Aviation Weather Formats: METAR/TAF

March 1999

U.S. Department of Transportation
Federal Aviation Administration

Introduction

On July 1, 1996, the United States converted airport surface observations (SA's and SP's) and airport terminal weather forecasts to the International Civil Aviation Organization (ICAO) formats. Other weather products such as winds aloft (FD), area forecasts (FA), and pilot reports (PIREPs) changed little except to incorporate the new weather coding and station identifiers.

With a little practice and the help of the tear-out "decoder" card included in this booklet, pilots will find it is easy to understand METARS (Aviation Routine Weather Reports) and the airport terminal forecast referred to as TAF (aerodrome Forecast). Those who use DUATs (Direct User Access Terminal) or commercially provided weather services will find all providers have included a plain language interpreter.

METAR
Let's check out a **METAR**

METAR (or SPECI for Special Report) KPIT 201955Z (AUTO for automated observation) (COR for correction to observation) 22015G25KT 3/4SM R28R/2600FT TSRA OVC010CB 18/16 A2992 RMK SLPO13 T01760158

Note: When METAR data is missing from the body of the report (e.g. dew point), it is simply omitted and the user must know the sequence to recognize this. Some exceptions apply in remarks such as RVRNO, or SLPNO when RVR or SLP are normally reported but not currently available.

To help remember the sequence, think of 3W's at the beginning-
Where, When, and Wind This works for METAR as well as TAF!

METAR KPIT 201955Z 22015G25KT

WHERE
KPIT is the ICAO station identifier. The usual 3 letter identifiers we are all familiar with are now receded by a "K" for the contiguous United States. Alaska and Hawaii will use 4 letter identifiers beginning with "PA" and "PH"
respectively.

WHEN
201955Z is the **20th** day of the month.

201955Z at **1955Z** time

WIND
22015G25KT is reported as the 3 digit true direction to the nearest 10 degrees. (Note: ATC towers, ATIS and airport advisory service report wind as *magnetic*.)

22015G25KT next is the 2 or 3 digit speed.

22015G25KT a "G" comes next if the wind is gusting.

22015G25KT followed by the 2 or 3 digit maximum speed and units (KT).

00000KT for calm winds.

22015KT 180V260 When wind direction varies 60 degrees or more and wind is greater than 6 knots.

VRB Used when wind direction is variable and speed is less than or equal to 6 knots.

RMK Peak wind is one element reported in the remarks section whenever the maximum instantaneous speed is greater than 25 knots. **22030/15** means a maximum instantaneous wind of **30** knots occurred **15** minutes past the hour from **220** degrees. PK WND 22030/15

VISIBILITY
3/4SM meaning 3/4 statue mile visibility. Miles and fractions are also reported (e.g., 3/4SM for **2 and 3/4** statute miles visibility).

R28R/2600FT Means Runway Visual Range (RVR). Signifies that the runway visual range for runway **28 Right is 2600 feet**. The format is **R**(XXX) Runway Designator including (**L**)eft (**C**)enter or (**R**)ight /(XXXX) 4 digit visibility in feet.

Some coding pilots may also see for RVR include:

M Indicates that RVR is less than lowest reportable sensor value (e.g. **M0600FT**)

P Indicates RVR greater than highest reportable sensor value (e.g. **P6000FT**).

V Variable If the RVR is variable between 2000 and 4000 feet for runway 6L: (**R06L/2000V4000FT**). May contain up to four RVR reports.

SIGNIFICANT PRESENT WEATHER
TSRA: **Thunderstorm/Moderate Rain** Format is a two character descriptor (e.g. TS, SH, DR) sometimes followed by a two character weather phenomenon (e.g. RA, SN, FG). (See Abbreviations Section). Intensity or proximity of weather phenomenon:

"-" **Light**
"+" **Heavy**
"no sign" **Moderate**
"VC" **In the vicinity**

CLOUDS
OVC010CB: Specifies cloud amount, height, and type. **Overcast** clouds are present at 1000 feet consisting of **umulonimbus** clouds.

Cloud height is reported in hundreds of feet. When clouds are composed of towering cumulus or cumulonimbus **TCU** or **CB** ill follow cloud height.

The clouds are categorized based on eighths (octas) of the sky:

SKC Sky Clear
FEW >1-2 octas
SCT 3-4 octas
BKN 5-7 octas
OVC 8 octas

VV may be listed here for **indefinite ceiling** such as "**VV004**" for **Vertical Visibility 400 feet**.

18/16: **Temperature/Dew Point** listed in degrees Celsius. When temperatures are below zero degrees Celsius, they are preceded by "**M**" for **Minus** (e.g., **10/M06 for temperature 10 degrees C, dew point Minus 6 degrees C**).

A2992 **Altimeter Setting "A"** indicates setting in **inches** of mercury for United States. Consists of 4 digits: inches and hundredths.

RMK SLP013 T01760158

RMK SLP013 T01760158. **Remarks** come last.

RMK SLP013 T01760158. Selected stations will contain **SLP** for **Sea Level Pressure** reported as the last three digits n hectoPascals (milibars) to the nearest tenth (e.g., 1001.3 is reported as **SLP013**).

RMK SLP013 T01760158. Also, at selected stations, the 9 character code (**T01760158**) breaks down the temperature and dew point to the nearest 1/10th of a degree Celsius. The "**T**" stands for temperature and the "**0**" means positive temperature. A "**1**" in place of the "**0**" stands for negative temperature. At selected stations, other temperature codes, such as **0142**, **20012**, or **401120084**, may appear to document temperatures not related to aviation.

METAR ON ASOS/AWOS

ASOS/AWOS reports will also use METAR/SPECI code formats. An ASOS/AWOS report can be identified by the term **A01** or **A02** (see abbreviations in back cover) in the remarks (RMK) section. Example:

METAR KOFP 251955Z AUTO 30008KT 10SM CLR 22/10 A3010 RMK AO2 SLP138 T02180096
Some ASOS/AWOS sites are attended. When a site is attended, the term **AUTO** is not included in the report (**A01** or **A02** remain). An attended site may contain information that has been manually provided by the observer.

Only a fully automated site without human intervention will contain the word AUTO.

When ASOS/AWOS reports sky condition is **clear (CLR**) it means no clouds at or below 12,000 feet.

TAF
Let's try a TAF

TAF (TAF AMD is Amended Forecast when included)
KPIT 091730Z 091818 22020KT 3SM -SHRA BKN020

FM2030 30015G25KT 3SM SHRA OVC01 5 TEMPO 2022 1/2SM TSRA OVC008CB

FM0100 27008KT 5SM -SHRA BKN020 OVC040 PROB40 0407 00000KT 1SM -RA BR

FM1000 22010KT 5SM -SHRA OVC020 BECMG 1315 20010KT P6SM NSW SKC

Once you know how to pick out the TAF forecast time periods, the same logical sequence that we saw in METAR will follow. Below, a TAF is broken down to highlight its individual segments. Key words, and their definitions, indicating a new time period has started are highlighted in **bold print**.

TAF

KPIT 091730Z 091818 22020KT 3SM -SHRA BKN020

FM2030 30015G25KT 3SM SHRA OVC015 WS015/30045KT
TEMPO 2022 1/2SM TSRA OVC008CB

FM2300 27008KT 5SM -SHRA BKN020 OVC040 PROB40 0407
00000KT 1SM -RA BR

FM1000 22010KT 5SM -SHRA OVC020 BECMG 1315
20010KT P6SM NSW SKC

The Where, When, and Wind trick works with TAF, too. There's a little twist with the "when," however.

TAF

KPIT 091730Z 091818 22020KT

Where
KPIT is the ICAO station identifier. The usual 3 letter identifiers are preceded by a "K" for the contiguous United States. Alaska and Hawaii use 4 letter identifiers beginning with "PA" and "PH" respectively.

When
091730Z This is the forecast for the **9th** day of the month with an issuance time of **1730Z** or UTC. This is a 2 digit date and 4 digit time.

091818 is the valid period with the first two digits containing the day of the month (**09**).

091818 the second two digits specify the hour beginning the forecast period (**1800Z**).

091818 the last two digits are the hour ending the forecast period (**1800Z** on the next day the 10th).

Wind
22020KT

See description under METAR

WS015/30045KT means at 1500 feet we expect wind to be **300** degrees at **45 KT**. This indicates low level wind shear, not associated with convective activity.

Time Periods, etc.
FM2030 From **2030Z** or UTC time. Indicates hours and minutes.

TEMPO 2022 Temporary changes expected between **2000Z and 2200Z**

FM2300 FROM 2300Z.

PROB40 0407 There is a **40 percent probability** of this condition occurring between **0400Z and 0700Z.**

FM1000 FROM 1000Z.

BECMG 1315 Conditions **Becoming** as described between **1300Z and 1500Z**

Once the specific time periods can be discerned, the sequence of **wind, visibility, significant weather, cloud cover and cloud height** follows and is repeated for each time block. The only exception is after qualifiers such as **PROB40, TEMPO, and BECMG**, some of the components may be omitted if these are not expected to change. Notice after **TEMPO 2022**, there is no wind given and after **PROB40 0407**, there is no cloud cover listed. Note: When No Significant Weather (**NSW**) appears it only indicates obstruction to visibility or precipitation previously noted has ended. (See Abbreviation Section)

INTERNATIONAL DIFFERENCES

Pilots and operators who fly to international destinations are cautioned to be alert to differences between U.S. METAR/TAF and international METAR/TAF Some key differences follow:

Altimeter Setting

The United States reports the altimeter setting in inches of mercury (e,g., **A2992**) and internationally it will be listed in ectoPascals (millibars) (e.g., **Q1016**).

Wind

Internationally, wind may be reported in knots (KT), kilometers per hour (KMH) or meters per second (MPS). Appropriate units are indicated on both METAR and TAR

Wind Shear

Low level wind shear, not associated with convective activity (e.g., **WS015/30045KT see TAF**) will appear in TAFs in the United States, Canada, and Mexico only.

Visibility

Internationally, visibility is reported in 4 digits using meters with the direction of the lowest visibility sector (e.g., 6000SW - meaning visibility is lowest at 6000 meters to the southwest). In the United States, we use prevailing visibility, in statute miles, not the lowest visibility, so the same conditions would be reported differently.

International visibility reports also contain a trend such as:

D Down
U Up
N No change
V Variable

OTHER

Remarks (**RMK**) included in U.S. METAR are transmitted to only Canada and Mexico and no other international stations.

Pilots may also see the notation on International METAR/TAF: **CAVOK**. This means ceiling and visibility OK and is used to replace weather and clouds if visibility is 10 kilometers or more, there are no clouds below 1500 meters (5000 feet) or below the highest minimum air traffic control sector altitude, whichever is greater. Also, there must be no other significant weather. **NSC** means no significant clouds.

International TAF's may include temperature, turbulence, and icing forecasts.

METAR TAF - Abbreviations

Abbreviations	
AO1	**Automated Observation without precipitation discriminator (rain/snow)**
AO2	**Automated Observation with precipitation discriminator (rain/snow)**
AMD	**Amended Forecast (TAF)**
BECMG	**Becoming (expected between 2 digit beginning hour and 2 digit ending hour)**
BKN	**Broken 5-7 octas (eighths) cloud coverage**
CLR	**Clear at or below 12,000 feet (ASOS/AWOS report)**
COR	**Correction to the observation**
FEW	**1 or 2 octas (eighths) cloud coverage**
FM	**From (4 digit beginning time in hours and minutes)**
LDG	**Landing**
M	**In temperature field means "minus" or below zero**
M	**In RVR listing indicates visibility less than lowest reportable sensor value (e.g. M0600)**
NO	**Not available (e.g. SLPNO, RVRNO)**
NSW	**No Significant Weather. Note: NSW only indicates obstruction to visibility or precipitation previously noted has ended. Low ceilings, wind shear, and other weather conditions may still exist.**
OVC	**Overcast 8 octas (eighths) cloud coverage**
P	**In RVR indicates visibility greater than highest reportable sensor value (e.g. P6000FT)**
P6SM	**P6SM Visibility greater than 6 SM (TAF only**
PK	**WND Peak wind**
PROB40	**Probability 40 percent**
R	**Runway (used in RVR measurement)**
RMK	**Remark**

RY/RWY	**Runway**
SCT	**Scattered 3-4 octas (eighths) cloud coverage**
SKC	**Sky Clear**
SLP	**Sea Level Pressure (e.g., 1001.3 reported as 013)**
SM	**Statue Mile(s)**
SPECI	**Special Report**
TEMPO	**Temporary changes expected (between 2 digit beginning hour and 2 digit ending hour)**
TKOF	**Takeoff, T01760158, 10142, 20012 and 401120084. In Remarks- examples of temperature information**
V	**Varies (wind direction and RVR)**
VC	**Vicinity**
VRB	**Variable wind direction when speed is less than or equal to 6 knots**
VV	**Vertical Visibility (Indefinite Ceiling)**
WC	**Wind shear (In TAFs, low level and not associated with convective activity)**

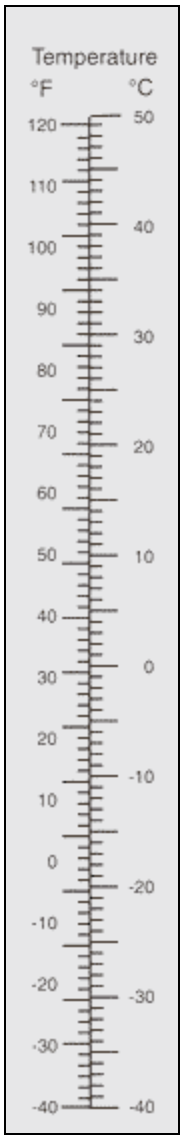
Descriptors	
BC	**Patches**
BL	**Blowing**
DR	**Low Drifting**
FZ	**Supercooled/Freezing**
MI	**Shallow**
PR	**Partial**
SH	**Showers**
TS	**Thunderstorm**

Weather Phenomena	
BR	**Mist**
DS	**Dust Storm**
DU	**Widespread Dust**
DZ	**Drizzle**
FC	**Funnel Cloud**
+FC	**Tornado/Water Spout**

FG	**Smog**
FU	**Smoke**
GR	**Hail**
GS	**Small Hail/Snow Pellets**
HZ	**Haze**
IC	**Ice Crystals**
PE	**Ice Pellets**
PO	**Dust/Sand Whirls**
PY	**Spray**
RA	**Rain**
SA	**Sand**
SG	**Snow Grains**
SN	**Snow**
SQ	**Squall**
SS	**Sandstorm**
UP	**Unknown Precipitation (Automated Observations)**
VA	**Volcanic Ash**

Cloud Types	
CB	**Cumulonimbus**
TCU	**Towering Cumulus**

Intensity Values	
(-)	**Light**
No Sign	**Moderate**
(+)	**Heavy**



Converting Celsius into Fahrenheit is easy.
Double the Celsius temperature. Then subtract 10% of the doubled temperature. Finally add 32. You now have the equivalent Fahrenheit temperature.

Here's an example:

To determine the Fahrenheit equivalent of 150C

15°C x 2 = 30°C
30°C x 10% = 3°C
30°C - YC = 27°C
27°C + 32 = 59°F

Useful Web Sites and Phone Numbers:

- Come visit the Aviation Weather Program Directorate web site at www.faa.gov/ats/ars/ARW/Arw-home.htm, and watch us grow.
- For ASOS program status or current weather observations, visit the ASOS web site at www.faa.gov/asos/asos.htm, or www.nws.noaa.gov/oso/osol/osol2/asos/asos.shtml.
- Aviation Safety Reporting System (ASRS): http://olias.arc.nasa.gov/asrs
- FAA Safety Data (NASDAC): http://www.asy.faa.gov/safety_data/
- FANs Consumer Hotline: **1-800-322-7873**
- FANs Safety Hotline: **1-800-255-1111**
- Have you given a PIREP lately: Don't forget to call flight watch on **122.0**. Too busy to call? No problem! Just call Flight Service at **1-800-WX-BRIEF (1-800-992-7433)** after landing.

For Additional Copies Contact:

FAA Aviation Weather Standards Division
Publication No. FAA/ARW-200/99/001
202-366-1107

METAR/TAF information is available from the National Weather Service on the internet: http://weather.noaa.gov/weather/coded.html

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METAR (SPECI or Special Report)

(*Note: These examples are used as a quick reference tear off page in the booklet.*)

Note: When METAR data is missing (e.g. dew point), it is simply omitted and the user must know the sequence to recognize this. Some exceptions apply in remarks such as RVRNO, or SLPNO when RVR or SLP are normally reported but not currently available.

METAR KPIT 201955Z 22015G25KT 3/4SM R28R/2600FT TSRA OVC010CB 18/16 A2992 RMK SLP013 T01760158

Where: **KPIT**

When: **201955Z** 20th day of month at 1955Z

Wind: **22015G25KT** 220 degrees at 15 gusting to 25 knots

V: Variable direction e.g., 20015KT 220V280

VRB: Variable direction when speed is less than or equal to 6 knots

Visibility: **3/4SM** 3/4 statute miles, typical: 2 3/4SM, 1SM

RVR: **R28R/2600FT** Runway 28 Right visibility 2600 feet

M: Used for RVR less than lowest reportable sensor value (e.g. **M0600FT**)

P: Used for RVR greater than highest reportable sensor value (e.g. **P6000FT**)

V: Variable

Significant Weather: **TSRA** thunderstorm/moderate rain (See Abbreviations)

Sky Condition: **OVC010CB** overcast clouds at 1000 feet consisting of cumulonimbus

Typical: **SKC, FEW, SCT, BKN, VV004** indefinite ceiling (Vertical Visibility) 400 feet

Temperature/Dew Point: **18/16** 18 degrees Celsius/dew point 16 degrees Celsius

M: Minus (below zero)

Altimeter: A2992 inches of mercury and preceded by an "A"

RMK SLP013 T01760158 10142 20012 401120084 At selected stations, Sea Level Pressure is reported as the last three digits in hectoPascals (milibars) (e.g., 1001.3 is reported as **SLP013**). Codes such as T01760158 10142 20012 and 401120084 are climate temperature information.

TAF (AMD is Amended Forecast when included)

KPIT 091730Z 091818 22020KT 3SM -SHRA BKN020 WS015/30045KT

FM2030 30015G25KT 3SM SHRA OVC015 TEMPO 2022 1/2 TSRA OVC008CB

FM2300 27008KT 5SM -SHRA BKN020 OVC040 PROB40 0407 00000KT 1SM -RA BR

FM1000 22010KT 5SM -SHRA OVC020 BECMG 1315 20010KT P6SM NSW SKC

Where: **KPIT**

When: **091730Z** issuance day and time: 9th day at 1730Z
091818 valid period: 9th day at 1800Z to next day (10th) at 1800Z

Wind: **22020KT** 220 degrees at 20 knots

Visibility: **3SM** 3 statute miles, typical - **2 3/4SM, 1SM**,
P6SM: Greater than 6 statute miles

Significant WX: - **SHRA** light rain showers (See Abbreviations)

Sky Condition: **BKN020** broken clouds at 2000 feet

Typical: **FEW, SCT, BKN, OVC**.

VV004 indefinite ceiling (Vertical Visibility) 400 feet. **CB** and **TCU** clouds noted when present.

Wind Shear: **WS015/30045KT** low level wind shear at 1500 feet forecast to be 300 degrees at 45 knots (only nonconvective, low level, wind shear is forecast)

Sequence of Wind, Visibility, Significant Weather and Sky Condition repeats preceded by:

FM2030: From 2030Z

TEMPO 2022: Temporarily between 2000Z and 2200Z.

FM2300: From 2300Z

PROB40 0407: There is a 40 percent probability between 0400Z and 0700Z

FM1000: From 1000Z

BECMG 1315: Becoming between 1300Z and 1500Z

Note: Weather conditions such as wind and sky condition may be omitted **after PROB40, TEMPO, and BECMG** if no change is expected from those same conditions given in the previous time block.