VFR tougher than IFR

- Weather is difficult to understand and forecast
- Weather can change rapidly
- As a competent IFR pilot, only the crazy bad stuff matters: icing, thunderstorms, ground fog
- While you’re a VFR-only pilot, the main risk of a non-local flight will be weather
Goal: make sure that an IFR plane coming out of a cloud will have time to see and avoid you.

• Visibility and cloud clearances
  – Class A: not applicable (IFR only)
  – Class B: 3 SM and clear of clouds
  – Class C: 3 SM and 500 feet below, 1000 feet above, 2000 feet horizontal
  – Class D: 3 SM and 500/1000/2000
91.155 - Basic VFR Weather Minimums

• Class E:
  – Below 10,000 MSL: 3 SM and 500/1000/2000
  – At/Above 10,000 MSL: 5 SM and 1000/1000/1 SM

91.155 - Basic VFR Weather Minimums

• Class G:
  – ≤ 1200 feet AGL:
    • Day: 1 SM and clear of clouds
    • Night: 3 SM and 500/1000/2000
91.155 - Basic VFR Weather Minimums

- Class G:
  - > 1,200 feet AGL and < 10,000 feet MSL
    - Day: 1 SM and 500/1000/2000
    - Night: 3 SM and 500/1000/2000
  - > 1,200 feet AGL and ≥ 10,000 feet MSL
    - 5 SM and 1000/1000/1 SM

- Class G Exceptions!
  - At night within 1/2 mile of runway, allowed to operate with 1 SM and clear of clouds
  - In controlled airspace around an airport, must have ≥ 1,000 foot ceiling and ≥ 3 SM visibility
VFR Weather Minimums

- With ATC Clearance
- 1 SM visibility
- Clear of clouds
- At night, aircraft and pilot are IFR equipped and rated
- ATC cannot offer; you must request
Cirrus Personal Minimum Matrix

Source: Public Domain

Certificate Types
Category & Class

Airplane
Glider
Rotorcraft
Lighter-than-air
Powered Lift
Powered Parachute
Weight Shift Control

Single-Engine Land
Multi-Engine Land
Single-Engine Sea
Multi-Engine Sea

Helicopter
Gyroplane
Airship
Balloon

Land
Sea
Categories and Classes

- With respect to certification of AIRCRAFT
  - Category
    - Normal (+3.8/-1.52g)
    - Utility (+4.4/-1.76g)
    - Acrobatic (+6/-3g)
    - Commuter and Transport
  - Class
    - Airplane
    - Rotorcraft
    - Glider
    - Balloon
    - Powered Lift

Four Forces of Flight

- Lift
- Weight
- Thrust
- Drag
Three Axes of Flight

- **Longitudinal (green)**
  - Nose to tail
- **Lateral (blue)**
  - Wingtip to wingtip
- **Vertical (red)**
  - Top to bottom

The Flight Controls

- **Elevator** to control **Pitch**
  - Motion about the lateral axis
- **Ailerons** to control **Roll**
  - Motion about the longitudinal axis
- **Rudder** to control **Yaw**
  - Motion about the vertical axis
Why Johnny Cessna can’t hover

Figure 2-6. As the angle of attack is increased, the separation point shifts near the trailing edge of the aileron and progresses forward. Finally, the aileron loses its lift and a stall condition occurs.

Source: Public Domain

Left Turning Tendencies

- Torque
- P Factor
- Spiraling Slip Stream
- Gyroscopic Precession
- This is not always a left turning tendency

Source: Public Domain
Altitude Definitions

- True — actual height above sea level
- Indicated — what is shown on altimeter
- Absolute — height above the ground
- Pressure — height above standard datum plane (29.92” Hg), read from altimeter set to 29.92”
- Density — pressure alt. corrected for non standard temperature

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Taxiway and Runway Markings

- ILS abeam area holding position sign:
  - This sign indicates a point on the taxiway which is to the right of the ILS course. ILS abeam area holding position signs are yellow and black and have chevrons on either side. They are used to position aircraft on the ILS approach and to separate the ILS approach from the taxiway. They are used to provide guidance for pilots during ground operations.

- Runway boundary sign:
  - This sign indicates the boundary of the runway. It is used to separate the runway from other areas of the airport.

- Runway holding position sign:
  - This sign indicates a point on the taxiway which is to the right of the ILS approach. ILS holding position signs are yellow and black and have chevrons on either side. They are used to position aircraft on the ILS approach and to separate the ILS approach from the taxiway.

- Directional sign for runway exit:
  - This sign indicates the direction of the runway exit. It is used to guide pilots as they prepare to take off or land.

- ILS threshold area boundary sign:
  - This sign indicates the boundary of the ILS threshold area. It is used to separate the ILS approach from other areas of the airport.

- Taxiway location sign:
  - This sign indicates the location of the taxiway. It is used to guide pilots as they navigate the airport.

- Outbound destination sign:
  - This sign indicates the direction in which aircraft are being directed. It is used to guide pilots as they navigate the airport.

- Inbound destination sign:
  - This sign indicates the direction in which aircraft are being directed. It is used to guide pilots as they navigate the airport.

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Source: Public Domain
Best Glide Ratio

- What airspeed would you fly when you lost your engine? Why?

- L/D\text{MAX} is the airspeed at which the aircraft covers maximum distance for a given altitude loss.

Thunderstorms

- Cumulonimbus = greatest turbulence
  - Conditions for thunderstorm formation:
    - Lifting action
    - Unstable air
    - Moist air

- Squall Line: frontal band of thunderstorms
  - Produce the most intense weather hazards for aircraft!
  - Typically develops in front of a cold front.
Mountain Wave Turbulence

- Get additional training before flying out West. Cessna v. Mountain is an unequal contest.

- Mountain Wave Turbulence:
  - Expect it when winds across a ridge are 40 knots or greater and the air is stable
  - Crests of mountain waves may be marked by lenticular clouds
    - Lenticular clouds can look stationary but may contain winds of > 50 knots!

Structural Icing

- Rime Ice
  - Freezing of tiny supercooled water droplets on impact
  - Usually on the leading edge of the aircraft
  - Stratus clouds

- Clear Ice
  - Large supercooled water droplets
  - Cumulus clouds
  - Freezing rain beneath a warm front inversion

- Mixed Ice
Aviation Routine Weather Report

METAR

• KPDK 161653Z VRB04KT 10SM OVC060 14/07 A3015 RMK AO2 RAE46 SLP209 T01390072=

• Location: Peachtree Dekalb Airport
• Date: 16th of the month
• Time: 16:53 Z
• Time: 12:53 PM EDT
• Wind Direction: Variable
• Wind Speed: 04 knots
• Visibility: 10 Statute Miles
• Clouds/Wx/Remarks: Overcast 6000
• Temperature: 14 C
• Dewpoint: 07C
• Altimeter Setting: 30.15 in Hg
• Remarks ...

Our Human Factors Summary

• The newest airplanes are essentially products of the 1950s.
• Therefore, you are the weakest link.
• Personal minimums should be a function of recent experience.
• If you know that you won’t be at your best, grab a co-pilot or CFI!
Magnetic Variation

- **Isogonic Lines** (correction factor to convert from True to Magnetic)
  - Dashed magenta lines on sectional charts
  - Memory aid: east is least, west is best (subtract east, add west)

*Deviation* is the compass card!

VORs are magnetic headings. If you forget the above, derive it from a Sectional chart.

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Flight Planning Tip

FAR 61/91 allow for a lot of dangerous stuff, e.g.:
- flying at night with no instrument rating
- flying single-pilot IFR with no autopilot
- planning to land on a minimum-length runway

Consider adopting FAR 135 (charter) and FAR 121 (airlines) operating limitations as personal minimums, e.g., land in 60 percent of runway.
Night flying advice

• Try to take off before civil twilight; gives you time to adjust to the world of darkness
• Americans are not smarter than Mexicans: Treat any non-local night flight as an instrument flight. Use IFR approach to find the correct runway at the correct airport (alternative)
• Choose a big airport as your destination
• Ballistic parachute is comforting at night

Owner/Operator is Responsible

• “The owner or operator of an aircraft is primarily responsible for maintaining that aircraft in an airworthy condition” (91.403)
• 91.405: “Each owner or operator of an aircraft
  – “Shall have that aircraft inspected…”
  – “Shall ensure that maintenance personnel make appropriate entries in the aircraft maintenance records…”
  – Must fix or placard INOP anything broken
91.3 - Responsibility and Authority of PIC

- Pilot in command is directly **responsible** for, and is the **final authority** as to, the operation of the aircraft
- Allowed to deviate from rules in an emergency
- Report deviation *if requested to*

Safety is not high-tech

- Well, if the fanciest airplanes were as smart as the cheapest DJI drones, maybe it would be...
- Airline safety can be adapted to GA:
  - Recurrent training
  - Develop and practice instrument flying skills
  - Two-pilot crew
  - Checklists
All of those regulations

Code of Federal Regulations

http://www.ecfr.gov

Title 14 – Aeronautics and Space

Most relevant parts:
• Part 1 – Definitions and Abbreviations
• Part 39 – Airworthiness Directives
• Part 43 – Maintenance
• Part 61 – Pilot Certification
• Part 67 – Medical Certification
• Part 91 – General Operating Rules

Title 49 – Transportation

Part 830 – Notification and Reporting of Accidents

<Title #> CFR <Part #>.<Regulation #>
e.g. 14 CFR 61.56

Study Guide

To get close to 100 on the FAA Knowledge test:
• Re-read the FAA textbooks
• Read FAR/AIM
• Read an ASA or Gleim test-prep book (or use the online equivalents)
• To finish this class:
  https://www.kingschools.com/free-faa-exam/private-pilot
Next Steps

- Join the MIT Flying Club
- Visit a flight school...
  - Hanscom Field (East Coast Aero Club)
  - Norwood (ECAC, Horizon, or Blue Hill Helicopters)
  - Beverly (Avier)
  - Lawrence (Eagle East)

Thanks

Thanks for spending this week with us.