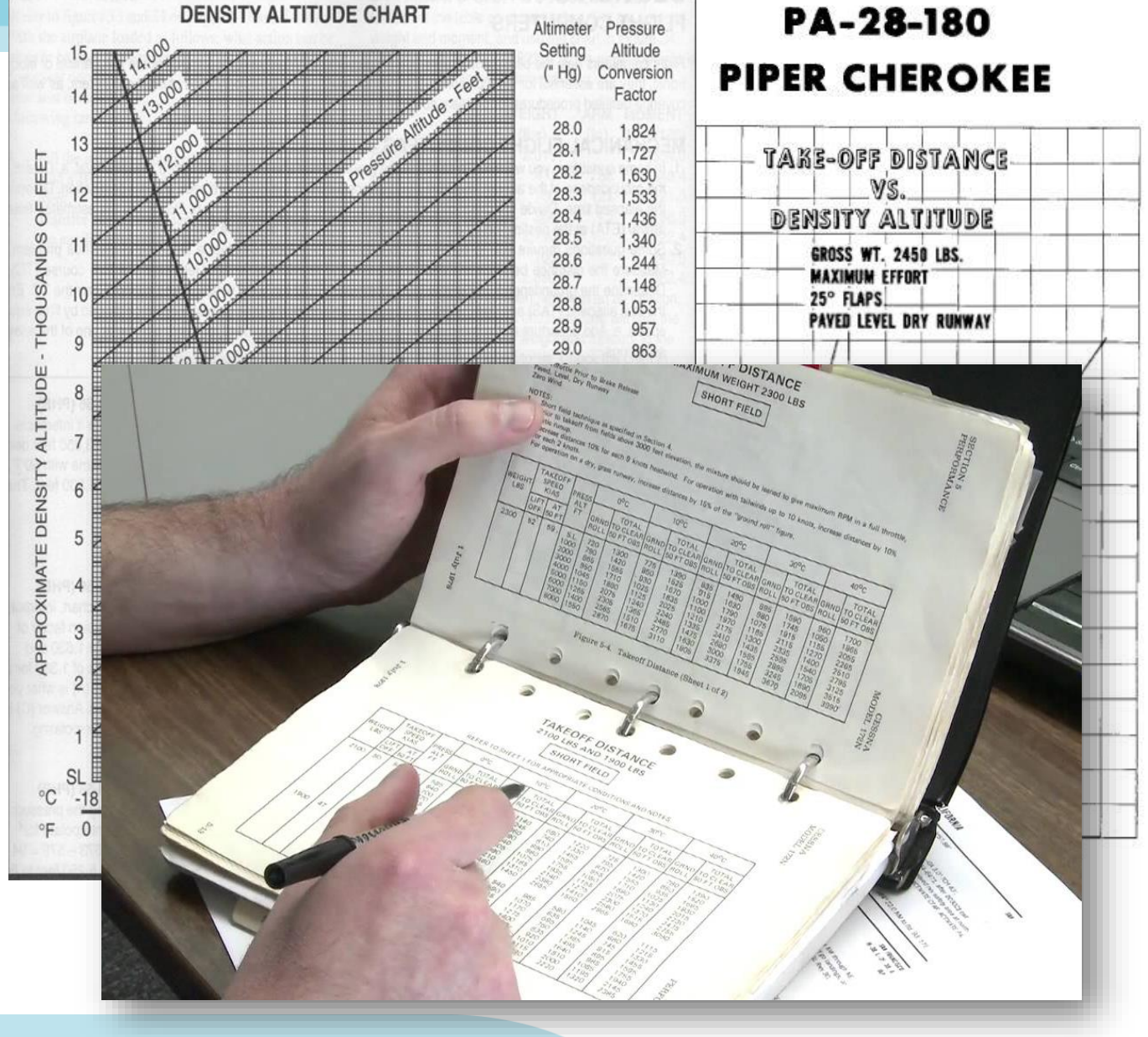


# Pilots need to know

- **Weight *and* Balance calculations**
  - Takeoff weight and CG location
    - Don’t guess – weigh it!
    - Location, location, location
    - “Items may shift in flight…”

# Pilots need to know

- **Takeoff and climb calculations**
  - Based on Density Altitude
    - Might be presented in terms of DA
    - Remember how to determine DA?
    - Might be presented as pressure altitude and temperature
- **Need to know:**
  - Runway length, composition, condition and slope (91.103)
  - Obstacle clearance
  - Aircraft configuration
    - Normal, short field, soft field

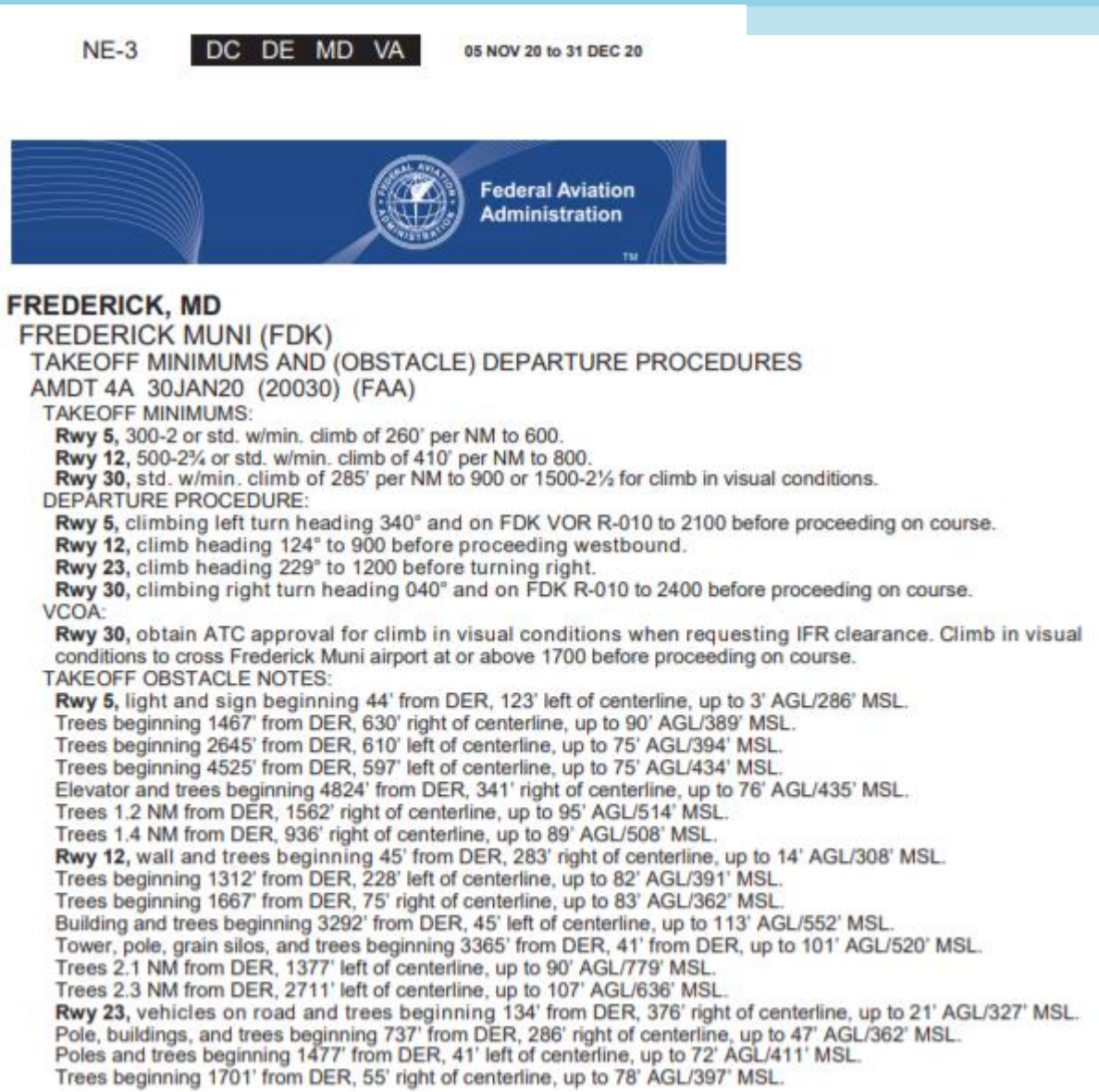


# Pilots need to know

- **Takeoff and departure calculations**
- **Rejected takeoff decision point**
  - 70/50 rule
  - Be at 70% of $V_r$ by 50% of runway
    - 60 Kts or MPH rotation speed
      - 60 x 70% = 42
    - 2,200 ft. available
      - 2,200’ x 50% = 1,100’
- **Forced landing prospects**

# Pilots need to know

- **Takeoff and departure situation**
- **Terrain and obstructions**
  - Sneak a peek at the IAP/TPP charts for obstacle departure procedures
    - Climb gradient and climb rate
    - Instrument Approach Procedures and Terminal Procedure Publication



NE-3 DC DE MD VA 05 NOV 20 to 31 DEC 20

Federal Aviation Administration

**FREDERICK, MD**
FREDERICK MUNI (FDK)
TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES
AMDT 4A 30JAN20 (20030) (FAA)

TAKEOFF MINIMUMS:
**Rwy 5,** 300-2 or std. w/min. climb of 260' per NM to 600.
**Rwy 12,** 500-2¾ or std. w/min. climb of 410' per NM to 800.
**Rwy 30,** std. w/min. climb of 285' per NM to 900 or 1500-2½ for climb in visual conditions.

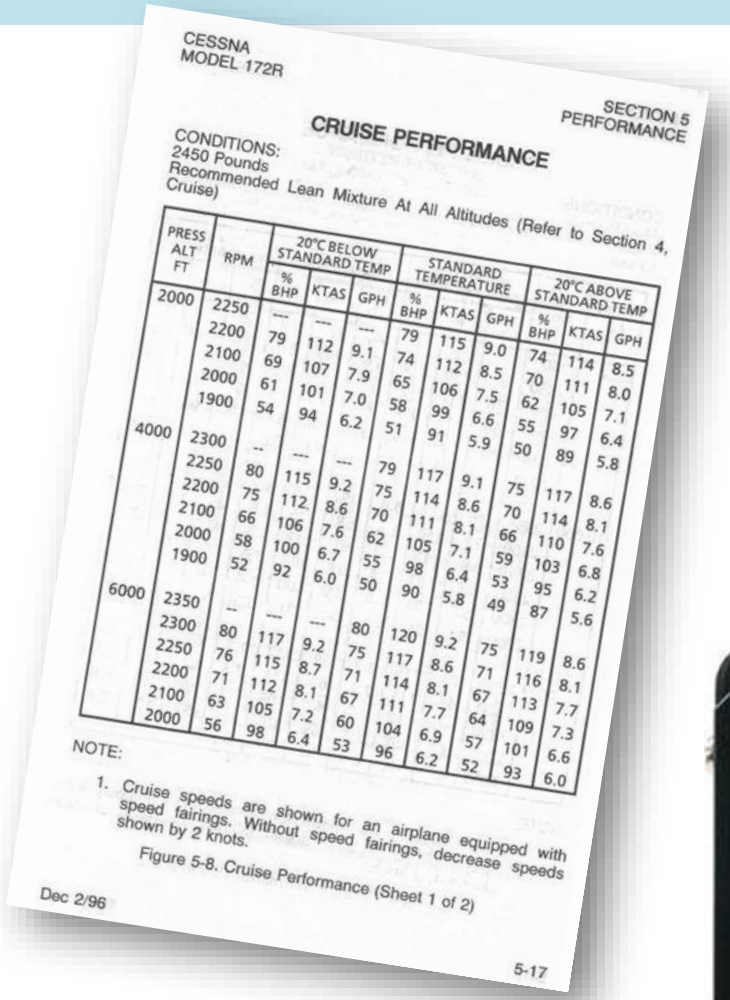
DEPARTURE PROCEDURE:
**Rwy 5,** climbing left turn heading 340° and on FDK VOR R-010 to 2100 before proceeding on course.
**Rwy 12,** climb heading 124° to 900 before proceeding westbound.
**Rwy 23,** climb heading 229° to 1200 before turning right.
**Rwy 30,** climbing right turn heading 040° and on FDK R-010 to 2400 before proceeding on course.

VCOA:
**Rwy 30,** obtain ATC approval for climb in visual conditions when requesting IFR clearance. Climb in visual conditions to cross Frederick Muni airport at or above 1700 before proceeding on course.

TAKEOFF OBSTACLE NOTES:
**Rwy 5,** light and sign beginning 44' from DER, 123' left of centerline, up to 3' AGL/286' MSL.
Trees beginning 1467' from DER, 630' right of centerline, up to 90' AGL/389' MSL.
Trees beginning 2645' from DER, 610' left of centerline, up to 75' AGL/394' MSL.
Trees beginning 4525' from DER, 597' left of centerline, up to 75' AGL/434' MSL.
Elevator and trees beginning 4824' from DER, 341' right of centerline, up to 76' AGL/435' MSL.
Trees 1.2 NM from DER, 1562' right of centerline, up to 95' AGL/514' MSL.
Trees 1.4 NM from DER, 936' right of centerline, up to 89' AGL/508' MSL.
**Rwy 12,** wall and trees beginning 45' from DER, 283' right of centerline, up to 14' AGL/308' MSL.
Trees beginning 1312' from DER, 228' left of centerline, up to 82' AGL/391' MSL.
Trees beginning 1667' from DER, 75' right of centerline, up to 83' AGL/362' MSL.
Building and trees beginning 3292' from DER, 45' left of centerline, up to 113' AGL/552' MSL.
Tower, pole, grain silos, and trees beginning 3365' from DER, 41' from DER, up to 101' AGL/520' MSL.
Trees 2.1 NM from DER, 1377' left of centerline, up to 90' AGL/779' MSL.
Trees 2.3 NM from DER, 2711' left of centerline, up to 107' AGL/636' MSL.
**Rwy 23,** vehicles on road and trees beginning 134' from DER, 376' right of centerline, up to 21' AGL/327' MSL.
Pole, buildings, and trees beginning 737' from DER, 286' right of centerline, up to 47' AGL/362' MSL.
Poles and trees beginning 1477' from DER, 41' left of centerline, up to 72' AGL/411' MSL.
Trees beginning 1701' from DER, 55' right of centerline, up to 78' AGL/397' MSL.

# Pilots need to know

- **In Flight Performance**
  - Take off, climb, cruise, descent
  - Power setting & fuel consumption
  - Altitude, wind, & ground speed
  - En-route fuel availability

CESSNA
MODEL 172R

SECTION 5
PERFORMANCE

## CRUISE PERFORMANCE

CONDITIONS:
2450 Pounds
Recommended Lean Mixture At All Altitudes (Refer to Section 4, Cruise)

| PRESS ALT FT | RPM | 20°C BELOW STANDARD TEMP % BHP | 20°C BELOW STANDARD TEMP KTAS | 20°C BELOW STANDARD TEMP GPH | STANDARD TEMPERATURE % BHP | STANDARD TEMPERATURE KTAS | STANDARD TEMPERATURE GPH | 20°C ABOVE STANDARD TEMP % BHP | 20°C ABOVE STANDARD TEMP KTAS | 20°C ABOVE STANDARD TEMP GPH |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | 2250 | --- | --- | --- | 79 | 115 | 9.0 | 74 | 114 | 8.5 |
| | 2200 | 79 | 112 | 9.1 | 74 | 112 | 8.5 | 70 | 111 | 8.0 |
| | 2100 | 69 | 107 | 7.9 | 65 | 106 | 7.5 | 62 | 105 | 7.1 |
| | 2000 | 61 | 101 | 7.0 | 58 | 99 | 6.6 | 55 | 97 | 6.4 |
| | 1900 | 54 | 94 | 6.2 | 51 | 91 | 5.9 | 50 | 89 | 5.8 |
| 4000 | 2300 | -- | --- | --- | 79 | 117 | 9.1 | 75 | 117 | 8.6 |
| | 2250 | 80 | 115 | 9.2 | 75 | 114 | 8.6 | 70 | 114 | 8.1 |
| | 2200 | 75 | 112 | 8.6 | 70 | 111 | 8.1 | 66 | 110 | 7.6 |
| | 2100 | 66 | 106 | 7.6 | 62 | 105 | 7.1 | 59 | 103 | 6.8 |
| | 2000 | 58 | 100 | 6.7 | 55 | 98 | 6.4 | 53 | 95 | 6.2 |
| | 1900 | 52 | 92 | 6.0 | 50 | 90 | 5.8 | 49 | 87 | 5.6 |
| 6000 | 2350 | -- | --- | --- | 80 | 120 | 9.2 | 75 | 119 | 8.6 |
| | 2300 | 80 | 117 | 9.2 | 75 | 117 | 8.6 | 71 | 116 | 8.1 |
| | 2250 | 76 | 115 | 8.7 | 71 | 114 | 8.1 | 67 | 113 | 7.7 |
| | 2200 | 71 | 112 | 8.1 | 67 | 111 | 7.7 | 64 | 109 | 7.3 |
| | 2100 | 63 | 105 | 7.2 | 60 | 104 | 6.9 | 57 | 101 | 6.6 |
| | 2000 | 56 | 98 | 6.4 | 53 | 96 | 6.2 | 52 | 93 | 6.0 |

NOTE:

1. Cruise speeds are shown for an airplane equipped with speed fairings. Without speed fairings, decrease speeds shown by 2 knots.

Figure 5-8. Cruise Performance (Sheet 1 of 2)

Dec 2/96

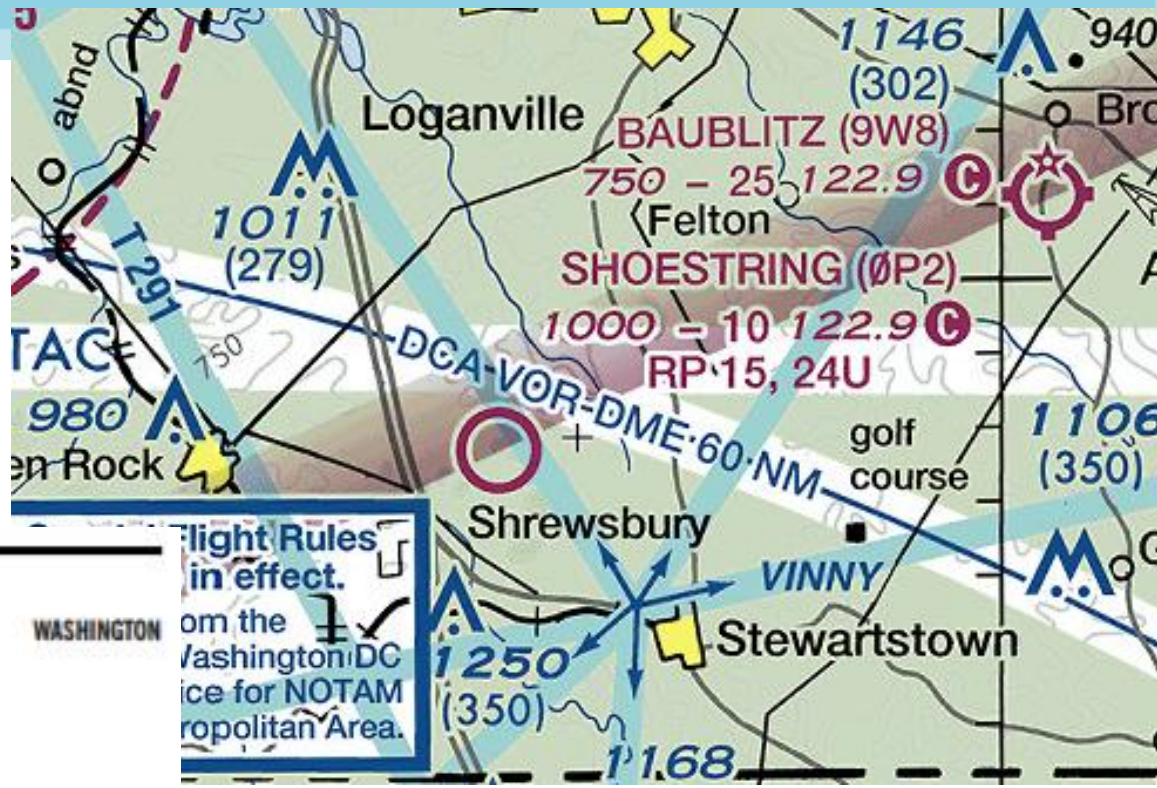
5-17

# Recommendations:

- **Brief each takeoff, approach, and landing**
  - Runway and available distance for takeoff or landing
  - Aircraft configuration and target airspeeds
  - Rejected takeoff or landing decision point
  - Departure/approach path
  - Return to airport altitude
  - Forced landing opportunities

# Real World Example

- **Shoestring Airport, PA**
- **1,000’ grass runways**




**STEWARTSTOWN**

**SHOESTRING AVIATION AIRFIELD** (ØP2) 3 NW UTC–5(–4DT) N39°47.78′ W76°38.78′ WASHINGTON

1000 NOTAM FILE IPT

**RWY 06U–24U:** 1000X100 (TURF)

**RWY 06U:** Tree.

**RWY 24U:** Rgt tfc.

**RWY 15–33:** 1000X100 (TURF)

**RWY 15:** Rgt tfc.

**RWY 33:** Thld dsplcd 500′. Tree.

**SERVICE:** S4

**AIRPORT REMARKS:** Attended irregularly. Extensive ultralgt activity on and invof arpt. Rwy 15–33 and Rwy 06–24 used for ultralight ops. Major airframe and powerplant repair for light sport acft only. Rwy 06, Rwy 15, Rwy 24, Rwy 33 marked with white patio blocks. Dsplcd thlds marked with three white paver each side. Rwy 24U dsplcd 183 ft.

**AIRPORT MANAGER:** 717-235-6724

**COMMUNICATIONS: CTAF** 122.9

**CLEARANCE DELIVERY PHONE:** For CD ctc Potomac Apch at 866-429-5882.

# Real World Example

- Shoestring Airport, PA
- 1,000’ grass runways
- Possible in your C152…C172…C182?
- Are you capable…?
- So, practice short TO/LNDs
- Say, at KDMW with distance markers

# Flight Data Monitoring

# Flight Data Monitoring Back in the Day

# Flight Data Monitoring


- Cockpit Voice Recorder (CVR)
- Flight Data Recorder (FDR)

## FOQA

# Flight Data Monitoring for GA


**Flight Data**

**Flight Data + Visual**

# Flight Data Monitoring for GA



# Sample of What's Available to the GA Community


PRIMARY ENGINE MONITOR SYSTEM

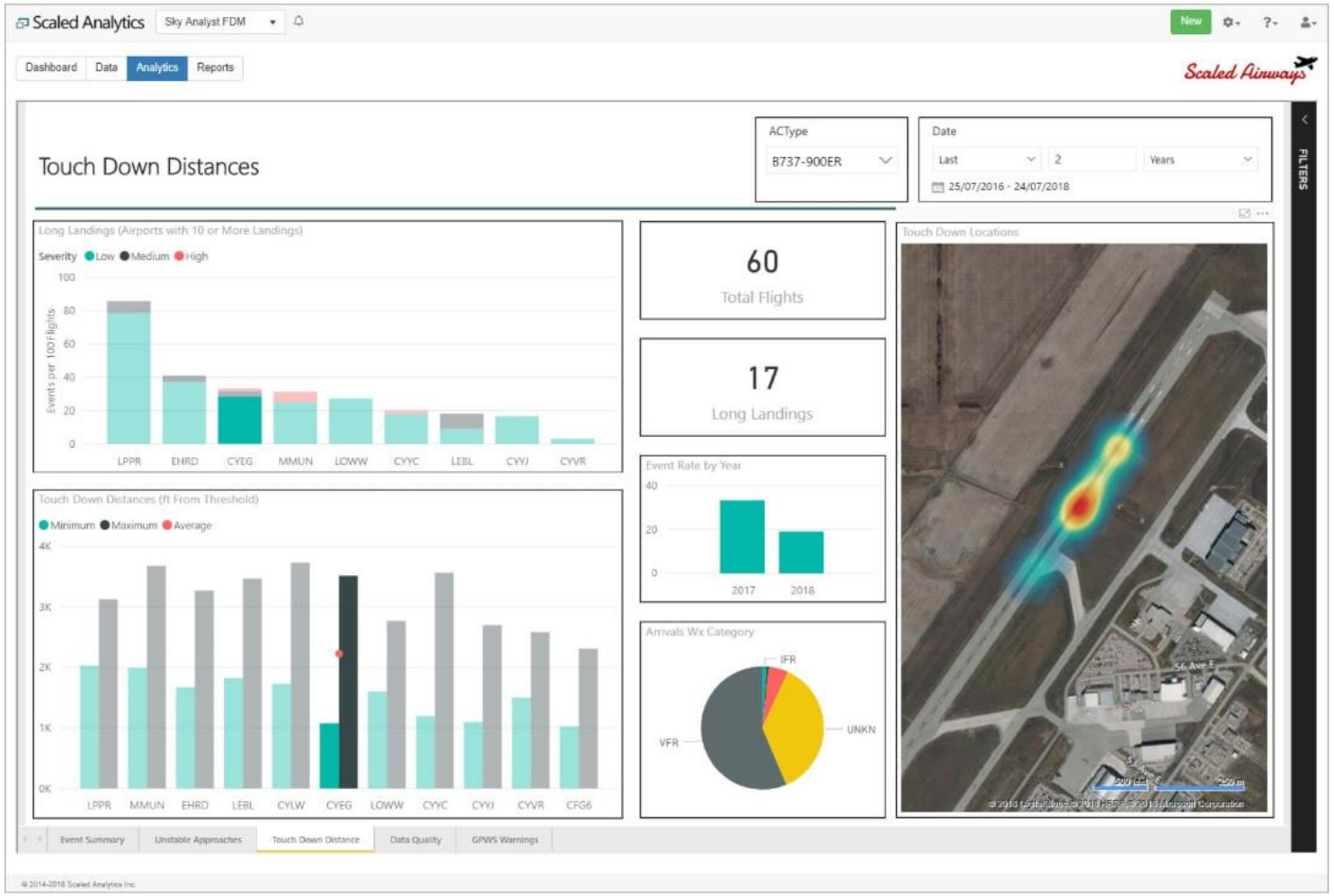
RPM
M.P.
EGT/CHT Bar Graph
Oil Pressure
Oil Temperature
TIT
Hyd Pressure
C.O.
OAT
Vac.

Fuel Pressure
Fuel Level
Fuel Flow
Fuel Remaining
Fuel Used
Fuel -GPS Related Data
Low Fuel Alarm
Recurring Fuel Alarm
Volts
Amps

Flight Timer
Tach Timer
Local Time
Zulu Time
Annunciators
Data Recording
USB Port
External Caution Lights
And More

# Flight Data Monitoring for GA - Free


# Data Driven Improvements



# Data Driven Automation

# Flight Data Monitoring Using Your EFB

- For example, Foreflight
- Use Track log and play back for post flight review
- Export to Google Maps – 3D view
- Flight Data Review



# Flight Data Monitoring Using Your EFB

- **Flight Data Review**
  - Speed and altitude
  - Pitch and bank


# Flight Data Monitoring Using Other Apps

- **Example - CloudAhoy…**
- **Free app for data collection**
- **Subscription for analysis**
- **Can import from FF, Stratus, etc.**
- **If import from EFIS, get data for engine, comms, AHRS, etc.**
- **Take a look at the CloudAhoy videos…**

# Proficiency and Peace of Mind

- **Fly regularly with your CFI**
- **Perfect Practice**
- **Document in WINGS**

# Thank you for attending

- **You are vital members of our GA safety community**