Navigation - Flight Planning Notes

Initial Preparation

- The key to a successful trip is being well organized and prepared
- Allow plenty of time to obtain and prepare as much information as possible prior to the flight
- You will need:

    - Current Charts, a current CFS, POH and an up-to-date AIP
    - Protractor, Chart Rule, Pencils and Colored High Liters
    - E6B Computer and Calculator
    - Weight and Balance Form, Flight Plan Log and ICAO Flight Plan

- Items that can be obtained or completed in advance are:

    - Route Selection and Chart Preparation
    - Aerodrome Information
    - Long Range Weather Forecast
    - Preliminary Weight and Balance
    - On the Flight Plan Log
        - From / To
        - MOCA
        - True Track
        - Magnetic Variation
        - Distances
        - Radio Frequencies
        - Navigation Aids and Frequencies
        - Checkpoints

Final Preparation

- If the initial preparation has been completed, final preparation on the day of the flight will be that much easier
- Items that must be obtained, checked and completed on the day of the flight are:

    - Actual Weather Reports / SIGMETS / NOTAMS / PIREPS
    - Aerodrome Information
    - Completion of Flight Plan Log and Final Weight and Balance Calculation
    - Filing of Flight Plan
    - Aircraft Documents and Journey Log

Navigation - Flight Planning Notes

FLIGHT PLANNING GUIDELINE

Initial Preparation

1. Decide where you want to go. Check the CFS and ensure the destination airport is suitable:

    - Runway Surface, Width, Length, Alignment
    - Availability of Services
    - Type of Communications (ATF, MF, CZ) and Radio Frequencies
    - Special Requirements / Procedures (read **PRO** and **CAUTION** sections carefully)
    - Field Elevation, Surrounding Terrain, Circuit Direction

2. Complete a Preliminary Weight and Balance Report:

    - Obtain weights of passengers and baggage
    - Calculate amount of fuel that can be carried. Is it enough? Is the aircraft within weight limits? Adjust accordingly:

        - take less baggage
        - take fewer passengers
        - arrange for less fuel to be in tanks prior to flight (if less fuel being carried, you may have to plan refueling stops en route)

3. Select Appropriate Chart(s):

    - VNC / WAC / VTA / US Sectional
    - Chart(s) must be current (see AIP)

4. Choose the Route:

    - Make it as straight as possible
    - Note Airspace Restrictions (Especially Class F)
    - Note Airspace Equipment Requirements (Radio / Transponder)
    - Determine Elevation of Terrain and Obstacle Clearance (MEF / MOCA)
    - Note Availability of Alternate Airports
    - Identify Clear Landmarks and Map Reading Requirements

- Calculate Gliding Distance if Flying over Water
- Select Communication and Navigation Aids
- Consider Fuel Economy and Requirements
- Consider Pilot and Passenger Requirements (small children may need more stops)
- Consider Populated / Sparsely Populated Areas
- Recommended VFR Routes and Airways
- Avoidance of High Density Traffic Areas
- Altitude Capability (Service Ceiling)
- **SAFETY**

5. Chart Preparation

A. Choose Departure Method

- Overhead
- En Route
- Off Airport (Set Heading Point)
- Review Procedures (see **Attachment #1**)

B. True Track

- Draw a line from the Airport of Departure or SHP to the transition point(s) or Airport of Destination, if going direct
- Lines should be solid, dark, neat and distinguishable
- Use a yellow High Liter or transparent tape for clarity
- Use a protractor to measure the direction of your True Track line and record on the Flight Plan Log (place protractor at the midpoint of the True Track line to obtain a more accurate heading)
- Use your chart rule and measure the length of your True Track line and record on the Flight Plan Log (make sure you use the scale appropriate to the chart)

C. 10° Drift Lines

- Use your protractor to measure and mark 10° drift lines each side of the True Track from the Airport of Departure or SHP and from the transition point(s) or Airport of Destination
- Extend drift lines approximately two-thirds the length of the True Track
- Make them distinct from the True Track line (dashed lines)
- Drift Correction Methods (see **Attachment #2**)

Navigation - Flight Planning Notes

D. 10 Mile Marks

- Make small marks along the True Track at 10 NM increments back from the Airport of Destination and mark accordingly (e.g.: 10, 20, 30 . . .)
- These will assist in assessing your progress during flight

E. Fractional Distance Marks

- Make larger marks dividing your True Track line into equal segments (one-quarter, halfway and three-quarters)
- These will help you to revise your ETA quickly without the use of a computer

F. Obstructions

- Note any obstructions within 5 NM each side of the True Track
- Use a different color High Liter to identify

G. Checkpoints and Alternate Aerodromes

- Choose and mark (circle) checkpoints along your True Track
- Checkpoints should:
    - be kept on the pilot's side of the aircraft and be easily recognizable from the air (power lines, railways, major highways, rivers, lakes and towns are all good checkpoints)
    - have two ways of being positively identified
    - be approximately 10-15 NM apart in the early stages of the flight and 20-25 NM apart in the later stages of the flight
- Note the chosen checkpoints and record on Flight Plan Log
- Note the distances between the checkpoints and record on Flight Plan Log
- Note Alternate Aerodromes that can be used in the event of an emergency or diversion

H. Magnetic Variation

- Locate the Isogonic Line closest to the center of your True Track for each leg of the flight
- The Isogonic Line will indicate the variation either East (E) or West (W)
- Note the variation and record on the Flight Plan Log (Eg: 14°W)

Navigation - Flight Planning Notes

6. Complete Advance Items on Flight Plan Log:

FROM -	Airport of Departure	
TO	-	Set Heading Point and / or Airport of Destination
MOCA	-	Check MEF and Highest Obstacle En Route
	-	Rule of Thumb is highest obstacle rounded up to the nearest 100' plus 1000'
TRUE TRACK-		See True Track in Chart Preparation
VAR	-	See Magnetic Variation in Chart Preparation
DIST	-	Note the Distances between Airport of Departure and Set Heading Point and / or Transition Point(s) and Airport of Destination

RADIO FREQUENCIES

Note Frequency for Airport of Departure, Destination, En Route and Alternates

NAVIGATION AIDS

Note Frequencies of any Navigation Aids that you may use or require en route

CHECKPOINT / DIST COVERED / DIST REM

See Checkpoints in Chart Preparation

Navigation - Flight Planning Notes

FLIGHT PLANNING GUIDELINE

Final Preparation

1. Weather

- Obtain as much information as possible with respect to your chosen route, origin and destination airports, en route and alternate airports
- Obtain a weather briefing from FSS
- Is the weather favorable and within **your** limitations ?
- Is the ceiling high enough for terrain and obstacle clearance ?
- What is the weather trend along your chosen route ?
- Obtain, read and clearly interpret all issued reports:

    - Aviation Routine Weather Report = **METAR**
    - Aerodrome Forecast = **TAF**
    - Graphic Area Forecast = **GFA**
    - Wind and Temperature Aloft = **FD**

- For completion of the Flight Plan Log we require the following to be extracted from the weather reports:

    - Cloud Base and Tops
    - Winds and Temperature at Altitude
    - Standard Temperature at Altitude
    - Altimeter Setting

2. SIGMET / NOTAM / PIREP

- Obtain any **SIG**nificant **MET**eorlogical conditions that may exist
- Check and obtain any **NOT**ice to **A**ir**M**an that have been issued (AIP and FSS)
- Obtain any **PI**lot **REP**ort's that have been issued

- Do any of these reports affect or contain information about the route you have chosen ?
- Are certain facilities or runways closed or not available between certain hours ?
- Are there radio frequency or navigation aid changes ?
- Are there any restrictions along your route. Will you have to divert ?

Navigation - Flight Planning Notes

3. Aerodrome Conditions

- Are departure, destination, en route and alternate aerodromes and runways operational (call ahead if in doubt) ?
- Do the aerodromes have the required services and facilities that you require ?
- Are the runways suitable for take-off and landing in today's conditions (surface, length, width, crosswind and obstacle clearance) ?
- Obtain as much information from the CFS, NOTAM's, visual observations and aerodrome operator's as possible
- Record any pertinent information on the Flight Plan Log
- Place tabs on pages in the CFS that you will want to access quickly

4. Cruising Altitude

- Select a cruising altitude and record on the Flight Plan Log. Considerations in addition to those noted in 'Choosing a Route' are:

    - Cloud Coverage and Ceilings
    - Visibility
    - Turbulence
    - Winds Aloft
    - Radio and Navigation Aid Reception
    - Oxygen Requirements
    - Direction of Flight if over 3000' AGL (try to avoid 3000' as many VFR pilots fly at this level)

5. Completion of Flight Plan Log

The Flight Plan Log is an organized plan of your flight. It minimizes the amount of work required in flight and reduces the possibility of forgetting information. During the initial preparation of the Flight Plan Log certain information was recorded. The Log can now be completed as follows:

a. True Airspeed (TAS)

- TAS is obtained from the Cruise Performance Chart in the POH
- TAS should be chosen based on specific requirements or concerns:

    - Range and Fuel Economy
    - Passenger Comfort and Time En Route

Navigation - Flight Planning Notes

- To determine TAS using the Cruise Performance Chart, Pressure Altitude and Non-Standard Temperature need to be calculated

- To calculate **Pressure Altitude** (PA):

  PA = (Standard Altimeter Setting - Current Altimeter Setting) x 1000 + Field Elevation

- Eg: Standard = 29.92" Hg
  Current = 29.52" Hg
  Field Elevation = 188'

  PA = (29.92 - 29.52) x 1000 = 400' + 188' = 588'

- If you intend to fly at 3000' the PA you will use to obtain TAS will be 3400'
- If PA is negative, then subtract from intended altitude

- To determine **Non-Standard Temperature**:

  Using the METAR and FD reports, obtain the actual temperature at the altitude you intend to fly. Non-Standard Temperature will be obtained by calculating the difference between actual and standard temperature at the altitude you intend to fly

- Eg: Actual Temperature at 3000' = 29°C
  Standard Temperature for 3000' = 9°C

  29° - 9° = 20°C Above Standard Temperature

- On the Cruise Performance Chart where a PA of 3400' and the 20°C over standard temperature meet, TAS can be obtained
- If PA and / or Non-Standard Temperature fall between the figures shown on the Cruise Performance Charts, then interpolate to obtain TAS

b. Calibrated Airspeed (CAS)

- CAS is obtained using your E6B Computer
- Set PA against OAT and read CAS on the inner scale opposite the TAS obtained from the Cruise Performance Chart

Navigation - Flight Planning Notes

c. Indicated Airspeed (IAS)

- IAS is obtained using the Airspeed Calibration Chart in your POH
- Locate CAS and interpolate the IAS

d. Gallons Per Hour (GPH)

- Obtain from the Cruise Performance Chart, based on the TAS and RPM setting you have chosen

e. Winds

- Obtain winds from the FD, interpolate the direction and speed for the altitude you intend to fly and note on the Flight Plan Log

f. True Heading

- True Heading is obtained by using your E6B Computer. Instructions are listed on the E6B

g. Ground Speed

- Ground Speed is obtained while calculating True Heading on the E6B. Instructions are listed on the E6B

h. Magnetic Heading

- To obtain Magnetic Heading add Variation (if West) or subtract Variation (if East) to True Heading

i. Compass Heading

- The Compass Heading can be obtained by reading the Compass Correction Card mounted in the aircraft or from the Aircraft Journey Log

j. Estimated Time En Route (ETE)

- ETE is obtained using your E6B. Place the ‘60' mark on the inner scale under Ground Speed
- Locate the Distance on the outside scale and read ETE on the inner scale

Navigation - Flight Planning Notes

k. Fuel Required

- Using the E6B, place the ‘60' mark on the inner scale under the Fuel Burn amount on the outer scale
- Fuel required will be located on the outside scale over the ETE

l. Climb Data

- Climb Data is obtained from the Time, Fuel and Distance to Climb Chart in the POH

m. Fuel Computations

- Useable fuel is obtained from the POH
- Start / Taxi / Takeoff fuel is obtained from the POH
- Fuel burn has already been obtained from the Performance Chart (see ‘d’ above)
- Fuel for landing can be equal to the Start / Taxi / Takeoff fuel burn amount

n. Airport Information

- Use CFS to obtain:
    - Runway Information
    - Airport Elevation
    - Circuit Altitude and Direction
    - Radio Frequencies
    - Special Procedures

6. Complete Final Weight and Balance

- Actual passenger weights should be used
- If actual weights are not available, use standard weights (AIP)
- If aircraft is not within weight limits, adjust the load accordingly
- If aircraft is not within CG limits, complete weight shift formula and adjust the load accordingly

Navigation - Flight Planning Notes

- Weight Shift Formula:

$$\frac{\text{Weight to Move}}{\text{Weight of Aircraft}} = \frac{\text{Distance C.G. Must Move}}{\text{Distance Between Arms}}$$

Eg: $\frac{X}{3000} = \frac{2}{85}$

$X = 70.5$ lbs

- If the aircraft is close to the maximum weight limit, remember the following:
  - Heavier aircraft require more lift to balance the weight, therefore aircraft will fly at a higher AOA and will stall at a higher airspeed
  - In turns the load factor increases and the stall speed will be higher
  - A longer takeoff run will be required
  - Angle of climb and rate of climb will be reduced
  - Fuel consumption will be higher due to the increased drag caused by the aircraft being flown at a higher AOA

- If the aircraft is close to the CG limits, remember the following:
  - Aircraft with a more aft CG are less stable, and:
    - Recovery from maneuvers will be more difficult
    - Aircraft is more easily upset by gusts
    - Stalls at a slightly lower airspeed (due to elevator being trimmed for an upload, horizontal stabilizer produces more lift and wings obtain a slightly lower AOA)
    - Has a better range (due to lower AOA of wings)
  - Aircraft with a more forward CG are more stable, and:
    - Nose heavy, therefore more back pressure required to raise the nose on takeoff and landing
    - Has higher stalling speeds
  - **Overloading** will decrease aircraft performance and subject the aircraft to unseen stresses which will lead to **component fatigue** or **structural failure**

Navigation - Flight Planning Notes

7. Check Takeoff and Landing Distances

   - This information is obtained from the POH
   - Density Altitude and runway surface conditions will have a significant affect on aircraft performance
   - Are you sure you have enough runway length to takeoff and land safely ?

8. Check Crosswind Component

   - Based on the surface winds (METAR) at the departure and destination airports, calculate the crosswind component
   - Is the crosswind within the capabilities of the aircraft ?
   - Is the crosswind within **your** capabilities ?

9. Frequency / Procedure / Reminder List

   - List frequency order, procedure order or any notes to remind you when things need to be checked or actioned

10. Verify Aircraft is Legal

    - AROWJIPI
    - Are all documents on board ?
    - Are all documents valid ?
    - Walk-Around - Is the aircraft fit to fly ?

11. I'M SAFE Check

    - Is the crew fit to fly ?
    - Are passengers fit to fly ?

12. Complete and File Flight Plan

    - See AIP

Navigation - Flight Planning Notes

FLIGHT PLANNING GUIDELINE

En Route

1. Cockpit Organization

    - Required charts folded correctly and in sequential order ready for use
    - Flight Plan Log folded, positioned on clipboard and ready for use
    - Frequency / Procedure / Reminder list ready for use
    - Notepad or extra paper easily accessible
    - Reliable time piece easily accessible
    - E6B Computer or Electronic Calculator easily accessible
    - Pencils (more than 1) easily accessible
    - CFS on board, marked for actual and alternate aerodromes to be used and easily accessible

2. Prior to Arrival at Set Heading Point

    - Climb to Altitude (if required, obtain clearance)
    - Open Flight Plan with FSS (as soon as possible upon departure)
    - Set Power to chosen Cruise RPM (as determined from POH)
    - Lean Mixture
    - Reset Heading Indicator
    - Check Engine Gauges

3. Arrival at Set Heading Point

    - Take time over SHP
    - Turn to planned course (compass heading)
    - Check Departure Angle

Navigation - Flight Planning Notes

4. En Route Procedures

- Revise ETA with Planned Checkpoints to verify fuel consumption
- Reset Heading Indicator (max. 15 minutes)
- Correct for Wind Drift
- Check for Carb Icing
- Check Engine Gauges
- Obtain Revised Weather Forecasts (FSS)
- File VFR Position Reports
- File PIREPS (if required)
- Maintain Listening Watch on Appropriate Frequency or 121.5 (if able)
- Maintain a Lookout for Emergency Landing Areas
- Maintain Situational Awareness with respect to Alternate Aerodromes

5. Descent and Arrival Procedures

- Cabin Security (seats, harnesses, baggage, etc.)
- Access CFS (review aerodrome layout, circuit altitude, etc.)
- Mixture Rich Prior to Descent
- Start Descent at Planned Letdown Point
- Contact Controlling Frequency
- Are Surface Winds within Crosswind Component Capabilities ?
- Plan the Approach, Join the Circuit and Land (at a controlled airport be prepared for a partial circuit or a straight-in approach)
- **Close Flight Plan** (within 60 minutes of expiry time)

Navigation - Flight Planning Notes

Attachment 1 - DEPARTURE METHODS

1. **Overhead**

- Climb in the vicinity of the airport to the planned cruising altitude
- Once level, cross overhead the airport
- The "Set Heading" time will be the time you pass directly over the airport
- Simple procedure, but not efficient as time is lost if not climbing while en route
- Procedure may not be possible at a busy airport, due to conflict with other traffic
- More suitable procedure for areas with few landmarks

6. En Route

- As soon as possible after takeoff and with due consideration to departure procedures as outlined by Transport Canada, turn the shortest way possible to intercept the planned heading
- Climb to altitude as you maintain your heading
- Most direct, but most difficult method to use:

    - Judging the intercept angle can be difficult, especially if there are few landmarks
    - The "Set Heading" time will have to be the "wheels up" or track interception time, which will make calculations difficult
    - Allowance will have to be made for the reduced speed during the climb (Rule of Thumb for a C150 / C172 is to add one minute for every thousand feet of climb)

3. **Off Airport (Set Heading Point)**

- Most efficient method to use
- Choose a recognizable landmark (a "Set Heading Point"):

    - Far enough from the airport so cruising altitude can be reached
    - That can be reached and located easily without having to navigate
    - That is in the general direction of the chosen destination

- At an unfamiliar airport, use a road, railway or a shoreline to help get you to the Set Heading Point (SHP)
- Allows you to avoid or get away from a busy circuit pattern or control zone
- The "Set Heading" time will be taken when you are over your SHP

Navigation - Flight Planning Notes

Attachment 2 - DRIFT CORRECTION METHODS

7. **Visual Alteration**

- Establish your position, note time and number of degrees off track
- Identify and pick a landmark or recognizable point on original track
- Fly an approximate heading to that point
- Once back on track apply necessary correction to maintain track and note the time

8. **Double Track Error**

- Using your drift line from the Set Heading Point (SHP), estimate the number of degrees off track
- Determine the time flown since departure from the Set Heading Point
- Double the number of degrees off track and turn back towards track by that number. Ie: Off track 5° to the right, turn left 10°
- Fly this heading for the same amount of time since your Set Heading Point
- When time expires, turn back on course by the number of degrees you were off track (wind correction)
- **This method must be used prior to the midpoint**

9. **Opening and Closing Angle**

- Using drift lines find the angle off track from origin (opening angle) and the angle off track from destination (closing angle)
- Add the two angles and turn toward the track by this amount
- Fly the new heading until arrival at destination
- **This method can only be used once and will only get you to destination, it will not get you back on track**

Notes:

- Drift corrections only work if you are off track due to wind drift, they do not work if you are off track due to navigation or pilot error

- Drift correction works best if you are able to maintain a constant altitude and heading