The Front

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Vertical Wind Profiles Available On Seattle CWSU Website

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Vertical wind profiles are now available from the Seattle Center Weather Service Unit (CWSU) Website for the 34 Operational Evolution Partner (OEP) airports (**Figure 1**) across the continental United States. Profiles are also available for several additional airports monitored by the FAA's Air Traffic Control System Command Center (ATCSCC) in Herndon, VA. These include Raleigh-Durham, NC (RDU); Nashville, TN (BNA); Indianapolis, IN (IND); Kansas City, MO (MCI); and San Jose, CA (SJC).

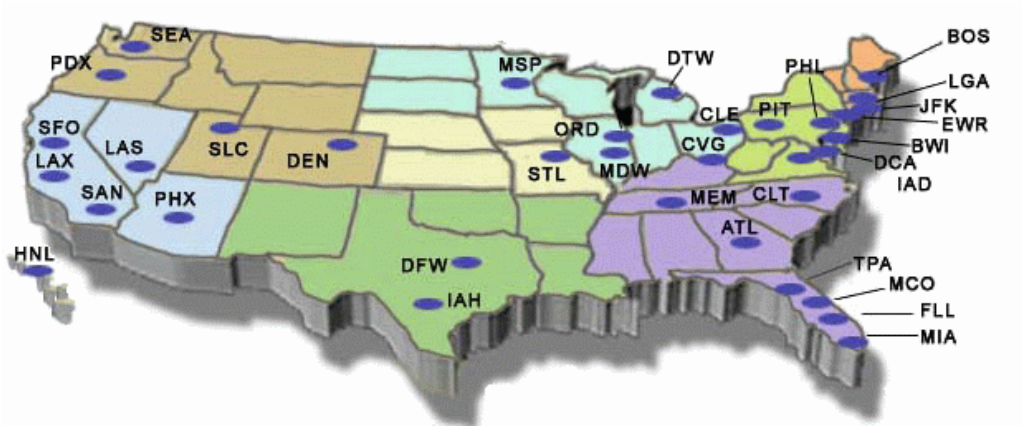

Figure 1. *Map of OEP airports*

Vertical wind profiles are also available for 30 smaller, regional airports across the Pacific Northwest that feed traffic to the major hubs or pacing airports in the West. Using Java and PHP scripts developed by CWSU Seattle, offices in Washington D.C. and New York have also created vertical wind profiles for OEP and regional airports in the Northeast.

Each airport has different, weather-related thresholds that factor into the Airport Arrival Rate (AAR). Rates vary according to current weather conditions, the mix of aircraft seeking to land at the airport during any given period of time, and the current capacity of the airport to handle operations. Vertical wind profiles—updated hourly from the Rapid Update Cycle (RUC) model—can help FAA traffic managers reduce delays and manage traffic flow issues in the approach zone caused by "meteorological compression" on final approach. Inbound aircraft normally experiences a tail wind at the arrival gate followed by a transition to a headwind on final approach. If the flow

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The Front

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Mission Statement

To enhance aviation safety by increasing the pilot's knowledge of weather systems and processes and National Weather Service products and services.

is not managed properly, the result is the loss of required separation between aircraft. When the approach zone includes strong winds or strong wind shear below 5,000 to 10,000 feet above ground level (ft-agl), the effect is further magnified. The result is reduced AAR due to the increased spacing between aircraft required to account for increased compression. Meteorological compression is not a problem by itself; however, it becomes a problem when it occurs simultaneously with high demand.

A typical profile is shown in **Figure 2** below for Boston's Logan International Airport. Site selection is made from a drop-down list on the left side of the Web page. The page offers additional options for selecting the height of the profile in ft-agl and the type of screen output. As mentioned above, vertical profiles are produced using BUFKIT data files created for individual sites with RUC model data. This software provides information consistent with other FAA decision support tools, like the User Request Evaluation Tool (URET), which also uses RUC model data updated hourly. Each display is a 9-hour time versus height forecast of winds from the surface up to the selected altitude. Winds are color coded based on speed. Winds less than 28 knots are displayed in grey,

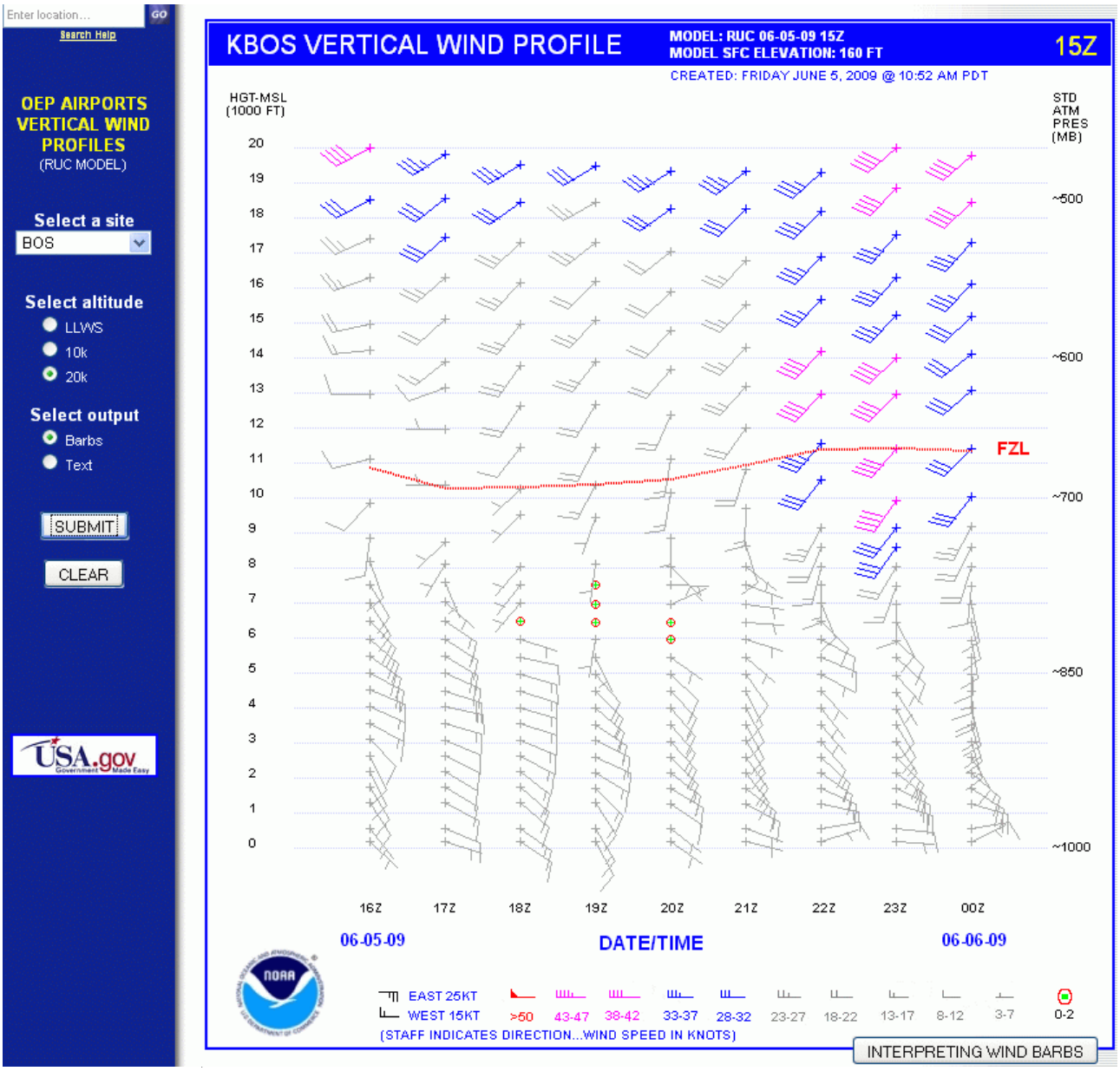

Figure 2. *Vertical wind profile for Boston, MA displayed to 20,000 ft-agl*

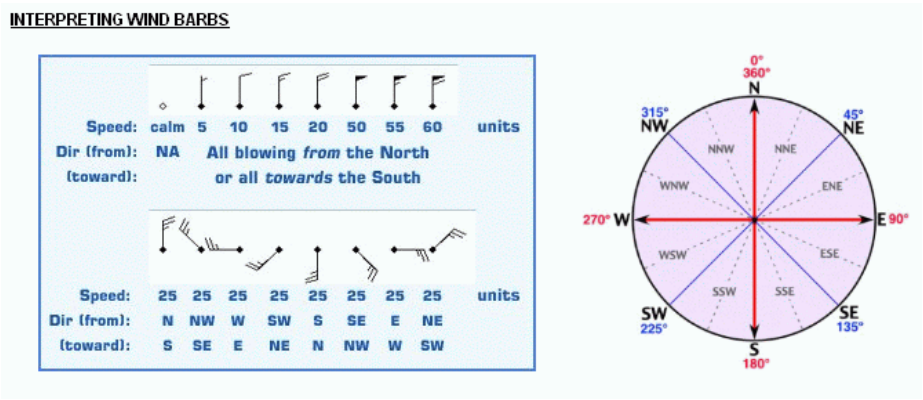

Figure 3. *Help window for interpreting wind barbs*

28-37 knots in blue, 38-47 knots in magenta, and greater than 47 knots in red. A red dashed line labeled "FZL" marks the forecast as freezing.

Figure 4 shows the same profile for Boston, this time with the output displayed to 11,000 ft-agl. Notice how the freezing level is only displayed when it falls below 11,000 ft msl. On both

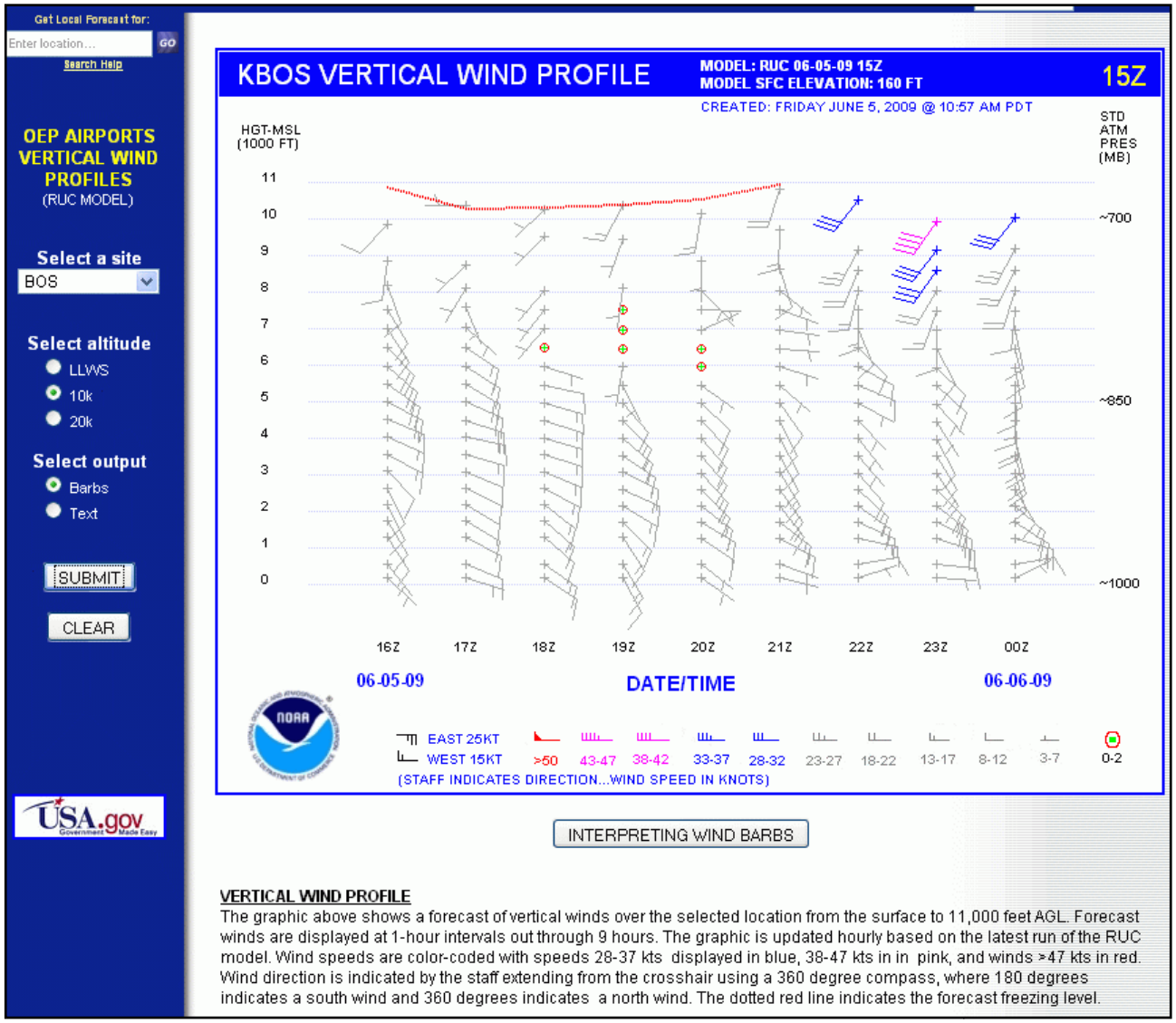

Figure 4. *Vertical wind profile for Boston, MA displayed to 11,000 ft-agl*

displays there is a help button available for information on interpreting wind barbs. **Figure 3** shows the contents of the popup window when the button is clicked. Wind barbs always show the direction the wind is coming from using an 8-point cardinal compass to determine direction.

RUC model wind data can be output either as wind barbs or text. The text option adds another layer of consistency with some of the FAA decision-support systems used at FAA traffic control facilities. **Figure 5** displays the same wind data as shown in **Figure 4** but with the text option selected as the screen output. The format of the wind is "ddd/ff" where "ddd" is direction in degrees and "ff" is wind speed in knots.

Another option available on the menu is the Low Level Wind Shear (LLWS) display. Here, the full resolution of RUC model data is used to display forecast winds to 2,000 ft-agl (**Figure 6**) along with hourly forecasts of LLWS in knots per 2,000 ft agl. In aviation weather, LLWS is defined as

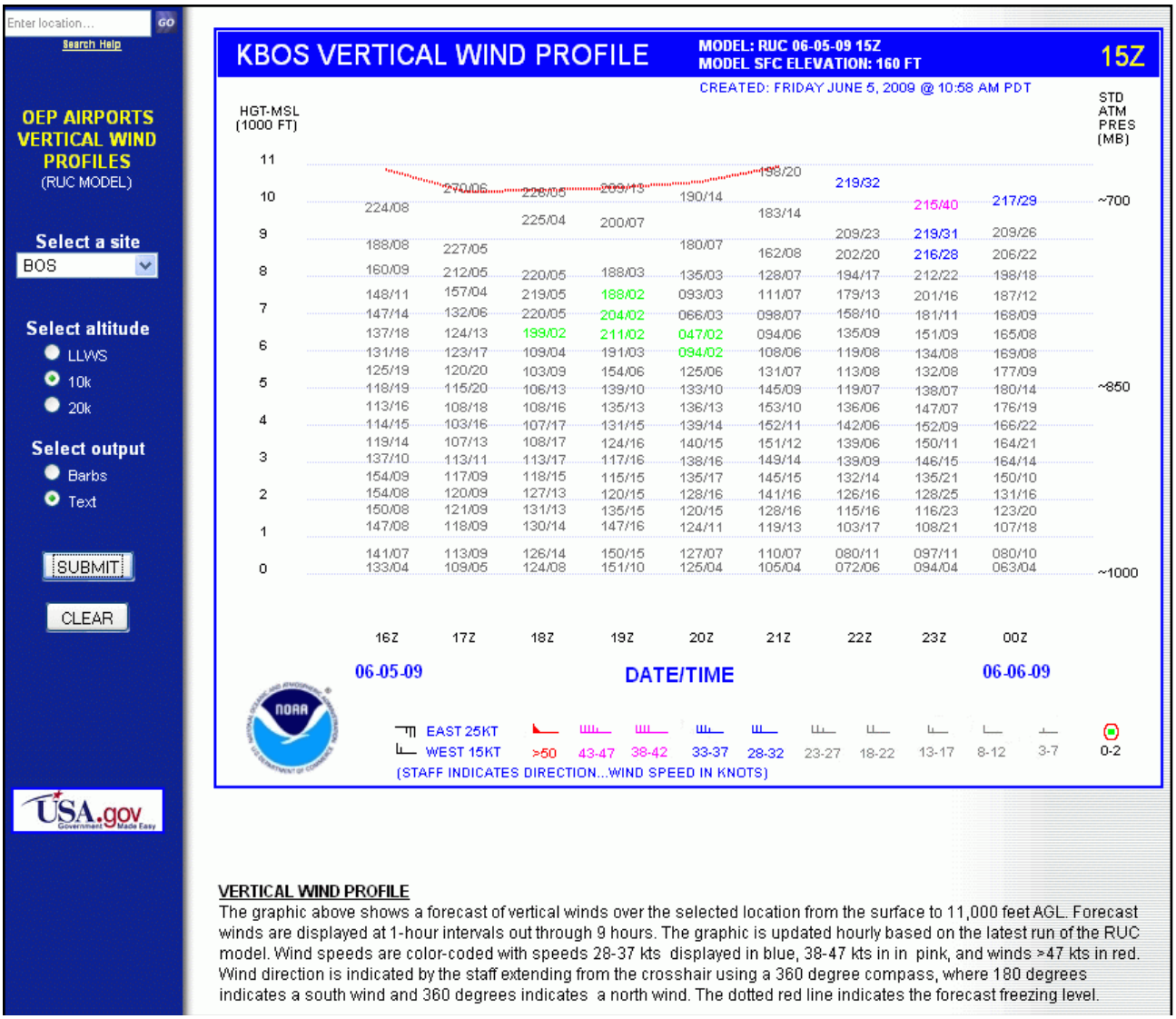

Figure 5. *Boston, MA, vertical wind profile to 11,000 ft-agl in text format*

the vertical change in wind vectors between the surface and 2,000 ft-agl. NWS Instruction 10-813 requires NWS aviation forecasters to include non-convective LLWS in TAFs whenever severe LLWS is observed or forecast. Forecasters will include LLWS in the TAF when one or more Pilot Reports (PIREPs) of non-convective LLWS within 2,000 ft-agl is received in the approximate vicinity of the airport, causing a loss or gain of 20 knots or more in indicated air speed. The forecaster must then determine if the report(s) reflect a valid non-convective LLWS event rather than mechanical

turbulence. Another criterion for severe LLWS is when non-convective vertical WS of 10 knots or more per 100 feet, in a layer more than 200 feet thick, is reliably observed within 2,000 ft-agl near the airport. Output of calculated LLWS is included in the wind profile displays to help aviation forecasters determine the potential for LLWS at a specific airport throughout the day.

LLWS greater than 20 knots can be hazardous to airplane landing operations, especially smaller aircraft. LLWS is a major concern to airport management and aviation weather forecasters. Output is color-coded with LLWS <15 knots displayed in green, 15-20 knots in yellow, and >20 knots in red. Numbers in italics indicate directional shear within the layer is greater than 60 degrees

The algorithm to calculate LLWS is the same one used by the National Centers for Environmental Prediction (NCEP) in it's Short Range Ensemble Forecast (SREF) LLWS forecasts. The algorithm uses the surface wind and the wind at 2,000 ft-agl to calculate the bulk shear within the layer. This is not to be confused with "cumulative" or "total" shear, which sums up the shear segments within each layer of the model up to 2,000 ft-agl. For unidirectional flow (unidirectional hodograph), bulk shear and total shear will always be equal; however, for curved flow (curved hodograph), bulk shear will always be less than the total shear. ✈

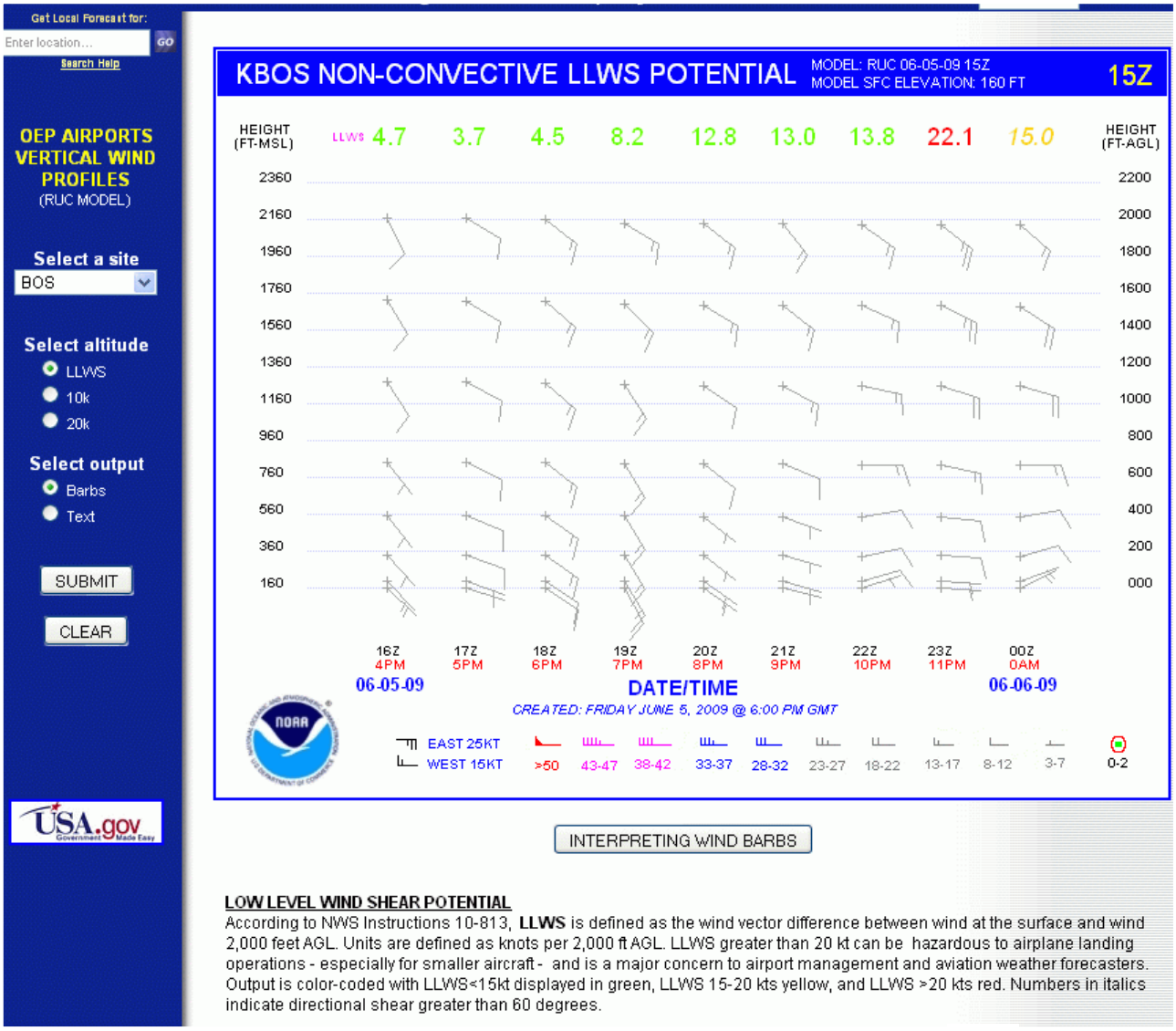

Figure 6. *Boston, MA, wind profile to 2,000 ft-agl with forecast Low Level Wind Shear (LLWS)*

Increased TAF Service in the East

By Fred Mcmullen, Regional Aviation Mesoscale Meteorologist, Bohemia, NY
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The Terminal Aerodrome Forecast (TAF) details the weather for a 5-mile radius around an airport through 24 hours. For select larger airports, the forecast extends out 30 hours. Since its inception, NWS Forecast Offices have issued TAFs routinely at 6-hour intervals: 00Z, 06Z, 12Z, and 18Z.

To provide enhanced forecast and service, some airports receive regular updates every 3 hours. The updates are sent at the following times: 9Z, 15Z and 21Z, when NWS has not issued an amended forecast the hour before. This initiative helps customers by almost doubling the number of daily issuances, assisting the FAA during routine conference calls, and providing airlines an update for their critical push periods.

How can you tell when you see an a regular update vs. an amended TAF? The following is a sample of a regular TAF:

KPIT 091721Z 0918/1024 25008KT P6SM SCT025 BKN035CB
TEMPO 0919/0922 5SM –SHRA BR OVC025CB
FM092200 28007KT P6SM SCT040 BKN100
FM100300 VRB04KT P6SM SCT250
FM100900 VRB03KT 4SM BR SCT010 BKN250
FM101400 15005KT P6SM BKN050
FM101800 16007KT P6SM BKN035CB

This format for Pittsburgh was issued on the 9th at 1721GMT. To compare, an amended TAF follows.

KPIT 092057Z 0921/1024 31009KT P6SM SCT045 BKN250
FM100300 VRB04KT P6SM SCT250
FM100900 VRB03KT 4SM BR SCT010 BKN250
FM101400 15005KT P6SM BKN050
FM101800 16007KT P6SM BKN035CB

The Amended TAF went out at 2057GMT.

Several Operational Evolution Plan (OEP) airports in the East (see **Table 1**) receive 3-hour amendments unless an amendment was issued the hour before. OEP airports are the 35 busiest airports in the United States as identified by a 2000 study by the FAA and Congress. For further information on OEP airports, visit the FAA OEP site. ✈

Airport Identifier	Airport Name
KBOS	Logan International Airport
KCLE	Cleveland - Hopkins International Airport
KCLT	Charlotte Douglass International Airport
KCVG	Cincinnati / Northern Kentucky International Airport
KPIT	Pittsburgh International Airport
KPHL	Philadelphia International Airport

Table 1. *OEP Airports that currently receive routine 3-hour amendments, the short-term goal is to add other OEP airports depending on weather forecast workload.*

Airport Identifier	Airport Name
KART	Watertown International Airport
KBKW	Raleigh County Memorial Airport
KBUF	Buffalo Niagara International Airport
KCKB	Clarksburg / Harrison / Marion Regional Airport
KCRW	Yeager Airport
KEKN	Elkins – Randolph County Airport
KHTS	Tri-State Airport
KIAG	Niagara Falls International Airport
KJHW	KJHW Chautauqua County – Jamestown Airport
KPKB	Mid-Ohio Valley Regional Airport
KROC	Greater Rochester International Airport

Table 2. *Non-OEP Airports that also receive routine 3 hour amendments*

Key to Terminal Aerodrome Forecast (TAF)

By Michael Graf, Meteorologist, NWS Aviation Services Branch
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This TAF guide follows the same format of the new 30 hour METAR/TAF guide provided in the AIM. The main difference is that we break that TAF down and go through it line by line. In addition the last line in the example uses the BECMG change group. This change group is not used for civilian TAFs in the United States. But we included it here, since they are used by the US military TAFs and also international TAFs. This is printed on two pages to serve as easy reference.

```
TAF KPIT 091730Z 0918/1024 15005KT 5SM HZ FEW020 WS010/21035KT
     FM091930 30015G25KT 3SM SHRA OVC015
      TEMPO 0921/1001 1/2SM +TSRA OVC008CB
     FM100100 27008KT 5SM -SHRA BKN020 OVC040 PROB30 1008/1012 1SM
      -RA BR VV005
     BECMG 1013/1015 P6SM NSW SKC=
```

Aviation forecast for Pittsburgh, issued at 1730UTC on the 9th. Forecast period is 1800UTC on the 9th, valid through 2359UTC on the 10th. Winds from 150 degrees at 5kts, Visibility 5 miles with haze, few clouds at 2000ft, Wind shear 1000ft AGL winds from 210 degrees at 35kts. At 1930UTC on the 9th: Winds from 300 degrees at 15kts and gusting to 25kts, Visibility 3 miles in a moderate rain shower, overcast ceiling at 1500ft. Temporarily from 2100UTC on the 9th through 0100UTC on the 10th: Visibility ½ mile in heavy rain and a thunderstorm, ceiling 800ft with cumulonimbus clouds. At 0100UTC on the 10th: Winds from 270 degrees at 8kts, Visibility 5 miles in a light rain shower, Ceiling broken at 2000ft and clouds overcast at 4000ft. At 0800UTC on the 10th through 1200UTC on the 10th a 30 percent chance of visibility dropping to a mile with light rain and vertical visibility down to 500ft. From 1300UTC on the 10th through 1500UTC on the 10th expect gradual improvement…then by 1500UTC through the rest of the TAF valid period: Visibility better than 6 miles, no significant weather occurring and clear skies.

Table of Significant Forecast Weather – Grouped in categories and used in the order listed below or as needed in TAF, No Significant Weather

ELEMENT	EXPLANATION
TAF	Message type: TAF-routine, TAF AMD-Amended forecast or TAF COR-Corrected TAF
KPIT	ICAO location indicator
091730Z	Issuance time: ALL times in UTC "Z", 2-digit day, 2-digit hour and 2-digit minutes
0918/1024	TAF Valid period: 2-digit day, 2-digit hour begin time / 2-digit day, 2-digit hour end time.
15005KTG15	Wind: 3 digit true-north direction, nearest 10 degrees (or VaRiaBle) next 2-3 digits for speed and unit, KT (KMH or MPS); as needed, Gust and maximum speed; 000KT for calm
5SM	Prevailing visibility: in U.S., Statute Miles & fractions; above 6 miles in TAF Plus 6SM. (Or, 4-digit minimum visibility in meters and as required, lowest value with direction)
HZ	Significant forecast weather: see table (back)
FEW020	Cloud amount, height and type: SKy Clear 0/8, FEW >0/8-2/8, SCaTtered 3/8-4/8, BroKeN 5/8-7/8, OVerCast 8/8; 3-digit height in hundreds of ft; CumulonimBus in TAF, only CB. Vertical Visibility for obscured sky and height "VV004". More than 1 layer may be reported or forecast

WS010/31022KT	In U.S. TAF, non-convective low-level (<=2,000 ft) Wind Shear; 3-digit height (hundreds of ft); "/", 3-digit wind direction and 2-3 digit wind speed above the indicated height, and unit, KT
REMARKS	AMD NOT SKED AFT DDHHMM: Amendments not scheduled for this TAF after a given day-DD, Hour-HH and Min-MM in UTC
FM091930	FroM and 2-digit day, 2-digit hour and 2-digit minute beginning time: indicates significant change. Each FM starts on a new line, indented 5 spaces.
TEMPO 0921/1001	TEMPOrary: 2-digit day and 2-digit hour beginning time / and 2-digit day and 2-digit hour ending time: indicates conditions lasting less than an 1 hour and less than half the total time period, and a 50 percent or greater of occurrence.
PROB30* 1008/1012	PROBability: 2-digit day and 2-digit hour beginning time / and 2-digit day and 2-digit hour ending time: Indicating a (30) percent chance of conditions occurring during this interval. * U.S TAFs do not use this group during the first 9 hours of a TAF.
BECMG 1013/1015	BECoMinG: gradual change expected during 2-digit day and 2 digit hour beginning time / and 2-digit day and 2 digit hour ending time. *Used in U.S. military TAFs and international TAFs.

Table of Significant Forecast Weather – Grouped in categories and used in the order listed below or as needed in TAF, No Significant Weather

QUALIFIER

Intensity of Precipitation or Proximity

- Light "no sign" Moderate +Heavy

VC Vicinity: but not at aerodrome; in U.S. TAF, 5 to 10SM from center of runway complex (elsewhere within 8000 m)

Descriptor

MI	Shallow	BC	Patches	PR	Partial	TS	Thunderstorm
BL	Blowing	SH	Showers	DR	Drifting	FZ	Freezing

WEATHER PHENOMENA

Precipitation

DZ	Drizzle	RA	Rain	SN	Snow	SG	Snow grains
IC	Ice crystals	PL	Ice pellets	GR	Hail	GS	Small hail/snow pellets

UP Unknown precipitation in automated observations

Obscuration

BR	Mist (≥5/8SM)	FG	Fog (<5/8SM)	FU	Smoke	VA	Volcanic ash
SA	Sand	HZ	Haze	PY	Spray	DU	Widespread dust

Other

SQ	Squall	SS	Sandstorm	DS	Duststorm	PO	Well developed dust/ sand whirls
FC	Funnel cloud	+FC	Tornado/waterspout				

The latest TAF/Aviation products are online. ✈