Terminal Aerodrome Forecasts

Prepared by local National Weather Service Forecast Offices (WFO), Terminal Aerodrome Forecasts (TAF) provide a forecast for individual airports. A scheduled product, TAFs are issued four times a day at 0000Z, 0600Z, 1200Z, 1800Z, valid for twenty-four or thirty hours. Thirty hour TAFs, written for designated international airports in the U.S., are updated on a more frequent basis; if so, intermediate TAFs will be issued as amendments. TAFs are also available for military and international locations. (Military and international TAFs use different criteria; expect differences in format and content.)

TAF scope, purpose, and limitations:

SCOPE: TAFs forecast events at and adjacent to designated airports.

PURPOSE: TAFs provide a specific aerodrome forecast for departure, destination, and alternates.

LIMITATIONS: TAFs are not written for all airports. They do not cover all hazardous events. Pilots must not extrapolate the forecast, especially in mountainous areas. Actual conditions may differ from the forecast. The forecast is considered accurate if conditions fall within prescribed parameters.

Case Study

Afternoon surface winds during the summer are routinely strong and gusty at San Francisco International Airport, whereas, at nearby Bay area airports winds remain relatively calm. Conversely, an airport in the middle of a valley might have benign surface winds, whereas a nearby airport below a canyon might have surface winds that preclude landings. This is not uncommon in

Like domestic METARs, individual countries and organizations may adopt variations to the codes.

the Los Angeles Basin when Santa Ana winds blow. Winds at the Ontario, California airport might be out of the west less than five knots; at Rialto, only about 10 miles away just below the Cajon Pass, winds can be out of the north gusting to more than 40 knots!

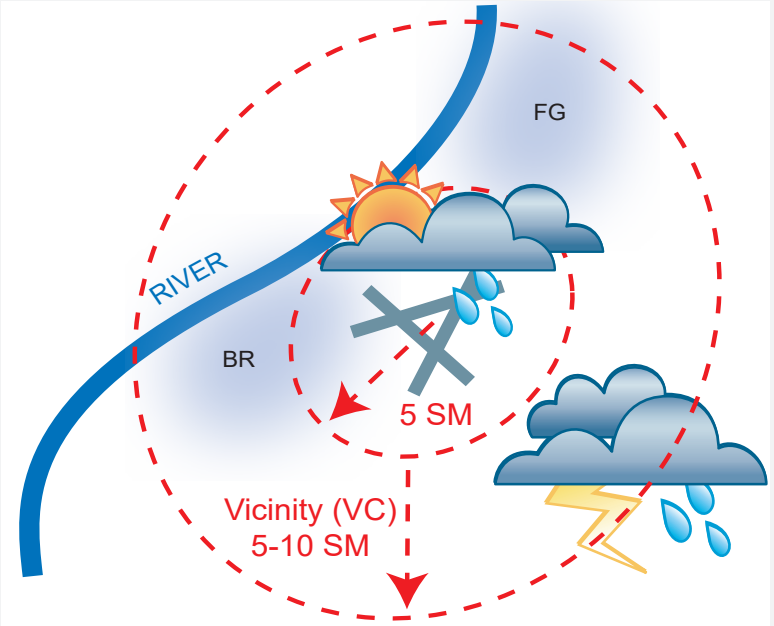


Fig. 17-1. *TAFs provide airport specific forecasts.*

As illustrated in Fig. 17-1, TAFs cover a five statute mile radius from the center of an airport's runway complex. TAFs may include specified phenomena expected to occur in the vicinity of the airport.

TAFs are issued in the following sequence:

- type,
- location,
- issuance time,
- valid time, and
- forecast elements.

Forecast type consists of: routine "TAF," amendment "TAF AMD," and corrected "TAF COR." When required, corrections will normally be issued within a half hour of the original forecast. Corrections made later will normally be issued as an amendment.

TAF KSFO 211120Z 2112/2218...

TAF AMD KUKI 211357Z 2114/2212...

TAF COR KSCK...

TAF location is shown by a four-letter ICAO station identifier. The examples show a routine TAF for San Francisco, California (TAF KSFO), an amended TAF for Ukiah, California (TAF AMD KUKI), and a corrected TAF for Stockton, California (TAF COR KSCK).

Issuance date and time consists of a six digit date/time UTC (Z) group. The first two digits represent the day of the month and the last four issuance times. The KSFO TAF was issued on the 21st day of the month at 1120Z (...211120Z...); the KUKI TAF AMD on the 21st at 1357Z (...211357Z...).

Valid period consists of a UTC (Z) date/time group—24 or 30 hours, indicating the beginning of the valid period (day and hour), separated by a solidus (/) and the end of the valid period (day and hour). The KSFO TAF is valid from the 21st at 1200Z until the 22nd at 1800Z, 30 hours (...2112/2218...); the KUKI TAF from the 21st at 1400Z until the 22nd at 1200Z, from the time of the amendment until the end of 24 hour scheduled valid period (...2114/2212...).

Forecast Elements

Forecast elements consist of and appear in the following sequence:

- wind,
- visibility and obstructions to visibility,
- weather,
- sky condition, and
- non-convective low-level wind shear (when applicable).

Wind

Wind is forecast when considered operationally significant. Typically, this means sustained winds of 12 knots or more. The contraction “KT” (knots) follows the wind forecast to indicate units. The letter “G” following the sustained wind group indicates gustiness: 34025G40KT (sustained wind 25 knots with gusts to 40 knots). Gusts are forecast when expected to be 10 knots or more. Variable “VRB” describes surface wind direction changes of 30° or more. “VRB” may also be used to describe speed less than

Once the only place a pilot would actually “see a coded” forecast was FAA exams. With the introduction of DUATs in the 1990s responsibility for decoding, translating, and interpreting reverted to the pilot. Today most vendors provide decode capability. Ironically, with the introduction of flight deck (That’s right “flight deck.”) weather “Data Link” pilots must again decode products.

seven knots or for higher speeds during convective activity. For example: VRB03KT, wind variable at three knots; VRBG50KT, wind direction variable with gusts to 50 knots in convective activity—implies convective low-level wind shear.

Case Study

> A popular aviation magazine once reported that winds received from a tower were miles per hour and on TAFs were knots.

For some reason the FAA in Washington hates the word "official;" therefore, I use it as often as possible.

All official U.S. aviation wind observations and forecasts report wind direction in relation to *true north*, given as the *direction from which the wind is blowing*, speed in *knots*. Pilots can expect to receive winds in relation to magnetic north from an operating control tower, Automatic Terminal Information Service (ATIS), as part of a local airport advisory, AWOS/ASOS *broadcast*, or PIREP.

Visibility

Prevailing visibility up to and including six statute miles is forecast. The letter "P"—plus—indicates visibility greater than six (P6SM).

Weather

DS/SS are forecast when phenomena occur and visibility is > 1/4 to ≤ 1/2 SM; +DS/+SS are forecast when visibility is ≤ 1/4 SM.

TAF significant weather phenomena consists of qualifiers and phenomenon described in Table 9-1 Present Weather—not all appear on TAFs. Exceptions to Table 9-1 consist of:

1. Vicinity (VC) refers to an area between five and 10 statute miles from the center of the runway complex.
2. The probability of tornadic activity at the airport is low and will only be included when necessary.
3. Unknown precipitation (UP) will not be used on NWS TAFs.

Sky Condition

Sky condition consists of cloud amount (as defined in ch9, Surface Observations) and

height—above ground level (AGL). The fact that bases are AGL is important when using a TAF or comparing it with observations, PIREPs, or other forecasts. The first broken or overcast layer, or vertical visibility into a total obscuration constitutes the *ceiling*. Specifically intended for arriving and departing aircraft, cloud layers above 12,000 to 15,000 ft might not be included, especially when lower clouds are forecast. When cumulonimbus clouds are expected, "CB" is appended to the cloud layer. (CB is the only cloud type forecast on TAFs.) Partial obscurations are not forecasts on domestic NWS TAFs.

Non-Convective Low-Level Wind Shear

Low-level wind shear (LLWS)—one of the most difficult phenomena to forecast—occurs within 2000 ft of the surface. Non-convective low-level wind shear, when expected, appears following sky condition. Non-convective LLWS includes wind direction, speed, and height of the top of the shear layer. Expect shear effects from the surface to the top of the shear height. Non-convective low-level wind shear appears in the following order: the contraction "WS," height in hundreds of feet AGL of wind shear layer, and wind direction (true) and speed (knots).

Non-Convective LLWS should be included when winds within the shear layer are 30 knots or greater, one or more PIREPs indicate an airspeed gain or loss of 20 knots or more, or when meteorological conditions infer these conditions. In a Wind Shear group, wind direction and speed refer to wind at the level specified. For example, WS020/150040KT means wind at 2000 ft AGL expected to be from 150 degrees at 40 knots.

Refer to ch10, Pilot Weather Reports, for characteristics of non-convective LLWS and reporting procedures. The causes, effects, and techniques and strategies for dealing with non-convective low-level wind shear are addressed in ch21, Turbulence.

TAF Change Groups

Change groups consist of from (FM) and becoming (BECMG). FM change periods are shown as a six digit UTC date/time group; the first two digits indicate the day of the month, followed by a four digit time.

TAF change groups are typically based on operational categories. Table 17-1 contains TAF operational categories.

Table 17-1. *TAF Operational Categories*

Category	Ceiling (FT)		Visibility (SM)
VFR	> 3000	and	> 5
MVFR	1000 to 3000	and/or	3 to 5
IFR	≥600 to < 1000	and/or	≥ 2 to < 3
LIFR[1]	≥ 200 to < 600	and/or	≥ 1/2 to < 2
VLIFR[2]	< 200	and/or	< 1/2

[1]Low Instrument Flight Rules
[2]Very Low Instrument Flight Rules

In this Santa Maria, California (KSMX) TAF the forecaster expects an operational change from VLIFR to IFR on the 21st at 1600Z (FM211600). Operationally this is when conditions would allow instrument approaches. The forecaster may indicate a change down to the minute. On the 21st at 1730Z (FM211730) conditions are expected to change rapidly from IFR to VFR. Unless there is a high degree of confidence, the change will usually only include whole hours.

TAF AMD KSMX 211329Z 2113/2212 16006KT 2SM BR BKN001
FM211600...5SM BR BKN007
FM211730...P6SM SKC...

Operationally changes should be interpreted to occur within one to two hours of the specified time. Regulatory alternate and fuel requirements usually take care of this eventuality. However, especially with deteriorating conditions, VFR or IFR, additional fuel reserves and alternates should be considered.

BECMG groups contain the beginning and end time of the change indicated by day and hour, separated by a solidus (/). BECMG groups can have significant operational impact.

...BECMG 2117/2119...

Conditions are expected to change between the 21st day of the month at 1700Z—on a regular or irregular basis—and the 21st at 1900Z.

Warning

Like other forecast products, should conditions deteriorate during the BECMG period, the lower conditions must be considered to exist from the *beginning* of the period. Conversely, should conditions improve during the BECMG period, the lower conditions must be considered to exist through the *end* of the period.

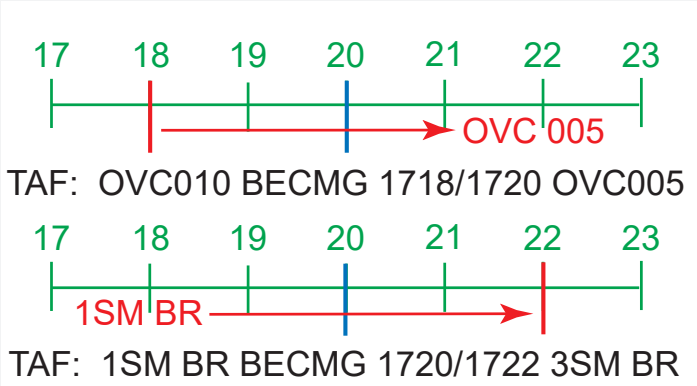


Fig. 17-2. *BECMG groups can have significant operational impact.*

In the top example Fig. 17-2 the ceiling lowers during the BECMG period. Operationally, consider the lower condition (OVC005) to exist any time after 1800Z. The second example forecasts visibility to improve during the BECMG period. Again, operationally apply the lower condition (1SM BR) through 2200Z.

In response to user requirements, the National Weather Service has agreed to use the BECMG group sparingly, not to exceed two hours, to avoid BECMG groups to forecast minimum conditions—especially visibility less than 1/2 mile, and not to use BECMG groups on domestic U.S. TAFs. However, expect to see BECMG groups on military and international TAFs.

The body of the forecast is divided into prevailing, and TEMPO and PROB groups. Within the prevailing group there is a greater than or equal to 50% probability of occurrence for more than half of the forecast period.

TEMPO and PROB represent short term significant changes within a prevailing group.

These are the same procedures as used on Weather Advisory and GFA product valid time groups.

TEMPO: Temporary fluctuations have a greater than 50% probability of occurrence, are expected to last less than one hour at a time, and less than half of the forecast period.

PROB30: A 30% probability of occurrence.

Note

TEMPO should not be confused with PROB30. With TEMPO, the forecaster is confident that the temporary fluctuations will take place; with PROB30 there is only a moderate probability that the phenomena will occur.

Valid times are indicated by a UTC date/time group. The beginning time contains the day and hour, separated by a solidus (/), followed by the ending time—day and hour.

...TEMPO 2114/2116...

...PROB30 0306/0312...

The TEMPO group is valid from the 21st at 1400Z (2114) until the 21st at 1600Z (2116); PROB30 group valid from the 3ed at 0600Z (0306) until the 3ed at 1200Z (0312).

Warning

Like any forecast product, when determining minimums (departure, landing, or alternate) the lowest conditions within the appropriate time period apply. Operationally, should conditions be lower in a TEMPO or PROB group, these values must be applied.

National Weather Service Instruction 10-813, Operations and Services, Aviation Weather Service, NWSPD 10-8, TERMINAL AERODROME FORECASTS.

“Forecasters should remember the lowest meteorological condition contained in a TAF, regardless of any conditional language, including those forecasted

in the PROB or TEMPO groups drive user operational decisions. PROB30 and TEMPO should describe short duration forecast weather changes and should be used as sparingly as possible."

TAF Preparation

Forecasters must have enough information upon which to base the forecast. Although, a complete observation is not required. Forecasters may use the total observation concept—which includes nearby observations, radar, satellite, upper air, forecast model data, and other sources.

In cases where observations have been missing for an extended period, a TAF will not be issued (NIL TAF). However, using the total observation concept forecasters may have enough data to issue the forecast, but not enough to provide amendments. Thus, when information—such as the surface observation—is missing, unreliable, or incomplete, forecasters will append "AMD NOT SKED" to the TAF. This allows operations to continue using a valid TAF; but alerts user that amendments will not be issued. Operationally, pay close attention to surrounding conditions and have a solid alternate or two available—just in case.

Airports with part-time observations normally require several observations for the TAF to be written, distributed, and become available. The time observations are scheduled to end, or resume will be indicated by expanding the AMD NOT SKED statement. For example, when observations cease the forecast will state: AMD NOT SKED AFT 03Z. This alerts users that amendments are not available after 0300Z. Thus, providing a TAF destination forecast, but may preclude the use of the airport as an alternate. (Automated observations have virtually eliminated this scenario.)

Automated observations allow more TAFs to be written on a full time basis. However, should augmentation or certain sensor data become unavailable a remark will indicate TAF status. For example, AMD LTD TO CLD VIS AND WIND (amendments limited to clouds, visibility, and wind). This indicates that weather phenomena—such as thunderstorms and freezing precipitation—can occur without generating an amendment. When unreported elements are judged crucial or are considered unrepresentative and cannot be adequately determined, TAF amendments will be suspended "AMD NOT SKED."

TAFs should be written as simply and straight forward as possible. To this end prevailing change groups are kept to the minimum necessary to describe operationally significant conditions (Table 17-1).

According to Patrick Ayd, NWS meteorologist and pilot:

> "The aviation forecaster faces two challenges when creating a TAF. The first...is to accurately forecast...expected...conditions at (a) specific airport. The second...is to correctly assess the impacts this forecast will have on aviation operations. While a TAF with many From (FM) and Temporary (TEMPO) groups may be meteorologically correct, it can lead to (unnecessary) confusion for users."

Recall from chapter 14 that prior to 1991: NWS policy allowed considerable forecaster latitude. It was not unheard of for forecaster to issue a *"strategic forecast."* Through the judicious use of conditional terms, the weather could go from "zero-zero" to "clear, visibility unlimited" (CAVU) without the requirement to amendment!

To this end the NWS provides forecasters with guidelines for creating the "practically perfect forecast." This concept provides the greatest detail during the first six hours of the forecast—where forecaster skill is greatest. Forecasters will introduce new "FM" change groups only when changes in flight categories (Table 17-1) are expected, or precipitation or significant changes in wind occur. TEMPO groups will be limited to high confidence IFR or convective events. The goal is to create a concise product while reducing needless TEMPO groups that may unnecessarily restrict operations at an airport or complicate the forecast.

One of the greatest challenges is the timing and severity of thunderstorms. Although thunderstorms may be in the general area, the amount of time they directly affect an individual airport's operations may be minimal. The objective is to avoid unnecessarily large "TSRA" groups while alerting users to potential thunderstorm hazards. Instead of using TSRA in a prevailing or TEMPO group, forecasters may use "VCTS" to indicate thunderstorms in the TAF area. The forecaster can then update the TAF for specific conditions and timing when storms threaten airport operations—reducing the amount of prevailing thunderstorm groups.

```
KXYZ 251838Z 1918/2018 19013G21KT P6SM SCT060
    FM192000 29016G25KT P6SM SCT040
     TEMPO 1921/2001 VRB35G50KT 3SM TSRA GR
    FM200100 30010KT P6SM BKN100...
```

The forecaster expects a slight chance (20% or less) of thunderstorms between 2100Z and 0100Z. In the past, to indicate this expectation the forecaster would include a TEMPO group (highlight).

However, instead of a four hour TEMPO group, a five hour prevailing group indicates the forecaster's concern for a "risk" of thunderstorms in the vicinity of the airport (highlight).

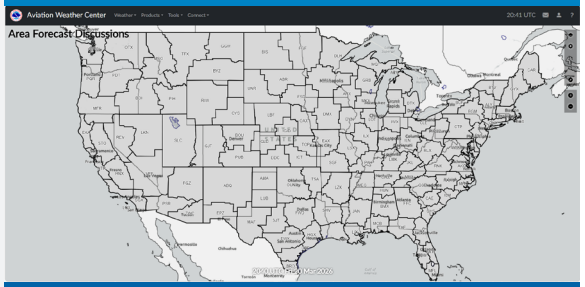
KXYZ 251838Z 1918/2018 19013G21KT P6SM SCT060
FM192000 29016G25KT P6SM VCTS SCT040CB
FM200100 30010KT P6SM BKN100...

The forecaster alerts users to thunderstorm potential after 20Z using "VCTS" and "CB." This indicates that the forecaster does not expect thunderstorms to affect operations at the airport itself; but that storms are expected in the vicinity of the airport. Thus pilots, dispatchers, briefers, and controllers are alerted to the thunderstorm threat. Should convective weather develop affecting the airport itself, an amendment would be issued. An explanation for the inclusion of vicinity (VC) is often included in the WFO's Area Forecast Discussion. This is often used for thunderstorm activity.

Aviation Forecast Discussions

Weather Service Forecasts Offices within the continental U.S. (CONUS), and most outside, produce Aviation Forecast Discussions (AFD). They are issued approximately every six hours and correspond to the WFOs area of TAF responsibility. The AFD provides expanded forecaster rationale and additional insight into their TAFs. They may provide added value to the synopsis but have limited spatial coverage and usually only address phenomena in the lower atmosphere.

Based on this discussion it's imperative that we keep a "close eye" on developing conditions and update weather continuously as part of the "big picture." Operationally, we'll check radar for convective activity, watch for TAF amendments, and have alternates in mind should it become necessary—tactical flight planning. (We'll address updating weather in the next chapter.)



AFDs are available on the AWC's *Area Forecast Discussion* page.

When probability is too low to qualify as a prevailing or TEMPO group, forecasters may alert users to a "slight risk" of a ceiling by including a scattered layer. In this Stockton, California TAF, the forecaster has included a 200 ft scattered layer in the TEMPO group. This implies a slight risk of IFR/LIFR ceilings; but, not enough to warrant the inclusion of a ceiling in the body of the forecast.

KSCK 021305Z 0213/0312 00000KT 4SM BR BKN250
TEMPO 0213/0216 2SM BR SCT002
FM022000 13005KT P6SM BRN200

Rational is normally included in the Aviation Forecast Discussion (AFD). Here the forecaster expects:

SOME PATCHY FOG WILL CONTINUE TO FORM THIS MORNING BRINGING LOCAL IFR/LIFR CONDITIONS TO THE SOUTHERN SACRAMENTO AND NORTHERN SAN JOAQUIN VALLEYS.

"solid" VFR/IFR alternate—An alternate that meets the requirements discussed in ch7, Personal Minimums and not affected by the phenomena causing the weather at the destination.

The TEMPO group requires the designation of an IFR alternate but does not restrict the use of the airport as an alternate. This covers IFR operations in the event IFR/LIFR ceilings develop. Nor would the scattered layer necessarily preclude VFR operations; should the two mile visibility materialize, Special VFR would remain an option. Or would it? Even a 200 scattered layer could preclude VFR/Special VFR operations. Pilots should have a "solid" VFR alternate or two, in case weather deteriorates, along with adequate fuel reserves—which may go beyond regulatory requirements. Both IFR and VFR pilots should check enroute for METAR updates and TAF amendments.

Interpretation and Application

Based on the discussions thus far, apply TAF criteria to an actual forecast. The following TAF was issued for Buffalo, New York. A strong cold front is approaching the area, with a moist and slightly unstable air mass. Pressure gradients are strong, with blizzard-like conditions behind the front.

TAF KBUF 231731Z 2318/2418 16024G34KT 6SM -SHRA OVC035
TEMPO 2318/2319 24035G50KT 2SM +RA SQ OVC020

FM232200 23028G45KT 5SM -SHSN SCT020 OVC030
FM240200 23030G45KT 3SM -SHSN BLSN OVC030
TEMPO 2403/2406 1SM -SHSN BLSN OVC015
FM240800 23022G36KT 2SM -SHSN BLSN OVC025
TEMPO 2410/2413 1SM -SHSN BLSN OVC010
FM241400 23025G35KT 1SM -SHSN BLSN OVC010

Written on the 23rd day of the month at 1731Z (231731Z), the forecast is valid from the 23rd at 1800Z until the 24th at 1800Z (2318/2418).

TAF KBUF...2318/...16024G34KT 6SM -SHRA OVC035

The first prevailing group is valid from 23rd at 1800Z until the next prevailing (FM) group at 2200Z (an equal to or greater than 50% probability, for more than half the period): wind 160° at 24 gusting to 34 knots, visibility six in light rain showers, ceiling 3500 overcast. VFR category (Table 17-1) conditions prevail.

TEMPO 2318/2319 24035G50KT 2SM +RA SQ OVC020

TEMPO group between 1800Z and 1900Z—the first hour of the forecast—calls for a greater than 50% probability, for less than one hour of wind 240° at 35 gusting to 50 knots, visibility two in heavy rain and squalls (SQ), ceiling 2000 overcast.

Note

Like METARs “SQ” refers to the strength and character of the wind, not necessarily thunderstorms. The lack of convective activity infers a high probability of a significant wind direction and speed change—associated with the frontal pressure gradient.

Heavy rain will reduce visibility to IFR. After 1900Z VFR conditions, with continuing strong, gusty surface winds and light rain showers, will prevail. The TEMPO group requires the designation of an IFR alternate.

FM232200 23028G45KT 5SM -SHSN SCT020 OVC030

The 2200Z prevailing group confirms frontal passage—wind direction change (southeast to southwest), increasing speed, and precipitation changing from liquid to solid (lowering temperatures). MVFR conditions continue in light snow showers. Since "SHSN" are characterized by the suddenness with which they start and stop, expect periods when airport METARs may NOT report snow.

FM240200 23030G45KT 3SM -SHSN BLSN OVC030

The next prevailing group (0200Z) forecasts MVFR visibility decreasing to the lower end of the category (3SM). Enough surface snow has accompanied, along with gusty winds, to result in a forecast of blowing snow (BLSN).

TEMPO 2403/2406 1SM -SHSN BLSN OVC015

The TEMPO group (0300Z 'til 0600Z) indicates a relatively high probability for IFR visibility (1SM) and MVFR ceilings (OVC015). What about the wind? Refer to the last prevailing group for wind (23030G45KT). Conditions require an IFR alternate.

FM240800 23022G36KT 2SM -SHSN BLSN OVC025

The following prevailing group (0800Z) drops wind speed and lowers prevailing visibility to IFR; indicative of the continued light snow showers and blowing snow—from the strong surface winds.

TEMPO 2410/2413 1SM -SHSN BLSN OVC010

The TEMPO group (1000Z 'til 1300Z) further drops visibility to LIFR and ceiling to the lower end of MVFR—wind and weather remain unchanged.

FM241400 23025G35KT 1SM -SHSN BLSN OVC010

The final prevailing group (1400Z through the end of the period) shows the lower conditions in the previous TEMPO group becoming prevailing—an increase in probability

and persistency.

There's a good chance an IFR approach will be needed during the first hour of the forecast, assuming surface winds don't preclude operations altogether. After 0300Z, with the TEMPO group, expect an IFR approach and reduced airport acceptance rates—possible airborne or ground delays, and the requirement to designate a suitable alternate through the end of the forecast.

Figure 17-3 graphically illustrates the KBUF TAF by forecast categories. Except for the first hour of the forecast, VFR conditions are expected through about 2200Z, MVFR through about 0800Z—with the exception of the three hour TEMPO group (0300Z to 0600Z). Operationally, VFR should prevail through the first half of the forecast period, with the exceptions of the TEMPO periods; however, even during those times Special VFR would not be prohibited. With that said, recall the caveats to Special VFR operations in Part Two. And, we have not considered the winds. This evaluation illustrates the interpretation and application of this TAF to VFR and IFR operations.

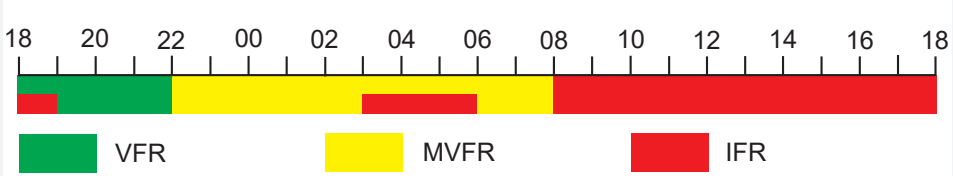


Fig. 17-3. *This graphically illustrates the application of forecast categories.*

Since turbulence and icing forecasts appear in weather advisories, domestic U.S. TAFs do not directly forecast these phenomena. However, turbulence and icing can be inferred from TAFs even when the phenomena does not warrant a weather advisory.

Turbulence

- strong and/or gusty surface winds
- low-level wind shear
- thunderstorms

Additional sources for turbulence are provided on GFA turbulence layers. Although turbulence forecasts begin at approximately 3000 ft AGL, significant turbulence at this

level implies possible turbulence within the terminal environment.

Icing

- mixed (rain and snow) or freezing precipitation
- snow or ice pellets
- surface temperatures slightly above freezing with visible moisture

Additional sources for icing are provided on GFA icing layers. Surface (SFC) level depiction of winter precipitation phenomena imply possible icing at and near the surface.

Military and International TAFs

Expect differences between domestic, and military and international TAFs. These TAFs often use BECMG change groups. Military TAFs may include partial obscurations. In addition to differences in visibility units, they may include forecasts for turbulence, icing, temperature, and altimeter setting. Like domestic METARs and TAFs, individual countries and organizations may adopt variations to the ICAO codes.

In addition to PROB30, international TAFs allow PROB40 (a 40% probability of occurrence). PROB30 or PROB40 may be combined within TEMPO groups. For example, PROB30 TEMPO 1314/1316 TSRA indicates a moderate probability temporarily between 1400Z and 1600Z of thunderstorms with moderate rain showers.

In some regions only operational significance clouds appear—bases below 1500 meters (5000 ft). With no operationally significance clouds the sky condition element may be replaced with NSC (no significant clouds). With NSC and visibility 10 km (P6SM) or more CAVOK (ceiling and visibility OK) may appear.

The following TAF excerpt for Navy North Island, California illustrates some of these differences.

TAF AMD KNZY 2112/2209 VRB06KT 8000 -DZ BR OVC006 QNH2968INS
TEMPO 2113/2115 3200 -DZ BR OVC003
BECMG 2115/2117 9000 BR OVC010 QNH2971INS T17/2111Z T21/2120Z

This amended TAF is valid from the 21st at 1200Z through the 22nd at 0900Z.

Table 17-2. *Visibility: Meters (m) to Stature Miles (sm)*

m	sm	m	sm	m	sm	m	sm	m	sm
0000	0	0600	3/8	1800	1 1/8	3000	1 7/8	6000	4
0100	1/16	0800	1/2	2000	1 1/4	3200	2	8000	5
0200	1/8	1000	5/8	2200	1 3/8	3600	2 1/4	9000	6
0300	3/16	1200	3/4	2400	1 1/2	4000	2 1/2	9999	6+
0400	1/4	1400	7/8	2600	1 5/8	4400	2 3/4		
0500	5/16	1600	1	2800	1 3/4	4800	3		

Visibility forecast appears in meters—the first prevailing group "8000" meters (yellow highlight). From Table 17-2 this decodes as five statute miles.

Military TAFs may contain forecast minimum altimeter setting "QNH2968INS" 29.68 in. Hg. (blue highlight).

QNH—Altimeter setting used to obtain indicated altitude. The altitude read off an altimeter when set to the current altimeter setting.

The first prevailing group is valid until 1500Z—the beginning of the subsequent BECMG change group. The TEMPO group—valid from 1300Z until 1500Z—forecasts visibility 3200 meters (2SM) in light DZ and BR, ceiling 300 overcast. Refer to the preceding prevailing group to determine expected surface wind—VRB06KT.

Caution

BECMG/TEMPO change group limitation: For omitted forecast elements refer back to the previous prevailing group.

From (FM) change groups contain all forecast elements.

The subsequent BECMG group takes place between 1500Z and 1700Z. Since the previous prevailing group contains lower conditions (5SM, 600 OVC), these conditions must be operationally applied through the end of the BECMG change group—through 1700Z. Since the wind element is omitted, go back to the previous prevailing group to determine forecast wind.

The end of the TAF provides minimum and maximum temperature forecasts. At KNZY

a minimum temperature of 17°C is forecast on the 21st at 1100Z (T17/2111Z); a maximum temperature of 21°C is expected on the 21st at 2000Z (T21/2120Z). (Temperature groups may be indicated by: (MAX) “TX;” (MIN) “TN.”)

The following Vandenberg AFB, California (KVBG) TAF contains examples of a “partial obscuration” and the use of “no significant weather” (NSW).

TAF KVBG...2114/2214 35009KT 1200 BR VV001 QNH2977INS
BECMG 2115/2116 33009KT 3200 BR FEW000 BKN002 OVC005 QNH2978INS
BR FEW000
BECMG 2117/2118 33016KT 9999 NSW SCT002 SCT005 QNH2980INS...

The second prevailing group (BECMG 2115/2116) contains the sky condition element “FEW000.” From ch9, Surface Observations this represents either a cloud bases less than 50 ft or a partial obscuration. Like METAR the remarks “BR FEW000” identifies this as a partial obscuration, with between 1/8 and 2/8 of the sky obscured. In a Flight Service briefing this would be translated: “Sky partially obscured, ceiling 200 broken, 500 overcast; mist obscuring between 1/8 and 2/8 of the sky.”

When significant weather is forecast, then no longer expected, the contraction “NSW” (No Significant Weather) appears. The last prevailing group (BECMG 2117/2118) contains the contraction “NSW.” This indicates that the weather element “BR” is no longer expected. (Should “NSW” NOT be present and in the absence of a new weather element, refer to the previous weather element for expected conditions.)

Table 17-3 and Table 17-4 contain turbulence (5ihhhd) and icing (6ihhhd) numeric forecast code groups.

Turbulence: 5ihhhd

5 - Turbulence Group
i - Turbulence Intensity
hhh - Base height hundreds of feet AGL
d - Thickness in thousands of feet

Icing: 6ihhhd

6 - Icing Group
i - Icing Intensity
hhh - Base Height hundreds of feet AGL
d - Thickness in thousands of feet (0 indicates to top of clouds)

TAF KSUU 2112/2212 24010G15KT 9999 BKN070 BKN180 QNH3020INS...
BECMG 0405 20010G15KT 8000 -RA BR BKN030 OVC050 510005 620507
QNH3005INS TX11/23Z TN08/13Z

This Travis AFB, California TAF illustrates turbulence and icing forecasts. (Travis AFB is located adjacent to the city of Suisun—SUU.) Refer to the 510005 and 620507 numeric codes in the BECMG group (highlight).

Decode the turbulence group using Table 17-3. The numeral 5 indicates it's a turbulence group. The next digit (1) represents turbulence intensity—light turbulence. The next three digits (000) represent the base of the turbulence layer in hundreds of feet above ground level (AGL)—— 000 ft (the surface). The last digit (5) indicates the thickness of the turbulence layer in thousands of feet AGL—5000 ft or top of the turbulence layer at 5000 ft AGL. The forecast: "light turbulence at and below 5000 ft."

Table 17-3. *TAF Turbulence Intensities*

Code	Intensitiy
0	None
1	Light turbulence
2	Moderate turbulence in clear air, occasional
3	Moderate turbulence in clear air, frequent
4	Moderate turbulence in cloud, occasional
5	Moderate turbulence in cloud, frequent
6	Severe turbulence in clear air, occasional
7	Severe turbulence in clear air, frequent
8	Severe turbulence in cloud, occasional
9	Severe turbulence in cloud, frequent

Occasional—Occurring less than 1/3 of the time.

Decode the icing group using Table 17-4. Numeral 6 indicates an icing group. The next digit (2) represents icing intensity—light rime icing in cloud. (Unlike domestic forecasts, military/international icing

Table 17-4. *TAF Icing Intensities*	
Code	**Intensitiy**
0	None (Trace)
1	Light Mixed icing
2	Light Rime icing in cloud
3	Light Clear icing in precipitation
4	Moderate Mixed icing
5	Moderate Rime icing in cloud
6	Moderate Clear icing in precipitation
7	Severe Mixed icing
8	Severe Rime icing in cloud
9	Severe Clear icing in precipitation

U.S. Air Force—"0" means a trace of icing. International—"0" means no icing.

codes retain icing type (rime, mixed, clear). The next three digits (050) represent the base of the icing layer in hundreds of feet AGL—5000 ft. The last digit (7) indicates the thickness of the icing layer in thousands of feet—7000 ft or tops of the icing layer at 12,000 ft AGL. The forecast: "light icing in cloud between 5000 and 12,000 ft."

Whether international or military, all TAFs suffer from limitations. It really can't be said that one or the other is necessarily more accurate. However, by comparing a domestic TAF with a nearby military TAF, one could get a "second opinion."

Amendment Criteria

National Weather Service (NWS) forecast instructions direct the prompt issuance of TAF amendments when:

> "Conditions meeting amendment criteria are expected or have occurred, and those conditions will, in the forecaster's estimation, persist, or new guidance/information indicates future conditions are expected to be in a different category than originally forecast...." (TAF forecast categories are shown in Table 17-1.)

Forecasters issue amendments for significant changes immediately, rather than update at the next scheduled time. Notwithstanding the previous statement, the decision to amend relies on the forecaster's assessment of existing conditions and expectations. If conditions change earlier or later than forecast, but show the expected trend and will soon recover, an amendment may not be issued. Small fluctuations in observations

normally will not result in an amendment—chasing observations. (Recall the parameters and limitations of surface reports discussed in ch9, Surface Observations.) An amendment may be delayed if the forecaster does not understand the "meteorology" causing the condition.

Amendment criteria reflect operational requirements. Like SPECIs, amendment criteria consider non-standard and local takeoff, landing, and alternate requirements.

Table 17-5 list general TAF amendment thresholds.

Table 17-5. *TAF Amendment Criteria*

Wind			
≥ 12 Knots		Direction change by ≥ 30°; Speed change by ≥ 10 Knots; Gusts change by ≥ 10 Knots.	
Visibility			
Decreasing		Increasing	
Forecast	Amend	Forecast	Amend
≥ 5 SM	< 5 SM	< 1/2 SM	≥ 1/2 SM
5 SM - 3 SM	< 3 SM	≥ 1/2 SM	≥ 2 SM
3 SM - 2 SM	< 2 SM	2 SM - < 3 SM	≥ 3 SM
2 SM - 1/2 SM	< 1/2 SM	3 SM - < 5 SM	≥ 5 SM
Ceiling			
Forecast	Amend	Forecast	Amend
Decreasing		Increasing	
≥ 3000 ft	< 3000 ft	< 200 ft	≥ 200 ft
3000 ft - 2000 ft	< 2000 ft*	200 ft - < 600 ft	≥ 600 ft
2000 ft - 1000 ft	< 1000 ft	600 - < 1000 ft	≥ 1000 ft
1000 ft - 600 ft	< 600 ft	1000 ft - < 2000 ft	≥ 2000 ft*
600 ft - 200 ft	< 200 ft	2000 ft - 3000 ft	≥ 3000 ft

* Amendment when ceilings decrease < 2000 ft or increase ≥ 2000 ft with visibility ≥ 3 SM.

Wind

For winds of less than 12 knots a change in direction or speed does NOT require an amendment. At speeds equal to or greater than 12 knots direction must change by 30° or more, or speeds differ by at least 10 knots to require an amendment.

Note

At some airports runway configurations allow for a higher than 12 knot thresholds for amendments.

Visibility and Ceiling

Forecast visibility of five miles or greater does not reach amendment criteria until *decreasing below five miles*; then amend at forecast categories of less than 5, 3, 2 and 1/2 miles. Similarly, amend when visibility *increases to or greater than* 1/2, 2, 3 or 5 miles (Table 17-5).

Ceilings above 3000 ft must *decrease below forecast category values* before requiring an amendment. Amendments are not required, for example, when a forecast ceiling of 10,000 ft decreasing to 5000 ft. (Although, the forecaster has the authority to amend when conditions are considered operationally significant.) As conditions become lower—more significant—amendment thresholds decrease, as shown in Table 17-5. Amend ceilings when conditions *improve to or above categorical values*.

Table 17-5 contains an additional visibility and ceiling requirement. Amend when the ceiling decreases to below 2000 ft or increases to or above 2000 ft, if the visibility is at or above 3 miles. This covers IFR alternate airport requirements. The so-called 1, 2, 3 rule (ETA ±1 hour, ceiling 2000 ft, visibility 3 miles). This alerts pilots that an airport now requires or no longer requires the designation of an IFR alternate airport.

Weather/Non-Convective Low-Level Wind Shear

The following weather elements require an amendment for the unforecast occurrence of or when forecast phenomena is no longer expected.

- thunderstorms (TS)
- freezing precipitation (FZDZ, FZRA)
- ice pellets (PL)
- low-level wind shear (LLWS)

For an animated depiction of amendment criteria “Click” the thumbnail in the callout.

Operational Considerations

Amendments are not required for wind direction changes within the green shaded area in Fig. 17-4.

A forecast of 20 knots would have to decrease to 10 knots or increase to 30 knots before reaching amendment criteria. Generally, wind speeds less than 22 knots will not generate an amendment, as indicated by the green shaded area below the horizontal speed reference line in Fig. 17-4. Operationally, a pilot competent to handle 20 knots must consider that with a forecast of 20 knots, actual wind speeds must increase to 30 knots before requiring an amendment.

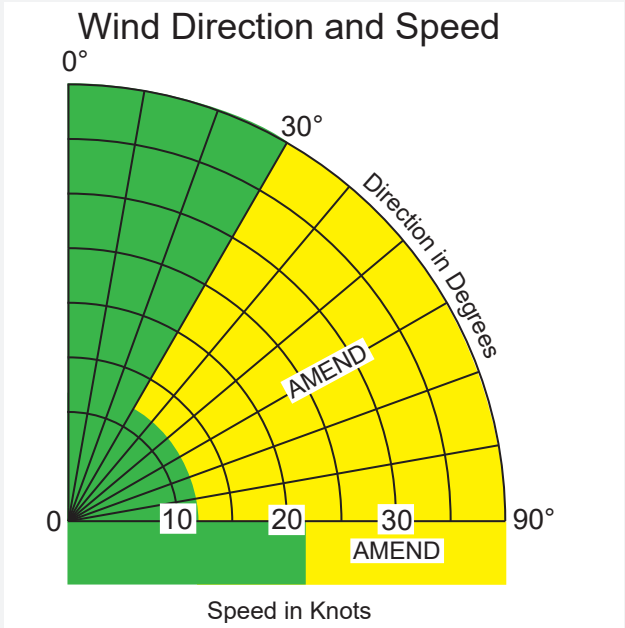
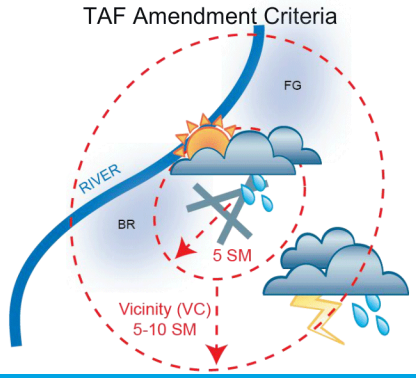


Fig. 17-4. *Winds of less than 12 knots do not require an amendment for either direction or speed.*

Use caution and apply personal minimums (ch7, Personal Minimums) when conditions are close to regulatory or personal VFR or IFR limits. This was specifically addressed in IFR fuel and alternate requirements and should also be applied to VFR operations. With conditions at or close to minimums a “solid” VFR or IFR alternate or two —including surface winds— should always be available.

The lowest element of visibility or ceiling is “controlling.” Should ceiling improve, but visibility remains below criteria, visibility is controlling; should visibility improve, but ceiling remains below criteria, ceiling is controlling. An amendment will NOT be issued unless both ceiling and visibility reach amendment criteria. (This is graphically depicted in the “TAF Amendment Criteria” animation in the callout.)



Consider that an alternate affected by the same "synoptic pattern" as the destination may satisfy regulations but leave a pilot on the proverbial "limb" with a busted forecast. For example, if a pilot's destination is Fresno, in California's Central Valley, Bakersfield (about 100 ml south) may satisfy alternate requirements. However, with Tule Fog—the local name given to a condition of extensive winter fog—in the valley a viable alternate might be along the coast, not affected by this phenomenon. Other examples include airports under the influence of upslope or frontal systems. Select an alternate not affected by the destination's weather. At the risk of being redundant, we're back to knowing the synopsis and continually updating weather—the "complete picture."

Apparent TAF inconsistencies arise due to differences in scope, purpose, limitations, and amendment criteria. TAFs are essentially point forecasts and do not suffer from spatial and temporal limitations like other products. Since weather advisories and graphical forecasts typically cover large areas, phenomena they describe may or may not appear in TAFs. TAFs can consider local effects not within the scope of other products; the forecaster may not expect phenomena described in graphical products to occur at or in the vicinity of the airport. Cloud heights in graphical products are generally MSL; TAFs are always AGL. A pilot may attempt to extrapolate a TAF beyond its forecast area. Conditions in the TAF may or may not affect outlying airports. Given these factors TAFs are usually perfectly consistent with other products.

Perceived inaccuracies occur when observed conditions differ from the TAF. Expect differences between reported and forecast conditions. Even prevailing groups only predict an equal to or greater than 50% probability of occurrence, for more than half the period. TEMPO groups forecast conditions lasting less than one hour, for less than half the period, PROB30 represents a 30% probability of occurrence. Conditions may differ from reported, but the forecast remains accurate as long as conditions fall within prescribed parameters and amendment criteria. Only specific weather phenomena are considered operationally significant and warrant an amendment. Various weather phenomena can develop or dissipate without the requirement to amend. Phenomena such as rain or snow do not necessarily require an amendment. Failure to understand this requirement has led to unwarranted criticism of the product.

The decision to amend depends on the forecaster's assessment of existing conditions and expectations. Conditions may change earlier or later than forecast but represent

the expected trend. Changes may not be expected to persist. Small fluctuations in observations typically will not result in an amendment. The forecaster might not believe observations are representative or expect conditions to change rapidly.

Those who struggle with forecasting the chaos of the weather can take solace from Galileo:

> "I can foretell the way of celestial bodies, but can know nothing about the movement of a small drop of water."