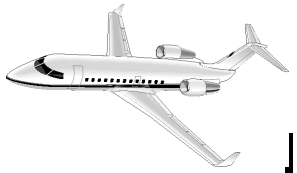
CEE 5614
Analysis of Air Transportation
Flight Planning

Dr. Antonio A. Trani

What is Flight Planning



- Procedure whereby airlines or individuals and ATC entities enter into a tentative agreement on what route will be flown.
- Several considerations are of paramount importance

  Weather conditions (wind, visibility, etc.)

  Aircraft weight and balance (to comply with c.g. envelope)

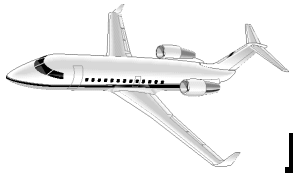
  Traffic density over congested fixes and airports

  Restricted ATC sections (SUA)

  Fuel reserves

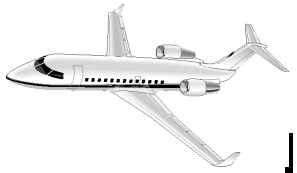
  Aircraft performance and NAV capabilities (Minimum equipment lists over NATS)

Differences in Flight Planning and Schedule Planning (Airline Prespective)



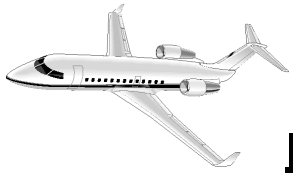
- While schedule planning looks at a 6-8 month horizon, flight planning is concerned with daily aircraft operations (a tactical planning activity)
- Flight planning is carried out by professionals at every airline or corporate department
- Private aircraft operators carry out their own planning using either manual computations or software like the one being demonstrated in class (Jeppessen Flight Star)

Why is Flight Planning Important?



- Enroute savings can save the airline Direct Operating Costs
- 2-3% Fuel consumption reductions are possble with wise planning (1995 United Airlines study on possible savings over the Pacific Ocean using SATNAV systems)
- Pilots like to have information before a flight to avoid surprises (weather being the most important reason)
- Free flight operations will increase the need for real-time flight plans

Sample Flight Plan



The following flight plan illustrates an FAA approved form

Department of Transportation
Federal Aviation Administration

FLIGHT PLAN

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 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.

1. TYPE	2. AIRCRAFT IDENT	3. AC TYPE/EQUIP	4. TRUE AIRSPEED	5. DEPARTURE POINT	6. DEPARTURE TIME		7. CRUISING ALT
					PROPOSED	ACTUAL	
IFR	N1234FS	DC-8-61/P	403	KROA	1400		22000

8. ROUTE OF FLIGHT

OAKLE J24 FLM

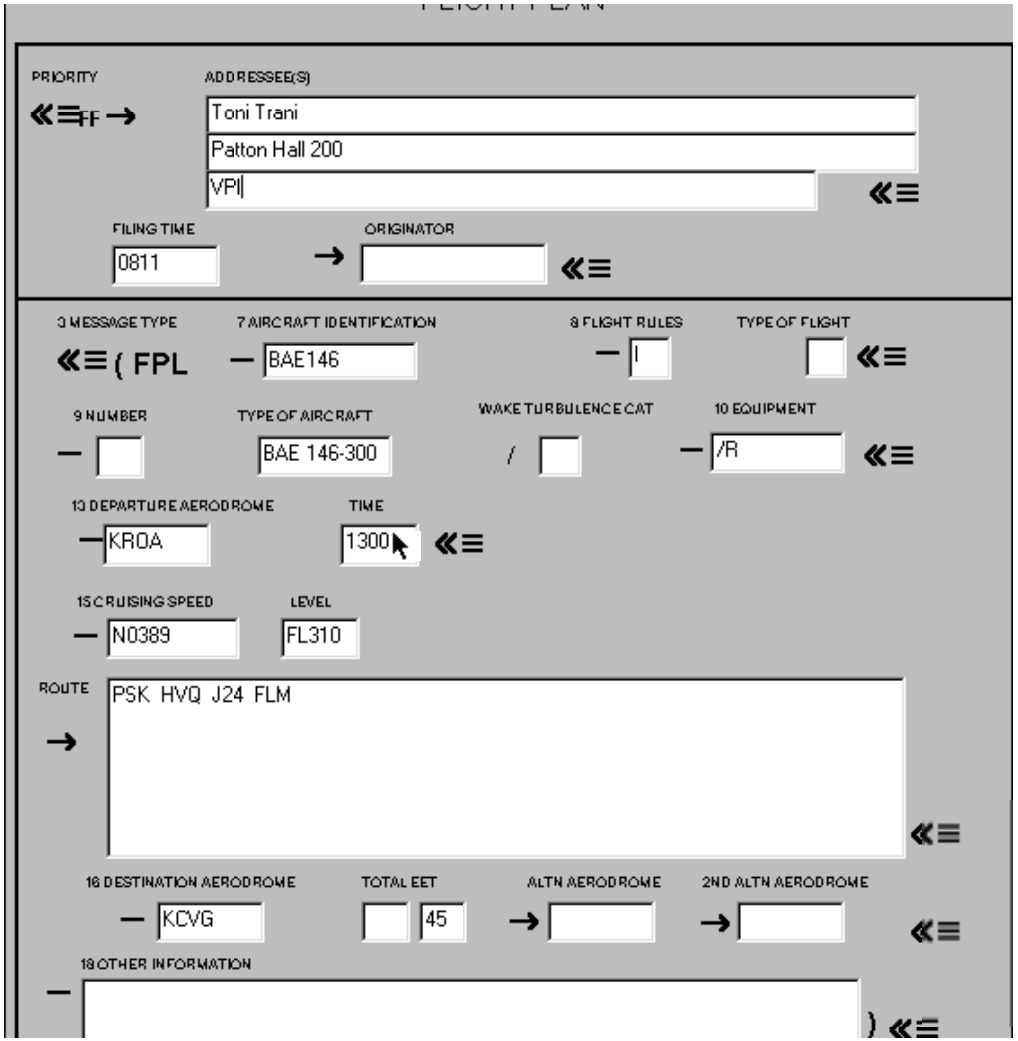
9. DESTINATION	10. EST. TIME ENROUTE		11. REMARKS
	HOURS	MINUTES	
KCVG		48	

12. FUEL ON BOARD		13. ALTERNATE	14. PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE	15. NUM ABOARD
HOURS	MINUTES			
04	19		Toni Trani Patton Hall 200,	2

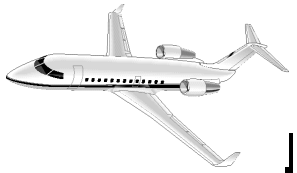
16. COLOR OF AIRCRAFT	
tan/blue	**CLOSE VFR FLIGHT PLAN WITH _____ FSS ON ARRIVAL**

FAA Form 7233-1

ICAO Sample Form



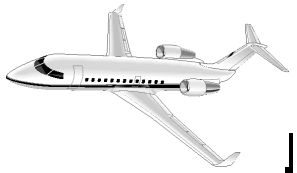
Flight Planning Software



Several computer software packages exist to automate the flight plan process

- Jeppesen Flite Star
- Jeppesen Jet Planner Pro
- Web-based flight plan services
- Garmin FltPlan (fltplan.com)
- Skyvector (skyvector.com)
- Many others

Typical Procedures in Flight Planning Software



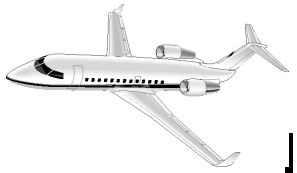
Inputs

- Select aircraft
- Select origin-destination pair (quick flight plan option)
- Select type of route (great circle, point to point, high altitude airways, etc.)
- Enter weight and balance information

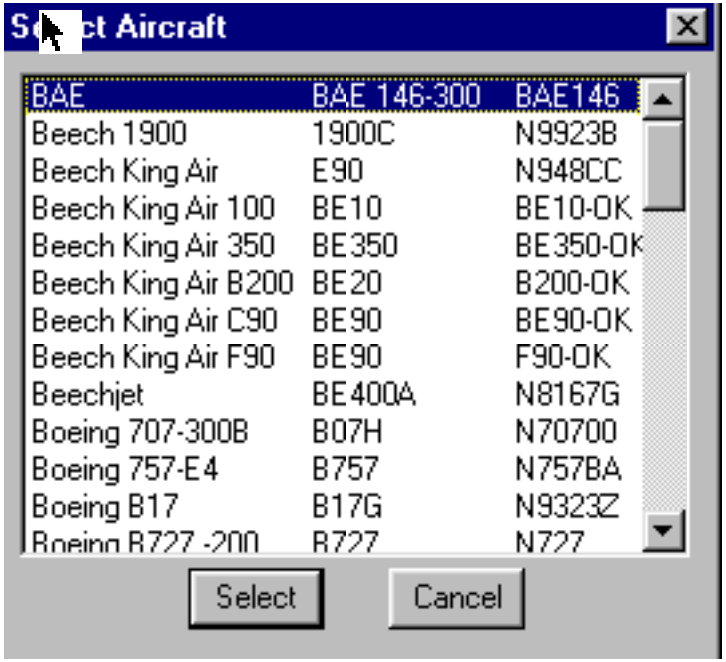
Outputs:

- Travel time, fuel consumed, trip report, trip profile and a hard copy (or electronic form) of the flight plan

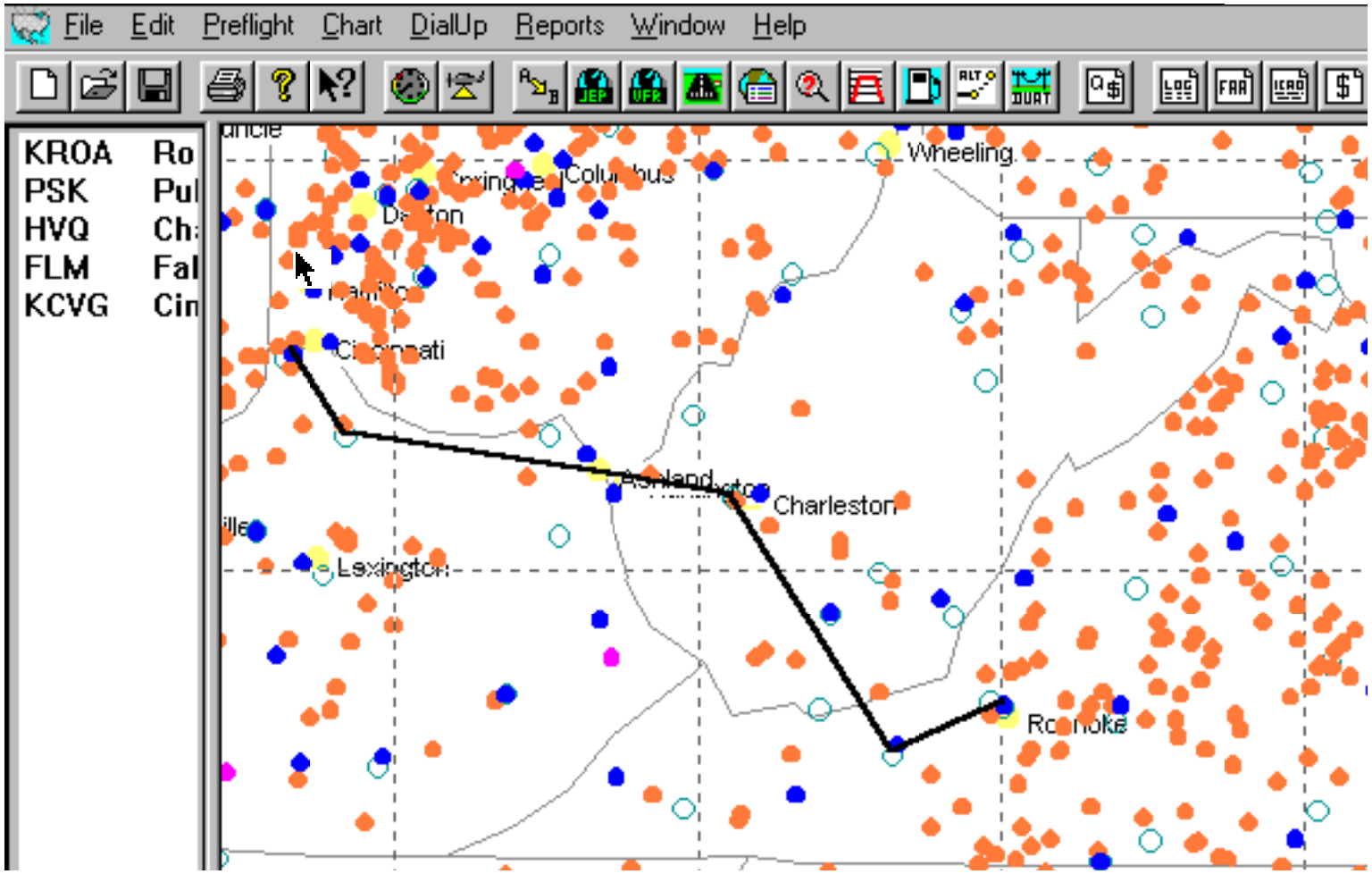
Sample Flite Star Pro Screens (Aircraft Selection Screen)



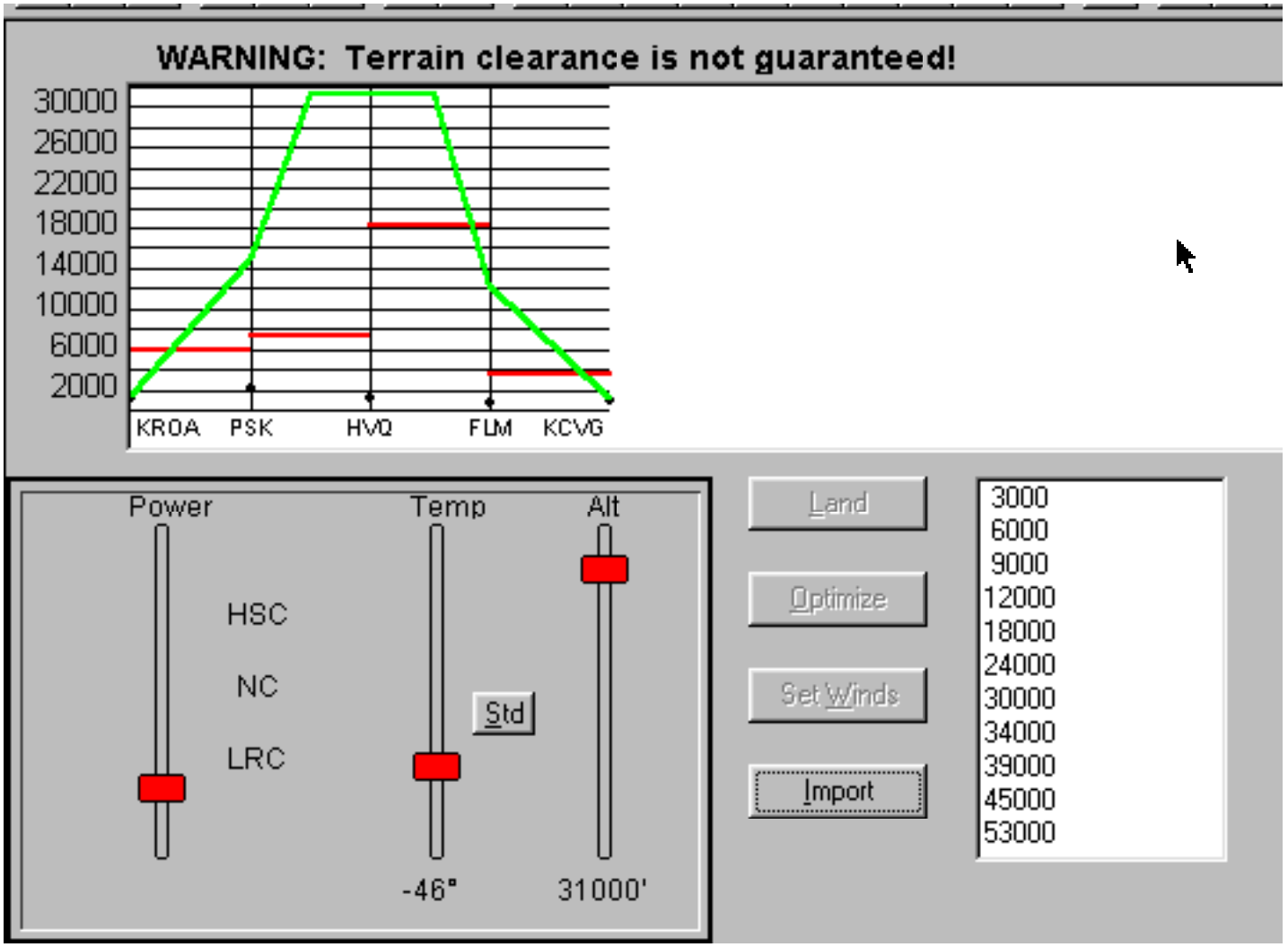
This screen shows various aircraft available to Flite Star database



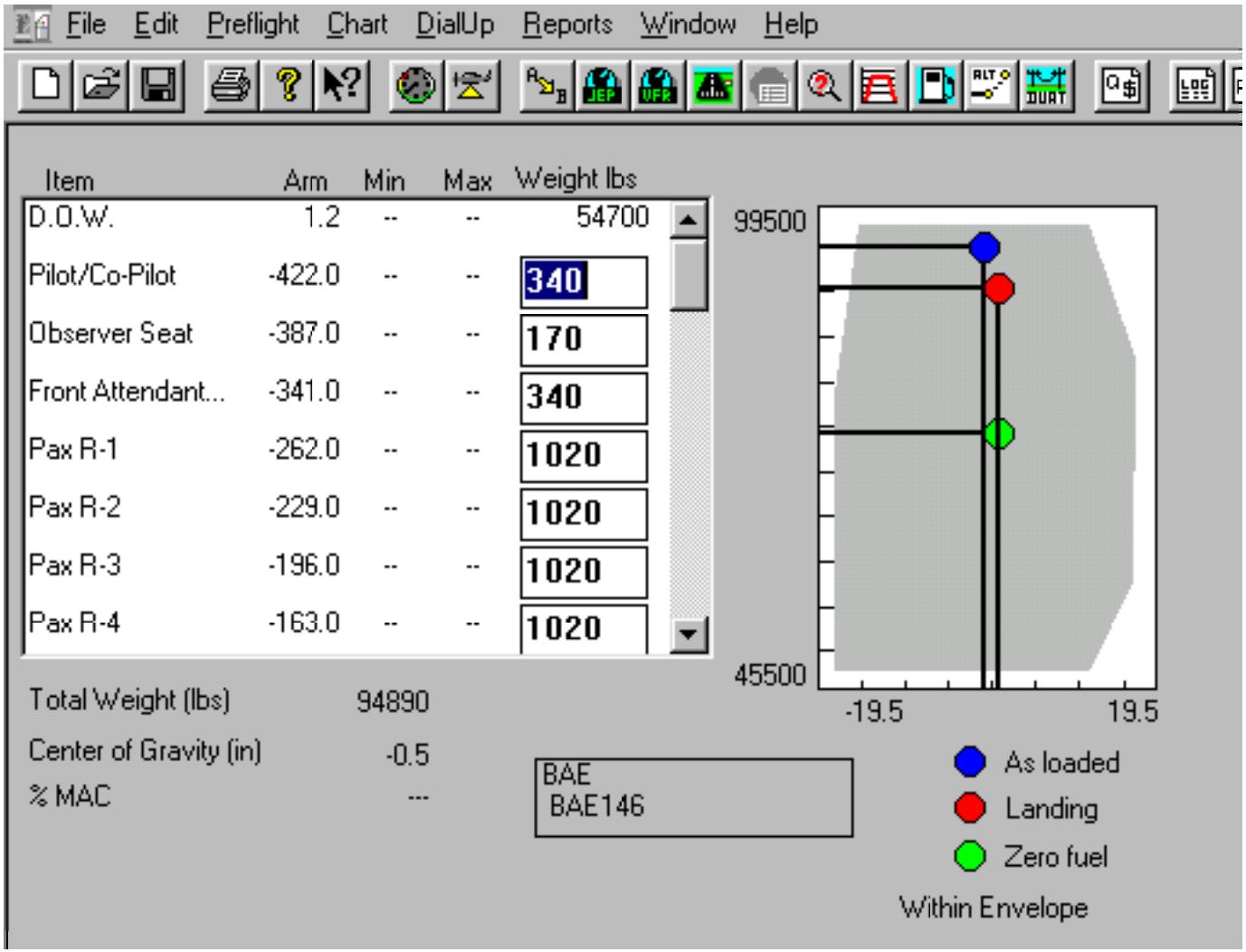
Sample Screens of Jeppessen Flite Star Professional (ROA-CVG Flight)



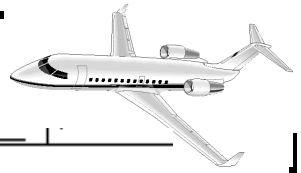
Flite Star Screen (Flight Plan Profile)



Flite Star Screen (Acft. Weight and Balance)



Flite Star Screen (Reporter)



PSK	**116.80**	**Pulaski (Dublin)**				**N 37° 05.2' W 080° 42.7' W6**			
Climb	333	14606	347		45.1	916.5	00:07 .3		climb
	333	31000	347		195.3	18140.7	00:15 .3		power
	333	31000	389	L&V	45.7	550.1	00:07 .0		LRC
MSA 7100	333		389	-46° C	149.6	17590.6	00:22 .3		
HVQ	**117.40**	**Charleston**				**N 38° 20.9' W 081° 46.1' W3**			
J24	282	31000	389	L&V	66.3	789.1	00:10 .2		LRC
MEA 18000	282		389	-46° C	83.3	16801.5	00:32 .5		
Descend	282	31000	433		54.4	518.5	00:07 .5		
	282	12156	433		28.9	16283.0	00:40 .0		
FLM	**117.00**	**Falmouth**				**N 38° 38.9' W 084° 18.6' W4**			
Descend	330	12156	385		28.9	264.1	00:04 .5		
	330	897	385		0.0	16018.9	00:44 .5		
KCVG	**Cincinnati/Norther**					**N 39° 02.8' W 084° 39.7' W3**			

Ramp weight (lbs)	94890			**Total distance**	278.4
Takeoff weight (lbs)	94450	**Landing weight (lbs)**	90268	**Total time**	0:45
Takeoff CG (in)	-0.4	**Landing CG (in)**	1.3	**Total fuel (lbs)**	4621
Takeoff % MAC	---	**Landing % MAC**	---		

Example - Flight Plan Using Garmin FLTPlan™ (https://www.fltplan.com/)

- Assume we want to fly from KBCB (Blacksburg, VA) to New York Teterboro (KTEB) airport
- We will fly the Hokie Bird (a Cessna Citation Excel XL)
- The following screens show the typical information supplied to the flight plan

Cessna Citation Excel XL

Sample Flight Plan Information

FltPlan.com
A Garmin Company

Main Menu Log Out

Note: Route is LYH FAK and JAIKE3
We plan to fly at FL 350 (35,000 feet)

Departure Airport KBCB BLACKSBURG, VA *(GMT-4)* → Arrival Airport KTEB TETERBORO, NJ *(GMT-4)*

Type: IFR Distance: 369nm True Course: 54°

Possible Altitudes FL290 FL310 FL330 FL350 FL370 FL390 FL410 FL450

Headwind(-) Tailwind(+)	-125	-100	-75	-50	-25	0	+25	+50	+75	+100	+125
Est.Enroute Times @ 284kt	2:34	2:15	2:00	1:49	1:40	1:32	1:26	1:21	1:16	1:12	1:09

PIC / Captain	SIC / Co-Pilot	Aircraft	Call Sign (Optional)	Depart Date
ANTONIO TRANI		N57VT		03/23/2020 Mon

Altitude	Speed	ETD	Fuel	S.O.B.	Alternate	Suggested Altn	Remarks
350	321	1800	0300	2	KEWR	KEWR	SAMPLE FLIGHT PLAN

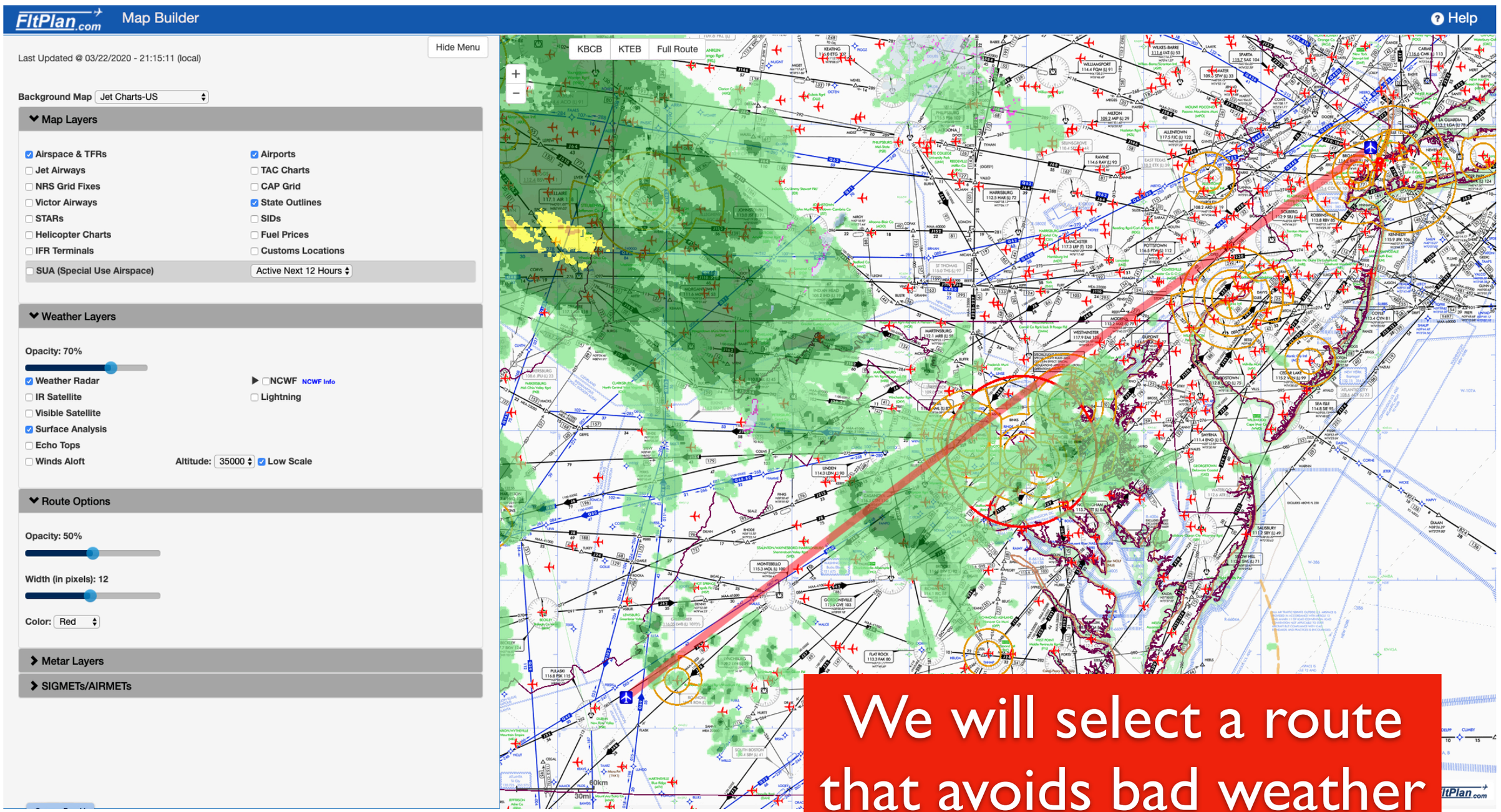
Route Selection Help

Direct (369nm)

Own Route LYH FAK.JAIKE3

We selected a route that avoids bad weather between Blacksburg and Washington

Sample Flight Plan : Map Builder

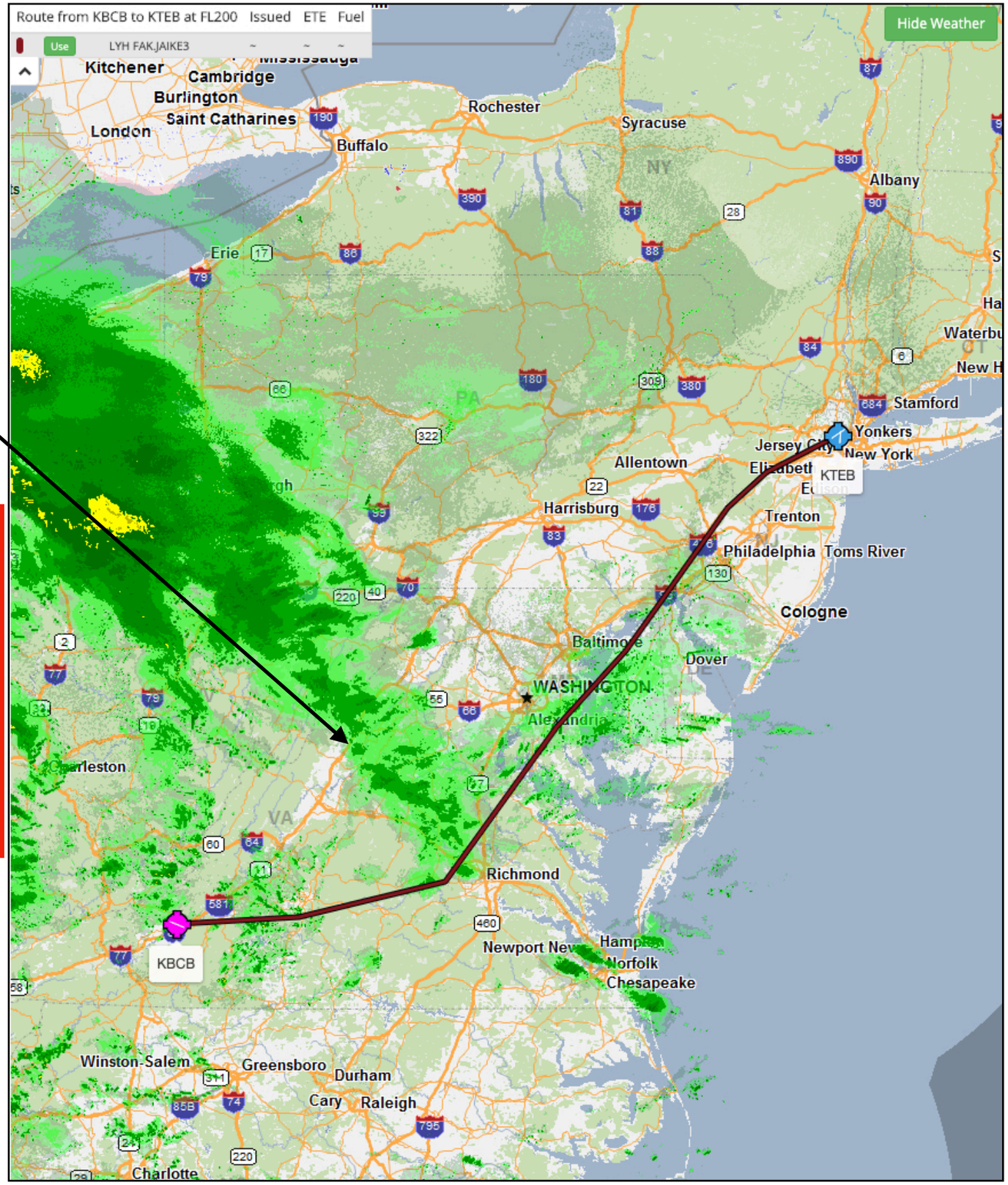


We will select a route that avoids bad weather between Blacksburg and Washington

Flight Plan Information

Bad weather

We selected a route that avoids bad weather between Blacksburg and Washington



Flight Plan Information

FltPlan.com
A Garmin Company

Main Menu | Log Out

Digital Approach Charts

U.S. GOVERNMENT FLIGHT INFORMATION PUBLICATION

U.S. TERMINAL PROCEDURES

EFFECTIVE 0901Z **Feb 27 2020** to 0901Z **Mar 26 2020**

KBCB - VIRGINIATECH/MONTGOMERY EXECUT - BLACKSBURG, VA

PNG Format

TAKEOFF MINIMUMS
ALTERNATE MINIMUMS

Instrument Approaches
- RNAV (GPS) RWY 12
- RNAV (GPS) RWY 30
- LOC/DME RWY 12
- NDB-A

DP/SID Departures
- BEMAR TWO (RNAV)
- SETHY FOUR (RNAV)

View Selected PNG Charts

Instrument Approaches
- RNAV (GPS) RWY 12
- RNAV (GPS) RWY 30
- LOC/DME RWY 12
- NDB-A

DP/SID Departures
- BEMAR TWO (RNAV)
- SETHY FOUR (RNAV)

View Selected PDF Charts

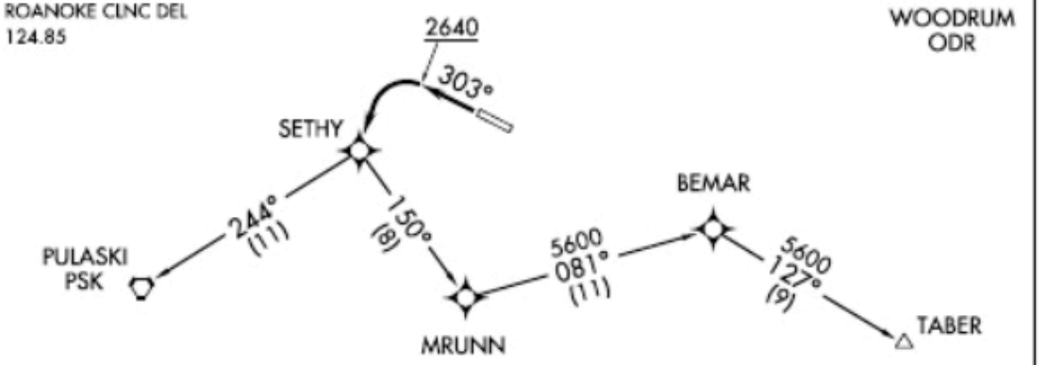
(SETHY4.SETHY) 18312 AL-5475 (FAA)
VIRGINIA TECH/MONTGOMERY EXECUTIVE (BCB)
BLACKSBURG, VIRGINIA

SETHY FOUR DEPARTURE (RNAV)

AWOS-3
133.325
CTAF
123.05
ROANOKE DEP CON
126.9 339.8
ROANOKE CLNC DEL
124.85

NOTE: Aircraft on TABER transition, do not exceed 220K until passing SETHY.

TOP ALTITUDE: 6000



NOTE: GPS Required.
NOTE: Radar Required.
NOTE: RNAV-1.
NOTE: When in Radar contact expect vectors to filed/assigned route.

TAKEOFF MINIMUMS:
Rwy 12: NA-ATC.
Rwy 30: Standard with minimum climb of 300′ per NM to 2640.

NOTE: Chart not to scale.

DEPARTURE ROUTE DESCRIPTION

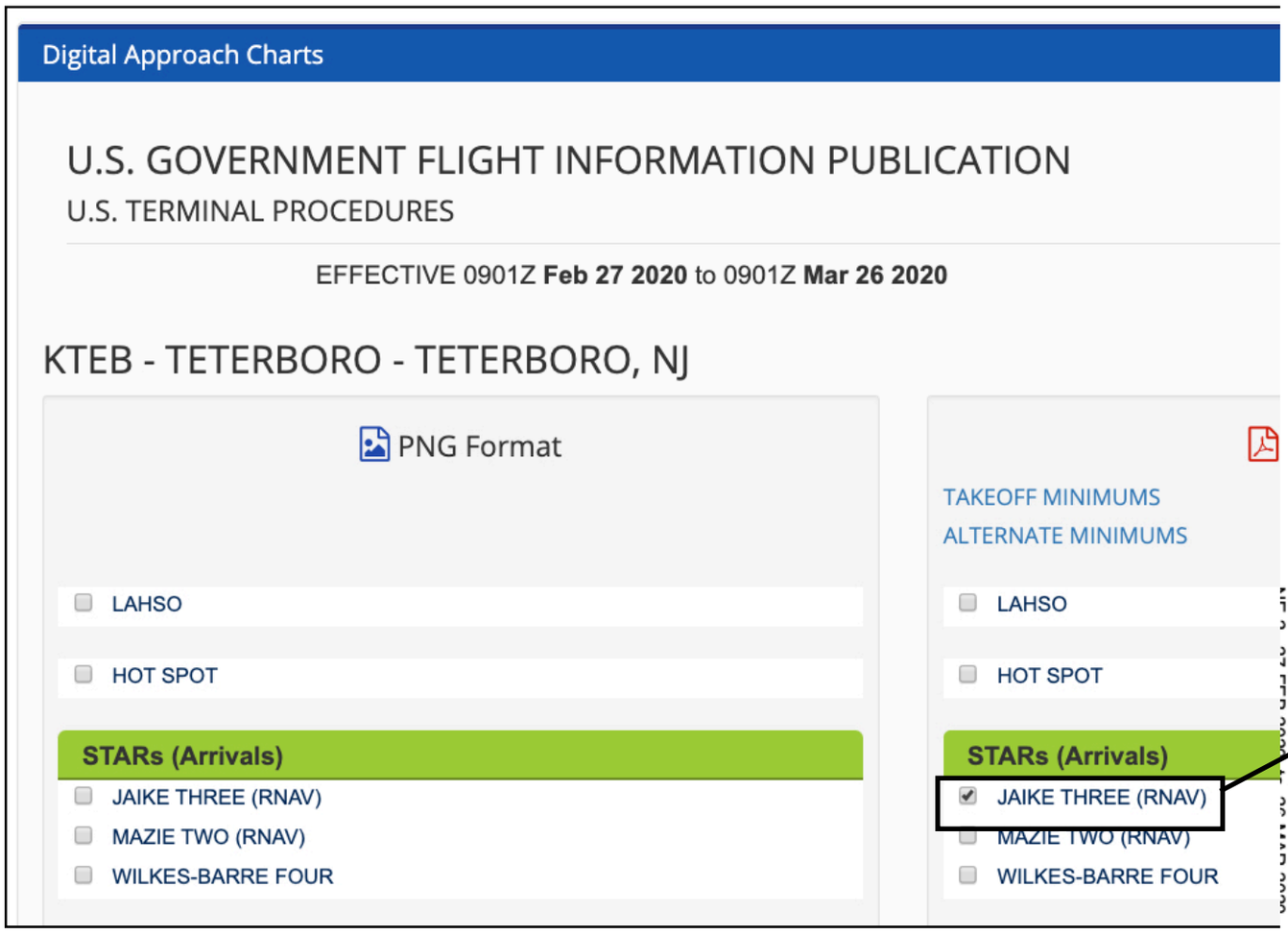
TAKEOFF RUNWAY 30: Climb heading 303° to 2640, then left turn direct SETHY, Thence . . . .

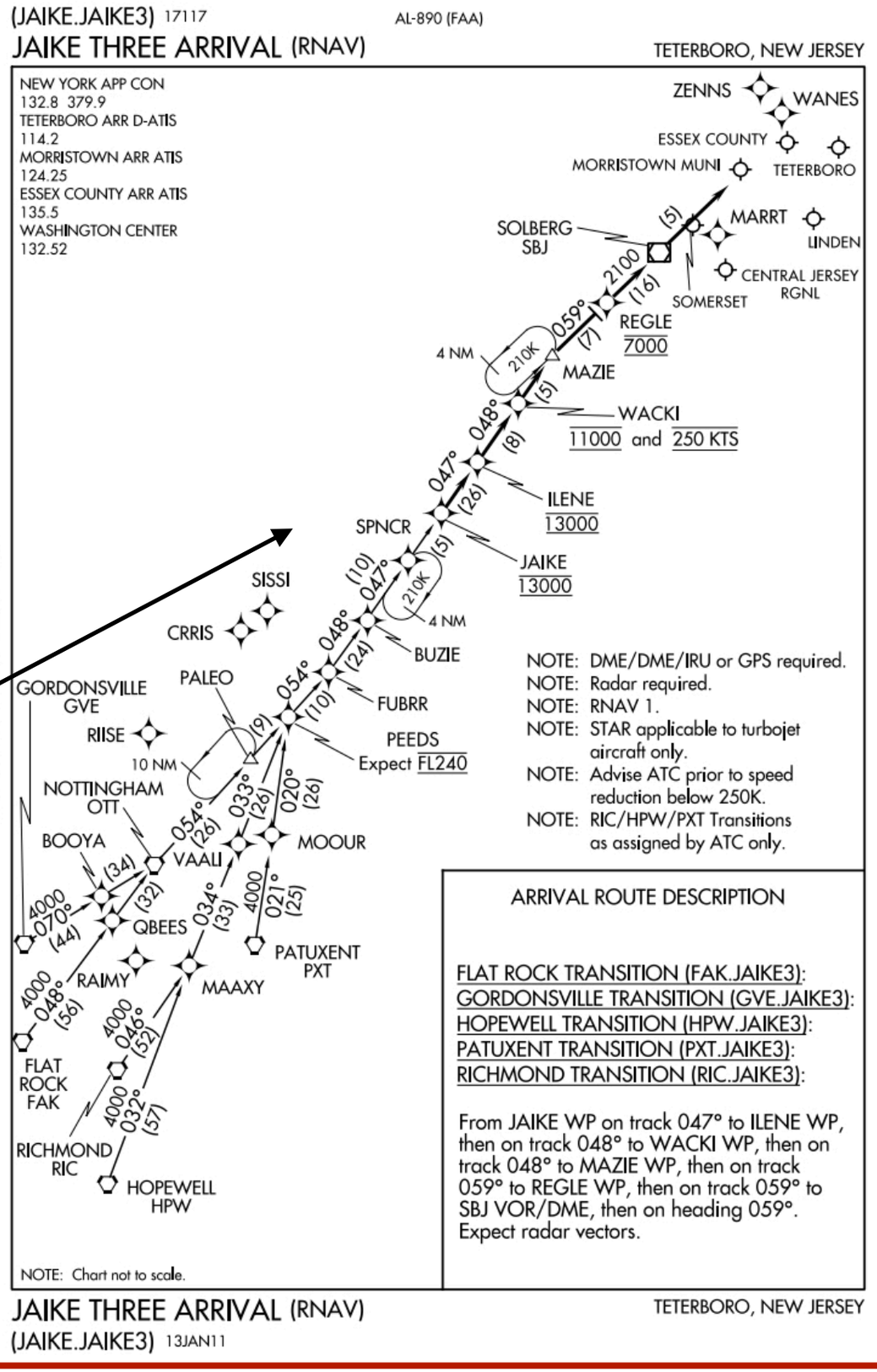
. . . .Via transition. Maintain 6000, expect clearance to filed altitude/flight level 10 minutes after departure.

PULASKI TRANSITION (SETHY4.PSK):
TABER TRANSITION (SETHY4.TABER):

Selected SETHY FOUR departure (SID = Standard Instrument Departure Procedure)

Flight Plan : Arrival Route Information





Selected JAIKE THREE arrival procedure (Standard Terminal Arrival - STAR)

Weather Information - Winds Aloft

AVIATION WEATHER CENTER
NOAA NATIONAL WEATHER SERVICE

Local Forecast | Go | HOME | ADVISORIES | FORECASTS | OBSERVATIONS | TOOLS | NEWS | SEARCH | ABOUT | USER

Winds/Temps Forecasts | W/T Home | W/T Plots | W/T

Overlays | View | Configure | FB Wind Display at 34,000 feet valid 0600 UTC 23 Mar 2020

Valid time:

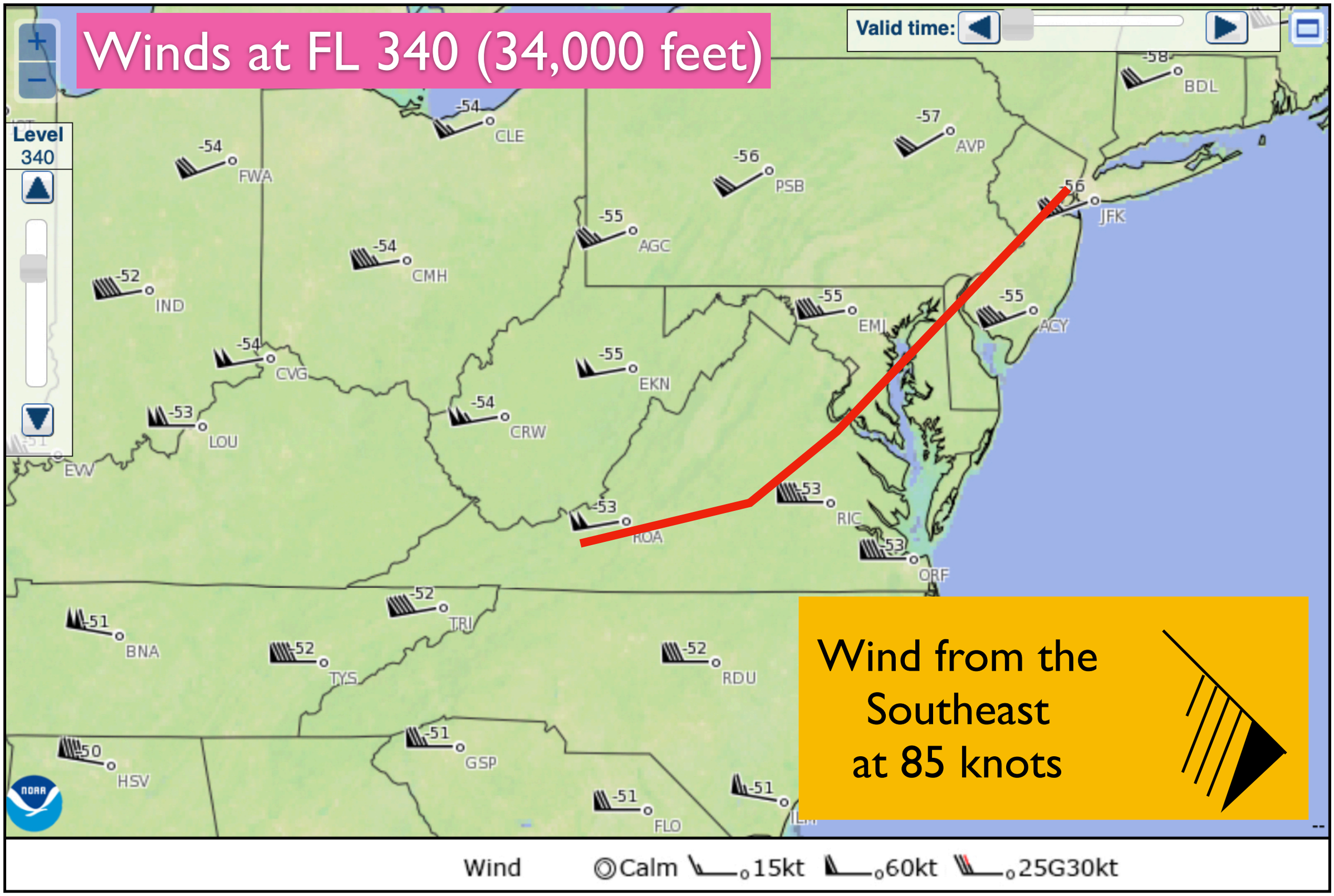
Level 340

Winds at FL 340 (34,000 feet)

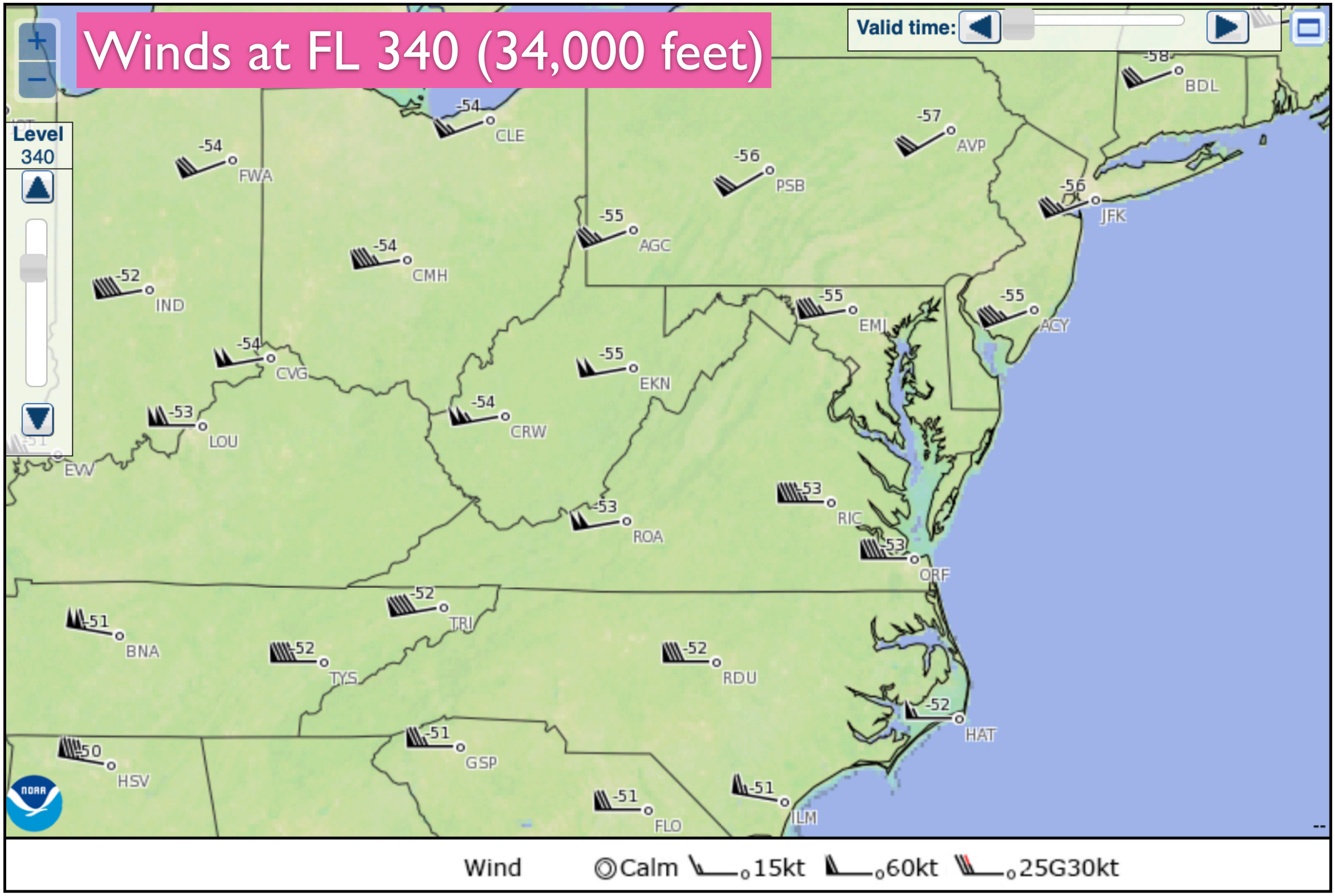
Aviation weather web site at:
https://www.aviationweather.gov

Wind ◎Calm 15kt 60kt 25G30kt

Interpreting Wind Data



Interpreting Wind Data



Weather Information - Airport METAR

Current METAR Grid — Legend — Weather Abbreviation

Airport	Ceiling	Visibility	Wind Speed	Temp	METAR
KBCB	●	●	●	●	KBCB 230055Z AUTO 10009KT 10SM OVC035 07/01 A3040 RMK AO2 T00730006
KTEB	●	●	●	●	KTEB 230051Z 14008KT 10SM CLR 03/M05 A3067 RMK AO2 SLP387 T00281050
KLGA	●	●	●	●	KLGA 230051Z 14010G18KT 10SM FEW050 SCT250 04/M06 A3068 RMK AO2 SLP389 T00391056 $
KEWR	●	●	●	●	KEWR 230051Z 12007KT 10SM FEW030 SCT050 BKN250 04/M04 A3068 RMK AO2 SLP388 T00391039
KMMU	●	●	●	●	KMMU 222345Z 16006KT 10SM BKN250 03/M03 A3066
KJFK	●	●	●	●	KJFK 230051Z 11011KT 10SM FEW050 BKN250 03/M05 A3070 RMK AO2 SLP395 T00281050
KHPN	●	●	●	●	KHPN 230056Z 13011KT 10SM FEW060 01/M06 A3066 RMK AO2 SLP393 T00061061
KSWF	●	●	●	●	KSWF 230045Z 14010KT 10SM SCT120 03/M09 A3063

MOS Forecast — Legend

KBCB

Date/Time UTC		Ceil	Vis	Wind	Temp	Details		
Mon 03/23/2020	00:00Z	●	●	●	●	Clouds: OVC > 12000 ft	Vis: > 6 mi	Wind:
	03:00Z	●	●	●	●	Clouds: OVC 3000 – 6500 ft	Vis: > 6 mi	Wind:
	06:00Z	●	●	●	●	Clouds: OVC 500 – 1000 ft	Vis: 3 to 5 mi Mist	Wind:
	09:00Z	●	●	●	●	Clouds: OVC 200 – 400 ft	Vis: 3 to 5 mi Mist	Wind:
	12:00Z	●	●	●	●	Clouds: OVC 200 – 400 ft	Vis: 1 to 2 mi Mist	Wind:
	15:00Z	●	●	●	●	Clouds: OVC 200 – 400 ft	Vis: 1 to 2 mi Mist	Wind:
	18:00Z	●	●	●	●	Clouds: OVC 200 – 400 ft	Vis: 2 to 3 mi Mist	Wind:

Ceiling (100s Feet)

LIFR	IFR	MVFR	VFR
< 5 ≤	< 10 ≤	< 30 ≤	

Visibility (Miles)

LIFR	IFR	MVFR	VFR
< 1 ≤	< 3 ≤	< 5 ≤	

Wind Speed (Knots)

Real Windy	Windy	Breezy	Light
> 30 ≥	> 20 ≥	> 10 ≥	

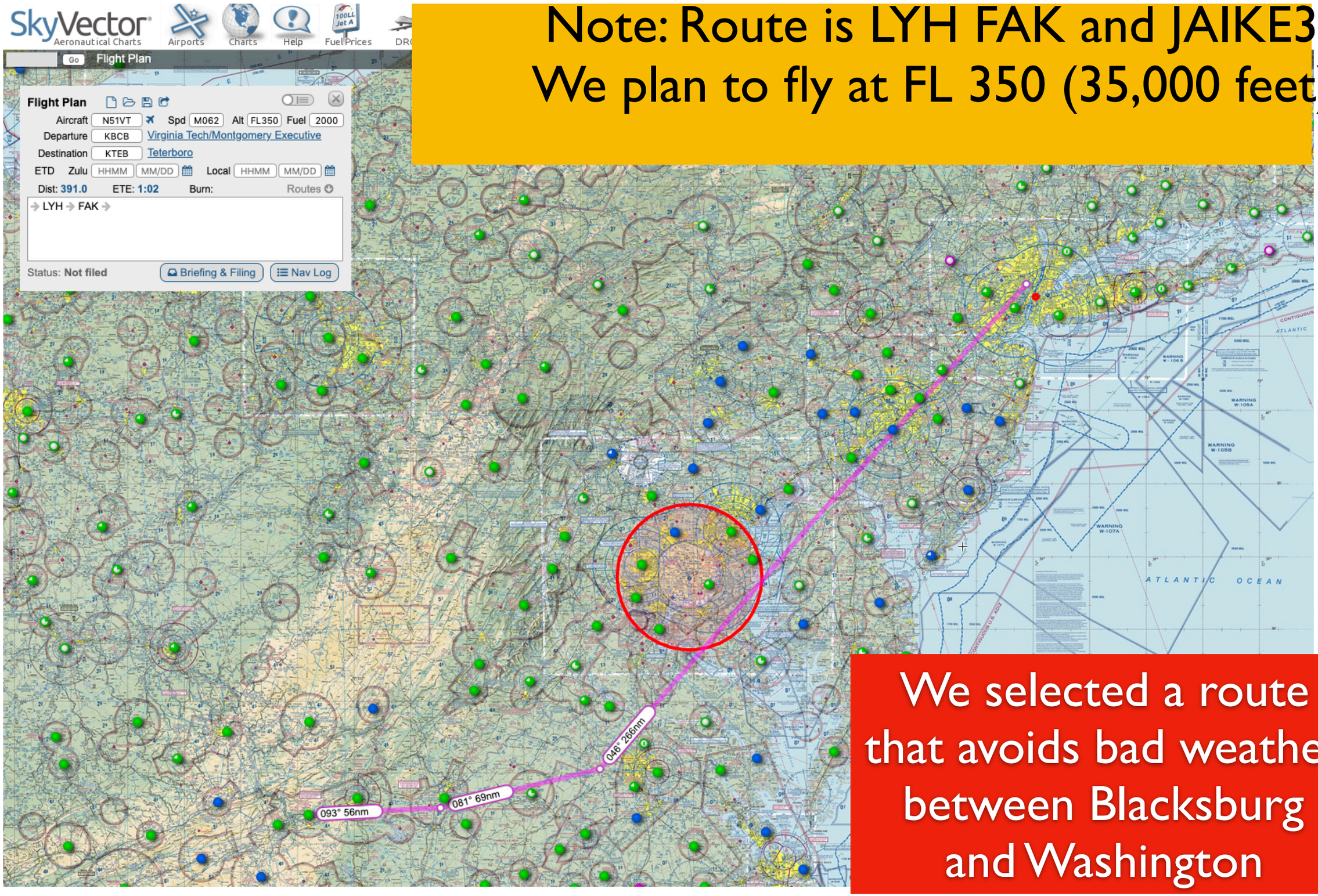
Temperature (Celsius/Fahrenheit)

Cold	Mild	Hot
≤ 0 / 32 <	< 30 / 86 ≤	

Remember: all times posted in Zulu time (London)

Sample Flight Plan Using Skyvector

Note: Route is LYH FAK and JAIKE3
We plan to fly at FL 350 (35,000 feet)



We selected a route that avoids bad weather between Blacksburg and Washington

Sample Flight Plan Using Skyvector

Note: Route is LYH FAK and JAIKE3
We plan to fly at FL 350 (35,000 feet)

Waypoint	Route / Altitude	wDir	wSpd	Temp (dev)	TAS	Track	TH	WCA	Var	MH	GS	Dist	ETE	ETO	ATE	ATO	Fuel EFR	Fuel AFR
KBCB N 37°12.46' W 080°24.47'																		
LYH 109.2 N 37°15.27' W 079°14.18'		120°	10	6°C (-5°)	238	87°	88°	+1°	+6°	94°	230	56.2	11	11			0.0	2000
TOC N 37°29.20' W 078°02.96'		262°	61	-26°C (+4°)	331	76°	75°	-1°	+5°	80°	392	58.5	8.4	19			0.0	2000
FAK 113.3 N 37°31.71' W 077°49.69'	35000	255°	80	-55°C (-1°)	356	77°	77°	+0°	+5°	82°	437	10.8	1.5	21			0.0	2000
TOD N 39°38.47' W 075°29.40'	35000	253°	81	-55°C (-1°)	356	40°	33°	-7°	+6°	39°	421	167.7	24	44			0.0	2000
KTEB N 40°51.01' W 074°03.65'		248°	87	-56°C (-2°)	356	42°	35°	-6°	+6°	41°	431	97.8	18	1h02			0.0	2000

Note:
TOC = Top of climb point
TOD = Top off descent point