

Flight Planning

Objective

Safely plan a VFR cross-country flight, use various types of navigation to get there, and use a navigation log to compute expected distances, times, and fuel requirements. Also use ForeFlight to plan a flight and interpret its output.

Motivation

Flying to another airport requires additional planning and multiple forms of navigation. A pilot needs to understand the information needed to accurately plan a flight and have the skills to execute that flight plan.

Overview

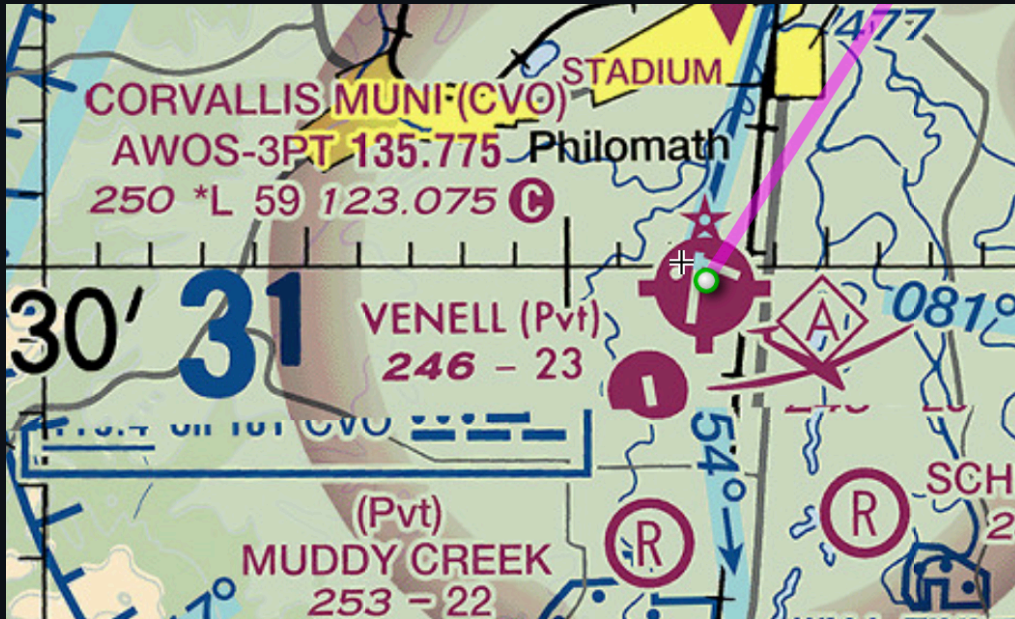
- Picking Destinations
- Picking Waypoints
- VFR Cruising Altitudes (91.159)
- Cruising Altitudes
- Dead Reckoning
- Navigation Log
 - Steps to manually complete a navlog
- Flight Planning with ForeFlight
- Preflight Information Requirements (91.103)
- Weather Briefings
- Flight Plans
- UTC Time Conversion
- Flying our Flight Plan
- VOR and DME navigation
- GPS Navigation
- Lost Procedures
- Diverting to an Alternate

Picking a Destination

What airport do we want to go to?

- Somewhere we want to go!
- How far can we make it in 1 hour of flying time?
- Airport
 - Elevation: Aircraft performance
 - Runway lengths, within our personal minimums?
 - Night flight: Lighting, VASI or PAPI?
- Services
 - Is there an FBO (Fixed-base operator)?
 - Self-serve fuel?
 - Crew cars?
- Weather

Going to Corvallis



- We hear Corvallis has a good restaurant, where should we land?
- Considering KCVO
 - At least 5900' runway
 - Airport is lighted
 - Airport has a beacon
 - Airport has fuel
 - Has an AWOS - Automated weather
 - Fuel available - tick marks

More Information: Chart Supplement

OREGON

167

CORVALLIS MUNI (CVO)(KCVO) 4 SW UTC-8(-7DT) N44°29.81' W123°17.37'

250 B TPA-1050(800) NOTAM FILE CVO

RWY 17-35: H5900X150 (ASPH) S-35, D-73, 2S-127, 2D-100 HIRL

RWY 17: MALSR. VASI(V4L)—GA 3.0° TCH 45'.

RWY 35: REIL. VASI(V4L)—GA 3.0° TCH 51'.

RWY 10-28: H3100X75 (ASPH) S-51, D-65, 2D-100 MIRL

RWY 28: PAPI(P4L)—GA 3.0° TCH 25'. Thld displcd 228'. Railroad.

RUNWAY DECLARED DISTANCE INFORMATION

RWY 10: TORA-3100 TODA-3100 ASDA-3100 LDA-3100

RWY 17: TORA-5900 TODA-5900 ASDA-5900 LDA-5900

RWY 28: TORA-3100 TODA-3100 ASDA-3100 LDA-2872

RWY 35: TORA-5900 TODA-5900 ASDA-5900 LDA-5900

SERVICE: S4 **FUEL** 100LL, JET A **OX** 1, 2, 3 **LGT** ACTVT MALSR Rwy 17, REIL Rwy 35; PAPI Rwy 28; VASI Rwy 17 and Rwy 35; HIRL Rwy 17-35 and MIRL Rwy 10-28—CTAF.

AIRPORT REMARKS: Attended 1600Z†-dusk. Migratory waterfowl and other birds on and invof arpt. Rwy 10-28 has white side stripes. Surf cond not reported daily 0100-1600Z† and all times Saturdays and Sundays.

AIRPORT MANAGER: (541) 766-6783

WEATHER DATA SOURCES: AWOS-3PT 135.775 (541) 754-0081.

COMMUNICATIONS: CTAF/UNICOM 123.075

® **CASCADE APP/DEP CON** 127.5 (1400-0730Z†)

® **SEATTLE CENTER APP/DEP CON** 125.8 (0730-1400Z†)

CLEARANCE DELIVERY PHONE: For CD ctc Cascade Apch at 541-607-4674/4675, when Apch clsd ctc Seattle ARTCC at 253-351-3694.

RADIO AIDS TO NAVIGATION: NOTAM FILE CVO.

(VH) (DH) **VORW/DME** 115.4 CVO Chan 101 N44°29.97' W123°17.62' at fld. 242/18E.

VOR unusable:

061°-073° byd 40 NM

097°-129° byd 40 NM

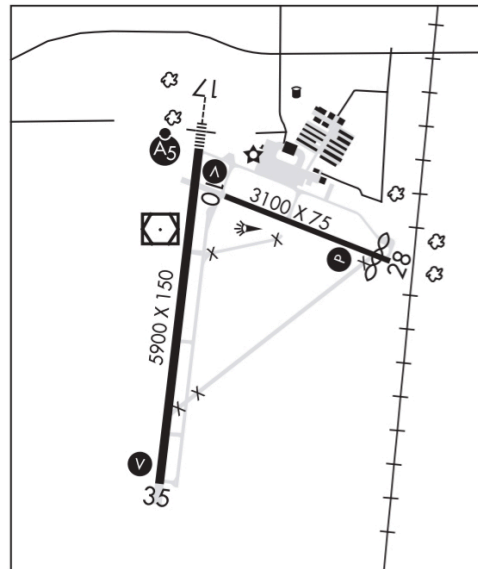
151°-334° byd 40 NM

225°-245° byd 40 NM bld 28,000'

KLAMATH FALLS

H-1B, L-1B

IAP



- 2 runways: 5900' and 3100'
- 4 mi SW of city of Corvallis
- 100LL available
- Has a VOR on the field

More Information: Services



KCVO: Corvallis Municipal

Corvallis, Oregon, US
44.50°N/123.29°W

☀️ 5:50 AM 🌙 8:27 PM PDT ➡️

3D View FBOs

Taxiways Comments

Latest Weather **VFR**, Variable at 3 kts, 10 sm, sky clear ☀️

Elevation **250' MSL**

Pattern altitude **1,050' MSL** ➡️

Fuel Jet A+ Jet A 100LL

Procedures ILS,

AWOS-3PT **135.775**

Clearance -----

UNICOM **123.075**

CTAF/UNICOM **123.075**

Back

Corvallis Aero Service



CORVALLIS MUNI ARPT
5695 SW Airport Pl.
CORVALLIS, OR 97333
8:00am to 6:00pm Mon-Fri
8:00am to 5:00pm Sat-Sun

Info

Fees

Comments

📞

📍

✉️

	SELF	FULL
100LL	\$6.40 1 month ago	\$6.80 1 month ago
Jet-A	None	\$6.70 1 month ago
Jet-A+	None	\$6.75 1 month ago

Info

FREQU

Weather

Cleara

Comm

Appro

Depart

Center

Flight

NOTAM

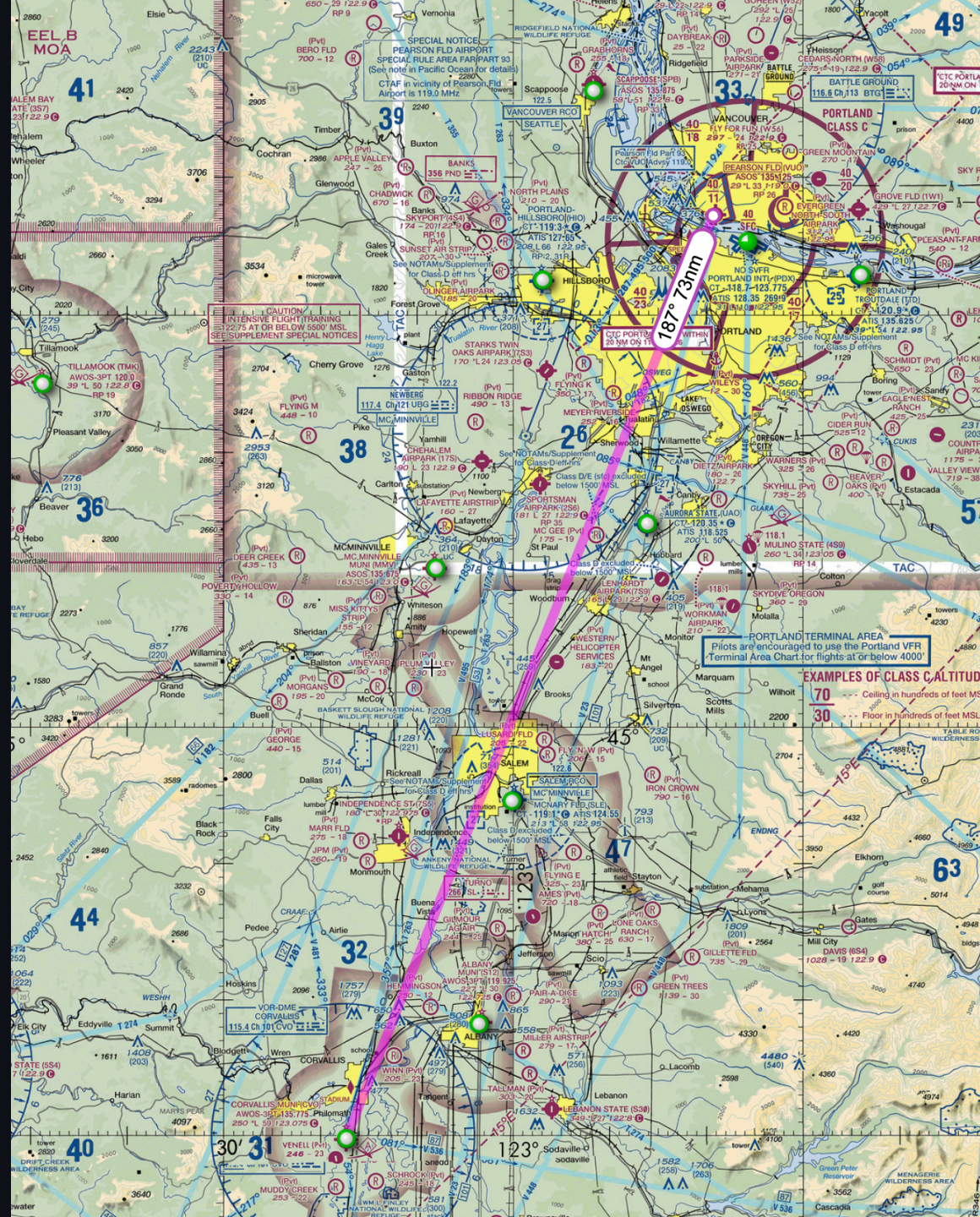
35.775

- FBO: Fixed-based operator
- Self-serve fuel
- Rental cars
- Attended 8-6pm M-F

Routing to our Destination

Direct Route

- What's the terrain like?
- Airspace:
 - B/C/D airspace
 - Restricted or prohibited areas
 - MOAs
- Where would we go in an emergency?
- Diversion options



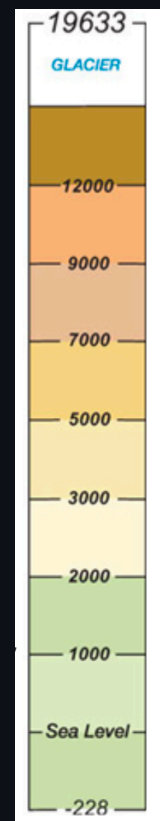
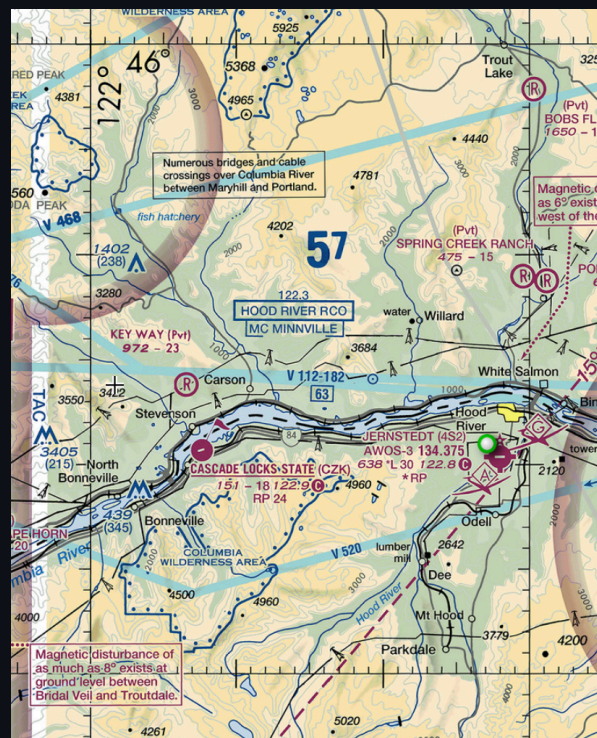
PORTLAND CLASS

PORTLAND INTERNATIONAL (PDX)
 CT-118.7-123.775
 ATIS 128.35 269.9
 30 NM 122.95

MULTNOMAH COUNTY (HILLSBORO)
 CT-119.3-119.3
 ATIS 127.65
 208 L66 122.95
 RP-2, 31P

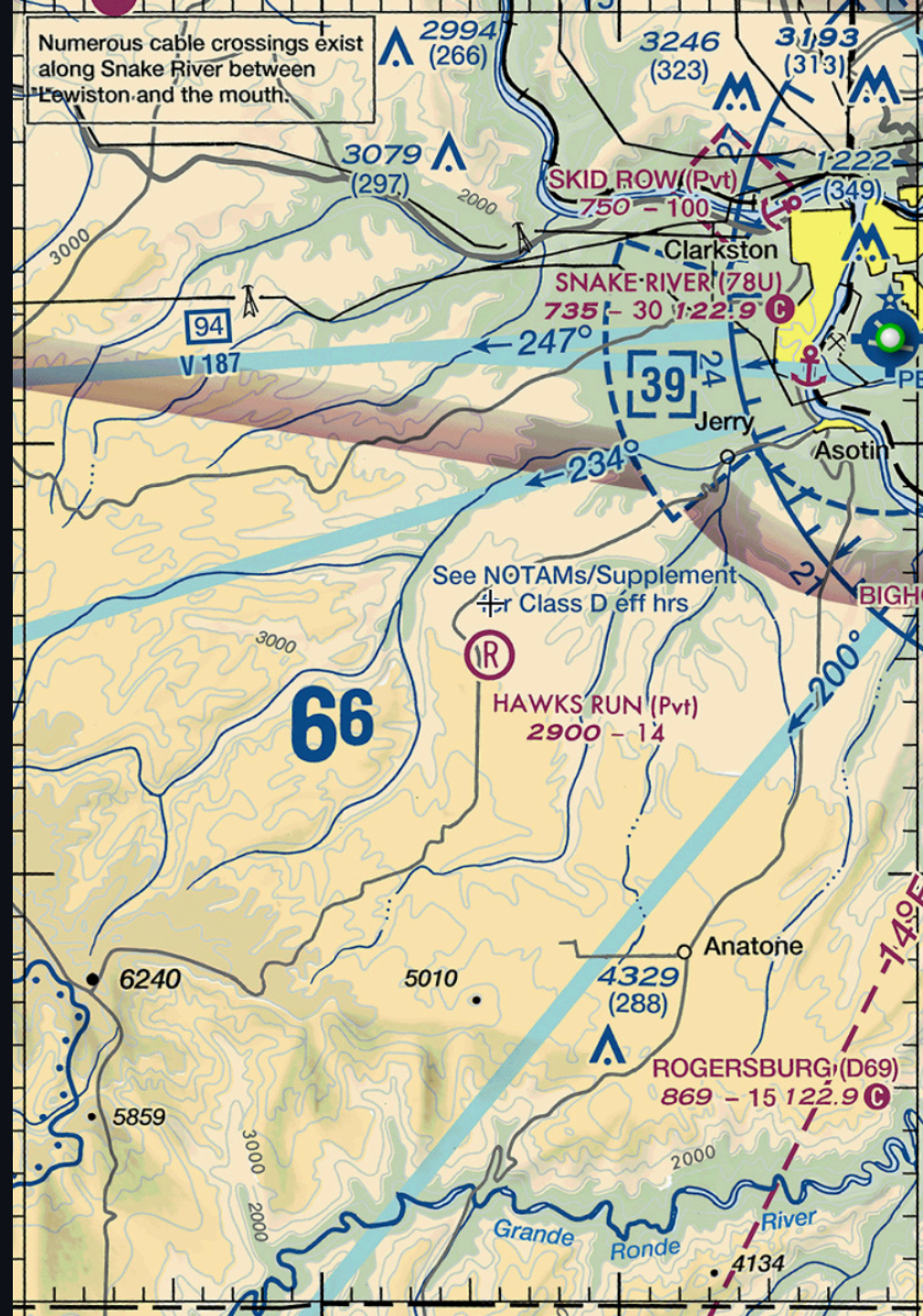
PORTLAND TERMINAL AREA
 Pilots are encouraged to use the Terminal Area Chart for flights at or below 3,000 feet.

EXAMPLES
 70
 20



Maximum Elevation Figures (MEF)

- Height of the highest terrain or obstacle in MSL
- +100 foot buffer
- Rounded up to near 100' level
- With a MEF of 6600, where would we want to cruise at?





Obstacles

- Top number: MSL altitude
- Bottom number: AGL altitude
- Some are lighted

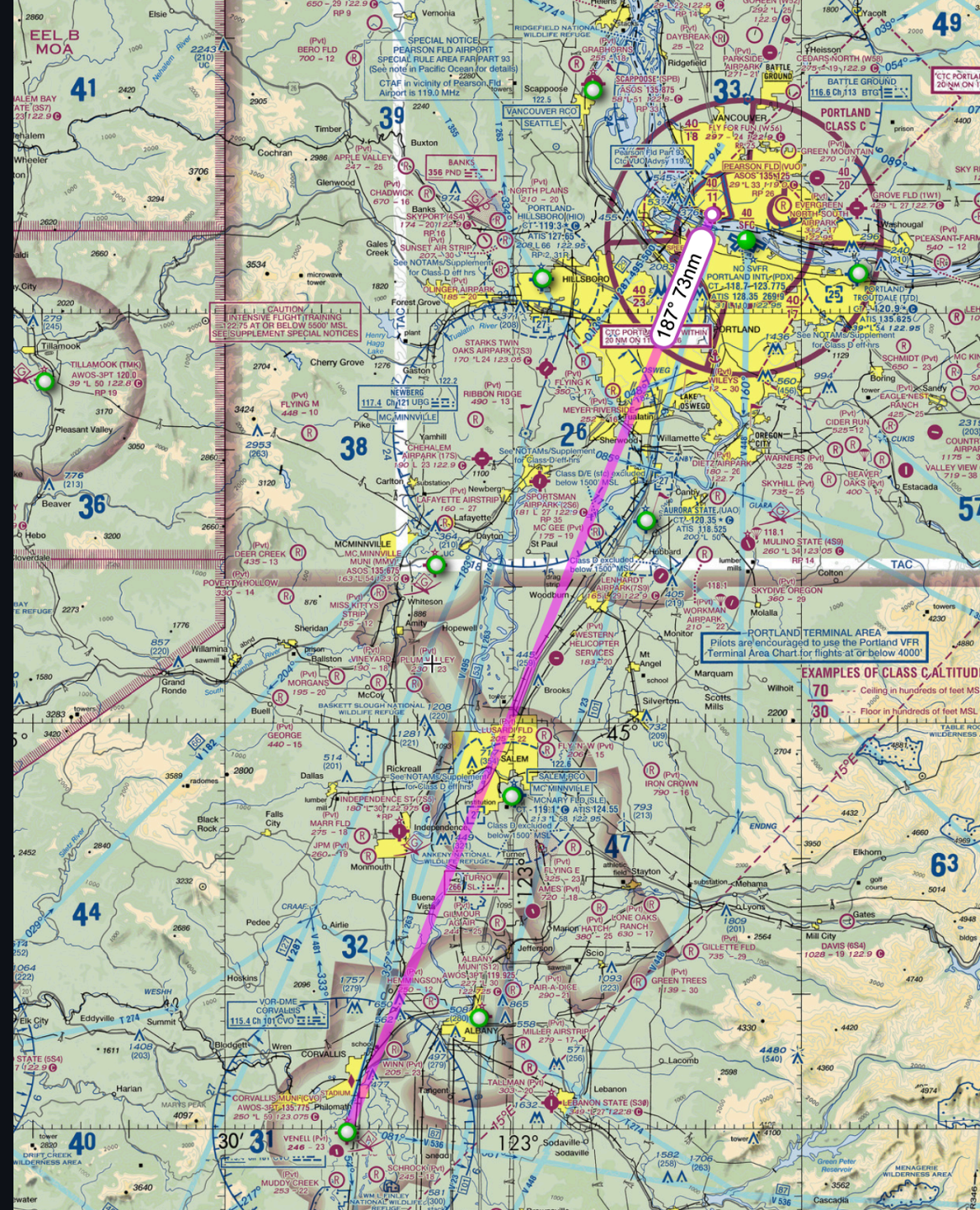
Airspace



Emergencies

- Where would go if our engine quits?
 - Airports
 - Type of terrain
 - Roads
 - Civilization





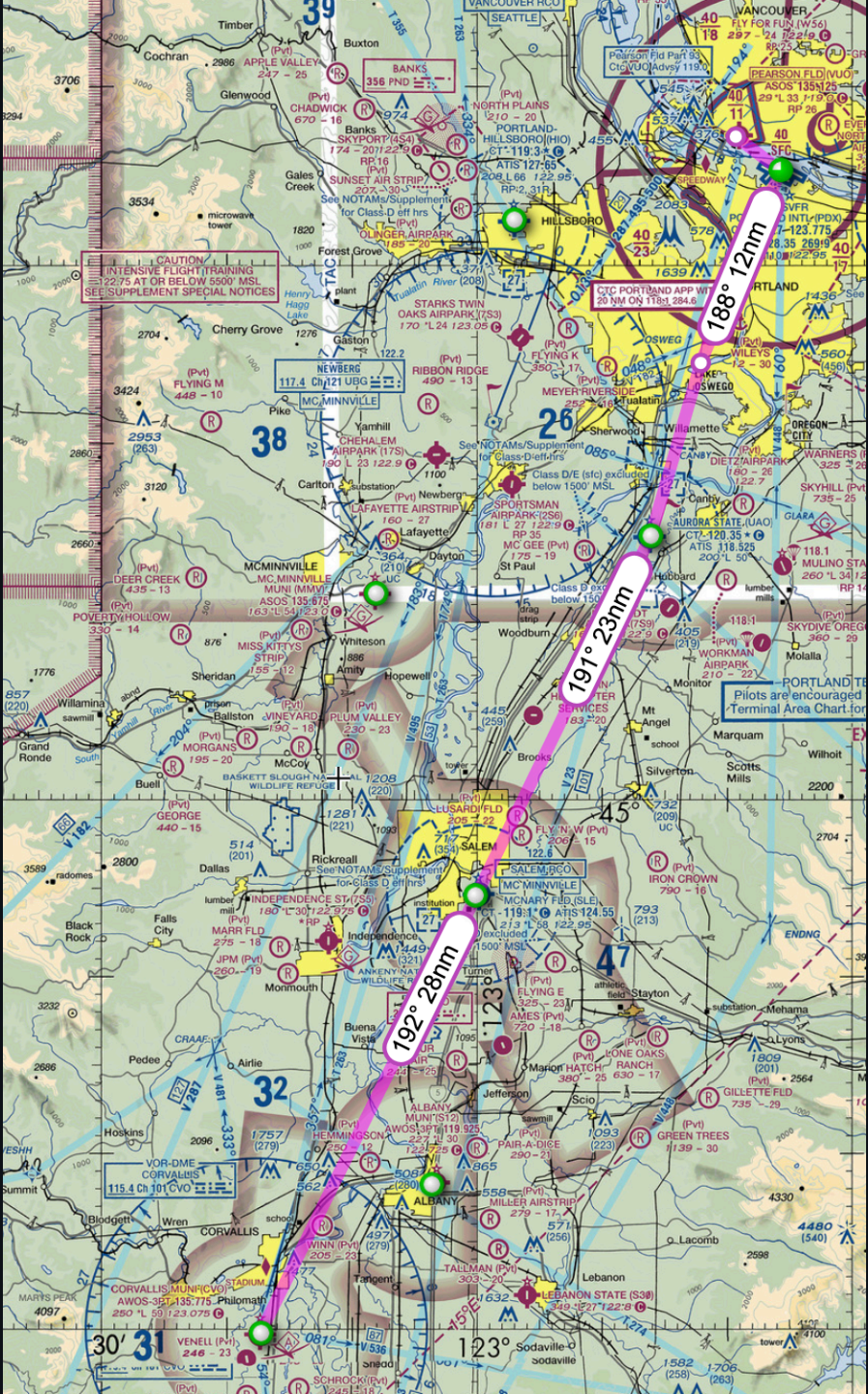
Our Corvallis Flight

- Terrain
 - MEFs: 3,200, 4,700, 2,600
- Airspace
 - Class C transition over PDX (up to 4000')
 - Aurora Class D (2700')
 - Salem Class D (2700')
- Emergencies
 - Lots of valley fields
 - Several towns
 - I-5



Picking Waypoints

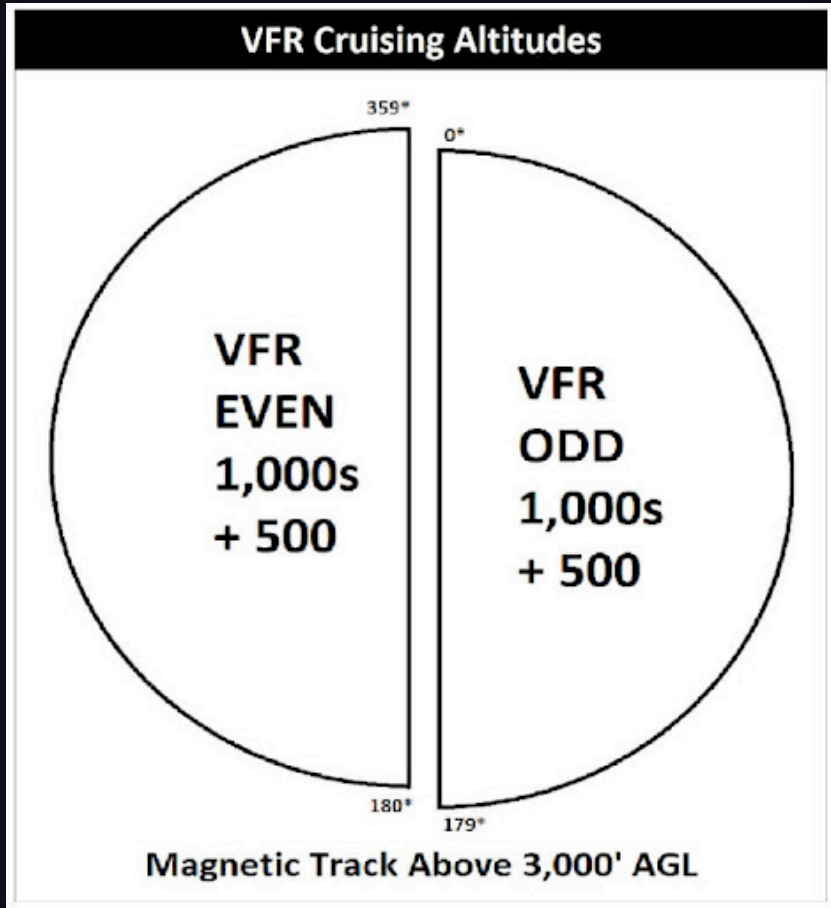
- Use waypoints to route along a path that works best
- Picking good waypoints: Something you can see easily from the air
 - Rivers, lakes, mountains
 - Towns, roads
 - VFR waypoints
 - Airports: Can be great
 - Small grass strips can be hard to see
 - Difficult to see at night



Corvallis Flight Waypoints

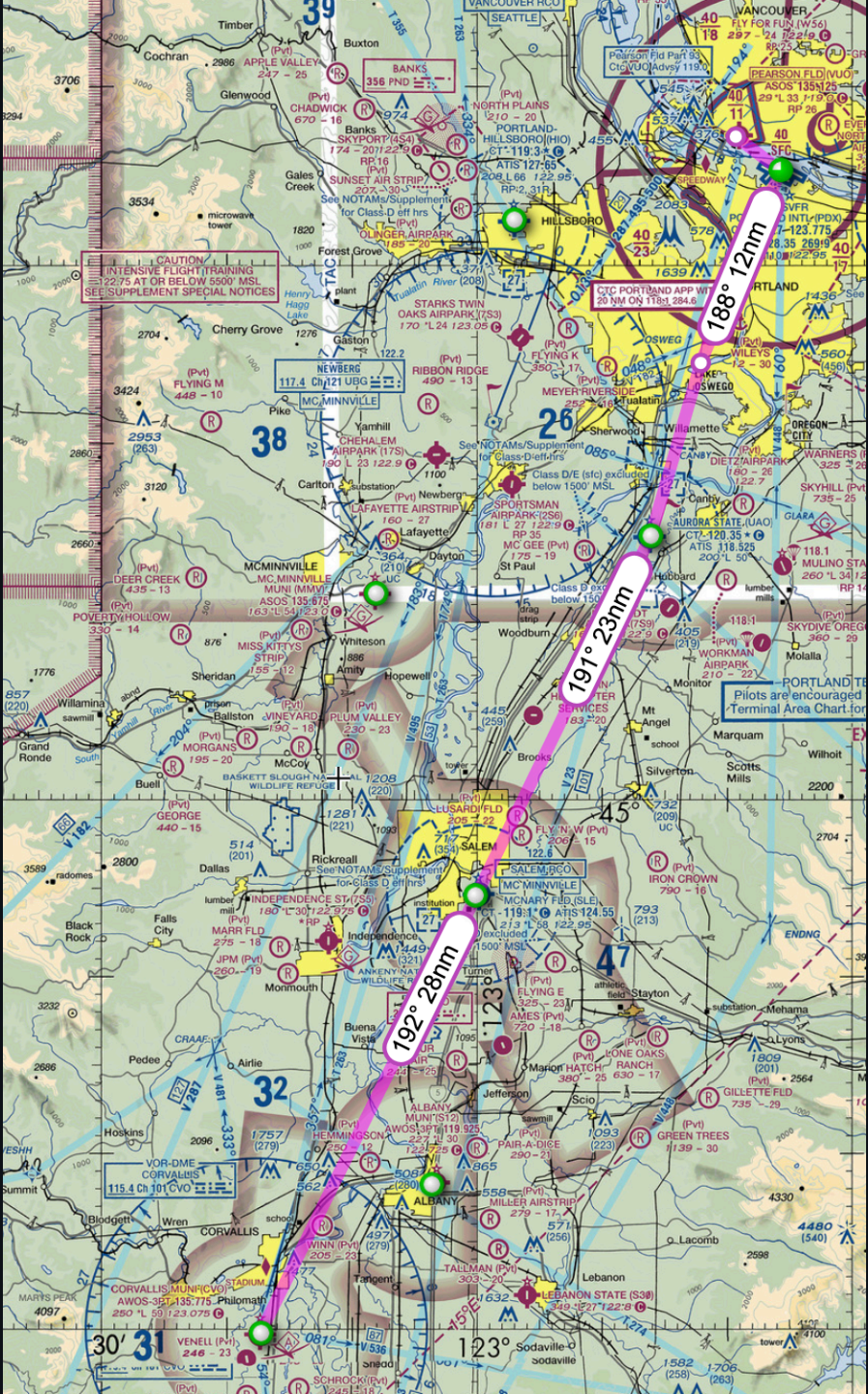
- KVUO
- KPDX
- Lake Oswego
- KUAO - Aurora
- KSLE - Salem
- KCVO

VFR Cruising Altitudes (91.159)



Above 3000' AGL, VFR traffic in level cruising flight shall fly:

- On **eastbound** headings (0 thru 179° magnetic)
 - Odd thousands + 500'
 - E.g. 3500', 5500', 7500'
- On **westbound** headings (180 thru 359° magnetic)
 - Even thousands + 500'
 - E.g. 4500', 6500', 8500'



Cruising Altitudes

- Select based on:
 - Terrain
 - Performance
 - Emergency considerations
- Our Corvallis flight
 - Highest terrain 3000'
 - Class D up to 2700'
 - Let's pick **6500 ft**

CONDITIONS:

Flaps Up
2400 RPM
31 Inches Hg
Mixture Full Rich
Cowl Flaps Open

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
3100	S.L.	87	1175	1055	935	815
	4000	86	1085	965	840	715
	8000	86	970	845	720	595
	12,000	85	825	700	580	- - -
	16,000	85	670	550	435	- - -
	20,000	84	505	390	- - -	- - -

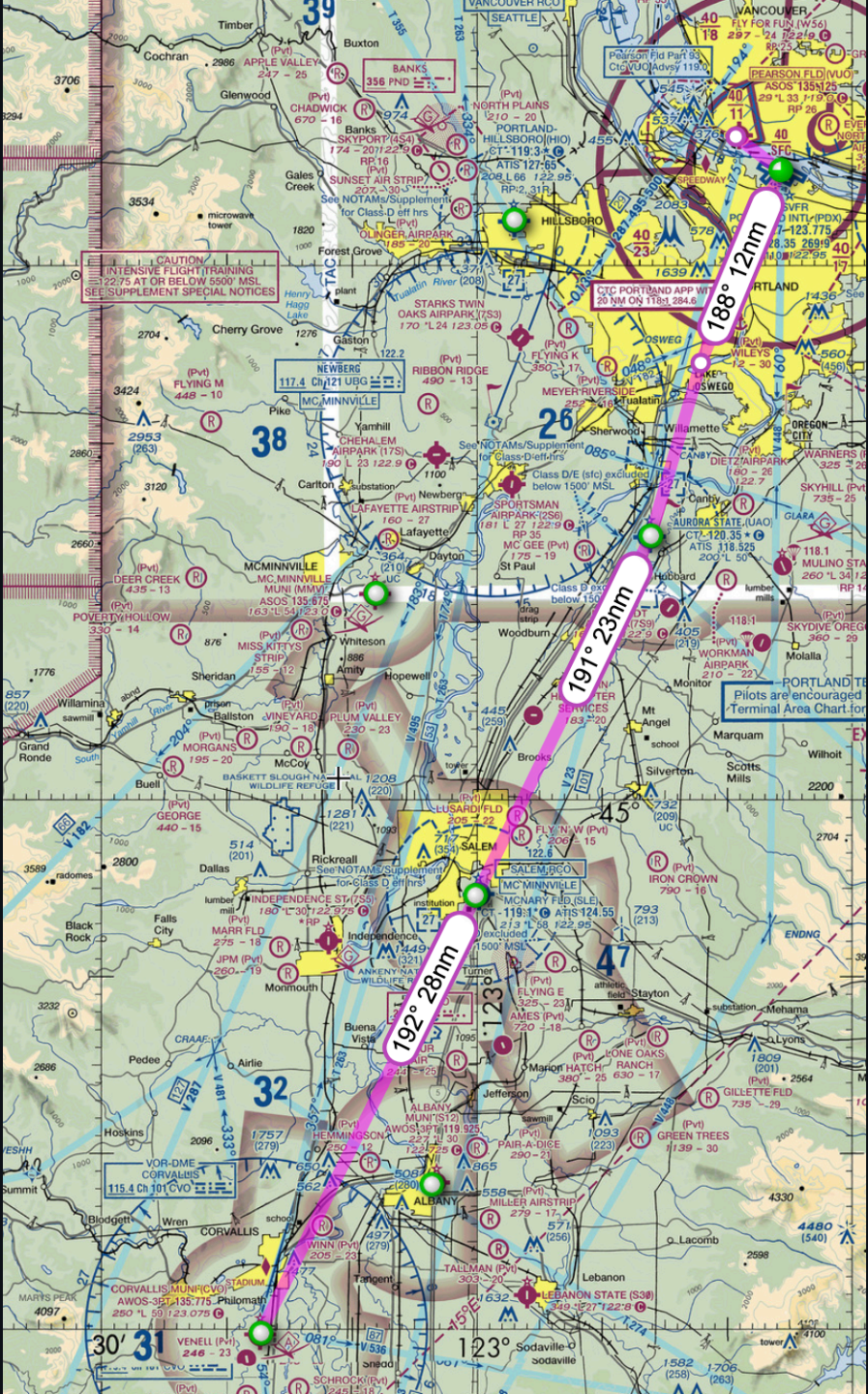
Figure 5-6. Maximum Rate of Climb

Simple Altitude Planning - Climb

- Takeoff from Pearson
- Start climbing to our cruising altitude
 - Let's say 1000 ft/min. climb
 - Climb from S.L. to 6,500 ft.
 - **6.5 minutes**
- Cruise at 6,500'

Simple Altitude Planning - Descent

- Takeoff from Pearson
- When do we want to descend?
 - Let's use 500 fpm down
 - Decent from 6,500 to KCVO pattern altitude (1250')
 - $6500 - 1500 = 5000'$
 - **10 minutes** before arrival
 - Plus some extra to enter traffic pattern

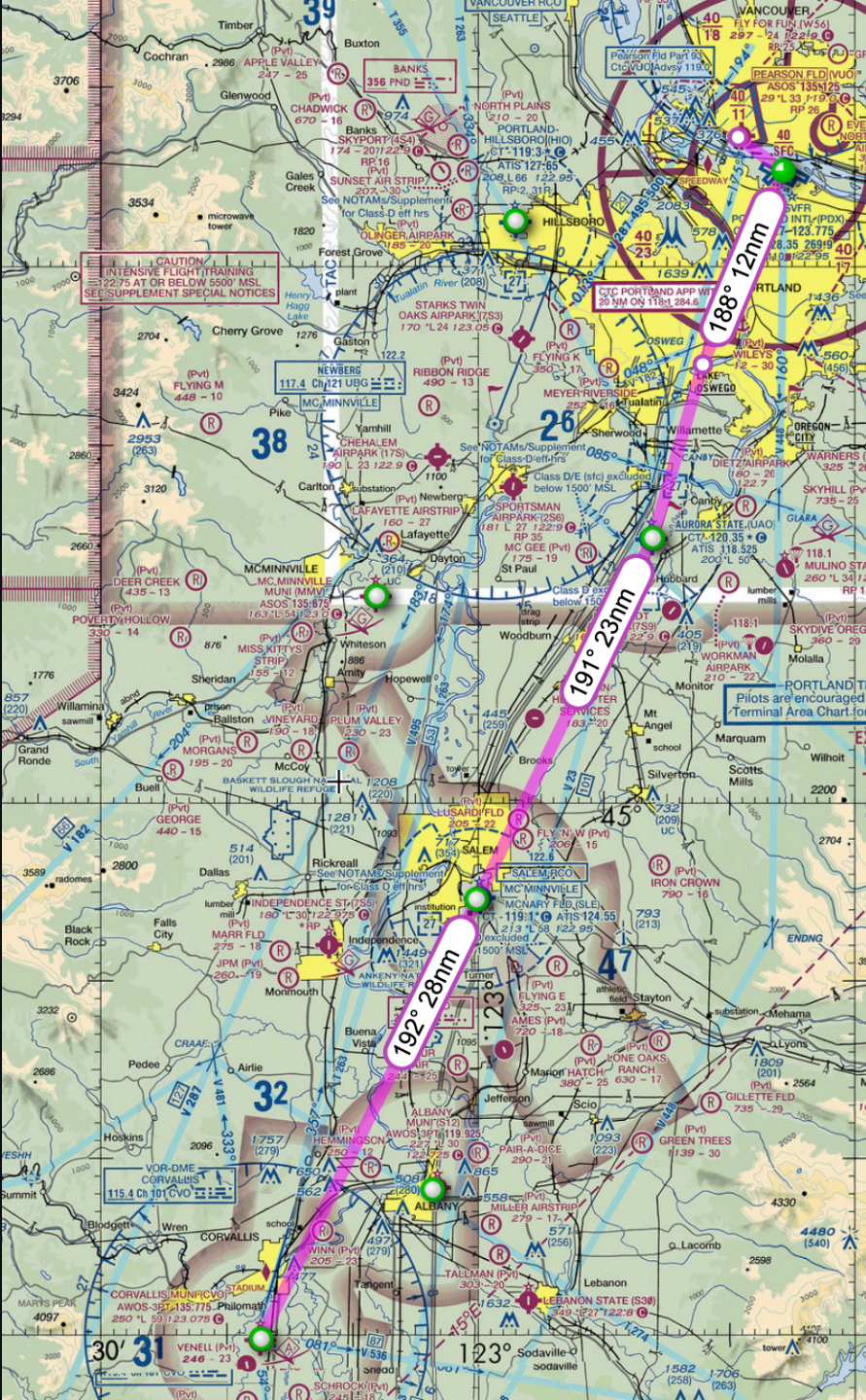


Final Plan

- KVVU
- KPDX
- Top-of-climb (TOC) - 6,500' MSL
- Lake Oswego
- KUAO - Aurora
- KSLE - Salem
- Top-of-decent (TOD)
- KCVO

Preflight Information Requirements (91.103)

- "NWKRAFT"
 - **NOTAMs**
 - **Weather**
 - **Known ATC delays:** For bigger airports
 - **Runway lengths:** For our intended airports
 - **Alternates available:** Other airports we can go to
 - **Fuel requirements**
 - **Takeoff and landing distances:** Performance charts



How are we going to get there?

- Pilotage: Look out the window
 - See our waypoints
 - (and everything in between)
- Dead reckoning:
 - $\text{Speed} * \text{Time} = \text{Distance}$
- Radio navigation:
 - Newberg VOR
 - Corvallis VOR
- GPS

Dead Reckoning

How much time will it take to take to fly from waypoint A to waypoint B?

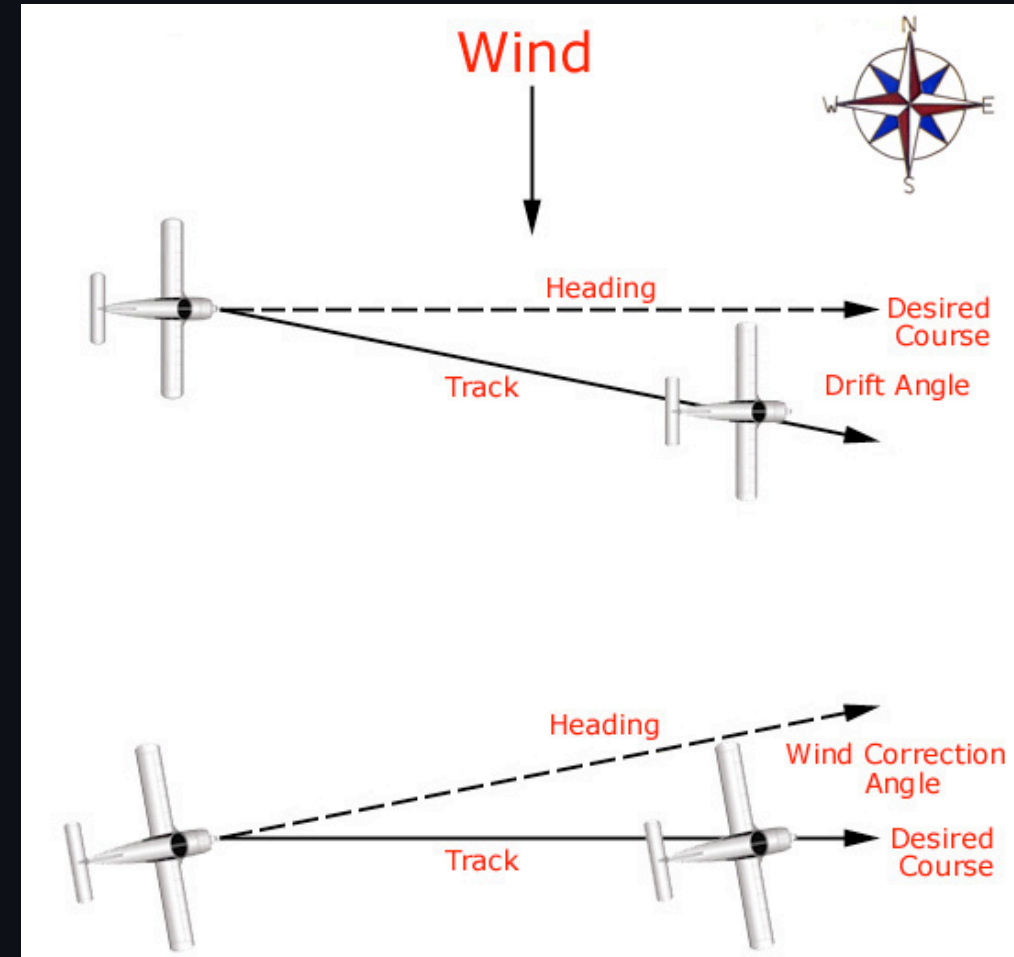
Time = Distance / Speed

We need to know our speed over the ground (groundspeed)

Dead Reckoning - Ground Speed

How do we find our speed over the ground?

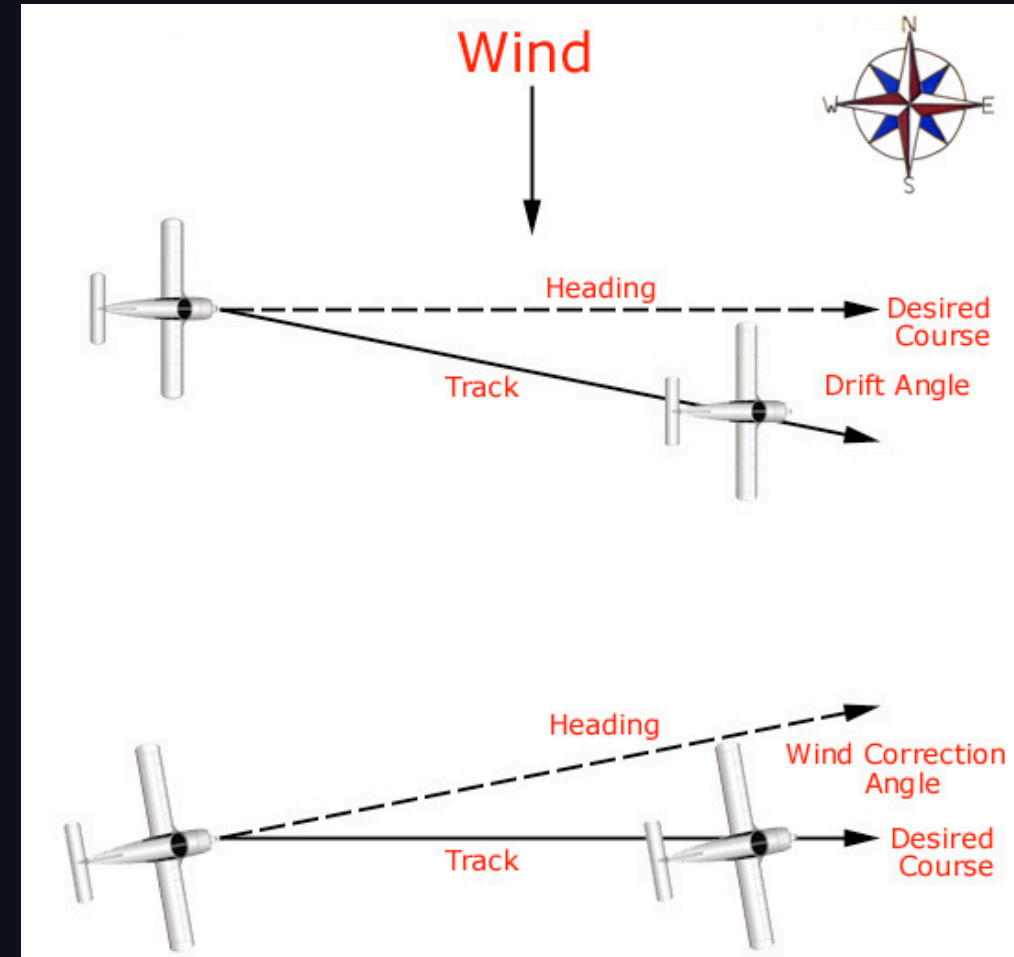
1. Start with our expected airspeed from performance
2. Account for atmospheric conditions (pressure, temperature)
3. Use forecasted winds to account for wind drift



Dead Reckoning - Wind Correction

What heading do we need to fly to get to waypoint B?

- We need to turn to correct for the direction the wind is blowing us
- We call this the **wind correction angle**
- It depends on wind speed and wind direction



VFR NAVIGATION LOG																						
Aircraft Number		N		Notes																		
Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC -L / +R WCA	TH -E / +W Var.	MH ± Dev.	CH	Dist.	GS	Time Off		GPH	Airport & ATIS Advisories						
	Ident Freq.			Dir.	Vel.	TAS					Leg	Est.	ETE	ETA	Fuel	Departure	Destination					
																		Rem.	Act.	ATE	ATA	Rem.
Totals »																						
Flight Plan and Weather Log on Reverse Side																						

Navigation Log

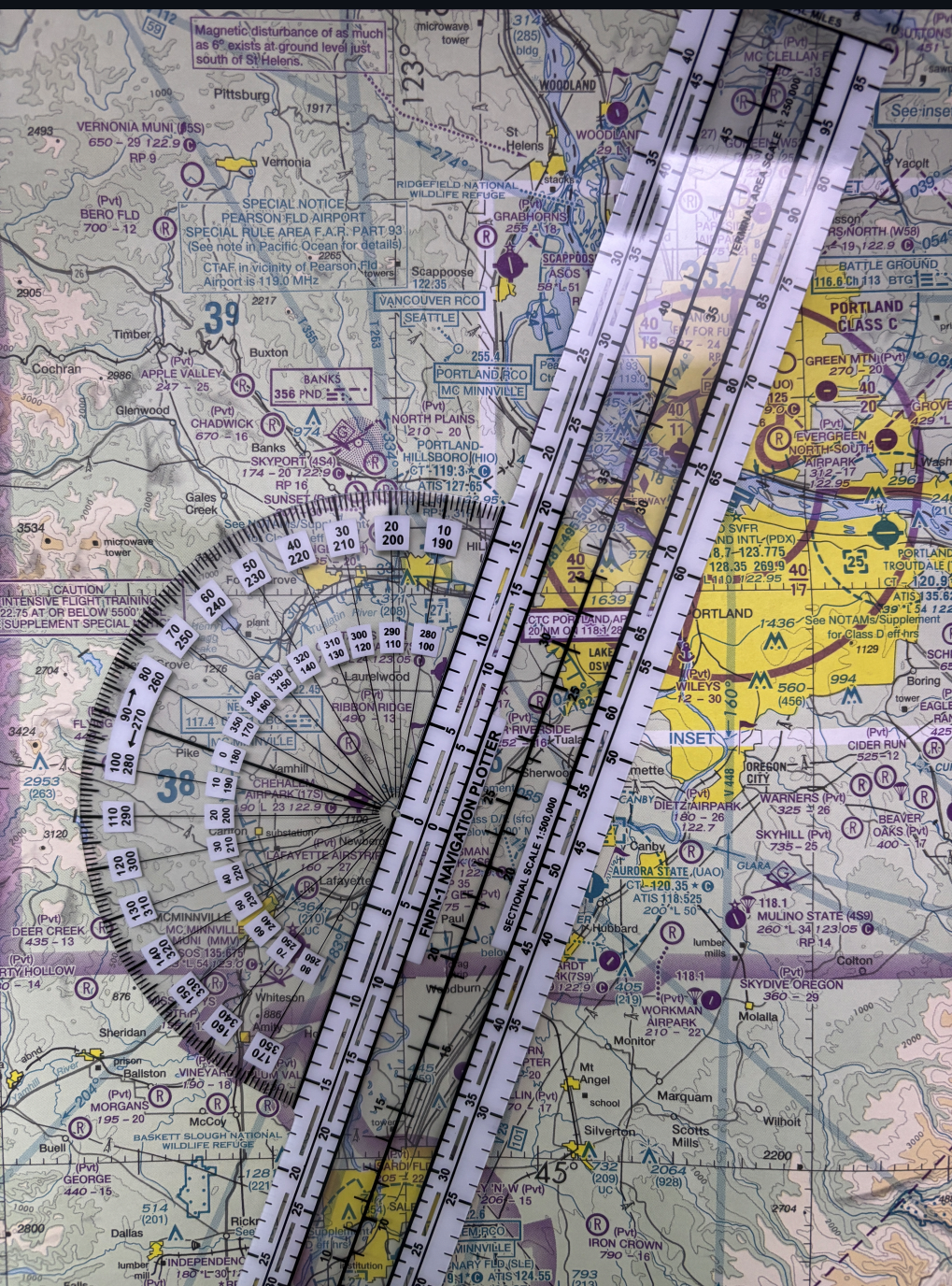
- Includes preplanned fields
 - Start with distance and true course
 - Compute heading to fly
 - Compute time
 - Compute fuel burn
- Fill out left to right

Navlog - Step 1: Enter our Waypoints

Check Points (Fixes)	VOR	
	Ident	Freq.
KVUO		
KPDX		
(TOC)		
LAKE OSWEGO		
KUAO		
KSLE		
KCVO		

Flight Plan and Weather Log

- List our fixes
- List our top-of-climb (TOC) after PDX
- Add any VOR identifiers with their frequencies / morse identifiers



Navlog - Step 2: Determine true courses

- Use a plotter
- Use [SkyVector.com](https://www.skyvector.com)

Navlog - Step 2: Determine true courses

Aircraft Number		N	Notes			
Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		
	Ident			Dir.	Vel.	
	Freq.			Temp		
KVUO		127				
KPDX		203	6500			
(TOC)		203	6500			
LAKE OSWEGO		196	6500			
KUAO		206	6500			
KSLE		206				
KCVO						

- True course for each leg
- Note (TOC) leg has same course as next leg
- Also added our altitudes



Navlog - Step 3: Determine distances

- Use a plotter and a paper chart
- Use an [SkyVector.com](https://www.skyvector.com)

Navlog - Step 4: Compute Climb

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
3100	S.L.	15	87	965	0	0	0
	2000	11	87	945	2	0.9	3
	4000	7	86	920	4	1.7	6
	6000	3	86	885	6	2.6	10

- From S.L. to 6000'
 - Time = 6 - 0 = 6 minutes
 - 10 - 0 = 10nm
 - 2.6 - 0 = 2.6 gallons
 - 6 / 60 = 0.1 hours
- Compute rates:
 - 10nm / 0.1 hours = **100 knots**
groundspeed (no wind)
 - 2.6 gallons / 0.1 hour = **26 gallons per hour**
- Use this as our TAS for the climb

Navlog - Step 4: Compute Climb

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS
	Ident			Dir.	Vel.	
	Freq.			Temp		TAS
KVUO		127				100
KPDX		203	6500			100
(TOC)		203	6500			
		203	6500			

Navlog - Step 5: Determine Cruise, Winds

Winds Aloft forecast from aviationweather.gov

(Extracted from FBUS31 KWN0 101358)

FD1US1

DATA BASED ON 101200Z

VALID 101800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
PDX	2306	2318+05	2229+00	2242-06	2164-17	2177-28	218843	218852	228861

- Climb: 230° true @ 6 knots
- Cruise: 6000 ft: 230° true @ 18 knots, 5° C

ForeFlight Winds

Close		KUAO Aurora State		★	
Direct To		Remove from Route		Fullscreen	
				More >	
Info		Weather		Runway	
				Procedure	
				NOTAM	
METAR		TAF		MOS	
				Daily	
				Winds	
9h 51m ago					
8:30 AM PDT					
3,000'		8°C (ISA-1)		231° at 8 kts	
6,000'		5°C (ISA+2)		222° at 19 kts	
9,000'		0°C (ISA+3)		215° at 30 kts	
12,000'		-4°C (ISA+5)		214° at 41 kts	
15,000'		-10°C (ISA+5)		215° at 51 kts	
18,000'		-15°C (ISA+6)		215° at 60 kts	
21,000'		-21°C (ISA+6)		213° at 63 kts	
24,000'		-29°C (ISA+4)		217° at 72 kts	

- We can also get winds over an airport using ForeFlight
- Uses weather model to predict winds

Navlog - Step 5: Determine Cruise, Airspeed

		20°C BELOW STANDARD TEMP -17°C			STANDARD TEMPERATURE 3°C			20°C ABOVE STANDARD TEMP 23°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	25	---	---	---	79	143	15.0	75	142	14.2
	23	75	137	14.3	72	137	13.6	68	136	12.9
	21	67	131	12.8	64	130	12.2	61	129	11.6
	19	60	123	11.4	57	123	10.9	54	121	10.4
2300	25	80	140	15.1	76	140	14.4	72	140	13.6
	23	72	135	13.7	68	134	13.0	65	133	12.4
	21	64	128	12.2	61	127	11.7	58	126	11.1
	19	57	120	10.9	54	119	10.4	51	118	10.0
2200	25	76	138	14.5	72	138	13.7	69	137	13.0
	23	69	132	13.1	65	131	12.4	62	130	11.8
	21	61	125	11.7	58	124	11.2	55	123	10.7
	19	54	117	10.4	51	116	10.0	49	115	9.5
2100	25	73	135	13.8	69	135	13.1	66	134	12.5
	23	65	129	12.5	62	128	11.9	59	127	11.3
	21	58	122	11.2	55	121	10.7	53	120	10.2
	19	51	114	9.9	49	113	9.5	46	111	9.1
	17	44	105	8.7	42	102	8.4	40	99	8.0

Pressure altitude, 6000' chart

- Use standard temperature (3° vs 5° C)
- 61% BHP
- 127 knots true airspeed (TAS)
- 11.7 gph fuel burn, with proper leaning

Airspeed Calibration

FLAPS UP													
KIAS	50	60	70	80	90	100	110	120	130	140	150	160	170
KCAS	61	65	72	80	89	99	109	118	128	138	147	157	167

- 127 knots indicated airspeed (IAS)
- ~125 knots calibrated airspeed (CAS)

Navlog - Step 5: Determine Cruise, Airspeed

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS
	Ident			Dir.	Vel.	125
	Freq.			Temp		TAS
KVUO		127				100
KPDX						
(TOC)		203	6500			100
		203	6500			127
LAKE OSWEGO						
		196	6500			127
KUAO						
		206	6500			127
KSLE						
		206				127
KCVO						

Navlog - Step 5: Determine Cruise, Add Winds

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS
	Ident			Dir.	Vel.	125
	Freq.			Temp		TAS
KVUO		127		230	6	100
KPDX						
(TOC)		203	6500	230	6	100
		203	6500	230	18	127
				+5 C		
LAKE OSWEGO		196	6500	230	18	127
				+5 C		
KUAO		206	6500	230	18	127
				+5 C		
KSLE		206		230	18	127
				+5 C		
KCVO						

Navlog - Step 6: Course and Headings

- We need to convert the true course we got from the chart into a heading we can follow in the airplane
- We need to correct for
 - Wind
 - Magnetic variation (magnetic vs true heading)
 - Compass deviation (interference with our airplane's compass)

Navlog - Step 6: Course and Headings

1. Compute true heading (TH) = True course (TC) + wind correction angle (WCA)
2. Compute magnetic heading (MH) = True heading + magnetic variation
3. Compute compass heading (CH) = Magnetic heading (MH) + compass deviation

Navlog - Step 6: Course and Headings, True Heading

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH
	Ident			Dir.	Vel.	125				
	Freq.			Temp		TAS	-L / +R WCA	-E / +W Var.	± Dev.	
KVUO		127				100	127			
KPDX										

Using an E6B, compute heading/airspeed:

- Climb leg winds (3000'): 230° true @ 6 knots
- Course: 127 ° True
- True airspeed: 100 knots

Result: Heading **130 ° True**, Wind correction angle (WCA): **+3°**, Groundspeed: **101 knots**

Navlog - Step 6: Course and Headings, True Heading

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH	Dist.	GS
	Ident			Dir.	Vel.	125					Leg	Est.
	Freq.			Temp		TAS	-L / +R WCA	-E / +W Var.	± Dev.		Rem.	Act.
KVUO		127		230	6	100	127	130			3.2	101
KPDX							+3					

Result: Heading **130 ° True**, Wind correction angle (WCA): **+3°**, Groundspeed: **101 knots**

Navlog - Step 6: Course and Headings, Magnetic Heading



- On the section find an "isogonic line"
- "East is least"
 - Subtract easterly variation
 - Add westerly variation
- We have 15° E, so we'll subtract 15°

Navlog - Step 6: Course and Headings, Magnetic Heading

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH	Dist.	GS
	Ident			Dir.	Vel.	125					Leg	Est.
	Freq.			Temp		TAS					Rem.	Act.
KVUO		127		230	6	100	127	130	115		3.2	101
KPDX							+3	-15				

Navlog - Step 6: Course and Headings, Compass Heading

For	N	30	60	E	120	150
Steer	0	27	56	85	116	148
For	S	210	240	W	300	330
Steer	181	214	244	274	303	332

- Compasses installed in airplanes are subject to magnetic interference due to
 - Skin and surface of the aircraft
 - Electrical components in the airplane
- This error is called **compass deviation**
 - A compass deviation card will be in your airplane
 - This card shows corrections for this error

Navlog - Step 6: Course and Headings, Compass Heading

For	N	30	60	E	120	150
Steer	0	27	56	85	116	148
For	S	210	240	W	300	330
Steer	181	214	244	274	303	332

- For our magnetic heading of 115°
 - Use the 120° . Error is -1°
- $115^{\circ} - 4 = 111^{\circ}$ Magnetic
- This is our **compass heading**

Navlog - Step 6: Course and Headings, EFIS Heading



Note that an airplane with an EFIS (like the Garmin G5), are calibrated for deviation error during installation

- We will fly **magnetic heading** when navigating with the G5
- We will fly with **compass heading** when navigating with our magnetic compass

Navlog - Step 6: Course and Headings, Compass Heading

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH	Dist.	GS	Time Off		GPH
	Ident			Dir.	Vel.	125					Leg	Est.			
	Freq.			Temp		TAS					Rem.		ETE	ETA	Fuel
												Act.	ATE	ATA	Rem.
KVUO		127		230	6	100	127	130	115	111	3.2	101			
KPDX							+3	-15	-4						

Navlog - Step 6: Course and Headings, Compass Heading

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH	Dist.	GS	Time Off		GPH		
	Ident			Dir.	Vel.	125					Leg	Est.					
	Freq.					Temp							TAS	-L / +R WCA	-E / +W Var.	± Dev.	Rem.
																	ATE
KVUO		127		230	6	100	127	130	115	111	3.2	101	2		1		
					+3		-15	-4									
KPDX		203	6500	230	6	100	203	204	189	193		128					
					+1		-15	+4									
(TOC)		203	6500	230	18	127	203	204	192	196		111					
				+5 C	+4		-15	+4									
LAKE OSWEGO		196	6500	230	18	127	196	201	186	190	10.1	112					
				+5 C	+5		-15	+4									
KUAO		206	6500	230	18	127	206	209	194	198	22.5	110					
				+5 C	+3		-15	+4									
KSLE		206		230	18	127	206	209	194	198	27.6	110					
				+5 C	+3		-15	+4									

Navlog - Step 7: Computing Top of Climb

- Compute climb distance
 - 6 minutes = 0.1 hours
 - $3.2\text{nm} / 101 \text{ knots} * 60 = 2 \text{ minutes}$
- Second leg
 - $6 - 2 \text{ minutes} = 4 \text{ minutes}$
 - $(4 / 60) * 128 \text{ knots} = \mathbf{8.5\text{nm}}$
- Computing leg distances
 - PDX to Lake Oswego: 12nm
 - Third leg: (TOC) to Lake Oswego: $12 - 8.5\text{nm} = \mathbf{3.5\text{nm}}$

Navlog - Step 7: Computing Top of Climb

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH	Dist.	GS
	Ident			Dir.	Vel.	125					Leg	Est.
	Freq.			Temp		TAS					Rem.	Act.
KVUO		127		230	6	100	127	130	115	111	75	101
KPDX							+3	-15	-4			
(TOC)		203	6500	230	6	100	203	204	189	193	8.5	128
							+1	-15	+4			
LAKE OSWEGO		203	6500	230	18	127	203	204	192	196	3.5	111
				+5 C			+4	-15	+4			
		196	6500	230	18	127	196	201	186	190	10.1	112
				+5 C			+5	-15	+4			

Navlog - Step 8: ETE and Fuel

Now that we know our groundspeed we can compute:

- Estimated time enroute (ETE): Time between waypoints
 - $3.2\text{nm} / 101\text{ knots GS} = \mathbf{2\text{ minutes}}$
 - Climb fuel: $26\text{ gallons / hour} * (2\text{ minutes}) = \mathbf{0.9\text{ gallons}}$
- Estimate fuel burn: How much fuel we will burn each leg

Navlog - Step 8: ETE and Fuel

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH	Dist.	GS	Time Off		GPH
	Ident			Dir.	Vel.	125					Leg	Est.			
	Freq.					Temp	TAS	-L / +R WCA	-E / +W Var.				± Dev.	Rem.	Act.
	KVUO													ATE	
		127		230	6	100	127	130	115	111	3.2	101	2		1
KPDX								+3	-15		-4				

Navlog - Final Navlog

Check Points (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH	Dist.	GS	Time Off		GPH
	Ident			Dir.	Vel.	125					Leg	Est.	ETE	ETA	Fuel
	Freq.			Temp		TAS					Rem.	Act.			Rem.
KVUO		127		230	6	100	127	130	115	111	3.2	101	2		1
KPDX							+3	-15	-4		71.8				49
(TOC)		203	6500	230	6	100	203	204	189	193	8.5	128	4		2
							+1	-15	+4		63.3				47.5
LAKE OSWEGO		203	6500	230	18	127	203	204	192	196	3.5	111	2		.5
				+5 C			+4	-15	+4		59.8				47
KUAO		196	6500	230	18	127	196	201	186	190	10.1	112	6		1
				+5 C			+5	-15	+4		50.1				46
KSLE		206	6500	230	18	127	206	209	194	198	22.5	110	12		2.5
				+5 C			+3	-15	+4		27.6				43.5
KCVO		206	6500	230	18	127	206	209	194	198	27.6	110	15		3
				+5 C			+3	-15	+4						40.5
Totals »											75.4		41		10

Flight Plan and Weather Log on Reverse Side

Flight Planning with ForeFlight

Entering a Flight Plan

Aero & TFRs

FPL

!

Search

N2017E

75% 2400 RPM

6,500'

KVUO

KPDX

LAKE OSWEGO

KUAO

KSLE

KCVO

Procedure

Routes (6)

ETD

DIST

75 nm

ETE

0h40m

ETA (PDT)

10:26 am

FUEL

12.6 g

WIND

14 kts head

RTE CORR

8 nm

!

Edit

NavLog

Profile

ForeFlight Profiles

"Advanced Profiles": ForeFlight-made

Close

Performance Profile

CLIMB

Max Rate of Climb (Default)

Details

✓

CRUISE

75% 2400 RPM (Default)

Details

✓

55% 2100 RPM

Details

65% 2300 RPM

Details

70% 2400 RPM

Details

DESCENT

Normal 500 FPM (Default)

Details

✓

CUSTOM PERFORMANCE PROFILES

6k, normal climb 23/23"

Basic

Edit

Add Basic Performance Profile

Basic profiles: User-entered

Back

6k, normal climb 23/23"

GENERAL

Profile Name

6k, normal climb 23/23"

CLIMB

Climb TAS (KTS)

95

Climb Fuel Per Hour

21.5

Climb Rate (FPM)

485

CRUISE

Cruise TAS (KTS)

134

Cruise Fuel Per Hour

13

DESCENT

Descent TAS (KTS)

135

Descent Fuel Per Hour

10

Descent Rate (FPM)

500

The fuel numbers above are in GALLONS PER HOUR. You can change this on the Aircraft view, under "Fuel Units."

Aero & TFRs

FPL

!

Search

FROM		TO	HDG	TOTALS			LEG			REMAINING		ETA
KVUO	➔	KPDX	114°M	3 nm	2.8 g	2m03s	3 nm	0.8 g	2m03s	-----	-----	--:-- --
KPDX	➔	LAKE OSWEGO	187°M	14 nm	5.2 g	9m01s	11 nm	2.4 g	6m58s	-----	-----	--:-- --
LAKE OSWEGO	➔	KUAO	188°M	25 nm	6.5 g	0h14m	11 nm	1.2 g	5m11s	-----	-----	--:-- --
KUAO	➔	KSLE	194°M	47 nm	9.1 g	0h25m	23 nm	2.7 g	0h11m	-----	-----	--:-- --
KSLE	➔	KCVO	194°M	75 nm	12.6 g	0h40m	28 nm	3.5 g	0h15m	-----	-----	--:-- --
DIST 75 nm		ETE 0h40m		ETA (PDT) 10:26 am		FUEL 12.6 g		WIND 14 kts head		RTE CORR 8 nm		
										Edit	NavLog	Profile



Aero & TFRs

FPL



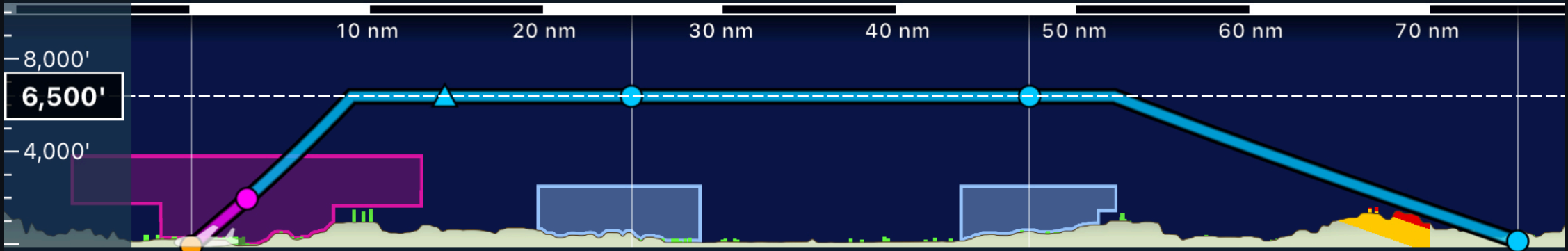
Search



Route



Airspace



KVUO
9:45 AM PDT

KUAO
9:59 AM PDT

KSLE
10:10 AM PDT

KCVO
10:25 AM PDT

DIST	ETE	ETA (PDT)	FUEL	WIND	RTE CORR	HIGHEST PT	CLEARANCE	FIRST STR
75 nm	0h40m	10:25 am	12.6 g	14 kts head	8 nm	1,757'	391'	None



Edit

NavLog

Profile

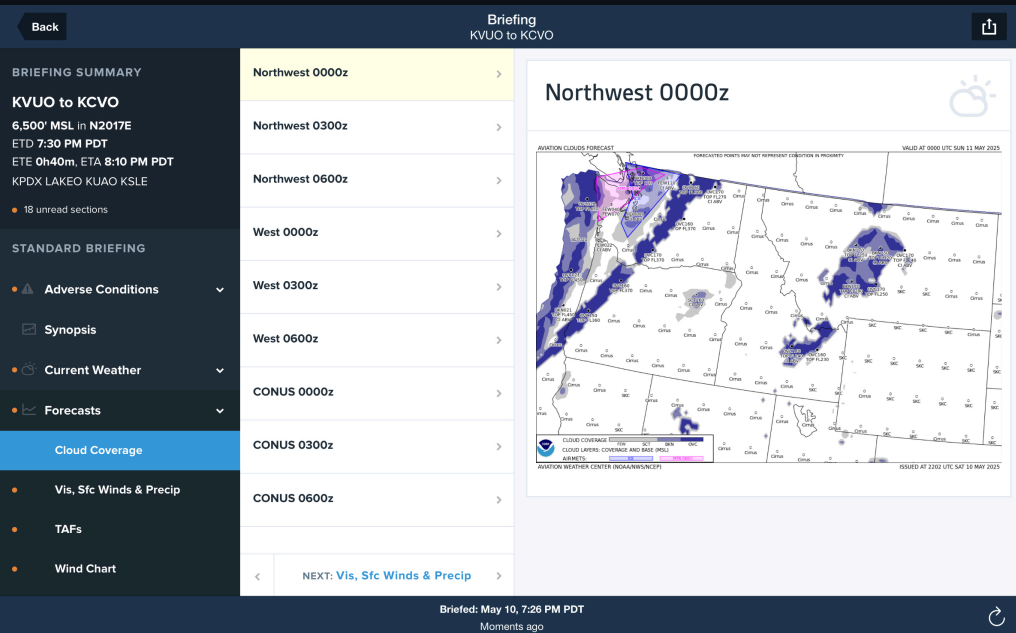
Manual Navlog vs ForeFlight

- Why are they different?
 - ForeFlight can compute changing winds as the route progresses
 - ForeFlight can calculate winds as we climb
 - ForeFlight performance
 - Rounding on manual navlog
- Sanity-check any ForeFlight output

Flying our Flight Plan

Getting A Weather Briefing

- What is a weather briefing?
 - Includes NOTAMs, METARs, TAFs, AIRMETS/SIGMETs for a route of flight
- Where can we get one?
 - ForeFlight
 - [1800wxbrief.com](https://www.1800wxbrief.com)
 - Calling 1800-WX-BRIEF or a Flight Service Station
- A record of the briefing is kept

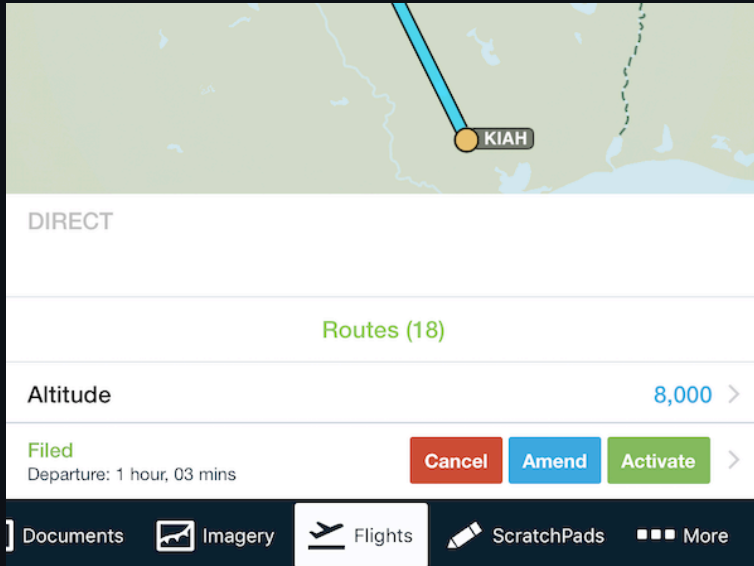


Filing a Flight Plan

FLIGHT PLAN		(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR			TIME STARTED		SPECIALIST INITIALS	
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION		☐ STOPOVER						
1. TYPE	2. AIRCRAFT IDENTIFICATION	3. AIRCRAFT TYPE / SPECIAL EQUIPMENT	4. TRUE AIRSPEED	5. DEPARTURE POINT	6. DEPARTURE TIME		7. CRUISING ALTITUDE	
VFR					PROPOSED (Z)	ACTUAL (Z)		
IFR			KTS					
DVFR								
8. ROUTE OF FLIGHT								
9. DESTINATION (Name of airport and city)		10. EST. TIME ENROUTE		11. REMARKS				
		HOURS	MINUTES					
12. FUEL ON BOARD		13. ALTERNATE AIRPORT(S)		14. PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE				15. NUMBER ABOARD
HOURS	MINUTES			17. DESTINATION CONTACT/TELEPHONE (OPTIONAL)				
16. COLOR OF AIRCRAFT		CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed \$1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.						

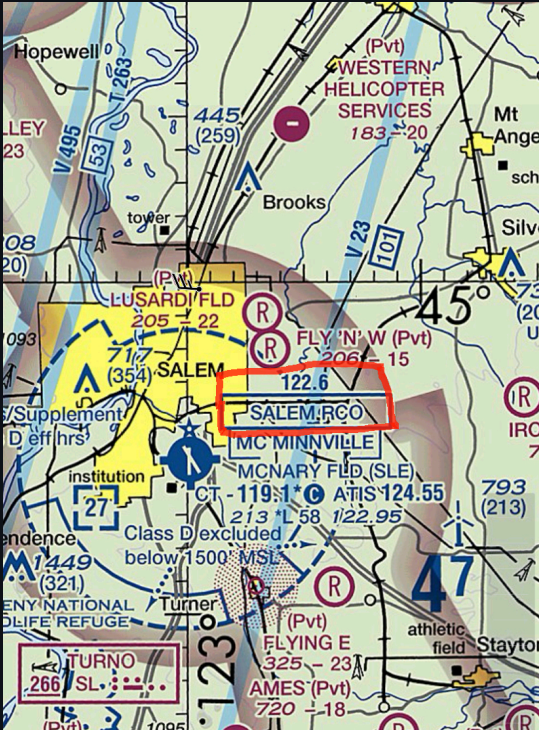
- What is a flight plan?
 - Details about your flight that you file with flight service
 - Includes your route, ETD, ETA, passengers
 - A flight plan that has not been closed 30 minutes after the ETA will initiate search and rescue
- Why use a flight plan?
 - It's not required, but it's a good idea
 - We want someone looking for us

Flight Plan: Activating



- Before takeoff, file your flight plan, use your best estimate for ETD and ETE
- Shortly before or after departure, open the flight plan
- If your ETA is going to change significantly, contact FSS or amend your flight plan
- After landing, close your flight plan
- Ways to activate or close a flight plan
 - Via ForeFlight
 - Calling an FSS: 1800-WX-BRIEF
 - Contacting FSS in the air

Flight Service Stations (FSS)



Close KVUO Pearson Field ★

Direct To Remove from Route Fullscreen More >

Info Weather Runway Procedure NOTAM

FLIGHT SERVICE

Flight Service
(800) 992-7433
Seattle (SEA), 24H 122.5

TRAFFIC PATTERNS

ALL 1,029' MSL

CHART SUPPLEMENT

A/FD >

NEARBY

- FSS frequencies
 - List on the sectional chart above airport datablock
 - Also listed in ForeFlight
- Example radio call
 - "McMinnville radio, Cessna 2017E on 122.6"
 - "McMinnville radio, Cessna 2017, I'd like to open my VFR flight plan to Renton, K-R-N-T"

UTC Time Conversion

Pacific Daylight Time (Summer) [UTC -7]

Zulu Time	Local Time	Zulu Time	Local Time
0:00Z	17:00 Local	12:00Z	5:00 Local
1:00Z	18:00 Local	13:00Z	6:00 Local
2:00Z	19:00 Local	14:00Z	7:00 Local
3:00Z	20:00 Local	15:00Z	8:00 Local
4:00Z	21:00 Local	16:00Z	9:00 Local
5:00Z	22:00 Local	17:00Z	10:00 Local
6:00Z	23:00 Local	18:00Z	11:00 Local
7:00Z	0:00 Local	19:00Z	12:00 Local
8:00Z	1:00 Local	20:00Z	13:00 Local
9:00Z	2:00 Local	21:00Z	14:00 Local
10:00Z	3:00 Local	22:00Z	15:00 Local
11:00Z	4:00 Local	23:00Z	16:00 Local

Pacific Standard Time (Winter) [UTC -8]

Zulu Time	Local Time	Zulu Time	Local Time
0:00Z	16:00 Local	12:00Z	4:00 Local
1:00Z	17:00 Local	13:00Z	5:00 Local
2:00Z	18:00 Local	14:00Z	6:00 Local
3:00Z	19:00 Local	15:00Z	7:00 Local
4:00Z	20:00 Local	16:00Z	8:00 Local
5:00Z	21:00 Local	17:00Z	9:00 Local
6:00Z	22:00 Local	18:00Z	10:00 Local
7:00Z	23:00 Local	19:00Z	11:00 Local
8:00Z	0:00 Local	20:00Z	12:00 Local
9:00Z	1:00 Local	21:00Z	13:00 Local
10:00Z	2:00 Local	22:00Z	14:00 Local
11:00Z	3:00 Local	23:00Z	15:00 Local

Flying our Flight Plan

Going to use all the tools at our disposal:

- Pilotage: Look out the window
- Dead reckoning:
 - Using our navlog, flying headings
 - Note the time of each waypoint
- Radio navigation
- GPS navigation
- VFR flight following

VOR and DME navigation



- Limited by line-of-sight, works better the higher you go
- Flying to a VOR:
 - i. Ensure CDI is in VLOC mode (not GPS mode)
 - ii. Tune the station
 - iii. Identify the station: Listen for morse code
 - No morse code means station is out of service
 - iv. Center the CDI with a TO indication
 - v. Turn to the course shown, bracketing for wind

GPS Navigation



- Ensure CDI is in GPS mode
- Guidance towards the purple line on the map
- Direct-To: Course from your current position to another waypoint

Lost Procedures

4 C's

- **Climb**
 - Better see landmarks, get
 - Get adequate radio or nav signal reception
- **Communicate:**
 - Talk to ATC
 - Ask for vector to a know location (airport, VFR point)
- **Confess**
 - Say that you're lost
- **Comply**
 - Follow what ATC says

Diverting to an Alternate: Picking an Alternate

- Use information available in the cockpit to decide on a good alternate
 - GPS Navigators
 - FIS-B Weather
 - ATC

Diverting to an Alternate: Navigating to an Alternate

- Use pilotage
- Use a GPS direct
- Use radio navigation
- Apply rule-of-thumb calculations:
 - ~60 knots of groundspeed: 1nm per minute
 - ~90 knots of groundspeed: 1.5nm per minute
 - ~120 knots of groundspeed: 2nm per minute

Summary

- Picking Destinations
- Picking Waypoints
- VFR Cruising Altitudes (91.159)
- Cruising Altitudes
- Dead Reckoning
- Navigation Log
 - Steps to manually complete a navlog
- Flight Planning with ForeFlight
- Preflight Information Requirements (91.103)
- Weather Briefings
- Flight Plans
- UTC Time Conversion
- Flying our Flight Plan
- VOR and DME navigation
- GPS Navigation
- Lost Procedures
- Diverting to an Alternate

Knowledge Check

How do you convert calibrated airspeed into indicated airspeed?

Knowledge Check

You're traveling at 120 knots ground speed and you have 50nm left to your destination. If we maintain our speed, how long will it take you to get there?

Knowledge Check

You're traveling at 120 knots ground speed and you have 50nm left to your destination. If we maintain our speed, how long will it take you to get there?

```
50 / 2nm / minute = 25 minutes
```

Knowledge Check

We're planning to divert to an airport with an elevation of 3500'. We're currently cruising at 8500' and our ground speed is approximately 120 knots.

When should we start descending to enter the traffic pattern 3nm from the airport?

Knowledge Check

We're planning to divert to an airport with an elevation of 3500'. We're currently cruising at 8500' and our ground speed is approximately 120 knots.

$$8500 - 4500 = 4000'$$

$$4000' / 500 \text{ fpm} = 8 \text{ minutes}$$

$$8 \text{ minutes} * 2 \text{ nm} / \text{min} = 16 \text{ nm}$$

$$16 \text{ nm} - 3 \text{ nm} = 13 \text{ nm}$$