How to Plan a
VFR Cross-Country Flight
in a Single-Engine Aircraft

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About the Author

Roni Britton began flight training while working as a flight attendant for a major international airline. Between airline trips, she obtained the private, commercial, and flight instructor certificates as well as the instrument and multi-engine ratings. She has logged cross-country flight hours in a variety of single-engine as well as multi-engine aircraft. She is a member of the Ninety-Nines: International Organization of Women Pilots, also known as the 99's.

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1. Introduction

Before beginning any cross-country flight, take time to organize your materials and plan your flight. Conditions and circumstances are different for every flight. Tailor each flight for the specific conditions of that flight.

Effective preflight planning helps make your flight safe and efficient. A careful flight plan is the foundation for exercising good judgment. Flight planning involves checking flight publications and aviation weather reports. It requires determining airplane performance, including calculating fuel, time, and distance. Flight planning involves forethought in navigation, as well as preparation for the unexpected. A meticulous flight plan helps get you from your departure point to your destination.

This handbook is for pilots who hold a private pilot certificate. The mission of this handbook is to provide private pilots with a simple, clear guide to planning cross-country flights in a single-engine aircraft using visual flight rules (VFR).

The handbook covers the basics of traditional flight planning and navigation. Fundamentals are always applicable in cross-country planning. Also, discussed are NextGen technology tools for planning and navigation. These tools include a global positioning system (GPS), a tablet, and software applications (apps).

2. The Pre-Planning Process

Evaluate your readiness, and that of your aircraft, before proceeding with your cross-country flight plan. Use the Federal Aviation Administration (FAA) designation **PAVE** (**Pilot, Aircraft, Environment, External Pressures**), and assess the following safety considerations in your flight planning.

PAVE - Pre-Flight Safety Considerations	
Pilot - (Private Pilot) – Begin with: **I'M SAFE**	• Consider *Illness, Medications, Stress, Alcohol, Fatigue, Eating/ Emotional factors [I'M SAFE].* • Ensure you are current for the flight you are planning [Biennial Flight Review (BFR), medical certificate, and currency appropriate for the

Aircraft – Begin with: **AROW**	• *Airworthiness* (100-hour check, Pitot Static/ Transponder check within 24 months). • *Registration* – Every 3 years. • *Operating Limits* – [According to the Pilot's Operating Handbook (POH)]. • *Weight and Balance* – See Pilot's Operating Handbook regarding fuel, take-off and landing distances, and runway lengths.
Environment	• Consider the weather during your departure, en route, and at the destination. • Check current METAR, TAF, and Area Forecasts. Be especially mindful of any significant weather. • Check Airmets, Sigmets, PIREPS, wind shear reports, and ATIS reports for the route and your destination. • Consider takeoff and landing distances, crosswind, ceiling and visibility, and your personal minimums.
External Pressures	• Determination to reach a destination can be strong. Avoid "Get-There Itis." • Allow for weather and mechanical delays, diversions, and plan for alternatives.

Figure 1. The FAAs preflight safety considerations, PAVE.

3. Choosing the Destination and Airport

Choose the destination and the airport where you would like to go. Also choose one or two alternate airports for each leg of your flight.

3.1. AIRPORT CONSIDERATIONS
Consider your airport options. As a private pilot, you *can* land at class "B" airports. However, some major international airports discourage General Aviation (GA) aircraft from landing. Slower GA aircraft interfere with the scheduling of the larger commercial aircraft. If you choose to land at a big airport, you may encounter landing fees, ramp fees, and prior-approval requirements. Fees and other requirements may depend on whether you travel during peak times.

Tip for Landing at class B airports: Call ahead to the Fixed Base Operator (FBO) where you plan to stop.

- Ask about landing and security fees.
- Ask about fuel prices. The price of 100LL fuel will give you a clue as to whether GA aircraft are welcome.
- Ask what would be a good time of day to arrive.
- Find out where the general aviation parking is located. Be sure they have parking space and fuel.
- Have a taxi diagram and be familiar with it.

Note: Much of the above information is available through flight planning apps.

Be mindful of the faster landing speeds of jet traffic behind you. Keep your speed up on final approach. With your slower aircraft, you can exit the runway more quickly than the large jets and this will help keep traffic moving.

If you are flying to a large metropolitan area, consider landing at a satellite airport. You will likely save time as well as money because you can avoid long taxi times and possible fees.

3.2. RECORD AIRPORT INFORMATION
Study and record pertinent airport information on your navigation log.
- List frequencies you will need.
- Know the runway lengths at your destination airport and alternates.
- Know the fuel services available, location of fuel at the airport, and hours of operation.
- Note any runway or taxiway closures or other information from Notice to Airmen (NOTAMS).
- Know the airport layout. Draw a small diagram. Diagram the traffic patterns relative to the direction of your entry.

4. Weather
For most flights, weather is the biggest variable. On all cross-country flights, pilots must, by law, ensure that weather conditions are suitable for a safe flight. This means checking current and forecast conditions.

If possible, begin watching the weather in the region of your flight a few days in advance. Your alertness to weather development in the region of your flight helps you know what to expect. Understanding more about weather improves your flight planning so you can make appropriate planning adjustments.

On the day of your flight:
- Get a weather briefing
  - Request a **Standard Briefing** anytime you are planning a flight and have not received a previous briefing.
- Get the following meteorological reports
  - Current and forecast conditions for the departure and destination airports, Terminal Aerodrome Forecast/Meteorological Aerodrome Report (TAF/METAR)
  - Winds aloft forecast
  - Pilot reports (PIREPS) and NOTAMS.

Getting a Weather Briefing	The Weather Briefing Process
By Phone - Contact the local Flight Service Station (FSS) at 1-800-WX-BRIEF, or National Weather Service Office (NWSO)	When speaking to the weather briefer, state the following: • The intended route, altitude, speed, destination, proposed departure time, and estimated time in route. • Advise if intending to fly only VFR. • State the airplane type and identification.
Online - https://www.1800wxbrief.com/Website/home#!/	You can access weather from the homepage without logging in to an account.

A Flight Planning App - [e.g. ForeFlight Mobile, Garmin Pilot, WingX]	Most flight planning apps will send a complete weather briefing to your email.

Figure 2. Three ways to get a preflight weather briefing.

5. Planning the Route

Planning a VFR cross-country flight in a small aircraft requires specific equipment and materials. Ensure that your materials are current.

5.1. OPTIONS IN PLANNING

The FAA requires the use of traditional materials in flight planning to earn a private pilot certificate. You may decide to continue planning your cross-country flights using the traditional methods. Or, you can use NextGen technology including GPS, a tablet, and a flight planning app. The planning method you choose depends primarily on:

- How comfortable you are with technology. If using NextGen tools:
  - You should be proficient in using a tablet.
  - Become thoroughly familiar with the use of the flight planning app you choose.
- Your budget.
  - A flight planning app requires a subscription (approximately $75 to $150 annually).
  - You need to purchase a tablet and a GPS.

- If you prepare your flight plan using only a tablet and a flight planning app, keep hardcopies of essential information. Record information about your route (to your destination and to your alternates). This preparation is a safeguard in case technology fails. Bring sectionals, an Airport/Facility Directory (A/FD), and a paper navigation log as a backup. Maintain your skills in traditional flight planning.

5.2. TRADITIONAL MATERIALS AND EQUIPMENT

- VFR Sectionals for the Route
- Rotating Plotter
- E-6B Flight Computer
- Copy of Deviation Card from the aircraft's compass
- Pilot Operating Handbook (POH)
- Airport/ Facility Directory
- VFR Navigation Log
- VFR Flight Plan Form

5.3. NEXTGEN Materials and Equipment

- iPad or Tablet
- Flight Planning Software
- GPS
- VFR Sectionals for the Route
- Pilot Operating Handbook (POH)
- Airport/ Facility Directory (Hardcopy)
- VFR Navigation Log (Paper)

6. Plotting the Route

Traditional Method

Enter your route planning information in the VFR Navigation Log (see *Figure 4*).

Draw a line from your departure airport to the point of intended flight.	• Mark your route or course line on the sectional chart.

	• Mark checkpoints approximately every 10 miles. • Choose checkpoints to the right or left of your course for easy visibility. • Record the distance between each checkpoint. This gives you the distance from your departure point to any checkpoint along your route.
Determine your *true course*	• Use the plotter to find the true course you'll fly to your checkpoints. • Finding the longitudinal lines on your sectional, measure the true course near the midpoint of the leg. • Enter the value in the TC box of the Navigation Log (see *figure 4*).
Determine your *true heading*	• Using your E6B calculator, take your true course and add (right) or subtract (left) to get the wind correction angle. • Record the true heading in the TH box of the Navigation Log.
Determine the *magnetic heading*	• Take your true course and add or subtract the magnetic variation found by referencing the nearest isogonic line (dashed magenta) on your sectional chart to get the magnetic heading. • Record the magnetic heading in the MH box of your Navigation Log.
Determine the *compass heading*	• Take the magnetic heading and add (west) or subtract (east) the deviation from the aircraft's compass deviation card. • Record the compass heading in the CH box of your Navigation Log.

Figure 3. Plotting your route.

6.1. ALTITUDE
- Check your sectional chart along your route to determine the minimum safe terrain clearance altitude.
- Choose a desired altitude.
  - Easterly (odd plus 500 feet) Westerly (even plus 500 feet).
  - Consider the performance of your aircraft in selecting the altitude. Use the performance charts in your POH to determine the best altitude and cruise power setting for optimal range and fuel economy.
  - Be aware of icing conditions at certain altitudes and locations.
  - Check the *area forecast* for bases and tops of clouds. Avoid being trapped by a lowering ceiling and rising elevation.
  - Enter the altitude in the Navigation Log.

VFR Navigation Log

VFR NAVIGATION LOG																	

Figure 4. Use the Navigation Log to record your time, speed, and distance.

6.2. AIRSPACE
- Plan for appropriate clearances.
- Avoid restricted airspace and Military Operations Areas (MOAs).
- Be aware of Temporary Flight Restriction (TFRs).
- Ensure you have appropriate equipment for Class B, C, and D airspaces.

6.3. OBSTRUCTIONS AND TERRAIN
- Plan for at least 2000-foot clearance for obstructions/terrain.
- Be sure that any terrain along the route is not above your aircraft's service ceiling.

6.4. CHECKPOINTS
- Select easily identifiable checkpoints along the route.
- Identify and mark an "X" at each checkpoint.
  - The following prominent landmarks are reliable checkpoints:
    - Rivers
    - Lakes
    - Roads / highways and highway intersections
    - Railways
    - Racetracks
    - Airports
    - Tall towers
  - Use a combination of two or more landmarks rather than relying on any single landmark.

> **Caution**:
> - Be aware that lakes and rivers may dry up and disappear in certain seasons of the year.
> - Be careful if using small towns and water towers as checkpoints as they often look similar.
> - Flying too high or too low can make identifying your checkpoints more difficult.

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- o Write or draw a description of checkpoints in the checkpoint box of the Nav Log. Include heights of towers and distance to next checkpoint.
- o If the checkpoint is a VOR, or NDB, enter the NAVAID name, frequency, and if there will be a "To" or "From" indication.

7. Aircraft Performance

7.1. SPEED, TIME, DISTANCE

Compute speed, time, and distance for each leg of the flight. Completing the Navigation Log form (*figure 4 above*) can help you keep your calculations organized.
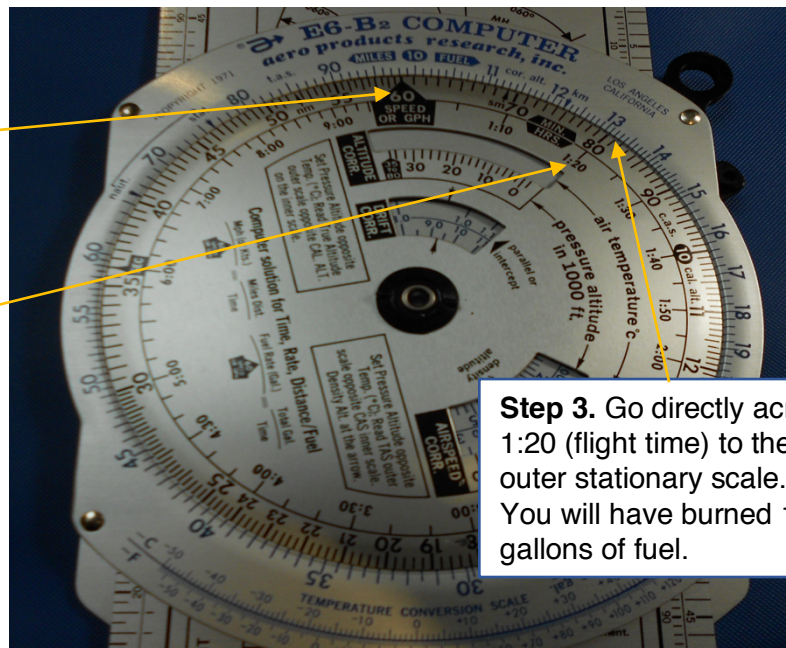
7.2. FUEL BURN

Refer to the cruise performance charts in your POH and your E6-B computer when calculating fuel burn.

- Know how fast you will burn fuel (gal. per hr.) and how long you will burn fuel (flight time).
- Determine your aircraft's fuel burn rate per hour.
  - o Using your E6-B computer, follow these steps to determine your fuel burn rate:
    1. Align the rotating index of your calculator to your aircraft's fuel burn rate
    2. Find the *time* (of your flight segment) on the inner scale
    3. Move across to the stationary scale to find the total gallons of fuel burned.

Example: Suppose your aircraft burns 9.7 gallons per hour at cruise speed.
Your flying time is 1 hour and 20 minutes.
Follow steps 1 through 3 below to calculate your fuel burn rate per hour.

Step 1. Line up the index to gallons burned per hour (9.7 gallons of fuel).

Step 2. Find your flight time (1 hour 20 minutes) on the inner scale.

Step 3. Go directly across 1:20 (flight time) to the outer stationary scale. You will have burned 13.1 gallons of fuel.

Figure 5. Three steps to calculate fuel burn on an E6-B computer.

8. Navigation

The form of navigation you choose may depend on the equipment you are using. Traditional methods of VFR navigation on cross-country flights include a combination of dead reckoning, pilotage, and radio aids to navigation.

NextGen navigation includes the use of the global positioning system (GPS). GPS is now a primary method of navigation for cross-country flights because of its reliability and accuracy. GPS may be the most common NAVAID in use today.

8.1. NAVIGATION METHODS

Traditional and NextGen Navigation

Traditional Navigation	
Dead Reckoning	Use the calculations you have made based on the airspeed, course, heading, wind direction and speed, groundspeed, and elapsed time.
Pilotage	Constantly correct for error and variables after checking visually for nearby landmarks. [In conditions of low visibility, or if there are few prominent landmarks along your route, this method is impractical].
Radio Aids to Navigation	Radio NAVAIDS include VORs and ADF/NDB. Use Radio Aids to Navigation to navigate more accurately than with dead reckoning and pilotage alone.
NextGen Navigation	
GPS	GPS is now the preferred method of navigation for many pilots. Errors associated with GPS are rare. GPS systems are operative anywhere including mountainous areas. GPS is not subject to the errors of radio NAVAIDS including line-of-sight and electrical interference.
Apps Used in Navigation WingX, ForeFlight, and Garmin Pilot	These apps provide direct, efficient routes. They supply information on the weather, airports, airspace, and more. Apps display information in different layers including radar, airport weather, sectionals, TFRs, terrain, etc. With inflight navigation and digital charts, you can change flight plans on the go.

Figure 6. Traditional and NextGen methods of navigation.

8.2. USING APPS IN NAVIGATION

As reliable as apps are, they can crash. If you've come to rely solely on GPS and tablet apps for your navigation, consider these precautions:

- Check your VOR receiver monthly to ensure proper functioning in case your GPS is not available
- Carry a paper sectional for your region and a hard copy of the A/FD
- Backup your tablet app on your smart phone
- On your navigation log, record frequencies for the VORs along your route. Also record navigation frequencies for your alternates.

> **Tip**: Consider high-tech devices as your backup, and low-tech as your primary navigation method.

9. Filing a Flight Plan

Filing a VFR flight plan is not an FAA requirement. However, filing a flight plan is a wise practice and is always recommended. The primary purpose for filing and opening a flight plan is to aid the search and rescue team when an aircraft goes down or is overdue.

When departing from a Class C or Class B airport, heed the recommendation to file a flight plan. Larger airports want you to call clearance delivery to get a squawk before taxiing… much like IFR aircraft for whom filing is required.

9.1. HOW TO FILE

Choose a method to file your flight plan. Here are four options for filing.

Telephone – 1800 WX-BRIEF	• Use a telephone to call and speak with a briefer. • Have your flight plan completed and in front of you. • State the information in steps 1 to 16 on the form. • Write down the information they give you about weather and NOTAMS.
Online - https://www.1800wxbrief.com/Website/home#!/	• Use a computer to access the information. • Set up an account. • Enter your flight plan data.
Free Flight Planning Apps - Examples: fltplan.com or skyvector.com	• Set up an account and set up an aircraft profile. • Click *Create a Flight Plan*. • Click *VFR*. • Enter the required flight data for Nav Log. • Review for accuracy and Save • Click *File*.
Subscription Flight Planning Apps – Flight planning apps by subscription. Examples: ForeFlight, Garmin Pilot, and WingX (see flight app comparison)	• Pay the annual subscription fee. • Save your aircraft information for faster filing on your next flight. • You will receive a complete weather brief via email after filing. • Open your flight plan with one click. You do not need to call the FSS.

Figure 7. Four methods for filing a flight plan.

When you file and open a VFR flight plan (see Flight Plan Form *figure 8*), you're telling someone where you're going and when. Filing is a safeguard in case of an emergency.

FAA Flight Plan Form

Figure 8. The FAA Flight Plan form. Complete the information in questions 1 through 16.

9.2. FLIGHT FOLLOWING

When you use VFR Flight Following, you are effectively taking Air Traffic Control (ATC) along with you on your flight. Your flight plan goes into the ATC system. With Flight Following, ATC can help you:

- Navigate
- Avoid weather, TFR's, and traffic
- Divert to an alternate airport.

10. Planning for the Unexpected

Be mindful in all details of preflight preparation for your cross-country flight. Carry the documents you may need including your license, aircraft documents, and insurance papers. If your flight is near the border of another country, carry your passport. You may need to divert to an alternate where your passport is required.

Keep checklists for your aircraft close at hand. Know the emergency procedures by heart.

10.1. DEVIATING FROM THE FLIGHT PLAN

- Always have a 'Plan B.' Your actual route doesn't always work out as you plan. Things may happen that are out of your control. Be ready to adjust. For example, have a backup plan around restricted airspace, or a plan to fly around Class B airspace at a different altitude.
- Have a low-tech backup plan for when technology fails. Don't rely on an iPad or tablet. Write down frequencies. Keep a back-up paper copy of frequencies, check points, distances, estimated time in route, and approximate fuel burn.
- Always be planning; always be adjusting. Stay flexible.
- Minimize the impact of delays and diversions. Carry wholesome snacks and water. Flying hungry or dehydrated is not safe.

10.2. DETERIORATING WEATHER

Careful preflight planning that includes a weather briefing will help prevent emergency situations due to weather. Here are some precautions to avoid being trapped due to unexpected adverse weather.

- In deteriorating weather, know your personal minimums and hold to them. This may mean cancelling the flight, making a 180-degree turnaround, or landing at a nearby airport.
- If you're not certified for instrument flight, become familiar with flight by reference to instruments. The ability to maneuver for limited periods in a low-visibility environment is vital for flight safety.
- If caught in adverse weather conditions:
    - Maintain control of the aircraft using the attitude indicator as the primary reference
    - Resist false sensations and trust the flight instruments
    - Contact the nearest FAA facility by radio. They will provide instructions, and you can focus attention on maintaining control of the airplane.

10.3. EQUIPMENT FAILURE

Equipment failure can force you to land before reaching your intended destination. Keep the following key points in mind:

- Don't panic
- Fly the plane
- Use pitch and trim for the best glide
- Land in control.

With careful planning you can avoid unanticipated problems from weather or equipment failure. Maintain your situational awareness and prepare for the unexpected ahead of time.

10.4. SURVIVAL PLANNING

Carry a survival kit with you. Prepare for the type of terrain and the climate conditions below you. Depending on where you fly, your survival kit should meet your basic needs for conditions of heat, conditions of cold, or conditions over water.

Your winter survival gear will add more weight. Calculate and verify that any increased survival gear is within weight and balance limits. See FAA - Basic Survival Skills for Aviation also listed in Resources for Pilots.

Appendix A: Pilot Resources

Federal Aviation Administration. Aeronautical Chart Users Guide, Aeronautical Information Services.
https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/aero_guide/media/editions/cug-complete.pdf.

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Appendix B: Abbreviations/Acronyms used in this Handbook

AFIS	Airborne Flight Information Service
ADF	Automatic Direction Finder
AFD	Airport Facility Directory
AFSS	Automated Flight Service Station
AIRMET	Airmen's Meteorological Information
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
EFAS	En Route Flight Advisory Service
FAA	Federal Aviation Administration
FBO	Fixed-base Operator
FSS	Flight Service Station
GA	General Aviation
GPS	Global Positioning System
METAR	Meteorological Aerodrome Report
MOA	Military Operations Area
MTR	Military Training Route
NDB	Non-directional (Radio) Beacon
NOTAM	Notice to Airmen
NTSB	National Transportation Safety Board
NWSO	National Weather Service Office
PFB	Preflight Briefing
PIREP	Pilot Weather Report
POH	Pilot Operating Handbook
SIGMET	Significant Meteorological Information
TAF	Terminal Aerodrome Forecast
TFR	Temporary Flight Restrictions
VFR	Visual Flight Rules
VOR	Very High Frequency Omnirange
WX	Weather

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XC.pdf.

Style Sheet

Name	Roni Britton
Date	21 September 2018
Document Title	How to Plan a Cross-country Flight in a Single-engine Aircraft
Style Manual	The Chicago Manual of Style, 16th edition (2010)
Dictionary	Merriam Webster Dictionary, 11th edition

A	B backup	C cross-country Class B airspace	D	E en route
F flight plan fixed-base	**G**	**H** high-tech	**I**	**J**
K	**L** low-tech	**M**	**N** NextGen	**O**
P preflight	**Q**	**R**	**S** single-engine	**T**
U	**V**	**W**	**X**	**Y**
Z	**Numbers** 10 (miles) 500 (feet) 180 (degree)			

Notes:
1. Numbers in general context between zero and 100 are spelled out (Chicago Manual of Style: 9.2).
2. Express physical quantities as numerals (Chicago Manual of Style: 9.13).
3. No spaces before and after dashes (Chicago Manual of Style: 2.13).
4. Periods and comas inside quotation marks.
5. Use serial commas (A, B, and C) (Chicago Manual of Style: 6.18).
6. Acronyms generally appear in all capital letters and don't have periods or space between letters (Chicago Manual of Style: 10.5, 10.8.
7. Spell out abbreviations at first occurrence – even those in common use e.g., FDA (Chicago Manual of Style: 10.3).
8. Capitalize first and last words of Headings and subheadings, and capitalize all other major words. Lowercase the articles the, a, and an (Chicago Manual of Style: 8.157).
9. Subheads in headline-style (Chicago Manual of Style: 2.56).
10. Set subheads on a line separate from the following text (Chicago Manual of Style: 1.54).
11. See list of acronyms on page eighteen of this document.