

Question#1 (10pts):

Theta/Theta Position fixing: **Radial 126** from Danville VOR and **Radial 199** from Boiler VOR

Theta/Rho Position fixing:

From Danville VOR - Radial 126 and DME= 17.5, or

From Boiler VOR - Radial 199 and DME=37

Note: DME given in nautical miles.

See map at the end of this document.

Question#2(10pts):

Retrieving Wind information for altitude = 4500ft. Use interpolation.

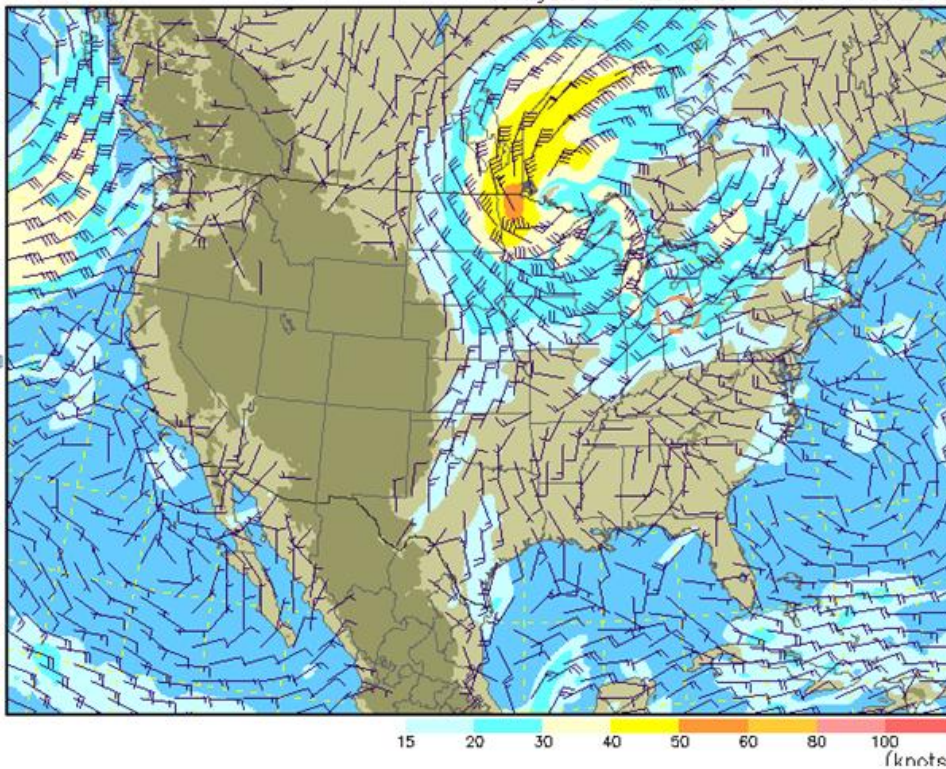
Wind/V at 3000ft (**250/20**)and 6000MSL (**250/25**) => **250/23**

Temperature: **15°** at 3000ft and **10°** at 6000ft => **13°**

Note: Approximate Values are accepted.

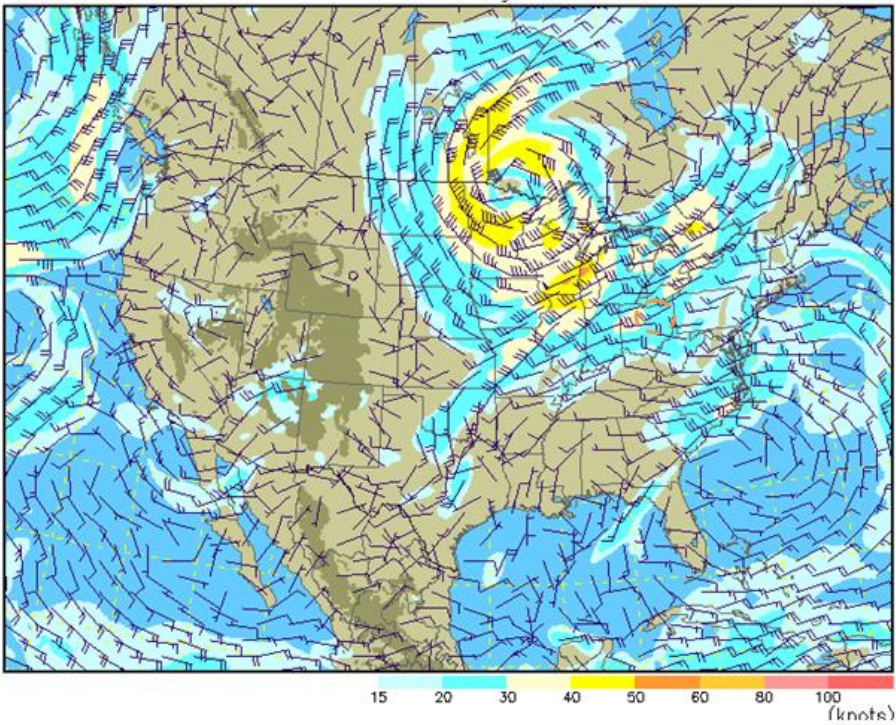
Wind speed (kts) at 3,000 ft MSL (900 mb)

Analysis valid 2000 UTC Thu 04 Oct 2012



Wind speed (kts) at 6,000 ft MSL (800 mb)

Analysis valid 2000 UTC Thu 04 Oct 2012



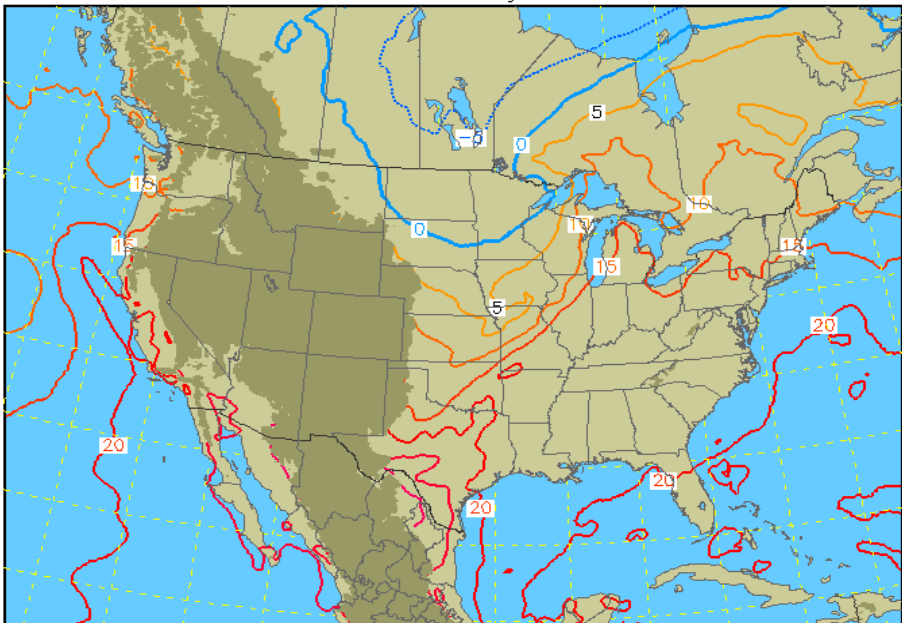
Note: Temperature retrieval is for demonstration purpose only (additional information). Temperature information is used to find TAS, but because we are using airspeed formula, we don't need to do this.

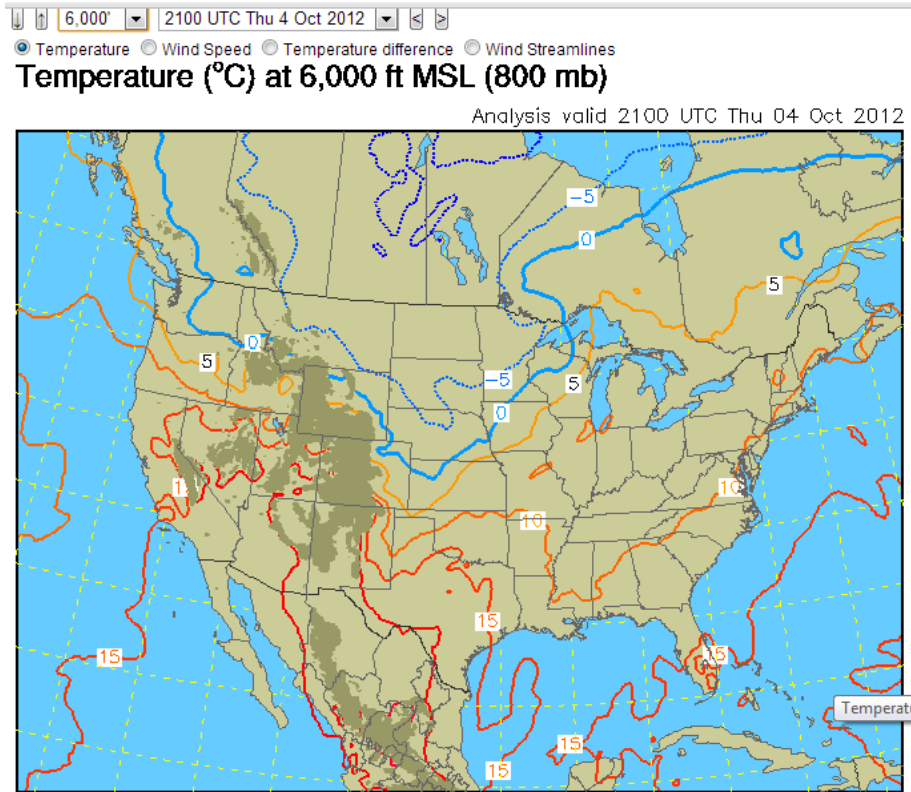
3,000' 2100 UTC Thu 4 Oct 2012

Temperature Wind Speed Temperature difference Wind Streamlines

Temperature (°C) at 3,000 ft MSL (900 mb)

Analysis valid 2100 UTC Thu 04 Oct 2012





After interpolation wind: 250/23 T=13degrees Celsius

$$TAS = CAS + \left(\left(2 * \frac{CAS}{100} \right) * \textit{Altitude in thousands of feet} \right)$$

$$TAS = 150 + \left(\left(2 * \frac{150}{100} \right) * 4.5 \right)$$

$$TAS = 163.5 \text{ kts}$$

Round TAS to:

$$TAS = 164 \text{ kts}$$

Computing GS:

$$GS = \sqrt{TAS^2 + V^2 - 2 * TAS * V * \cos(\gamma)}$$

$$GS = \sqrt{164^2 + 23^2 - 2 * 164 * 23 * \cos(170)}$$

$$GS = 184.7 \text{ kts}$$

Note: because of the tailwind component, GS is higher than TAS.

Computing the drift:

$$\frac{\sin(\text{Drift})}{WV} = \frac{\sin \gamma}{GS}$$

$$\frac{\sin(\text{Drift})}{23} = \frac{\sin 170}{185}$$

$$\sin(\text{Drift}) = 0.056$$

$$\text{Drift} = 3.59^\circ$$

Round drift to $\text{Drift} = 4^\circ$

Computing fuel consumption:

Fuel consumption 18gallons/hour = 18gallons/60 min → 6gallons/20 min

The assumptions that we are having is that we are taking off with 40gallons of fuel, and our rime of departure is 12:00 GMT. you will not be graded on calculation based on this data.

See last page of this document for completed Navigation Log.

Question#3(10pts):

Starboard (right) Drift, and Port (left) crab

Calculating the Ground Speed:

$$GS = \sqrt{TAS^2 + V^2 - 2 * TAS * V * \cos(\gamma)}$$

$$GS = \sqrt{230^2 + 42^2 - 2 * 230 * 42 * \cos(60)}$$

$$GS = 208 \text{ kt}$$

Note: the ground speed is smaller than the airspeed because the wind has a headwind component.

Calculating the Drift angle:

$$\frac{\sin(\text{Drift})}{WV} = \frac{\sin \gamma}{GS}$$

$$\frac{\sin(\text{Drift})}{42} = \frac{\sin 60}{208}$$

$$\sin(\text{Drift}) = 0.163$$

$$\text{Drift} = 10.44$$

Track = heading +Drift=270+10=280

Note: because the drift is to the right, add it to the heading.

Question#4(5pts):

T Course= 230, Variation = 7W, Deviation = 3E ==> Compass Heading= $230+7-3=234$

Question#5(5pts):

As opposed to the NDB, which transmits a nondirectional signal, the signal transmitted by the VOR contains directional information. Also, the NDB is found at airports while VORs can be terminal or en-route VORs.

DME: in contrary to the NDB and the VOR, the DME does not provide direction information. It provides distance information. Note that a DME is usually coupled with a VOR; therefore, the VOR /DME system provides direction and distance information.

Question#6(5pts):

- The three segments of a GPS system are: the control segment, the satellite segment, and the user segment.
- The GPS provides position and time information.

Question#7(5pts):

- The role of the gyroscopes in the INS system is to keep the INS platform level and enable the accelerometers to take accurate acceleration measurements.
- The INS generates position information by integrating twice the acceleration measured by the accelerometers.

Navigation Log (Question#2):

Check Point (Fixes)	VOR	Course (Route)	Altitude	Wind		CAS	TC	TH	MH	CH	Dist	GS	Time Off		Gallons
	Ident			Dir	Vel.	150					-L + R	-E + W	Leg	Est	ETE
DANVILLE	Freq					TAS	WCA	Var	+/- Dev		62	Act	ATE	ATA	Rem.
FRANKFURT		80	4500	13		164	080	084	080	086	62	184	20min13	12:20	6
							+4	+5	-2						34

