PPL Ground School Syllabus

Class 1: All About Air

You're down by 3 runs. The bases are loaded! It's full count as the fastball comes right down the pipe.

Now, are you more likely to hit a homerun on a hot and humid July night, or a cold and dry evening in October?

Can you use the same recipe to bake an apple pie in Toronto as you can in Calgary?

This class is an investigation into the medium in which we fly: air! This is foundational! You will learn about:

1. Composition of air
    a) Avogadro's Law
2. How air behaves and why
    a) Effects of altitude and temperature
    b) Datum and lapse rate
    c) ICAO: International Civil Aviation Organization and ISA: International Standard Atmosphere
3. Different Altitudes
    a. ASL: above sea level
    b. AGL: above ground level
    c. Pressure altitude
    d. Density altitude
4. Effects of Air on Performance
    a. Takeoff
    b. Airspeed
    c. Fuel
    d. Aerodynamics
5. **AIR LAW**: Oxygen Requirements

As this is our first class together, we'll talk about the course:

6. What makes a good pilot: competence versus proficiency
    a. Knowledge
    b. Skills
    c. Situational awareness
    d. Judgement
    e. Attitude
    f. Risk

7. Course Overview: what are the parts and how do they fit together
    a. Aeronautics and General Knowledge
    b. Air Law
    c. Meteorology
    d. Navigation
8. Assessment and Evaluation
    a. Term Tests
    b. Supplementary Tests
    c. BFC Qualifying Exam
    d. Transport Canada PPL Exam
9. What strategies lead to success – 100% - in this course?
    a. Attitude
    b. Time commitment
    c. Preparation
    d. Weekly online reviews on *Classtime*
    e. Asking questions
    f. What the successful graduates say…
10. Housekeeping Items:
    a. Start time
    b. Break
    c. Cell phones
11. Student Handbook

Homework

I. Classtime Review #1: About Air
II. FGU: Chapter 1: *The Airplane* (p. 3) is interesting, but not essential reading; we'll learn much of this as we go along.
Chapter 2 – *Theory of Flight* (p. 15) is crucial reading for next class. Focus on the following sections: 2.1.1, 2.1.2, 2.1.5. Also, read about *Wake Turbulence* (p. 281) 10.4 and avoiding it 10.4.1.

Class 2: Aerodynamics

"Scotty, have ya noticed tha' me ol' and scuff'd up golf balls go a wee bit farther than the nyooo ones!"

How is it that a sailboat can sail faster into *the wind than it can with the wind at its back?*

There's a glider that, from merely 5000' above the ground, can glide for more than 100 miles!

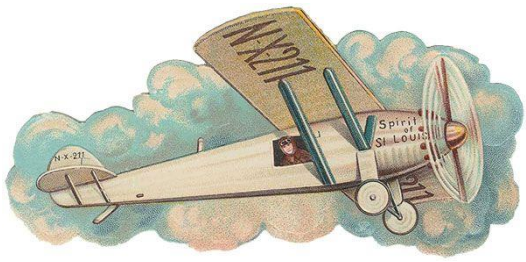
Last class we looked at the medium in which we fly: air. In this class, we will explore ways we can manipulate that medium to our advantage. We call this field of study AERODYNAMICS! Here's what we'll explore in class #2:

1. Aerodynamics
    a) A definition
    b) Why we need to understand aerodynamics
2. Four forces acting on an airplane
    a. Lift
    b. Drag
    c. Weight
    d. Thrust
3. The nature of Lift: the key players
    a. Newton
    b. Bernoulli
    c. Coanda
    d. Euler
4. The Aerofoil
    a. Aerofoil grammar
    b. How the aerofoil manipulates the air to create lift
    c. Boundary layer: laminar airflow versus turbulent airflow
    d. Flaps and Slats
    e. Aerodynamic stall
5. **AIR LAW**: Clean wing concept
6. The Wing
    a. Wing grammar
    b. Wing washout
7. Drag
    a. Induced drag
    b. Parasite drag
    c. Wing vortices
    d. Ground Effect
    e. Wake turbulence
8. Thrust
    a. Propeller aerodynamics

Homework

I. Classtime Review #2: Aerodynamics
II. FGU: Chapter 2 – *Theory of Flight* (p. 23) 2.1.3, 2.1.4, 2.1.5; *Weight & Balance* (p. 268): 10.2
III. Read NTSB Safety Alert: *Minding Weight, Maintaining Balance*
IV. Bring a calculator for next class; you can't use your phone!

Class 3: Stability, Load Factor, Weight & Balance



"So that's how Lindberg was able to go so far! Nice trick, Charlie!"

How can an airplane that weighs 2250 lb on the ground weigh 2300 lb in the air?

This is one of several classes that could save your life! So, *pay attention!*

The fact is that we rarely - if ever - fly through our medium of air when it's perfectly calm. Remember, like the sailor, we are moving through a moving medium. We need to understand the importance of stability, what happens to our aircraft when it is out of equilibrium, and how to fix it!

1. Axes:
    a) longitudinal
    b) lateral
    c) vertical
2. Control surfaces on an airplane
3. Stability
    a) Dynamic
    b) Static
4. Design characteristics to maintain stability:
    a) Roll
    b) Pitch
    c) Yaw
5. Taxiing in Wind Conditions
6. Elevator and Rudder Trim Tab Behavior
7. Aircraft Weight
    a) Standard Empty Weight
    b) Basic Empty Weight
    c) Ramp Weight
    d) Maximum Takeoff Weight
8. What is Center of Gravity
    a. Along vertical axis
    b. Along longitudinal axis
    c. C of G and Thrust line
9. Effect of aft / forward C of G
10. Calculating Center of Gravity limits
    a. Graph Method
    b. Table Method
    c. Correcting for Out of Center of Gravity Limits
11. Load factor
    a. Calculation
    b. In a turn: angle of bank
    c. Impact on stall speed

Homework

I. Classtime Review #3: Stability, Flight Controls, Load Factor
II. Classtime Review #3A: Weight and Balance
III. FGU: Chapter 3 – *Aero Engines* (p. 47) Focus on sections: 3.1.3, 3.1.4, 3.1.7, 3.1.10, 3.1.11, 3.2.7, 3.2.8, 3.3.1, 3.3.2, 3.3.5, 3.4, 3.5.2, 3.5.3, 3.7, 3.8.2

Class 4: Engines & Systems

Remember that apple pie you're going to bake in either Calgary or Toronto? To get it right, it's all about stoichiometry! *(It's the same with your airplane's carburetor – stoichiometry!)*

Speaking of carburetors, did you know that air passes through it as fast as 800 mph? And that the temperature in that little gizmo can drop 40°C?

What does an old hand-crank telephone have in common with an airplane's electrical system?

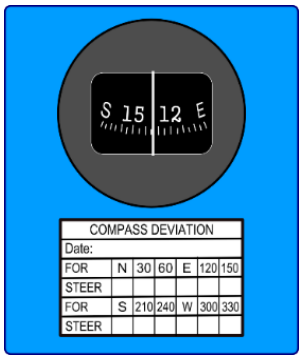
Unlike the relationship we have with our cars, we need to know how our airplane's engine and various systems work. A sound understanding of how an airplane engine and other systems function will help us keep them functioning! Or make us aware of a problem on the ground before we takeoff. Remember, you can't just "pull over" if you get in trouble. This is another "save your life" class!

1. Basics of the four-stroke engine
    a. The problem of heat
    b. Oil
2. The carburetor
    a. Mixture: stoichiometry
    b. Rich and Lean: flame front propagation
    c. Carburetor ice
3. Ignition system
    a. Live-mag check
    b. Dead-mag check
4. Fuel
5. **AIR LAW:** minimum fuel requirements and fueling procedures
6. Exhaust system
    a. turbocharging
7. Electrical system

Homework

I. Classtime Review #4: Aero Engines and Systems
II. FGU: *Flight Instruments* (p. 33) Sections: 2.2.1, 2.2.3, 7.2.1, 7.2.2

Class 5: Flight Instruments



"What are you doing with that magnetic compass in the living room?"

"Rearranging the furniture!"

An early form of the magnetic compass was created by Chinese inventors around 250 BCE. They used the device to help them align buildings and furniture according to the environment and forces of nature. This technique is called feng shui *and is still used today. More than a thousand years would pass before the same Chinese culture would use the compass for navigation. Imagine, a flight instrument that has been around – and fundamentally unchanged – for more than two millennia is still required equipment on an airplane!*

The instruments in our cars provide important information about three things: the machine, the car's motion, and where the car is on the planet. The instruments in front of you as pilot function in the same way. But, just like the aerofoil and the engine, we need to understand *how* these instruments work. Not so much to keep them working, but to recognize when they're NOT working! Failing to recognize a blocked pitot tube can be – and has been – fatal.

1. Magnetic compass
    a. True North versus Magnetic North
    b. Magnetic variation / declination
    c. Isogonic and Agonic lines
    d. Deviation
    e. Magnetic Dip
    f. Acceleration / Deceleration errors
    g. Turning errors
2. Pitot-Static Instruments
    a. Airspeed indicator (ASI)
        i. Different airspeeds
        ii. Airspeed errors
    b. Vertical Speed Indicator (VSI)
    c. Alternate static source
    d. Altimeter
        i. Datum
        ii. ICAO standard pressure and lapse rate
        iii. Altimeter setting error
3. Gyroscopic Instruments
    a. Properties of a gyroscope
        i. Rigidity in space
        ii. Precession
    b. Attitude Indicator (AI)
    c. Heading Indicator (HI)
    d. Turn Coordinator
    e. Vacuum failure
4. **AIR LAW:** minimum equipment list for Day and Night VFR flights

Homework

I. Classtime Review #5: Flight Instruments
II. FGU: *Airplane Performance* (p. 272) Sections: 10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.8
III. You will need a calculator for next class; no phones!

Class 6: Performance and Performance Calculations

Hot and humid summer days may be a good time to be at the beach. But getting there in your Cessna 172 may not be such a good idea!

You may need as much as 30% more runway! And your engine may lose as much as 10% of its rated horsepower! And if that runway is grass and you're close to max takeoff weight with a picnic cooler and all that beach gear… It might be a recipe for a disaster. Indeed, too often it has been.

You've already learned about some important limits when it comes to flying an airplane: weight and balance, load factor, stall speed. In this class, you'll learn about speed limits. Not so you don't get a ticket; but so you don't break the airplane! You'll also learn how to calculate takeoff distance so you know you not only have enough runway, but so you can clear those power lines beyond the end of the runway. You'll also learn about crosswinds and headwinds, both important considerations for takeoff and landing. And, when it comes to wind, your plane can handle only so much!

Yes, another save-your-life class, aviators!

1. Every airplane and every flight have LIMITS!
    a. Knowing the limits + respecting the limits = safe aviation
2. What can affect performance
    a. During takeoff
    b. During cruise
    c. During landing
3. Performance Limits in the POH
    a. The V speeds
    b. Best Angle of climb speed
    c. Best Rate of climb speed
    d. Vglide speed
4. **AIR LAW:** gliding distance and flights over water
5. Determining crosswind and headwind components
    a. Maximum demonstrated crosswind
6. Calculating takeoff distance
7. Where to find runway surface condition (RSC) information: NOTAM

Homework

I. Classtime Review #6: Performance and Performance Calculations
II. FGU: *Aerodromes and Airspace* (p. 89) Sections: 4.1.1, 4.1.4, 4.1.5, 4.1.6, 4.1.7, 4.1.8, all of 4.2
III. FGU: *Air Rules and Procedures* (p. 107) Sections: all of 5.1, 5.2.1, 5.2.2, 5.2.3, 5.2.5, 5.2.7, 5.2.9, 5.2.10, 5.2.12, 5.2.16

Class 7: Air Law

A person operated an aircraft at a distance less than 500 feet from any person, vessel, vehicle or structure. (CAR 602.14) $1000 fine!

A privately owned C152 on a flight to Courtney Park, BC (CAH3) flew into airspace closed by NOTAM for a Snowbirds practice.

A rented C172 failed to stop at the Hold Short line at Brantford (CYFD) forcing an inbound Bearskin Fairchild to overshoot.

A Piper Cherokee entered the Kitchener-Waterloo control zone without obtaining a clearance. $1000 fine!

"Insisting on your rights without acknowledging your responsibilities isn't freedom. It's adolescence."

Michael Okuda

Flying is truly one of the most liberating experiences one could have: to "slip the surly bonds of earth and dance the skies on laughter-silvered wings," as poet John Gillespie Magee so eloquently wrote in "High Flight."

There's no place in those skies for pilots who want to enjoy the right to fly yet not acknowledge their responsibility for knowing and abiding by the rules. These are pilots who think like an adolescent and pose a danger to themselves, their passengers and other pilots.

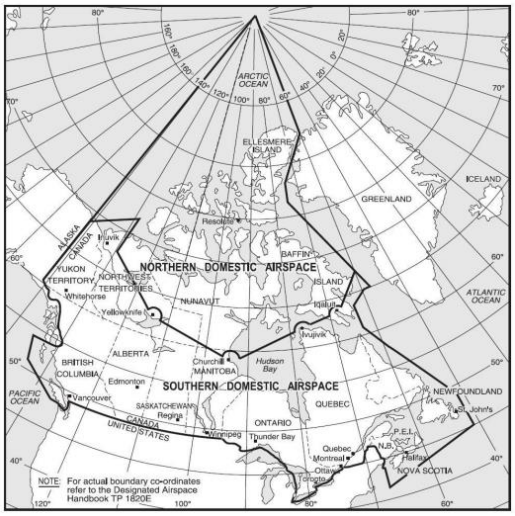
This topic of the PPL Ground School Course is pretty much learned by rote. There's no way around that: you just have to *memorize* and *remember* the rules.

You can see from the class agenda that there are a lot of topics – rules! – we're going to cover. Frequent review of this class is strongly encouraged! Prior to obtaining your student permit allowing you to fly solo, you must pass a PSTAR (Pre Solo Test of Air Regulations) exam with a minimum of 90%!

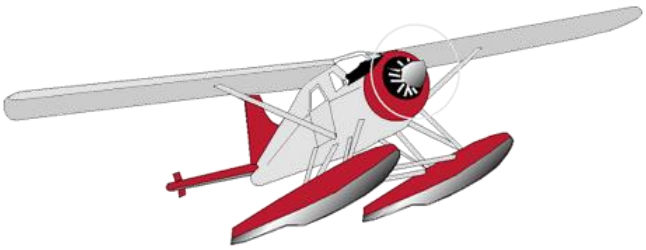
This is not only another save-your-life class; it's also save-your-license and your bank account!

1. Where are the rules?
    a. Canadian Aviation Regulations: CARs
    b. Aeronautical Information Manual: AIM

2. Air Space
    a. Northern Domestic airspace
    b. Southern Domestic airspace
    c. Standard Pressure Region
    d. Altimeter Setting Region
    e. Controlled airspace
    f. Uncontrolled airspace
    g. Classes of Airspace: A, B, C, D, E, F, G
3. Control Zones
    a. Terminal Control Areas: TCA
    b. Mandatory Frequency: MF
    c. Aerodrome Traffic Frequency: ATF
4. Surveillance
    a. Transponder Codes
    b. ADS-B
5. Air Traffic Control: ATC
    a. Clearances
    b. Instructions
6. Aerodromes
    a. Canada Flight Supplement
    b. Apron versus Maneuvering area
    c. Runway markings
    d. Displaced threshold
    e. Airside markings
    f. Approach lighting
    g. ARCAL lighting
    h. Minimum runway lighting
    i. Light gun signals
7. Uncontrolled Aerodrome
    a. Landing procedures
    b. Departure procedures
8. VFR Weather minima
    a. Controlled / uncontrolled airspace
    b. Day / night
9. Special VFR: SVFR
10. Minimum VFR altitudes
    a. Over built-up areas
    b. Over non-built-up areas
    c. Over non-populated areas
    d. Over water
    e. Over special farms
    f. Over provincial / national parks
    g. Over aerodromes



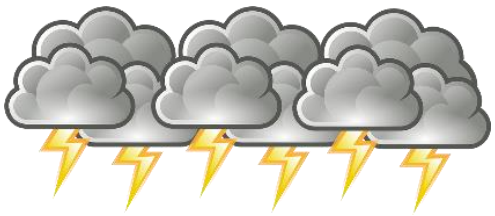
11. Cruising altitudes
12. Flight plans / itineraries
13. On-board documents
14. Minimum equipment
    a. Day VFR
    b. Night VFR
15. Definition of “night”
16. Fuel
    a. VFR minimum fuel requirements
    b. Fueling regulations
17. Starting / running aircraft engine
18. Seatbelts / shoulder harnesses
19. Minimum survival equipment
20. Flying over water
21. Position reports
22. Clean wing concept
23. Minimum oxygen requirements
24. Alcohol / cannabis
25. Over the counter prescriptions
26. Anesthetic
27. Recency / currency requirements
28. About your pilots’ license
    a. Surrendering?
    b. Medical requirements
29. Aviation occurrences
    a. Accidents
    b. Incidents
    c. Reporting



Homework

I. Classtime Review #7: Air Law
II. FGU: *Human Factors* - all of section 11 pp. 309 – 321
III. Send the instructor detailed questions about topics you wish to review next class in preparation for the First Term Test.

Class 8: Human Factors and Pilot Judgement



The following conversation takes place between an instructor and his student as the plane approaches for landing at the end of the first lesson. The student has control.

Instructor: "Well, do you think we're a little high or a little low?"

*Student: (how the *&%$ should I know?) "I think we're a little bit looooo…. HIGH!"*

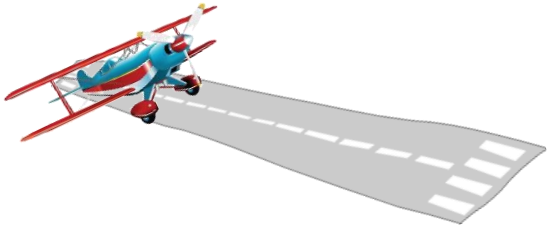
Instructor: "Well, what are you going to do about that?"

*Student: (how the *&%$ should I know?) "Uuuuhhhh… decrease the power and raise the nose a little?????"*

Instructor: "Well, give it a try and let's see what happens!"

The instructor in this scenario is asking questions; the student pilot is expecting answers.

There's much more to flying than knowing all the rules and being skilled at the controls: having "good hands and feet," as they say. While all this is important, the fact is that situations are going to arise that demand sound judgement. Most aviation incidents can be traced to someone – usually the pilot – exercising poor judgement and making a bad decision.



This class will explore those forces that exert influence on pilot judgement: psychological, physiological, personal, attitudinal, cultural, environmental and chemical. Some of these forces we're not even aware of; that can be deadly!

"Knowing yourself is the beginning of all wisdom."

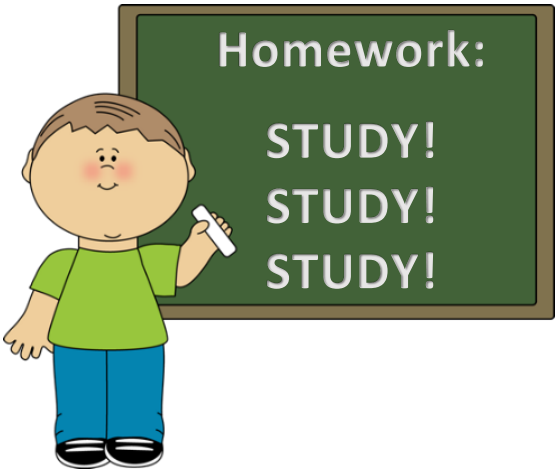
Aristotle

1. Human Factors that affect pilot / crew decision making
    a. Personal
    b. Psychological
    c. Cultural
2. Physiological
    a. Vestibular illusions
    b. Visual illusions
        i. At night
        ii. Landing
        iii. Empty field myopia
        iv. Downwind to base illusion
        v. Featureless terrain
        vi. Rain on windscreen
        vii. Haze
    c. Blood donations
    d. Scuba diving

e. Hypoxia
f. CO2 poisoning
g. Hyperventilation
h. Alcohol & smoking
i. Medication

3. Swiss cheese model of bad judgement

NOTE: The material in this class will be covered in the first part of the session. The second half will be devoted to reviewing topics in preparation for the Term Test next week. These review topics will be decided by the class according to their needs.



Class 9: First Term Test

This test will consist of 100 multiple-choice quesitons: 60 on Aeronautics / General Knowledge and 40 on Air Law.

To qualify for the BFC Qualifying Examination at the end of the ground school course, you must achieve a passing grade of 80% in each of these areas.

Homework

Check your First Term Test answers on Classtime.

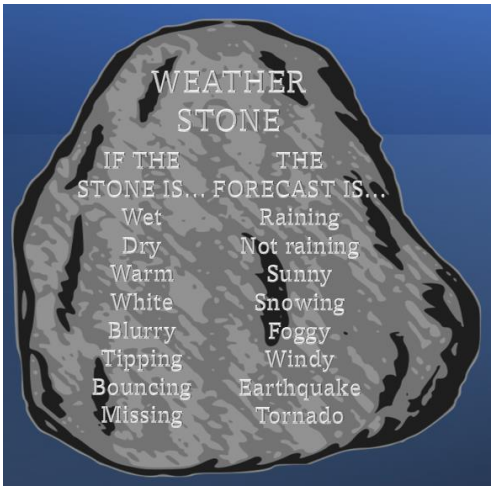
Class 10: First Term Test Review

During this class we will review common errors made on the First Term Test. Students who did not achieve a passing grade in either area – A/GK or Air Law – will have an opportunity to write a supplementary test the evening of Thursday, November 14th at 7:00 pm.

Homework

I. FGU: *Aviation Weather* (p. 123) Sections: 6.1.1, 6.1.2, 6.1.3, 6.3, 6.4, 6.5.2, 6.5.3, 6.11

Class 11: Metorology Theory Part I



Water can exist in three states. Which do you think a cloud is?

After takeoff, get ready to crab to the right; the wind is going to change direction!

Ever wonder why the diurnal temperature change in the desert can be as much as 40°C?

Which part of an airplane is going to collect ice first?

How can frost exist on a wing if the air temperature is above freezing?

Water does not have to freeze until -48°C!

In a word, weather is the pilot's number one threat! That's why the study of it is so important for the aviator. When discussing aviation accidents, you'll often hear or read the phrase "VFR into IMC." That means the pilot has a VFR rating and flew into Instrument Meteorological Conditions. That is, weather conditions requiring an Instrument Rating. Such events have the highest fatality rate of all aviation occurences.

While VFR into IMC is often assumed an unintentional digression by pilots, human factors expert Douglas Wiegmann notes that the cause of such occurrences is "often found to be a willful disregard for the regulations and cues that dictated an alternative and safer course of action."

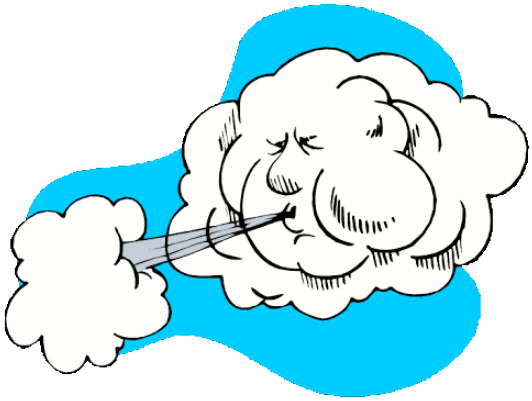
You guessed it: our classes on Meteorology are SYL – "Save your life!"

The first part of our 3 classes on Meteorology is theoretical. We'll then look at Practical Meteorology: reading weather reports and forecasts.

NOTE: *Reading the preparatory material in FGU, highlighting key points and making notes will help enormously with this part of the course.*

1. Properties of the atmosphere
    a. Mobility
    b. Compression
    c. Expansion
2. Heat vs Hot
3. Water vapour and changes of state
    a. Latent heat
    b. Molecular energy and movement
    c. Net evaporization / condensation
4. Layers of the Atmosphere
    a. Isothermal layer
5. Heating the troposphere
    a. Heat capacity of water versus soil

6. Cooling the troposphere
7. Adiabatic lapse rates
    a. Dry adiabatic lapse rate DALR
    b. Saturated adiabatic lapse rate SALR
8. Air mass stability
9. Inversions
10. Altimetry
    a. High and Low pressure systems
    b. Isobars
    c. Pressure gradient
    d. Divergence / convergence
11. Coriolis effect
12. Station Pressure
13. Mean sea level pressure MSL
14. Wind
    a. Pressure gradient force
    b. Geostrophic wind
    c. Buys-Ballot's Law
    d. Veering / backing winds
    e. Sea breeze / land breeze
    f. Anabatic / katabatic winds
    g. Gust / squall
    h. Turbulence
    i. Mountain wave
    j. Wind shear



Homework

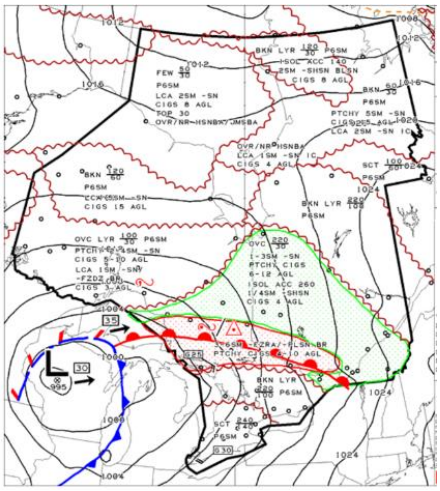
I. Classtime Review #9: Meteorology Theory I
II. FGU: *Aviation Weather* (p. 124) Sections: 6.1, 6.2, 6.5.1, 6.6, 6.7, 6.8, 6.9
III. FGU: *Weather Information* (p. 161) Sections: 6.14.3, 6.14.4

Class 12: Metorology Theory Part II and Practical Meteorology Part I

1. All about clouds
    a. Why and how clouds form
    b. Dew point
    c. Condensation nuclei
    d. Relative humidity & air temperature
    e. Cloud cover: Oktas
2. Fog
    a. Conditions for formation
    b. Types of fog
3. Visibiltiy
    a. Prevailing visibiltiy
    b. RVR: runway visual range
    c. Obscurations to visibility
4. Precipitation
    a. Conditions for precipitation
    b. Coalescence
    c. Supercooled water droplets
    d. Snow
    e. Lake-effect snow
    f. Types of precipitation: continuous / showery
    g. Forms of precipitation
5. Air masses and Fronts
    a. Air mass modification
    b. Types of fronts
    c. Frontogenesis / Frontolysis
    d. Naming of fronts
    e. Frontal weather
    f. Winter warm front
6. Thunderstorms
    a. Requirements for formation
    b. Stages
    c. Hazards to flight
    d. Virga
    e. Hail
7. Airframe icing
    a. Conditions for ice formation
    b. Types of icing
    c. Collection efficiency
    d. Hoar frost and cold-soaking
    e. Hazards to flight

Practical Meteorology Part I

1. Weather Services available
2. METAR
3. TAF



Homework

I. Classtime Review #10: Meteorology Theory II
II. FGU: *Weather Information* (p. 161) Sections: 6.14.26.14.6

Class 13: Practical Meteorology Part II

1. GFAs
2. Upper Wind and Temperature forecast: FDs
3. Significant Weather Prognostic Chart
4. PIREPSs
5. AIRMETs
6. SIGMETs

Homework

I. Classtime Review #11: Practical Meteorology
II. FGU: *Air Navigation* (p. 177) Sections: 7.1, 7.4.1, 7.4.2, 7.4.3, 7.4.4, 8.1.4
III. Bring VNC (VFR Navigation Chart) and a calculator. You can't use your phone as a calculator!

NAV CANADA Aviation Weather Web Site

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What's New | Weather and NOTAM | File a Flight Plan | Publications | Update Profile | FIC Tel.

My Wx Data/Wx Mail | Route Data | Regional Area Data | Local Data | Forecasts and Observations

NOTAM are not available on AWWS. AWWS News : There are 4 active notices. Last update: 2022/01/24

Request Generated 08/16/2022 at 22:54:44 UTC . Weather information available at that time is displayed.

METAR/TAF

HAMILTON/ON

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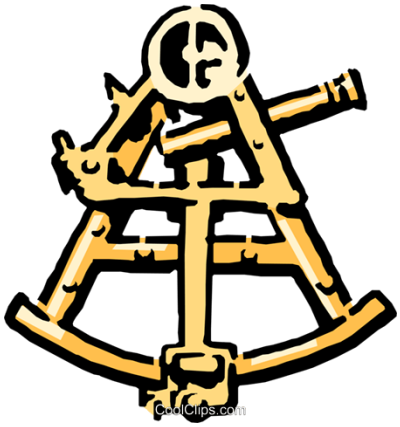
FM170400 02006KT P6SM BKN100
FM171500 VRB03KT P6SM SCT050
RMK NXT FCST BY 170000Z

Your time 16 Aug 2022 18:55:14 UTC time 16 Aug 2022 22:55:14 Clock Disclaimer Log out

Weather data provided by Environment Canada and NAV CANADA

Class 14: Navigtion Maps and Charts



Remember that flat map that was on the wall of your elementary school classroom? Well, it's now banned!

Despite the prevalence of satellite-based navigation (GPS), the United States is committed to maintaining almost 600 ground-based navigation aids. Interestingly, both of these aids – the VOR and the ILS – were invented in the 1930's!

If you're a pilot someone would describe as being "on the beam," it means that you're on the right track, functioning well, alert, keen, quick to learn something. Did you know that expression comes from the world of air navigation?

We now begin the last phase of our ground school course: Navigation! The next several classes will get you ready to leave the circuit and the practice area for that exciting cross-country trip: the kind of flying we really want to enjoy. In one sense, navigation has never been easier with the advent of panel-mounted GPS units coupled to the auto-pilot. But the aviator who lacks an understanding of what's going on underneath all that technology is ill-equipped to handle an emergency: things break. Electrical systems can fail. Constant awareness of position is critical for aircraft pilots.

Not only that, solving the problems of what heading to fly and how long it will take you to get to Orillia for lunch is just great fun!

This first navigation class explores the maps and charts we use with special emphasis on understanding the various symbols in the legend of the VNC. We'll also look at the concepts of *track, heading, bearing* and *course.*

1. What does it mean to "navigate"?
    a. Ground vector
    b. Air vector
    c. Wind vector
2. Maps
    a. Parallels of latitude
    b. Meridians of longitude
    c. Great circle
    d. Rhumb line
    e. Projections
3. VNC Chart
    a. Validity
    b. Finding degrees of latitude and longitude
    c. The VNC legend
4. Track, heading, bearing, course
    a. Reciprocals
    b. Determining the reciprocal track with wind drift

5. Radio Signals
    a. Ground waves
    b. Sky waves

Homework

I. Classtime Review #12: Navigation Part I
II. FGU: *Radio Navigation* (p. 231) Sections: 9.1, 9.5, 9.6, 9.8.3, 9.10.1, 9.10.3, 9.11

Class 15: Radio Navigation

The word "radio" became popularized in the early 20th century with the development of different radio-based technologies. The word itself originates from the Latin 'radius', meaning 'ray' or 'beam'.

On July 6, 1920, US Navy seaplane pilots used a radio compass to locate and navigate their way to a ship 100 miles offshore, marking the first use of radio navigation by an aircraft.

This class will focus on the two primary radio navigation instruments upon which pilots depend: the VOR and the ADF. With both of these instruments, you will learn interpretation, orientation and homing to a beacon. We will also look at Distance Measuring Equipment (DME), the Emergency Locator Transmitter (ELT) and radar surveillance. We'll finish up with a look at the Global Navigation Satellite System (GNSS).

1. The VOR: VHF Omnidirectional Range
    a. The US Minimal Operational Network
    b. How the VOR works
    c. VOR on the VNC
    d. Orientation
    e. Serviceability
    f. Reception distance
    g. VOR to determine position
    h. Intercepting a VOR radial
    i. VOR voice communication
    j. Advantages / Disadvantages
2. Distance Measuring Equipment
    a. Slant-range error
3. Automatic Direction Finder – ADF – and Non-Directional Beacon – NDB
    a. Fixed card ADF
    b. Relative bearing
    c. Station passage
    d. Correcting for wind drift
    e. Intercepting track TO a beacon
    f. Serviceability
    g. ADF voice communication
    h. Advantages / Disadvantages

4. VORTAC and TACAN
5. RMI and HSI
6. Transponder
    a. Special codes
    b. "Squawk ident"
7. **AIR LAW:** when is a transponder required equipment?
8. Radar
    a. Primary surveillance radar
    b. Secondary surveillance radar
9. Emergency Locator Transmitter ELT
    a. Different types of ELT
    b. Testing ELT
10. GPS
    a. RAIM: Receiver Autonomous Integrity Monitoring
    b. WAAS: Wide Area Augmentation System

Homework

I. Classtime Review #13: Navigation Part II
II. FGU: *Navigation Problems* (p. 197) Sections: 7.5.1, 7.5.27.5.3, 7.5.4
III. Flight Planning Materials: VNC, plotter, ruler, flight calculator (electronic or whizwheel), calculator, pencil, pink highlighter

Class 16: Flight Planning

In this class, we'll determine just what information we require to successfully plan a flight. Believe it or not, all we need to know before we take off is what magnetic heading to fly and how long it's going to take to get to our destination. Ah…, but there's a lot more we need to investigate and calculate to arrive at these two variables. There are also some chart preparations for enroute surprises; these we'll look at next week. One of the most important sources of information is *The Canada Fight Supplement* which I reverently refer to as "The Bible." We'll have a close look at how to read the bible!

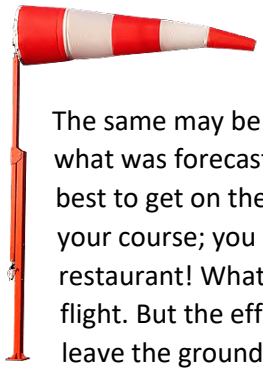
1. CFS
    a. Sections
    b. Airport entry information
    c. Airport diagram
    d. Obstacle clearance circle
2. Pilotage / Deduced (dead) Reckoning
3. Review: air vector, wind vector, ground vector
4. Airspeeds: ICE-T
    a. True Airspeed and Calibrated Airspeed on the Whizwheel
    b. KIAS and KCAS in the Pilot Operating Handbook (POH)

5. Performance Charts
    a. Cruise Performance Chart
    b. Time, Fuel, Distance to Climb Chart
6. True to Magnetic Track
7. The Flight Planning Sheet

Homework

I. Classtime Review #14: Navigation Part III
II. FGU: *Air Navigation* (p. 194) Section: 7.4.7

Class 17: Enroute Procedures and Diversions



"The best-laid plans of mice and men go oft awry."

Robert Burns

The same may be said of the best planned planes on a cross-country flight: the winds aren't quite what was forecast and you've drifted off course; one of your passengers isn't feeling well and it's best to get on the ground as soon as possible; the weather is deteriorating and you need to alter your course; you change your mind from a hamburger to fish 'n chips and change your destination restaurant! Whatever the reason, the proficient pilot is always prepared to make changes mid-flight. But the efficiency and safety of these decisions depend on careful preparation before you leave the ground.

Also tonight, you will be presented with the *Cross-Country Project*. This is a culmination of everything you've learned about navigation and will simulate each component of the cross-country flight you will be asked to plan for your flight test. This includes takeoff calculations as well as those pertaining to weight and balance.

1. Preparing the chart
    a. Drift lines
    b. Mileage line
    c. Landmarks
2. The Flight Log
3. Diversions
    a. Finding the magnetic track
    b. Determining distance
    c. The Wind Card
4. VHF Direction Finder: DF Steer
5. ICAO Flight Plan / Itinerary
6. The Cross-Country Project

Homework

I. Classtime Review #16: Cross-Country Flight
II. Study for Second Term Test