Appendix 10-813-3, TAF Code Elements

1. Terminal Forecast Coding. Each group of the TAF code used in NWS TAFs is described in the following sections. Each section includes partial or complete examples of one or more TAFs to clarify descriptions in the text.

1.1 Bulletin Headings. TAF bulletins begin with a WMO heading where the four letter ICAO identifier is the issuing office. For example:

FTUS31 KMFL 141200 BBB
TAFFLL
TAF AMD
KFLL 141223Z 141312 etc…

FT	TAF whose valid period exceeds 12 hours
US	Denotes CONUS airport location
31	Conus group location (usually by geographical area)
KMFL	Issuing WFO
141200	First 2 digits are the date; the last four are the cardinal hour prior to transmission, required to meet international requirements for scheduled TAFs.
BBB	Used to identify a non-scheduled TAF (corrections, delayed TAFs, amendments, etc.). If not used, simply omit (as in regularly scheduled TAFs). The indicators used are AAx for TAF amendments, RRx for delayed routine TAFs, and CCx for corrections of previously transmitted TAFs. The x is the letter A through X, used sequentially which indicate the subsequent use of the heading. For example, the first correction would be CCA, the second CCB, etc.
TAFFLL	First 3 letters identify a TAF, the last three are the site the TAF is for (this line is deleted when the gateway collects TAFs after transmission for disbursement as a group).

ICAO location identifiers in the CONUS begin with the letter K, those in the North Pacific (Hawaii, Alaska, and Guam) begin with a P, those in the Caribbean (Puerto Rico, Virgin Islands, etc.) begin with a T, and those in the South Pacific begin with an N.

Refer to Sections 8.1 through 8.3.1 for more information and examples of the use of the BBB group in amended, delayed, and corrected TAFs.

7.2 Forecast Text. The first line of text in a TAF includes the contraction TAF or TAF AMD. This indicates if the product is scheduled or amended, respectively. This information appears only once, on a separate line at the beginning of the product, regardless of how many TAFs it contains. Corrected and delayed TAFs are not identified in the text; that information is included at the end of the first line only on the WMO header.

The format of text in a NWS TAF is comprised of code groups, as shown below. Each term and

group shown is further described in Sections 7.2.1 through 7.2.9 below, and in the same sequence as they are required to appear in each forecast group.

GENERIC FORMAT OF THE FORECAST TEXT OF AN
NWS-PREPARED TERMINAL FORECAST

{TAF or TAF AMD)
CCCC YYGGggZ YlYlGlGlG2G2 dddffGfmfmKT VVVV w'w' (NSW) VVhshshs (SKC)
WShwshwshws/ddd ftKT TTGGgg
PROBC2C2GGGeGe TTTTT GGGeGe

For completeness, the entire international TAF code format of the text is shown in Appendix **F**. In addition, Appendix **G** includes explanations of international terms and groups not used in NWS TAFs. This information is available to aid in reading TAFs from other government agencies within the U.S. and other countries.

1.2.1 Location Identifier (CCCC). After the line containing either TAF or TAF AMD, each TAF shall begin with its four-letter ICAO location identifier. ICAO Document 7910 contains a complete list of all identifiers.

For NWS WFOs which transmit TAFs in a bulletin (collective), the TAF order should be decided by the respective regional headquarters and remain unchanged as much as possible. Newly added airports should generally be placed at the end of the bulletin. Location identifiers remaining after being deleted from the bulletin should occupy the same relative order as before the deletion.

1.2.2 Date/Time of Forecast Origin Group (YYGGggZ). The date/time of forecast origin group (YYGGggZ) follows the terminal's location identifier. It contains the day of the month in 2 digits (YY) and time in 4 digits (GGgg in hours and minutes) the forecast is completed and ready for transmission, with a Z appended to denote UTC. This time is entered by the forecaster. Paragraph 6.6 contains a table of issuance time windows for scheduled TAFs.

1.2.3 Valid Period (Y1Y1G1G1G2G2) and Routine Issuances. The TAF valid period (Y1Y1G1G1G2G2) is the next group. Scheduled 24-hour TAFs are issued four times per day, at 0000, 0600, 1200, and 1800Z. The first two digits (Y1Y1) are the day of the month for the start of the TAF. The next two digits (G1G1) are the starting hour, and the last two digits (G2G2) are the ending hour of the valid period. A forecast period that begins at midnight UTC shall be annotated as 00. If the end time of a valid period is at midnight UTC, it is annotated as 24.

1.2.4. Wind Group (dddffGfmfmKT). The initial time period and any subsequent FM and BECMG groups shall include a mean surface wind forecast (dddffGfmfmKT) for that period. Wind forecasts shall be expressed as the mean three-digit direction (ddd - relative to true north) rounded to the nearest ten degrees and the mean wind speed in knots (ff) for the time period. If wind gusts are forecast (gusts are defined as rapid fluctuations in wind speeds with a variation of 10 knots or more between peaks and lulls), they are indicated immediately after the mean wind speed by the letter G, followed by the peak gust speed expected. KT is appended to the end of

the wind forecast group. Any wind speed of 100 knots or more shall be encoded in three digits. Encode calm winds are 00000KT.

The prevailing wind direction shall be forecast. When it is not possible to forecast a prevailing surface wind direction due to its expected variability (variations in wind direction of 180 degrees or more), as may be the case for very light wind conditions (3 knots or less) or during convective activity, the forecast wind direction shall be encoded as VRBffKT. Variable wind direction **must have** a wind speed greater than zero. Do not encode VRB00KT. VRB shall not be used in the non-convective low-level wind shear group (refer to Section 7.2.8).

The forecaster should use prudence when determining whether to forecast a mean or variable wind direction with low wind speeds. Aviation customers require our best forecast. There is no amendment criteria (see Appendix H) for low wind speed conditions.

When forecasting variable wind direction, there is no requirement to specify direction variability limits in remarks.

Forecasters shall include a wind forecast in any subdivided time period which includes thunderstorms within the 5nm area enclosing the airfield.

Squalls are not forecast in the wind group. Rather, they included in the significant weather group (see Section 7.2.6). There is no means to encode the speed of squalls in the terminal forecast.

EXAMPLES:

TAF
KPIT 231732Z 231818 23010KT 4SM -SHRA BKN030
FM2200 28020G35KT P6SM OVC020
FM2300 30015KT P6SM SCT060 TEMPO 0104 BKN060
FM0500 30004KT P6SM SCT080=

This example demonstrates rapid changes in wind associated with a frontal passage. Also note the correct format for gusts.

TAF
KCSG 060537Z 060606 VRB03KT etc.

This example shows the correct format and use of variable wind direction with light winds at the beginning of the valid period (0600 UTC).

TAF
KGRB 241732Z 241818 11006KT 4SM -SHRA BKN030
BECMG 2324 22006KT
PROB30 0002 VRB20KT lSM +TSRA BKN015CB=

This example show the correct format and use of variable wind direction because of

convective activity in the immediate area. Since forecasting wind direction with convective activity is difficult, this is the only time you should consider using VRB with significant wind speeds.

TAF
KROW 021726Z 021818 30008KT 5SM HZ BKN030
PROB40 0002 27020G45KT lSM TSRA OVC012CB etc.=

This example depicts using high winds in an organized event.

TAF
KAMA 171130Z 171212 00000KT etc.=

This example shows the correct format for calm winds.

TAF
PASN 010530Z 010606 080100G140KT etc.=

This example shows the correct format of wind speed of 100 knots or more (the wind is from 80 degrees at 100 knots gusting to 140 knots).

1.2.5 Visibility Group (VVVV). The initial time period and any subsequent FM groups shall include a visibility forecast (VVVV) in statute miles. The valid values for visibility forecasts in NWS TAFs are shown below. Visibility shall be forecast rounded down to the next lowest reported value. The contraction SM is appended to the end of the visibility forecast group.

VALID VISIBILITY FORECAST VALUES

STATUTE MILES	METERS
0	0
1/4	0400
1/2	0800
3/4	1200
1	1600
1 1/2	2400
2	3200
3	4800
4	6000 (1)
5	8000
6	9000 (2)
P6SM	9999 (3)

NOTE: When visibility is reduced to <5/8 statute miles because of fog, the code used is FG. When visibility is $\geq$ 5/8 statute mile is encoded as BR.

1. Rounded down from 6400 meters

2. Rounded down from 9600 meters

3. Greater than 6 statute miles (10 kilometers or more)

When the prevailing visibility is forecast to be 6 SM or less, one or more significant weather groups (see Section 7.2.6) shall be included. However, low drifting dust (DRDU), low drifting sand (DRSA), low drifting snow (DRSN), shallow fog (MIFG), partial fog (PRFG), and patchy fog (BCFG) may be forecast with prevailing visibility of 7 statute miles or greater.

When a whole number and a fraction are used to forecast visibility, a space shall always be included between them (e.g., 1 1/2SM). Visibility greater than 6 statute miles shall be encoded as P6SM.

If the visibility is not expected to be the same in different directions, prevailing visibility, as described by Federal Meteorological Handbook No. 1 (FMH-l), shall be used.

When VA is forecast in the significant weather group, visibility shall be included in the forecast, even if it is unrestricted (P6SM). For example, an expected reduction of visibility to 10 statute miles by volcanic ash shall be encoded in the forecast as P6SM VA.

1.2.6 Significant Weather Group (w'w'). The significant weather group (w'w') consists of the appropriate qualifier(s) and weather phenomenon contraction(s) (shown in Appendix I and described in FMH-l) or NSW. Appendix J shows all possible valid combinations of weather phenomena codes and should be used to encode w'w'.

If the initial forecast period and subsequent FM groups do not contain an explicit significant weather group, the significant weather group shall be omitted. Do not use NSW in the initial forecast time period or in any FM groups.

The weather phenomenon code UP (unknown precipitation) listed in Appendix I will not be used in NWS TAFs. UP is reserved for use in automated surface observations.

Tornadic activity (tornadoes, waterspouts, and funnel clouds), should not be forecast in terminal forecasts because the probability of occurrence at a specific site is extremely small.

The significant weather group, if included in a terminal forecast, shall be a code group selected from the phenomena listed in Appendix J. One or more significant weather group(s) is(are) required when the visibility is forecast to be 6SM or less (see Section 7.2.5). With the exception of VA, DRDU, DRSA, DRSN, MIFG, PRFG, and BCFG, obstructions to vision are only forecast when the prevailing visibility is less than 7 statute miles or, in the opinion of the forecaster, is considered operationally significant.

VA shall always be forecast when expected. When VA is included in the significant weather group, visibility shall be included in the forecast as well, even if the visibility is unrestricted

(P6SM).

NSW shall be used in place of w'w' **only** in a BECMG or TEMPO group (Sections 7.2.9.b and 7.2.9.c, respectively) to indicate when significant weather (including in the vicinity - VCSH, Section 7.2.6.a) included in a previous sub-divided group is expected to end.

NSW is used only to indicate previously forecast significant weather (w'w') is expected to end. The use of NSW neither conveys any information about, nor replaces, the cloud and obstruction to vision group or the visibility group.

After NSW is used to forecast significant weather, any subsequent significant weather groups shall either be omitted or selected from the phenomena listed in Appendix I (with clarification by Appendix J). No two consecutive BECMG or TEMPO groups shall contain NSW as the significant weather group.

NOTE: P6SM NSW shall be used together in a BECMG or TEMPO group when the significant weather is forecast to end and the visibility is forecast to improve to greater than 6 statute miles.

EXAMPLES:

TAF
KBOS 050539Z 050606 VRB03KT 5SM SHRA VCFG BKN025
BECMG 1416 P6SM NSW SCT010 BKN025 etc.=

This example shows the correct use of NSW to indicate that both the rain showers and the fog in the vicinity is forecast to end between 1400 and 1600 UTC.

In many cases, only one weather phenomenon should be included in any one time period. Forecasters shall use their judgement when determining how many weather phenomena groups are included. NWS forecasters may include as many w'w' groups as necessary to accurately describe the expected conditions.

When more than one type of significant weather is forecast in the same forecast time period, significant weather shall be forecast in the following order:

1. Thunderstorms with/without associated precipitation.
2. Significant weather in order of decreasing dominance is based on intensity, i.e., the most intense type is reported first (see precipitation **exception** below).
3. Left-to-right in Appendix I (columns 1 through 5).

Forecaster judgement shall be used to resolve situations not addressed by the guidelines above.

A w'w' group shall be encoded:

(a) First, if appropriate, the qualifier for intensity or for proximity, followed without a

space by:

(b) If appropriate, the contraction for the descriptor followed without a space by:

(c) The contraction for the observed weather phenomenon or combinations thereof.

Multiple precipitation elements are encoded in a single group (e.g., -TSRASN). Non-precipitation significant weather elements are encoded after any precipitation in separate groups, each separated by a space (e.g., -SHSN BLSN BR).

If more than one type of precipitation is forecast, up to three appropriate precipitation contractions can be combined in a single group (with no spaces) with the predominant type of precipitation being first. In this single group, the intensity shall refer to the total precipitation and be used with either one or no intensity qualifier, as appropriate. The intensity qualifiers (light, moderate, and heavy) refer to the intensity of the precipitation and not to the intensity of any thunderstorms associated with the precipitation.

Exception for encoding multiple precipitation types: When more than one type of precipitation is forecast in a time period, any precipitation type associated with a descriptor (e.g., FZRA) **must** be encoded first in the precipitation group, regardless of the predominance or intensity of the other precipitation types. Descriptors shall not be encoded with the second or third precipitation type in the group. If this happens, the intensity is associated with the first precipitation type of a multiple precipitation type group. For example, a forecast of heavy snow and light freezing rain is properly coded as -FZRASN, even though the intensity of the snow is greater than that of the freezing rain. The reason is the descriptor (FZ) must be encoded first, and the intensity is associated with this precipitation type. In this example, since heavy snow is forecast, it would have to be inferred by a visibility forecast of < 1/4SM.

A qualifier (if relevant) shall precede (with no space) the phenomena (including descriptor) to which it applies. There are two categories of qualifiers (see Appendix I): intensity/proximity or descriptor. Except for VCSH and VCTS, which are used to forecast showers or TSTMs between 5 and 10 statute miles from the airport, only one intensity or proximity qualifier and only one descriptor shall be used for each weather phenomena group. The intensity qualifiers are light (-), moderate (no qualifier), and heavy (+).

Intensity shall be coded with precipitation types, except ice crystals and hail, including those associated with TSTMs and those of a showery nature (SH). No intensity shall be ascribed to blowing dust (BLDU), blowing sand (BLSA), or blowing snow (BLSN). Only moderate or heavy intensity shall be ascribed to sandstorm (SS) and duststorm (DS). Refer to FMH-l for criteria in determining intensity associated with these weather elements. Some intensity criteria are also described in the footnotes of Appendix J.

The only way to depict severe TSTMs in the TAF is to forecast surface winds of 50 knots or more for the same time you forecast TSTMs. This applies to a forecast of severe hail as well, since there is no significant weather contraction for 3/4 inch hail (hail criteria for severe TSTM). Refer to Section 9 for more information on severe weather.

If a significant weather code group has been used and conditions are forecast to change, the significant weather entry in the next BECMG or TEMPO group (refer to Sections 7.2.9.b and 7.2.9.c, respectively) should be a different code group or NSW. If the significant weather group does not differ in the subsequent BECMG or TEMPO group(s), no change to the significant weather group is necessary, and the current significant weather group shall apply to these subsequent group(s).

EXAMPLES (combinations of one precipitation and one non-precipitation weather phenomena):

-DZ FG	Light drizzle and fog (obstruction which reduces visibility to <5/8 SM)
RA BR	Moderate rain and mist (obstruction which reduces visibility to <7 SM but ≥5/8 SM)
-SHRA EG	Light rain showers and fog (visibility <5/8 statute miles)
+SN FG	Heavy snow and fog

EXAMPLES (showing combinations of more than one type of precipitation:

-RASN FG HZ	Light rain and snow (light rain predominant), fog and haze
TSSNRA	Thunderstorm with moderate snow and rain (moderate snow predominant)
FZRASNPL	Moderate freezing rain, snow, and ice pellets (freezing rain mentioned first due to the descriptor, followed by other precipitation types in order of predominance)
PLSHSN	Moderate ice pellet and snow showers

EXAMPLE TAF:

TAF
KFAR 091739Z 091818 21030G60KT 1/4SM +TSRAGR BKN050CB...

Winds southwest at 30 knots, with gusts to 60 knots. Visibility 1/4 SM in TSTMs (SEV) with heavy rain and hail. NOTE: the + qualifier is associated with the precipitation (RA) and not the TSTM. Broken cumulonimbus (CB) clouds (ceiling) at 5,000 feet.

TS is the only descriptor which may be encoded as a significant weather group without any associated precipitation. This may be done in one of two situations: 1) when TSTMs are forecast without associated precipitation, or 2) to indicate TSTMs with freezing precipitation (drizzle or rain).

When a TSTM is included in the significant weather group (even in vicinity - VCTS), the cloud group (NsNsNshshshs) shall include a forecast cloud type of CB.

EXAMPLE:

TAF
KMCI 252335Z 260024 31015KT 1 1/2SM TS-FZRA BKN010CB...

Winds northwesterly at 15 knots. Visibility 1 1/2 SM in thunderstorms and light freezing rain, broken CB clouds (ceiling) at 1,000 feet.

A visibility threshold must be met before a forecast for fog (FG) may be included in the TAF. When forecasting a fog-restricted visibility from 5/8SM to 6SM, the phenomena shall be coded as BR (mist). When forecasting a fog-restricted visibility that is <5/8SM, use code FG. Never encode weather obstruction as mist (BR) when the forecast visibility is greater than 6 statute miles (P6SM).

The following fog-related terms shall only be used as described below:

Freezing Fog (FZFG): Any fog (visibility <5/8 SM) consisting predominantly of water droplets at temperatures below 32^{o} F/0^{o} C, whether or not rime ice is expected to be deposited. FZBR is not a valid significant weather combination and shall not be used in terminal forecasts.

Shallow Fog (MIFG): The visibility at 6 feet above ground level is $\geq$5/8 SM and the apparent visibility in the fog layer is <5/8 SM.

Patchy Fog (BCFG): Fog patches covering part of the airport. The apparent visibility in the fog patch or bank is <5/8 SM, with the foggy patches extending to at least 6 feet above ground level.

Partial Fog (PRFG): A substantial part of the airport is expected to be covered by fog while the remainder is expected to be clear of fog (e.g., a fog bank).

NOTE: MIFG, PRFG and BCFG may be forecast with prevailing visibility of P6SM.

EXAMPLES:

TAF
KLWS 020530Z 020606 27010KT 1/2SM FG VV008

BECMG 1011 3SM BR BKN010...

This example shows the proper use of FG and BR.

TAF
KPVD 041132Z 041212 27006KT 1/2SM FG VV008
BECMG 1618 30010KT P6SM NSW FEW035

FM0030 18006KT P6SM OVC035...

This example shows the proper use of NSW (no significant weather). NSW is only used in BECMG and TEMPO groups, to indicate that the significant weather forecast in an earlier time period is expected to end. When significant weather is not expected in a FM group, the significant weather group is omitted.

TAF
KBIL 211140Z 211212 04005KT lSM -RA BR OVC050
BECMG 1618 34008KT 3SM -RA BKN050 etc.=

Change is expected between 1600 and 1800Z with the forecast becoming valid after 18Z. NOTE: The light rain is repeated in the BECMG 1618 group to indicate that light rain remains in the forecast. The mist is omitted from the BECMG 1618 group, which indicates it is forecast to end between 1600 and 1800Z.

TAF
KMPV 021130Z 021212 04006KT 3SM -DZ OVC008
BECMG 1719 36010KT P6SM NSW SCT025...

Improvement between 1700 and 1900Z to winds from 360 degrees at 10 knots, visibility greater than 6SM (unrestricted), no significant weather. NSW indicates the drizzle will end by 19Z with scattered clouds at 2,500 feet.

1.2.6.a Vicinity (VC). In the United States, vicinity (VC) is defined as the area between 5 and 10SM from the center of the airport's runway complex. The international TAF code does not allow forecasts of significant weather beyond the airport (defined as 5SM from the center of the airport's runway complex). However, the FAA requires TAFs to include certain meteorological phenomena which may directly affect flight operations to and from the airport. Therefore, NWS TAFs shall include in the significant weather section of the TAF prevailing condition forecasts of fog, showers and TSTMs in the airport's vicinity ($\geq$50% probability and expected to occur for more than ½ of the sub-divided forecast time period). Prevailing conditions are forecast in the initial time period, FM, and BECMG groups. Significant weather in the vicinity shall not be included in TEMPO or PROB groups.

The following significant weather phenomena are valid for use in prevailing portions of NWS TAFs in combination with VC:

Phenomenon	Coded as
fog*	VCFG
Shower(s)**	VCSH
Thunderstorm	VCTS

* Always coded as VCFG regardless of visibility in the obstruction, and without qualification as to intensity or type (frozen or liquid)

** Forecast weather in the vicinity should be the last entry in w'w' whenever vicinity is used in the TAF.

In BECMG or TEMPO groups (see Sections 7.2.9.b and 7.2.9.c, respectively), NSW shall be used in place of w'w' to indicate that weather in the vicinity (e.g., VCSH) previously included in the TAF is expected to end.

EXAMPLES:

TAF
KSPI 050539Z 050606 VRB03KT 1 1/2SM -DZ BR VCSH BKN025
BECMG 1416 23004KT P6SM NSW SCT010 BKN025...

Change between 1400 and 1600Z to visibility 6SM/more (unrestricted), no significant weather (light drizzle, mist and fog in vicinity in initial time period are all forecast to end), scattered clouds at 1,000 feet and broken clouds (ceiling) at 2,500 feet.

TAF
KPKB 121738Z 121818 30012KT P6SM VCSH OVC018
BECMG 2224 3SM SHRA SCT020...

Change between 2200 and 0000Z to visibility 3SM, rainshowers (no longer in vicinity, but occurring within 5SM of the airport) and scattered clouds at 2,000 feet.

1.2.7 Cloud and Obstruction Group. The initial time period and any subsequent FM groups shall include a cloud or obstruction group (NsNsNshshshs, VVhshshs or SKC), used as appropriate to indicate the cumulative amount (NsNsNs) of all cloud layers in ascending order and height (hshshs), to indicate vertical visibility (VVhshshs) into a surface-based obstructing medium, or to indicate a clear sky (SKC).

All cloud layers and obstructions shall be considered opaque as in the surface observations.

1.2.7.a Cloud Group (NsNsNshshshs). The cloud group shall be used to forecast cloud amount (NsNsNs) as follows:

SKY COVER CONTRACTION	SKY COVERAGE
SKC	0 oktas

FEW	>0 to 2 oktas
SCT	3 to 4 oktas
BKN	5 to 7 oktas
OVC	8 oktas

When SKC is forecast, the cloud group shall be replaced by SKC. The contraction CLR, which is used in the METAR code, shall not be used in TAFs. CLR is used in METAR only by ASOS/AWOS to indicate clear below 12,000 feet AGL. TAFs for sites with ASOS/AWOS shall contain the cloud amount and/or obstructions which the forecaster expects, not what is expected to be reported by an ASOS/AWOS.

Height of cloud (hshshs) shall be forecast in **hundreds of feet** AGL at the following resolution:

RANGE OF HEIGHT VALUES	REPORTABLE INCREMENT
< 3,000	To nearest 100
≥ 3,000 but < 5,000	To nearest 500
≥ 5,000	To nearest 1,000

In general, the number of cloud groups in each sub-divided time period should not exceed three. However, NWS forecasters should use their judgement (see Section 6.7) to determine how many cloud groups accurately describe the meteorological conditions at that time in the TAF.

Additionally, scattered cloud layers shall not be forecast at a higher level than broken or overcast cloud layers, and broken cloud layers shall not be forecast at a higher level than overcast layers. Using the principle of at/below, the lowest level at which the cumulative cloud cover equals 5/8 or more of the celestial dome is understood to be the forecast ceiling. For example, VV008, BKN008 or OVC008 all indicate an 800 ft ceiling.

1.2.7.b Obscuration Group (VVhshshs). The obscuration group (VVhshshs) is used to forecast, in hundreds of feet AGL, the vertical visibility (VV) into a surface-based total obscuration. VVhshshs is this ceiling at the height indicated in the forecast. TAFs shall not include forecasts of partial obscurations (i.e., FEW000, SCT000, or BKN000).

EXAMPLE:

TAF
KCPR 110537Z 110606 24015KT P6SM SKC
FM0820 24015KT lSM BR VV008...

Note that the wind in the FM group is the same as in the initial forecast period, but is repeated since all elements are required to be included in a FM group.

1.2.7.c Cloud Type. The only cloud type included in the TAF is CB. CB follows cloud or obscuration height (h5h5h5) without a space whenever TSTMs are included in w'w', even if TSTMs are only forecast in the vicinity (VCTS). CB can be included in NsNsNshshshs or VVhshshs without mentioning thunderstorm in w'w'. Therefore, there may be situations where

nearly identical NsNsNshshshs or VVhshshs appear in consecutive time periods, with the only change being the addition or elimination of CB in the forecast cloud type.

EXAMPLES:

TAF
KORD 110537Z 110606 06008KT P6SM FEW050 SCT100
FM1115 11010KT 2SM -RA OVC012...

Note the initial forecast period (beginning at 0600Z) does not contain w'w'. When significant weather is not expected in the initial period of an FM group, w'w' is omitted.

TAF
KDAY 221730Z 221818 19010G25KT P6SM BKN040
FM2230 26025G45KT 1/2SM TSSN OVC010CB...

Significant change at 2230Z to wind from 260 degrees at 25 knots gusting to 45 knots, visibility 1/2 SM in a thunderstorm with moderate snow, overcast clouds (ceiling) at 1,000 feet, including CB.

TAF
KUNV 101131Z 101212 30015G25KT P6SM VCTS OVC015CB
BECMG 1415 34006KT P6SM NSW OVC015...

Change between 1400 and 1500Z to NSW (thunderstorms in the vicinity will end or move beyond 10 SM from the center of the runway complex) and overcast clouds (ceiling) at 1,500 feet. Note the cloud forecast is repeated in the BECMG 1415 group to eliminate CB, even though there is no change in the forecast height nor amount.

TAF
KSYR 230532Z 230606 29012KT 1/2SM SHSN FZFG OVC003
TEMPO 0609 29014G28KT 1/4SM +TSSNPL BLSN VV004CB
FM1400 36011KT P6SM FEW008 BKN025
BECMG 2224 VRB03KT SKC...

NOTE: The + qualifier is associated with precipitation (SN) and ice pellets (PL) and not the thunderstorm (TS). Significant change at 1400Z to wind from 360 degrees at 11 knots, visibility 6 SM/more (unrestricted), few clouds at 800 feet. Change between 2200 and 0000Z to variable wind direction (light winds), wind speed 3 knots, and clear skies.

1.2.8 Non-Convective Low-Level Wind Shear (WS) Group (WShwshwshws/dddffKT). WS is defined in NOAA Technical Memorandum NWS FCST-23, Low-Level Wind Shear: A Critical Review, by Julius Badner, NWS Meteorological Services Division, April 1979, reprinted February 1989, as "...a change in horizontal wind speed and/or direction, and/or vertical speed with distance, measured in a horizontal and/or vertical direction." Wind shear is a vector

difference, composed of wind direction and wind speed, between two wind velocities. A sufficient difference in wind speed, wind direction, or both, can have severely impact airplanes, especially within 2,000 feet AGL.

The following, emphasizing the importance of wind shear, is taken from ICAO Circular 186-AN/122, entitled Wind Shear, published in 1987:

"Wind shear cannot be calculated by simple scalar subtraction of the wind speeds, except in the specific case where the directions of the two winds concerned are exactly the same or are exact reciprocals...The scalar shear (i.e. direct subtraction of wind speeds taking no account of their directions) is always less than or equal to the vector shear and thus for most cases underestimates the actual shear magnitude." Forecasters may use NOAA Technical Memorandum NWS FCST-23 as a reference for non-convective LLWS forecasting. The procedures described below are based on that study.

Forecasts of LLWS in the TAF shall refer only to non-convective LLWS from SFC up to and including 2,000 feet AGL (LLWS is always assumed to be present in convective activity). It shall be included in TAFs on an as-needed basis to focus the aircrew's attention on LLWS problems which currently exist or are expected. Non-convective LLWS may be associated with the following: frontal passage, inversion, low-level jet, lee side mountain effect, sea breeze front, Santa Ana winds, etc.

Non-convective LLWS forecasts (indicated by WS) when expected, shall be included in the TAF as the last group (after cloud forecast) in the initial forecast period or an FM group. Once included in the TAF, the WS group remains the prevailing condition until the next FM group or the end of the TAF valid period if there are no subsequent FM groups. Forecasts of non-convective LLWS shall not be included in BECMG (see Section 7.2.9.b), TEMPO (see Section 7.2.9.c), or PROB (see Section 7.2.9.d) groups.

The format of the non-convective low-level wind shear group is:

WShwshwshws/dddffKT

WS	Indicator for non-convective LLWS
hwshwshws	Height of the WS in hundreds of feet AGL
ddd	True direction in ten degree increments above the indicated height (see Note below)
ff	Speed in knots of the forecast wind above the indicated height
KT	Unit indicator for wind

NOTE: VRB shall not be used for direction in the non-convective LLWS forecast group.

EXAMPLE:

TAF
KPUB 181122Z 181212 27015KT 5SM -RA SCTO10 OVC035 WS020/27035KT

FM1400 32010KT P6SM FEW008 BKN045

In this forecast, the wind shear is a prevailing condition from1200Z until the beginning of the next FM group.

The WS group is not included in the international standard for the TAF code, FM 51-X Ext. TAF, which is documented in the WMO Manual on Codes, WMO No. 306, Volume I.1, Part A. However, the North American countries have agreed to provide it in terminal forecasts, based on national coding practices (see Section 2). The WS group may appear in a different order within TAFs prepared by other U.S. government agencies or other North American countries, but the coding and interpretation of the WS group by all countries in North America is the same, regardless of location in the TAF. For example, in Canadian TAFs, the WS group may appear immediately following the surface wind forecast (dddffGfmfmKT); in U.S. military TAFs, the WS group may follow the lowest surface pressure group (QNHPIPIPIPIINS), which is not used in NWS TAFs (see Appendix G for a description of the QNH group). A non-convective LLWS forecast shall be included in the initial time period or a FM group in a TAF whenever:

a. One or more PIREPs are received of non-convective LLWS within 2,000 feet of the surface, at or in the vicinity of the terminal forecast airport, causing an indicated air speed loss or gain of 20 knots/more, and the forecaster determines the report(s) reflect a valid non-convective LLWS event rather than mechanical turbulence,

b. When vertical non-convective WS (vector difference) of 10 knots/more per 100 feet in a layer more than 200 feet thick are expected or reliably reported within 2,000 feet of the surface at, or in the vicinity of the airport (see Technical Memorandum NWS FCST23, page 21, Table 3 -- Wind Shear Computation Table).

If meteorological conditions are such that non-convective LLWS of intensities similar to those described above are expected and/or could be inferred from less detailed PIREPs or other sources, the forecaster should include a WS group in either the initial time period or an FM group of the TAF.

Other possible tools for detecting or observing non-convective LLWS in the short-term are the Velocity Azimuth Display (VAD) wind profiles from the WSR-88D, data from the wind profiler network (if available), and data from FAA's Terminal Doppler Weather Radars (if available). The utility of these data sets depends on the elevation and proximity of the sensors to the airport for which TAFs are written. Mountain top WSR-88D radars will not be useful for detecting non-convective LLWS (below 2,000 feet AGL).

1.2.9 Forecast Change Indicators. Forecast change indicators are contractions which shall be used to sub-divide the forecast period (24-hours for scheduled terminal forecasts; less for amended or delayed forecasts) according to significant changes in the weather (refer to Section 6.7).

The intent of the following guidelines is to define forecast change indicators and the probability group, thereby enabling the forecaster to fully convey expected weather conditions accurately,

consistently and concisely so the pilot can make the proper go or no-go decision.

Forecasters are encouraged to sub-divide the TAF valid period using FM groups (see Section 7.2.9.a) as often as possible instead of BECMG, TEMPO, and PROB. The reason is that an FM group is a more definitive and precise forecast, and therefore more useful to the customer. BECMG, TEMPO, and PROB groups should be used sparingly in NWS TAFs.

An FMGGgg forecast group (see Section 7.2.9.a) indicates a change at a specific point in time in hours and minutes (GGgg), and includes a complete set of prevailing conditions beginning at the indicated time. Both FMGGgg and BECMG GGGeGe (see Section 7.2.9.b) are used to forecast changes in prevailing conditions. The changes described by FMGGgg occur quickly (in less than 1 hour), while forecast changes in a BECMG GGGeGe group occur more gradually, but never more than 2 hours in length in NWS TAFs. Having these two options (FMGGgg and BECMG) to describe gradual changes allows the forecaster to clearly convey their rational on the forecast timing to the customer.

To keep the forecast intent clear and unambiguous to the aviation customer, forecast groups should be as concise as possible, describing only significant changes which may potentially affect aviation operations. Overlapping of sub-divided forecast valid periods shall be avoided. Additionally, no more than two consecutive BECMG, TEMPO and/or PROB groups shall be used during the initial forecast period or following any subsequent FM groups.

Conditions described in BECMG, TEMPO and PROB groups must be considered by the forecaster when determining if specific update criterion has been met. Forecasters must understand the FAA requires TEMPO, PROB, FM and BECMG groups to be considered by pilots and dispatchers when determining destinations, alternates and required fuel loads. This fact alone makes the content of all forecast change groups operationally more significant than FM groups when describing lower conditions. For this reason BECMG, TEMPO and PROB groups should be used sparingly.

For example, a forecast of TEMPO 0507 3SM RA BR OVC015 would require the pilot to file an IFR alternate and carry additional fuel. And a forecast of TEMPO 2302 2SM -FZDZ BR VV005 would, in most cases prevent an airport from being used as an IFR alternate. A more extreme case would be this forecast: PROB30 1923 1/4SM TSRA OVC005CB. The visibility of ¼ SM could, in some circumstances, prevent the airport from being a destination by an air carrier.

The following forecast change indicators shall be used when a change in any or all of the elements forecast is expected:

1.2.9.a FMGGqq. The time-divider group TTGGgg in the form FMGGgg (voiced as "from") shall be used to indicate when prevailing conditions are expected to change significantly over a period of less than one hour. In these instances, the forecast shall be sub-divided into time periods using the contraction FM, followed, without a space, by four digits indicating the time (**in hours and minutes Z**) the change is expected to occur. While the use of a four-digit time in whole hours (e.g. 2100Z) is acceptable, if a forecaster can predict changes and/or events with higher resolution, then more precise timing of the change to the minute should be indicated. All

forecast elements following FMGGgg shall relate to the period of time from the indicated time (GGgg) to the end of the valid period of the terminal forecast, or to the next FMGGgg or BECMG GGGeGe if the terminal forecast valid period is divided into additional periods.

The sub-divided time period shall be a complete description of the weather (i.e., self-contained) and all forecast conditions given before the FMGGgg group are superseded by those following the group. All elements of the terminal forecast (surface wind, visibility, significant weather, clouds, obstructions, and when expected, non-convective LLWS) shall be included in each FM group. The only exception to this involves significant weather. If no significant weather is expected in the FM time period group, then significant weather is omitted. All elements shall be included in each FM group, regardless if it is forecast to change or not. For example, if forecast cloud and visibility changes warrant a new FM group but the wind does not, the new FM group shall include a wind forecast, even if it is the same as the most recently forecast wind.

There may be one or more FM groups, depending on the prevailing weather conditions expected. In the interest of clarity, each FM group shall start on a new line of forecast text, indented five spaces.

EXAMPLES:

TAF
KDSM 022336Z 030024 20015KT P6SM BKN015
FM0230 29020G35KT lSM +SHRA OVC005
TEMPO 0507 1/4SM +SHSN
FM1200 31010G20KT P6SM SCT025...

Note that significant weather is omitted from the initial forecast period, beginning at 0000 Z, since none was expected.

TAF
KAPN 312330Z 010024 13008KT P6SM SCT030
FM0320 31010KT 3SM -SHSN BKN015
FM0500 31010KT 1/4SM +SHSN W 007...

Note the wind in the FM0500 group is the same as the previous FM group, but is repeated since all elements are required to be included in a FM group.

1.2.9.b BECMG GGGeGe. The change-indicator group TTTTT GGGeGe in the form BECMG GGGeGe (voiced as becoming) shall be used to indicate a change to forecast prevailing conditions expected to occur at either a regular or irregular rate at an unspecified time within the period GG to GeGe. Note the change occurs during a period of time defined by four digits. The first two digits are the starting cardinal hour of change and the last two digits are the ending cardinal hour of change, both in Z. The duration of the change period covered by BECMG indicated by GGGeGe, shall never exceed 2 hours in a NWS TAF. The conditions forecast in a BECMG group remain in effect from the end of the defined period of change (GeGe), until the next FM or BECMG group, or if there are no other change groups, to the end of the terminal

forecast valid time.

The BECMG group shall be followed by a description of all the elements whether they've changed or not.

In response to feedback from aviation customers, and because of the need for concise and definitive forecasts, the use of BECMG groups should be kept to a minimum. Forecasts sub-divided by FM groups are preferred by aviation customers, because they indicate more specific times of the expected change(s). Since changes described with BECMG occur over a period of a couple of hours, and because the FAA interprets BECMG groups for dispatch purposes very conservatively, the lowest conditions in the BECMG group are controlling. This restricts the operations of aviation customers, and at times, may cause them to file an alternate flight plan or carry extra fuel.

To better serve our customers, no more than a total of two consecutive BECMG, TEMPO, and/or PROB groups shall be used during the initial forecast period or following any subsequent FM group. Additionally, forecasters should avoid using a BECMG group to forecast minimum prevailing conditions, especially visibility less than ½ SM.

Non-convective LLWS groups (WShwshwshws/dddffKT) shall not be included in BECMG groups.

EXAMPLES:

TAF
KDFW 220539Z 220606 21010KT 3SM BR SCT030
BECMG 1012 lSM TSRA BR OVC010CB
FM1830...

TAF
KHOU 092340Z 100024 22007KT P6SM SCT040 BKN100
BECMG 0204 16012KT 5SM HZ SCT040 OVC200...

1.2.9.c TEMPO GGGeGe. The change-indicator group TTTTT GGGeGe in the form TEMPO GGGeGe will be used to indicate temporary fluctuations to forecast meteorological conditions which are expected to:

A. Have a high percentage (≥50 %) probability of occurrence and,
B. Last for one hour or less in each instance and,
c. In the aggregate, to cover less than half of the period GG to GeGe

Note that temporary changes described by TEMPO groups occur during a period of time defined by a two-digit beginning and two-digit ending time, both in whole hours Z. If the TEMPO condition is expected to last more than 1 hour, a FMGGgg or BECMG GGGeGe group should be used to forecast conditions different from those forecast prior to GG. If the TEMPO condition is expected to last more than half the time period indicated (GGGeGe), then the TEMPO

condition is considered predominant and should be entered in the initial forecast period or following a FM, BECMG, or TEMPO group. In general, TEMPO groups should not exceed four hours.

The TEMPO group shall be followed by a description of all the elements which a temporary change is forecast. A previously forecasted element which has no temporary forecasted change during the TEMPO period is understood to remain the same. Only those weather elements forecast to temporarily change are required to be included in the TEMPO group. However, when a significant reduction in visibility is forecast to change in a TEMPO group, the significant weather causing the deterioration shall also be included. If a significant change is expected in the cloud forecast, **all** cloud layers, including any significant layer not expected to change shall be given.

No more than two consecutive TEMPO, BECMG, and/or PROB groups shall be used during the initial forecast period or following any subsequent FM group(s).

TEMPO groups shall not include forecasts of either significant weather in the vicinity (VC) or non-convective LLWS .

EXAMPLES:

TAF
KDDC 221130Z 221212 29010G25KT P6SM SCT025
TEMPO 1820 1 1/2SM SHRA BKN010...

TAF
KSEA 091125Z 091212 19008KT P6SM SCT010 BKN020 OVC090
TEMPO 1215 -RA SCT010 BKN015 OVC040...

Note that in the TEMPO 1215 group, all three cloud layers are included, even though the lowest layer is not forecast to change from the initial time period.

TAF
KBOI 091735Z 091818 24007KT P6SM SCT025 BKN040
TEMPO 1822 -SHSN BKN025 BKN040...

Note that in the TEMPO 1822 group, the two cloud layers are repeated from the initial time period, because of the addition of the significant weather group (-SHSN).

1.2.9.d PROBC2C2 GGGeGe. The probability group PROBC2C2 GGGeGe shall only be used by NWS WFOs to forecast a low probability occurrence (30 or 40% chance) of a thunderstorm or precipitation event and its associated weather and obstruction elements (wind, visibility and/or sky condition) when occurrence of those elements are directly related to, and contemporaneous with, the thunderstorm or precipitation event.

The PROBC2C2 group is the forecaster's assessment of probability of occurrence of the weather

event which follows it. PROB shall be followed by two digits (30 or 40) representing percentage, a space, then four digits (GGGeGe) stating the beginning and ending time (in hours) of the expected condition. PROB30 and PROB40 are the **only** PROB groups used in NWS TAFs.

If the thunderstorm or precipitation event probability is expected to equal or exceed 50%, the event should be considered a predominant feature and should be entered in the initial forecast period or following a FM, BECMG, or TEMPO group of the TAF.

The PROB group shall not be used in the first 6 hours of the TAF's valid period. Additionally, the time period covered by PROB group should generally be 6 hours or less, excluding widespread and/or self-sustaining convective systems.

No more than a total of two consecutive PROB, BECMG, and/or TEMPO groups shall be used during the initial forecast period or following any subsequent FM groups.

The decision to use PROB in a TAF should be based on the fact that the TAF is limited to a 5SM radius from the center of the respective airfield complex. This is a significantly smaller area than the zone covered by the corresponding public forecast. The 6- or 12-hour area probability of precipitation (PoP) guidance and the forecaster's hourly expectations of actual occurrence at a TAF site can vary over relatively short periods of time but should be synoptically consistent with the public forecast.

PROB groups shall not include forecasts of significant weather in the vicinity (VC) or non-convective LLWS.

The PROB group shall not be used by NWS offices as a direct modifier of BECMG or TEMPO, or with FM (WMO TAF regulations allow the use of PROB30 or PROB40 in combination with the TEMPO group, for example, PROB30 TEMPO 1214; refer to Appendix G, Section 1.3). Similarly, BECMG and TEMPO groups may not be used by NWS offices as a direct modifier of the PROB group e.g., BECMG PROB40 2324. This ensures the TAF is easy as possible to understand and correctly interpret.