AWS/TR-97/001

Preparation of Terminal Aerodrome Forecast Worksheets

AWS TR 218 Updated

By
MSgt. Rod Rabenneck
Aerospace Sciences Division

APRIL 1997

20060719099

Air Weather Service
102 W. Losey Street Room 105
Scott Air Force Base, Illinois 62225-5206

REVIEW AND APPROVAL STATEMENT

AWS/TR–97/001, *Preparation of Terminal Aerodrome Forecast Worksheets,* has been reviewed and is approved for public release. There is no objection to unlimited distribution of this document to the public at large or by the Defense Technical Information Center (DTIC) to the National Technical Information Service (NTIS).

MICHAEL L. DAVENPORT, Major, USAF
AWS Chief, Aerospace Sciences Division

FOR THE COMMANDER

CAROL L. WEAVER, PhD
AWS Scientific and Technical Information
Program Manager
30 April 1997

ERRATA

Page 3--"Subject Terms: Local **Anaylsis** Forecast **Plan**" should read "Local **Analysis** and Forecast **Program**."

Page 14--Appendix A/Statement B should read "When advisory, warning, or amendments are expected, attach numericals to back of **worksheet!**" instead of **worksheet 1.**

Page 16--Appendix B/Both of the Forecast Skew-T and the Satellite (LC) Curve/Visual tables have the word **shortwave** written as one word; it should actually be spelled as two words—**short wave.**

Page 17--In the text under the SOF worksheet, the word **products** is misspelled. The same error occurs on Pages 20, 23, 28, 31, 35, 39.

Page 21--In the first paragraph, line 8, the word **singularly** is spelled incorrectly.

Page 26--In the Forecast Skew-T table, the word **possibility** is misspelled. The same error occurs on Pages 30, 34, and 38.

Page 33--In the LAWC PRECIP table, the word **geostrophic** is spelled incorrectly. The same error occurs on Page 37.

Page 43--At the bottom of the page, in the second bullet statement under Helpful Hints, the word **possibly** is spelled incorrectly.

Page 49--At the bottom of the page, in Statement 3, the word **occurring** is misspelled.

Page 50--Section 2 should be entitled CENTRAL PLAINS **WIND** BOX vs. CENTRAL PLAINS **WPID** BOX.

--Section 3, Statement D, the last sentence should read, "Usually these systems take only 48 hours to drop from **Canada to Oklahoma**."

REVIEW AND APPROVAL STATEMENT

2. Report Date: April 1997

3. Report Type: Technical Report

4. Title: Preparation of Terminal Aerodrome Forecast Worksheets

6. Author: MSgt. Rod Rabenneck

7. Performing Organization Name and Address: Air Weather Service Aerospace Sciences Division

8. Performing Organization Report Number: AWS/TR—97/001

12. Distribution/Availability Statement: Approved for public release; distribution is unlimited.

13. Abstract: This report describes the characteristics of a good terminal aerodrome forecast worksheet and outlines steps for designing an effective worksheet for local use. The report recommends use of supplemental regime forms to ensure forecasters recognize and look at essential features that drive the weather.

14. Subject Terms: TERMINAL AERODROME FORECAST (TAF), LOCAL ANAYLSIS AND FORECAST PLAN (LAFP), TERMINAL FORECAST REFERENCE NOTEBOOK (TFRN), TAF WORKSHEETS, SUPPLEMENTAL REGIME WORKSHEETS

15. Number of Pages: 50

17. Security Classification of Report: Unclassified

18. Security Classification of this Page: Unclassified

19. Security Classification of Abstract: Unclassified

20. Limitation of Abstract: UL

Standard Form 298

PREFACE

This report supersedes AWS TR 218, dated October 1969. This technical report discusses how to design both meteorologically sound generic Terminal Aerodrome Forecast (TAF) worksheets and short, concise supplemental regime forms. Information herein describes the characteristics of a good forecast worksheet and outlines steps for designing an effective product.

CONTENTS

Chapter 1

INTRODUCTION

1.1 General. Forecast worksheets play a vital role for Air Force Weather (AFW) units with Terminal Aerodrome Forecast (TAF) responsibility. Although blocks are filled out according to Local Analysis and Forecast Program (LAFP) guidance, completing a TAF worksheet is one of the truly creative efforts still left in weather stations. Forecasters must weigh and relate centralized and local forecast products to formulate their TAF through use of deductive reasoning. A worksheet assists both craftsman and apprentice forecasters to develop sound judgement by ensuring all information at their disposal is reviewed and sensibly collated. Worksheets should lead the forecaster through a logical thought process.

Producing an accurate TAF is challenging for numerous reasons. First, the atmosphere is continually in motion at all scales from hemispheric to local. Second, TAFs cover a continuous time frame valid for 24 hours, but forecast charts normally provide data in 6 and 12 hour increments. Finally, forecasters must determine if centralized data is reliable. If not accurate, then model adjustments must be made. Whether or not the models are correct, forecasters must fill in the gap between product valid times.

Forecasters usually have to sort out large amounts of raw data. The goal is to compile this wealth of information using a format to ensure the best possible forecast is produced. This task is not simple. It's nearly impossible for anyone, even experienced forecasters, to keep track of this data. The way to approach this problem is to systematically organize information into an easy to use worksheet. Forecasters can then see at a glance, and begin to understand, the critical synoptic and mesoscale features affecting their station.

Some forecasters quake at the suggestion they complete some type of worksheet prior to disseminating a TAF. The importance of such a form, however, is recognized in many other fields. Most members of the Air Force are familiar with the checklist procedures followed by pilots for takeoff and landing, regardless of whether they have flown a particular aircraft for more than 20 years. Such a routine assures the pilot does not overlook critical flight safety steps.

The same concept applies to producing a TAF. Worksheets provide a standardized and systematic approach to TAF preparation. Most of us will agree that an organized attack on a problem is better than a helter-skelter approach. A worksheet can embody in an abbreviated form most of the important parameters your Terminal Forecast Reference Notebook (TFRN) and LAFP describes. Conscientious use of a worksheet helps ensure significant factors affecting the local forecast are not inadvertently missed.

Forecasters are vulnerable to overlooking key elements affecting their TAF on hectic "bad" weather days. Another worksheet advantage is that it allows forecasters to do much of the analysis work during slack times, yet still have the information on paper when it comes down to converting generalized forecast thoughts into specific values and times.

Worksheets provide continuity. If previous worksheets are kept nearby, the present forecaster has a quick reference to those factors affecting his TAF, plus a record of the reasoning and judgement made by previous shift forecasters.

Weather units use a wide range of forecast worksheets, from vague to very detailed, unwieldy documents that are so time-consuming to complete they become counterproductive. There are as many different TAF worksheets as there are weather units. Some worksheets are nothing more than a list of charts, bulletins, and products that the forecaster indicates he has studied by placing a check mark next to each item. This type of worksheet has limitations because it doesn't guide forecasters in understanding or recognizing relationships between atmospheric variables and how they affect the upcoming forecast. A good TAF worksheet should ensure forecasters show proof of sound meteorological reasoning and understand past, current, and future states of the atmosphere.

Many weather units use seasonal worksheets. Depending on the unit's geographical location, seasonal worksheets may be applicable. Because weather patterns that produce major forecast problems are often seasonal, another idea entails using a generic TAF worksheet supplemented by "regime" specific forms. Remember, regime is defined as a synoptic and/or mesoscale weather pattern that affects a location. Not all regimes will require a supplemental worksheet. Most weather units have two or three regimes that are associated with significant forecast problems such as thunderstorms, fog and stratus, or nonconvective winds. These regime worksheets should concentrate on asking specific questions that guide the forecaster in recognizing and correctly forecasting the phenomena associated with that weather pattern. When your TFRN spells out in detail how to identify a specific regime, and your LAFP describes how to forecast its associated phenomena, then a supplemental form should be developed. Some units may prefer to fit all basic TAF analysis requirements and regime data onto a single worksheet, referencing back to the TFRN and LAFP for more detailed information.

This technical report discusses how to design both meteorologically sound generic TAF worksheets and short, concise supplemental regime forms. Worksheets should address the regime concept to ensure forecasters recognize and look at essential features that drive the weather. Air Force Manual 15-125, *Weather Station Operations*, requires TFRNs to address applicable regimes and go into detail about techniques to forecast the weather associated with each pattern.

Obviously, it is impossible to design a TAF worksheet that can be used by every weather station. However, there are many elements common to a sound worksheet.

1.2 Good TAF Worksheet Characteristics. To be effective, a worksheet must address the following elements:

Purpose. Each entry on the worksheet should have a specific purpose in the preparation of your TAF. If it isn't applicable, it shouldn't be on the worksheet. A common mistake is designing TAF worksheets around products routinely used instead of around the local forecast problems most often encountered.

Simplicity. The worksheet should not be so detailed that the user gets more involved completing the form than in putting it to practical use. Your LAFP should contain a section providing instructions on how to fill out each block of the TAF worksheet, plus how to interpret and use the data effectively. Forecasters must be able to not only complete all entries in minimum time, but also be able to observe and quickly assimilate the information.

Content. A good TAF worksheet should follow the "funnel" forecast thought process of looking at hemispheric features down to local features. Suggested time spent on interrogating different atmospheric scales are 10 percent hemispheric, 30 percent synoptic, 60 percent mesoscale and local. The generic worksheet example in Appendix A lists several areas critical to thoroughly interrogating the atmosphere. Items to address include hemispheric analysis, METSAT analysis, synoptic analysis, vertical analysis (Skew-T), radar analysis, model initialization and verification, model output, climatology, hazards, PIREPS, SIGMETS, AIRMETS, forecast bulletins, and past/present local and upstream observations. Always include a section for the forecasters to summarize their thoughts.

Questions to consider asking on your TAF worksheet might include the following:

- What is causing the current weather situation?
- How will the current situation change over the next 24 hours?
- What will cause the current situation to change?
- How will the situation change affect weather in my local area?

Regimes affecting each AFW unit and the worksheet design chosen will dictate how in-depth these areas are discussed.

Cross-check your basic TAF worksheet with your shift change briefing checklist. Both products should follow the same logical sequence. Keep in mind, your shift change checklist usually contains additional items not pertinent to the local forecast.

Flexibility. Worksheets should be designed to serve as evaluation tools as well as forecast tools. Use it to determine how well a rule of thumb is performing. This concept applies more toward regime-specific supplemental forms than the generic TAF worksheet.

Functional. Station management should ask, "Can a different worksheet design better serve the purpose?" Realize it is impossible to develop any TAF worksheet that can be filled out in 5 minutes. Forecasters who complain about this task are missing the point. Worksheets need to be filled out gradually over your forecast shift as data becomes available. In order to put out the best possible TAF, it is critical that all worksheet blocks be completed prior to forecast transmission time.

1.3 Designing a Supplemental Regime Worksheet. It's not easy to design an effective regime-specific worksheet. This task requires considerable time and thought. Remember, each AFW unit has unique local weather problems. The following steps may prove helpful in developing your supplemental worksheets.

Thoroughly review the local TFRN and extract all significant forecast aids from climatology, case studies, rules of thumb, etc. At this point, don't be too selective. Consider everything, as it could be pertinent data. You can eliminate less reliable forecast tools and indicators later.

Identify weather regimes that constitute major forecast problems.

Evaluate each TAF weather element separately. Based on this regime pattern, historically, what cloud, visibility, hydrometer and/or lithometer, wind, temperature, and pressure conditions should be expected? How about warning and advisory criteria? Consider all empirical rules about forecasting individual weather elements.

List items such as applicable Doppler radar Routine Product Set (RPS) lists and user functions; graphic command sequences; METSAT enhancement curves, etc.; and critical parameter values to key on. For example, if the forecast problem is deciding between rain or snow, you may ask questions like "Are the '5400' 1,000-500 mb thickness and '0' Celsius 850 mb isotherm values south of my weather station?" If the forecast problem is deciding between rainshowers or thunderstorms, you may key on stability indices, Doppler radar reflectivity, vertically-integrated liquid, echo top values, and height of maximum dBZ reflectivity core, just to list a few of the many products someone might interrogate. If a regime typically produces severe weather, your supplemental worksheet might list a dozen atmospheric indicators to focus on. In some instances, if one or two indicators are positive, you might forecast a phenomenon. When the wet-bulb zero height is 9,000 feet and you're anticipating thunderstorms, your checklist might indicate to include hail in the forecast.

At this point start "weeding" out some of the less useful forecast products.

If your TAF worksheet (supplemental and/or generic) uses a format such as **questions to circle** (yes/no) or **boxes to check off**, always follow-up these blocks with a question to make the forecaster explain all markings in terms of impact on the 24-hour forecast. Does the forecaster have a good grasp of the atmosphere's behavior in relationship to answering how, why, and when it will change? Historically, this part of the worksheet often got pencil-whipped. Leadership needs to lay down the law as to what is acceptable performance when filling out the worksheet. This is where after-the-fact comments on the worksheet by the flight commander, station chief, or assistant can give feedback to forecasters and police the entire TAF process.

Upon completion of all pertinent blocks on the regime worksheet, the forecaster should be able to answer the following ultimate questions:

- What weather elements including amounts, category, and intensity do I actually forecast?
- When will conditions change?

A sound TAF worksheet should tie together all information and lead the forecaster to some definite conclusion about what weather conditions to forecast. Again, every regime does not require a separate worksheet. Station management needs to spell out in the LAFP when a regime specific worksheet should be used and when it's forecaster discretion to do so. The idea is to use the most appropriate products, tools, and techniques to make the best forecast. See Appendixes B through L as examples of regime and phenomena-specific worksheets developed by the Vance Air Force Base weather station.

Chapter 2

SUMMARY

Conclusion. This report provides many hints to assist AFW units in designing effective TAF worksheets. Units need to take the guidance contained in this report and tailor their worksheets around those regimes and forecast problems unique to the local area. The generic TAF worksheet in Appendix A is only an example. Use it as a starting point to build upon. Well-planned worksheets provide an organized, focused approach to forecast development. The ultimate payoff is enhanced forecast accuracy and forecasters who are more efficient at their job. Management efforts in the area of TAF worksheet design can pay rich dividends in terms of support and resource protection given to local customers.

APPENDIX A

TERMINAL AERODROME FORECAST (TAF) WORKSHEET

FORECASTER:________________________________ DATE / TIME:____________/__________Z

I. ANALYSIS:

A. HEMISPHERIC:

1. Circle long wave feature affecting your station: **Ridge / Trough** Axis location: **West / East / Overhead**
2. Describe long wave ridge/trough amplitude changes and axis shift during your 24-hour fcst plus why it is happening? ____________

B. METSAT: (When advisory, warning, or amendments are expected, attach analyzed picture from initialization time to back of worksheet!)
Describe features applicable to your 24-hour fcst:____________

C. SYNOPTIC:

1. Discuss synoptic fcst bulletins:____________
2. Input data, interpolating as necessary, to describe upper air and surface features that will influence your 24-hour fcst:

	00HR	06HR	12HR	18HR
200 mb: **Cold / Warm Pocket**	____	____	____	____
500 mb: **Trough / Ridge**	____	____	____	____
CAA / WAA / NEU	____	____	____	____
Moist / Dry	____	____	____	____
PVA / NVA / NEU	____	____	____	____
Hgt Falls / Rises	____	____	____	____
850 mb: **Front (C/W/O/QS)**	____	____	____	____
Trough / Ridge	____	____	____	____
CAA / WAA / NEU	____	____	____	____
Moist / Dry	____	____	____	____
Low-Level Jet (Y / N)	____	____	____	____
SFC: **Front (C/W/O/QS)**	____	____	____	____
Trough / Ridge	____	____	____	____

	00HR	06HR	12HR	18HR
300 mb: **Jet Maxima (Y / N)**	____	____	____	____
Confluence / Difluence	____	____	____	____
700 mb: **Trough / Ridge**	____	____	____	____
CAA / WAA / NEU	____	____	____	____
Moist / Dry	____	____	____	____
925 mb: **Front (C/W/O/QS)**	____	____	____	____
Trough / Ridge	____	____	____	____
CAA / WAA / NEU	____	____	____	____
Moist / Dry	____	____	____	____
Low-Level Jet (Y / N)	____	____	____	____
SFC: **CAA / WAA / NEU**	____	____	____	____
Moist / Dry	____	____	____	____

Name the current regime:____________
Summarize atmospheric changes over next 24 hours based on markings made above and anticipated development/dissipation/movement of features:____________

Discuss fcst problems of the day: ____________

D. VERTICAL: (When advisory, warning, or amendments are expected, attach analyzed Skew-T to back of worksheet!)

1. List 00Z / 12Z Skew-T values applicable to today's fcst problem: LI____ TT____ SSI____ SWEAT______ KI____ cT____(C) FZL______ CCL/LCL______ EL______ TROP______ WBZ______ -20C______ Inversion break time______ Other ______ ______
Explain why certain values are pertinent today: ____________
2. Was fcst Skew-T done? **Y / N** Explain atmospheric alterations made by millibar level, moisture, temperature etc.: ____________

List critical fcst Skew-T values: ______ ______ ______ ______ ______ ______

II. MODELS:

A. INITIALIZATION & VERIFICATION:

1. Discuss model initialization bulletins: ____________
2. Name which models were initialized: 1st model:__________ 2nd model:__________ 3rd model:__________
3. Explain how 1st model features initialized and timing adjustments made: ____________

Explain how 2nd and/or 3rd model features initialized and timing adjustments made: ____________

5. Did previous run's 12-hour fcst verify current 00-hour fcst? 1st model: **Y / N** 2nd model: **Y / N** Explain timing: ____________

B. MODEL OUTPUT & GUIDANCE: (When advisory, warning, or amendments are expected, attach numericals to back of worksheet 1.) ___

1. Circle products reviewed: ETA / NGM OUTPUT, NGM / AVN / MRF MOS, List Other: ________ ________ ________
2. Based on continuity, steering flow, model timing, discuss what output adjustments were made and what values were used in your 24-hour fcst:

____

____

____

III. CLIMATOLOGY:

1. Does your fcst make sense based on ISMCS/SOCS monthly climo summary data? (extreme temperatures, 24-hour precip extremes, etc.) **Y / N**
2. Conditional Climo

CC	OBS	1	2	3	4	5	6	12	24
CIG	__	__	__	__	__	__	__	__	__
VIS	__	__	__	__	__	__	__	__	__

3. Discuss MODCURVE, MODCV input compared to your expectations of when the atmosphere will change: ____________

____

IV. FINAL CONSIDERATIONS & REGIME SUMMARY:

1. Discuss local fcst bulletins: ____________

____

____

2. What type wx occurred over past 24 hours? ____________
3. What type wx is occurring upstream of the station? ____________
4. What is TAF time local observation? ____________
5. Describe TAF time radar signatures: ____________

____

6. Describe applicable SIGMETS, PIREPS, etc.: ____________

____

7. Describe watches, WW's, WA's in effect currently and expected cancel times: ____________

____

8. Describe watches, WW's, WA's you anticipate issuing and expected issue/cancel times: ____________

____

9. Complete the regime or phenomena specific worksheet (if necessary) and attach to back of this TAF form.

10. Having thoroughly examined the atmosphere, summarize final forecast thoughts, reasoning, and expected weather for the next 24 hours based on model timing adjustments, continuity, steering flow, persistence, etc.: ____________

____

____

V. LOGICAL CONCLUSION: (attach TAF paper copy or hand write TAF in this section)

____

____

____

____

AMD # 1:

Circle **BTF / ATF / REP** Time of Criteria Change: ______ Actual AMD Time: ______

Reason For Amendment: ____________

AMD # 2:

Circle **BTF / ATF / REP** Time of Criteria Change: ______ Actual AMD Time: ______ Full Review Required: **Y / N** Minor Review: **Y / N**

Reason For Amendment: ____________

VI. TAFVER (F = Favorable, U = Unfavorable)

		TAF TIME (___/_____Z)	**H+03 (___/_____Z)**			**H+06 (___/_____Z)**			**H+12 (___/_____Z)**		
		OBSD	**PERSIS**	**FCSTD**	**OBSD**	**PERSIS**	**FCSTD**	**OBSD**	**PERSIS**	**FCSTD**	**OBSD**
CIG/VSBY < 1500 / 3	(circle)	F / U	F / U	F / U	F / U	F / U	F / U	F / U	F / U	F / U	F / U

VII. STATION MANAGEMENT AFTER-THE-FACT COMMENTS: ____________

____

____

____

____

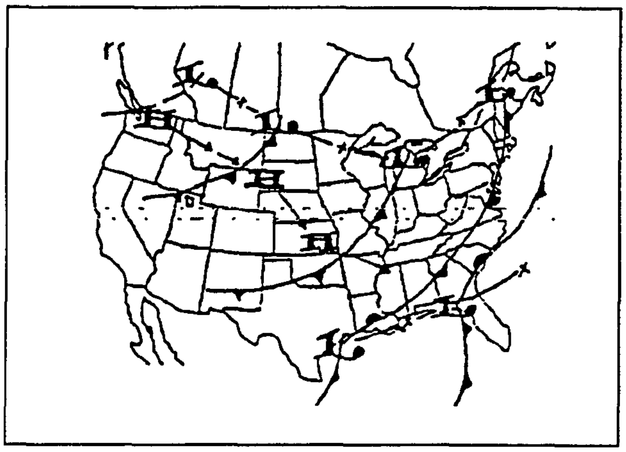
____

APPENDIX B

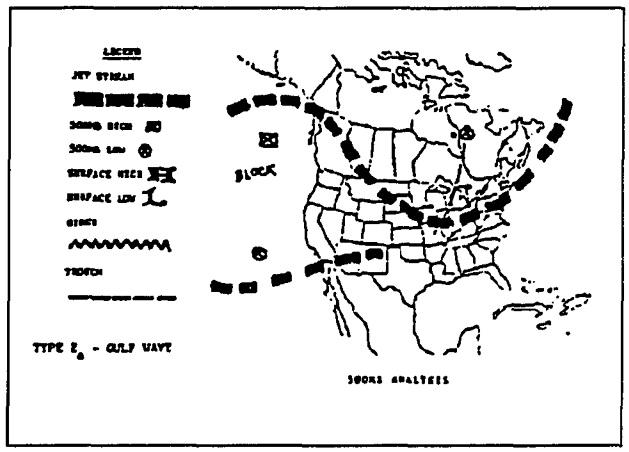
WEST GULF LOW (GULF WAVE)
(Spring Pattern) (Winter Pattern)

Weather. This pattern usually results when a cut-off low digs southward of the coast of California and becomes stationary south of a blocking ridge. This pattern with a ridge over a trough is a blocking pattern (Rex Block). Short waves converge off the Texas coast from two different directions. The stronger shortwaves progress over the ridge and into the long-wave trough, while the latter moves east from the cut-off low. The second and weaker short wave picks up quite a bit of moisture from the Pacific southwest. This is a good weather pattern for Vance. The surface low develops too far south and does not affect Vance. Little weather occurs with the initial frontal passage. Expect middle cloud ceilings and some upper cloudiness as the tropical moisture is pumped northeastward with the subtropical jet.

North Pacific Low Surface Weather Pattern



North Pacific Low 500 MB Pattern



LAWC WINDS COMPLETE WIND WORKSHEET (SPRING) (WINTER)

Is there high pressure located over the southeastern United States?	The Gulf of Mexico might be open. Low- level moisture could be advected northward.	Y	N
Are winds becoming more south/southeasterly?	This wind direction causes problems for Vance. Moisture moves in creating stratus/fog conditions.	Y	N
Has the front become quasi-stationary over Oklahoma?	If pattern persists this leads to overrunning conditions.	Y	N
Is a shallow cool air mass at the surface?	Also can lead to overrunning conditions.	Y	N
Are pressures falling behind the high in the lee of the Rockies?	Favored setup for stratus advection.	Y	N
How strong is the gradient behind the front?	Post-frontal winds can gust to 25 knots when fronts are fast moving.	Y	N

FORECAST SKEW-T (Use icing worksheet if freezing level is less than 15,000 feet)

Were colder temperatures forecast to move into the area?	Stability will decrease. Will create height falls in the upper levels.	Y N
Warm air advection or moisture forecast to move into the area? Look at Skew-T upstream.	Could be setting up an overrunning condition.	Y N
How thick is the cold air on the surface?	Possible overrunning conditions.	Y N
CAA in the upper levels?	Maybe indicates shortwave moving through or decreased stability.	Y N

SATELLITE (LC) CURVE /VISUAL

Low-level cloudiness evident in Texas?	Might indicate overrunning conditions or advected stratus condition setting up.	
Shortwave evident upstream?	Could be trigger for later development.	
Jet max moving into the region?	Could trigger convection.	
Longwave trough west of Oklahoma?	Creates diffluent area for Oklahoma.	
Enhanced cloudiness evident on visual?	Could be short wave moving through the area.	

NEXRAD RPS LIST NORTH PAC LOW

Base Reflectivity Product	Look for convergence zones or increase in reflectivity values.
Base Velocity Product	Look for areas of divergence, thermal advection patterns, shear and turbulence areas.
Base Spectrum Width Product	Identify first clue for convective areas, identifies areas of embedded convection.
Composite Reflectivity	Displays max dbZ over given area.
LRM Product	Good briefing tool, picks out strong storms.
VIL	Identifies hail bearing storms.
Echo Tops	Identify with -20 C height/TSTMS possible at that height.
VAD	Look for veering environment/SVR WX.
RCS	Look for strong updraft areas.

Complete SOF worksheet when changes to your TAF or weather changes in the military flying area are taking place.

LAWC	1	2	3	4
METSAT				
NEXRAD				

LAWC	5	6	7	8
METSAT				
NEXRAD				

The boxes will be filled out hourly when the produts are reviewed. If you have any questions refer to the LAFP or the forecaster SOPs for further guidance.

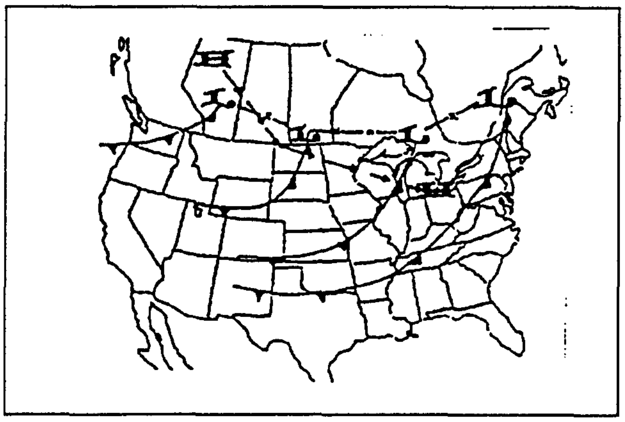
APPENDIX C

ALBERTA LOW

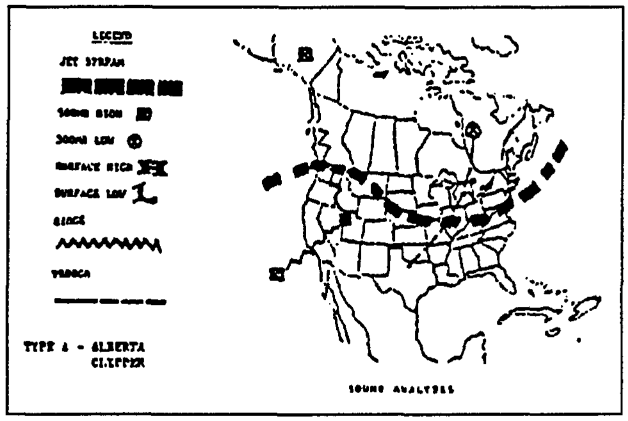
(Spring Pattern) (Winter Pattern) Little weather associated with this pattern.

Weather. Usually little weather exists with this classic pattern. Winds will shift rapidly to the north with frontal passage and increase 15-20 knots. Strong winds last only a short time. Light or no precipitation is the rule and ceilings of 1,000-1,500 feet sometimes follow frontal passage. Thickness and coverage of the cloud deck depends on the precipitation. Without the moisture, little cloudiness occurs, and if there is enough moisture ceilings below 1,000 feet are likely. If little cloudiness is evident north of the front before passage, do not expect cloudiness at Vance.

Alberta Low Surface Weather Pattern



Alberta Low 500 MB Pattern



LAWC WINDS

Is there high pressure located over the southeastern United States?	Monitor to see when southeast flow is established. Usually 36 hours after it's established expect advected stratus.	Y N
Surface gradient beginning to tighten?	As the leeside trough deepens, gradient will tighten and wind speed will increase from the south.	Y N
Will the cold front stall near Vance?	Front associated with nimbostratus, widespread light rain or snow, and occasional low visibilities.	Y N
How tight is the gradient behind the cold front?	Are warning level winds evident upstream behind the front? Remember warning level winds may occur within the first 12 hours after frontal passage.	Y N
If you expect southeasterly flow to be established within the next 24 hours and there's cloudiness in Central Texas.	Fill out the fog/stratus worksheet.	Y N

FORECAST SKEW-T

Were colder temperatures forecast to move into the area?	Stability will decrease. Will create height falls in the upper levels.	Y N
Warm air advection or moisture values forecast to increase in the low levels during the next 36 hours. (R1 values)	Could be the first indication of the gulf opening up and low-level ceilings moving in.	

SATELLITE (LC CURVE) or VISUAL

Cloud evident along the Texas coast?	Indicates possible beginning of stratus advection.	
Weak boundary located near Vance?	Could induce overrunning conditions within the next 36 hours.	
Jet max moving into the region?	Could trigger light rain over cloud mass area.	

NEXRAD RPS LIST ALBERTA

Base Reflectivity Product	Look for convergence zones outflow boundaries.
Base Velocity Product	Look for areas of divergence, thermal advection patterns, shear and turbulence areas.
Base Spectrum Width Product	Identify first clue for convective areas, identifies areas of embedded convection.
Composite Reflectivity	Displays max dbZ over given area.
LRM Product	Good briefing tool, picks out strong storms.
Echo Tops	Identify with -20 C height/TSTMS possible at that height.
VAD	Displays wind information look for low-level jet.

Complete SOF worksheet when changes to your TAF or weather changes in the military flying area are taking place.

LAWC	1	2	3	4
METSAT				
NEXRAD				

LAWC	5	6	7	8
METSAT				
NEXRAD				

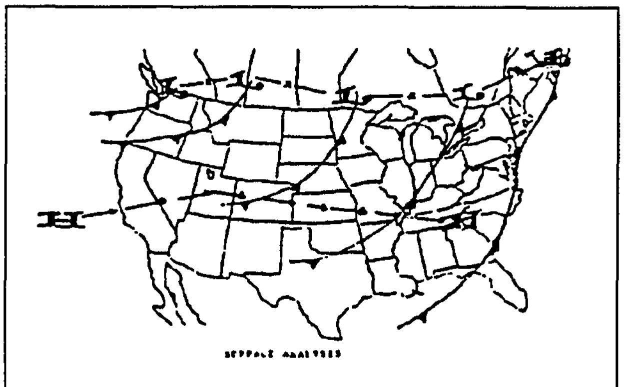
The boxes will be filled out hourly when the produts are reviewed. If you have any questions refer to the LAFP or the forecaster SOPs for further guidance.

APPENDIX D

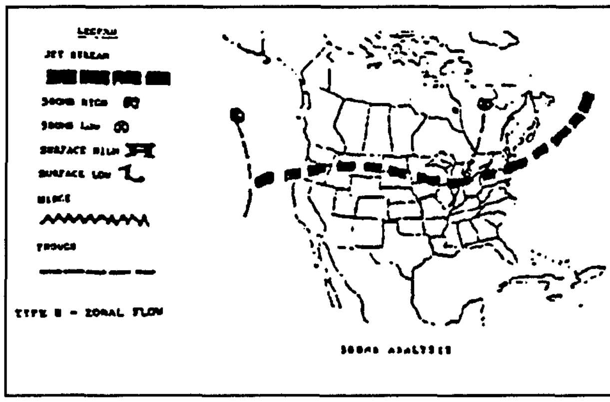
NORTH PACIFIC LOW
(Early Spring Pattern) (Winter Pattern)

Weather. Storms of this class usually make their appearance on the Washington and Oregon coasts and then move eastward in widely varying courses. Their path is usually due east along the northern U.S. border. The front moves very rapidly across the continent into the Atlantic. A polar outbreak usually occurs in the central Great Plains states. A feature of North Pacific storms is that they usually don't occur singly. Frequently this storm prevails with great intensity on the north Pacific coast; but unless it takes a southeasterly track, it loses its marked intensity and moisture while crossing the Rocky Mountains. This type frequently redevelops east of the Rockies into a much more potent storm. Cold fronts with this type are maritime polar and contain, at worst, brief middle cloudiness for Vance. Northwest post-frontal winds can gust to 25 knots when fronts are fast-moving. When a stagnant high lies in the lower Mississippi Valley, southeast flow from the Gulf may advect moisture northward. If pressures are falling behind the high in the lee of the Rockies, stratus may move into Oklahoma. If the front becomes quasi-stationary across Oklahoma, there will be no prolonged bad weather unless the pattern stays in existence for several days. Ceilings of 1,000-1,500 feet are common if pattern persists. Expect stratus and foggy conditions if pattern lasts for more than 72 hours.

North Pacific Low Surface Weather Pattern



North Pacific Low 500 MB Pattern



LAWC WINDS COMPLETE WIND WORKSHEET (SPRING) (WINTER)

Is there high pressure located over the southeastern United States?	The Gulf of Mexico might be open. Low-level moisture could be advected northward.	Y	N
Are winds becoming more south/southeasterly?	This wind direction causes problems for Vance. Moisture moves in creates stratus/fog conditions.	Y	N
Has the front become quasi-stationary over Oklahoma?	If pattern persists this leads to overrunning conditions.	Y	N
Is a shallow cool air mass at the surface?	Also can lead to overrunning conditions.	Y	N
Are pressures falling behind the high in the lee of the Rockies?	Favored setup for stratus advection.	Y	N
How strong is the gradient behind the front?	Post-frontal winds can gust to 25 knots when fronts are fast moving.	Y	N

FORECAST SKEW-T (Use icing worksheet if freezing level is less than 15,000 feet)

Is there high pressure located over the southeastern United States?	The Gulf of Mexico might be open. Low-level moisture could be advected northward.	Y N
Are winds becoming more south/southeasterly?	This wind direction causes problems for Vance. Moisture moves in creates stratus/fog conditions.	Y N
Has the front become quasi-stationary over Oklahoma?	If pattern persists this leads to overrunning conditions.	Y N
Is a shallow cool air mass at the surface?	Also can lead to overrunning conditions.	Y N
Are pressures falling behind the high in the lee of the Rockies?	Favored setup for stratus advection.	Y N
How strong is the gradient behind the front?	Post-frontal winds can gust to 25 knots when fronts are fast moving.	Y N

SATELLITE (LC) CURVE/VISUAL

Low-level cloudiness evident in Texas?	Might indicate overrunning conditions or advected stratus condition setting up.	
Short wave evident upstream?	Could be trigger for later development.	
Jet max moving into the region?	Could trigger convection.	
Long-wave trough west of Oklahoma?	Creates diffluent area for Oklahoma.	
Enhanced cloudiness evident on visual?	Could be short wave moving through the area.	

NEXRAD RPS LIST NORTH PAC LOW

Base Reflectivity Product	Look for convergence zones or increase in reflectivity values.
Base Velocity Product	Look for areas of divergence, thermal advection patterns, shear and turbulence areas.
Base Spectrum Width Product	Identify first clue for convective areas, identifies areas of embedded convection.
Composite Reflectivity	Displays max dbZ over given area.
LRM Product	Good briefing tool, picks out strong storms.
VIL	Identifies hail bearing storms.
Echo Tops	Identify with -20 C height/TSTMS possible at that height.
VAD	Look for veering environment/SVR WX.
RCS	Look for strong updraft areas.

Complete SOF worksheet when changes to your TAF or weather changes in the military flying area are taking place.

LAWC	1	2	3	4
METSAT				
NEXRAD				

LAWC	5	6	7	8
METSAT				
NEXRAD				

The boxes will be filled out hourly when the produts are reviewed. If you have any questions refer to the LAFP or the forecaster SOPs for further guidance.

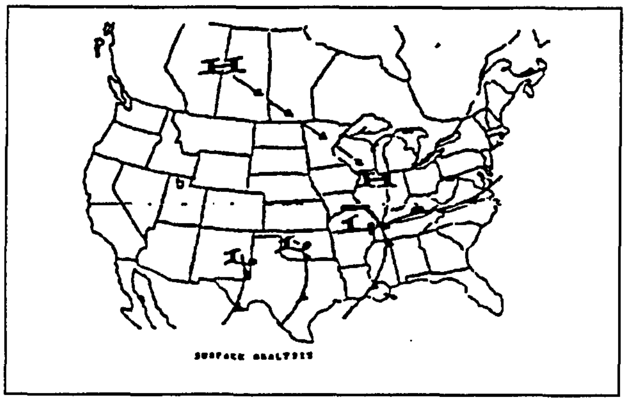
APPENDIX E

SOUTH PACIFIC (CALIFORNIA) LOW

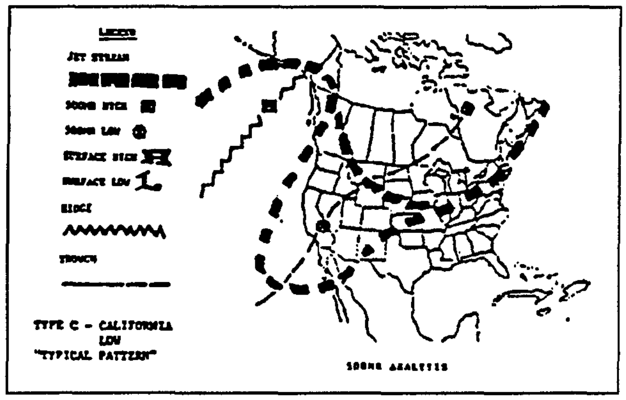
(Spring/Severe Weather Pattern) (Winter Freezing/Snow Producer)

Weather. Weather conditions vary greatly with this system. If the upper low develops over the mountains expect the worst. Ceilings less than 1,000 feet with strong northerly winds will accompany the surface low as it passes to our south. Moderate-to-heavy precipitation is likely. If the upper-level low passes to our south (during the winter from December to early March), expect the possibility of heavy snow (see heavy snow pattern on back). Each system will vary in strength and movement; therefore, forecast snowfall amounts should be based on the particular characteristics of each situation. If the upper-level low moves north of Vance, expect rain (see the rain pattern for rain, strong surface winds and low ceilings). When the upper-level low develops over the west of California, as in the typical pattern, expect clouds with ceilings of 10,000 feet or above and light precipitation, if any. Patchy ceilings of 1,000-3,000 may accompany the system if precipitation occurs (see TFRN for further guidance).

California Low Surface Weather Pattern



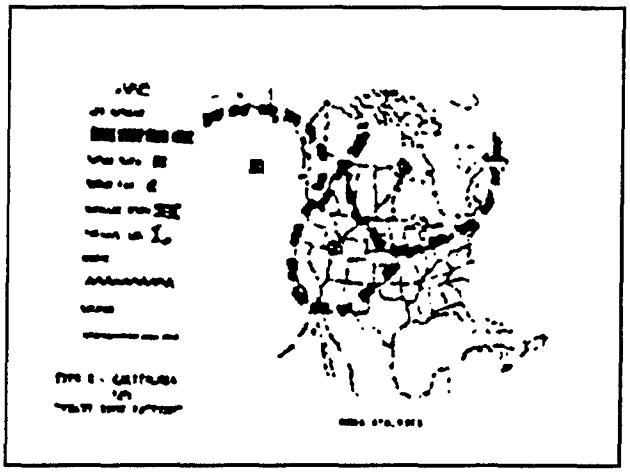
California Low 500 MB Pattern

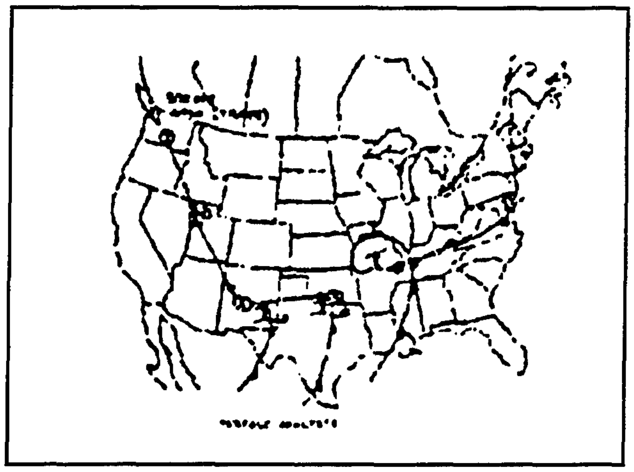


LAWC PRECIP COMPLETE TSTM WORKSHEET (SPRING) WINTER PRECIP (WINTER)

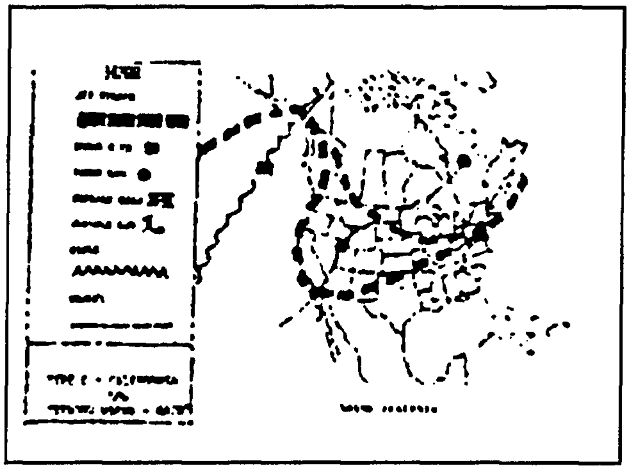
Surface temperatures greater than or less than 32 F?	What's the current weather taking place upstream?	
Is a quasi-stationary boundary front located over Oklahoma or Texas?	Watch for low development in the Panhandle area. Monitor short waves moving close to the front.	Y N
What is the storm's track?	Remember heavy snowfalls are common immediately north of the storm's center.	Y N
Is moisture increasing in the mid levels?	Overrunning air begins to show up as middle clouds.	Y N
Is there a marked increase in the southerly flow? Have winds shifted to a more southerly direction?	This leads to stratus ceilings and freezing rain or snow. Expect lower ceilings in light precipitation. Heavier snow usually reduces conditions by one category.	Y N
What are the wind speeds upstream? Do you think cold air will move into the area from the backside of the low?	Monitor the gradient as the cold air moves in. Expect wind speeds to increase.	Y N
Quasi-stationary boundary located in Kansas?	Expect brief stratocumulus ceilings late at night and in the morning. Higher clouds may be extensive. If temperatures are unseasonably warm, showers and thunderstorms will develop on any waves that move along the front and in squall lines south of the front.	Y N

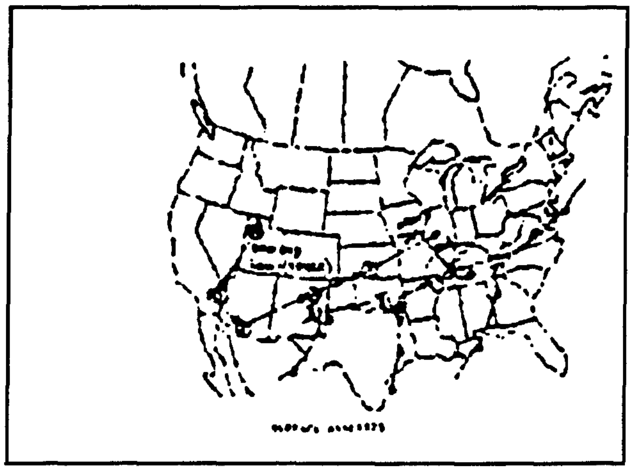
HEAVY SNOW PATTERN





STRONG WIND/RAIN PATTERN





FORECAST SKEW-T (Use icing worksheet if freezing level less than 15,000 feet.)

Were colder temperatures forecast to move into the area?	Stability will decrease. Will create height falls in the upper levels.	Y N
Strong veering evident throughout the column?	A strong veering environment increases helicity and the possiblity of severe weather.	Y N
Warm air advection or moisture values forecast to increase in the low levels?	Will decrease stability.	Y N
Temperatures at 10,000 feet 12 C or higher?	This could cap TSTM development.	Y N

SATELLITE (MB CURVE) OR VISUAL

Cloud tops becoming colder on MB shot?	Indicates possible thunderstorm development.	
Short wave evident upstream?	Could be trigger for later development.	
Jet max moving into the region?	Could trigger convection.	
Long-wave trough west of Oklahoma?	Creates diffluent area for Oklahoma.	
Are clouds evident in SW Oklahoma?	Outflow boundary signature.	
Enhanced cloudiness evident on visual?	Could be short wave moving through the area.	
Line of convection firing in TX panhandle?	Determine if it's associated with the dryline.	

NEXRAD RPS LIST SOUTH PACIFIC LOW

Base Reflectivity Product	Look for convergence zones outflow boundaries.
Base Velocity Product	Look for areas of divergence, thermal advection patterns, shear and turbulence areas.
Base Spectrum Width Product	Identify first clue for convective areas, identifies areas of embedded convection.
Composite Reflectivity	Displays max dbZ over given area.
LRM Product	Good briefing tool, picks out strong storms.
VIL	Identifies hail bearing storms.
Echo Tops	Identify with -20 C height/TSTMS possible at that height.
VAD	Look for veering environment/SVR WX.
RCS	Look for strong updraft areas.

Complete SOF worksheet when changes to your TAF or weather changes in the military flying area are taking place.

LAWC	1	2	3	4
METSAT				
NEXRAD				

LAWC	5	6	7	8
METSAT				
NEXRAD				

The boxes will be filled out hourly when the produts are reviewed. If you have any questions refer to the LAFP or the forecaster SOPs for further guidance.

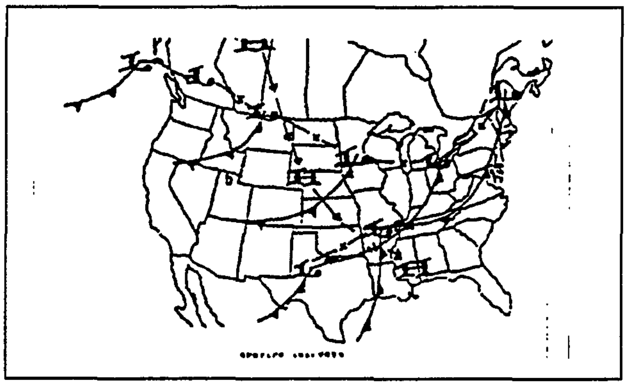
APPENDIX F

TEXAS LOW

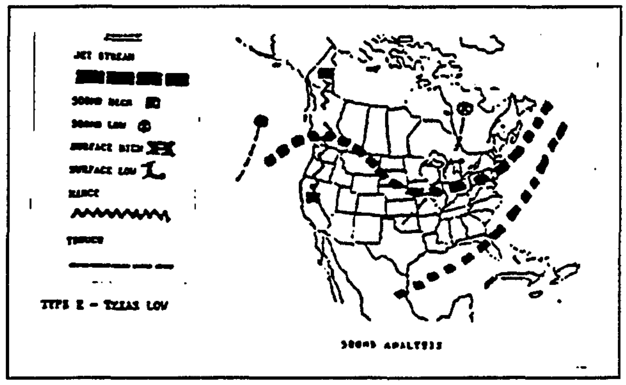
(Winter/Possibly Heavy Snow or Freezing Precipitation) (Spring/Thunderstorms)

Weather. These lows closely resemble Colorado lows with a more southerly track. Location and development extends from the New Mexico border to western Arkansas. The track of the low pressure is to our south and must be close enough to produce to weather at Vance. If the low develops anywhere north of central Texas, low ceilings, drizzle, and rain are possible. Surface winds will normally be north or northeast and temperatures will slowly drop. Freezing precipitation is possible from November to March with these systems and may change to light snow as the low moves into Arkansas. Ceilings lift rapidly as the low crosses the Mississippi River. Surface winds are usually light, but pick up sometimes as high as 30 knots if the low deepens over Arkansas and a strong polar high pushes down from Canada. When the low develops south of central Texas, expect middle cloud ceilings with scattered stratus ceilings at worst. Winds will generally be more northerly and the air mass will be much cooler.

Texas Low Surface Weather Pattern



Texas Low 500 MB Pattern



LAWC PRECIP COMPLETE TSTM (SPRING) WINTER PRECIP (WINTER)

Westerly flow over the central United States?	This must be present to form the leeside trough in eastern Colorado. **(Favored place for development)**	Y N
Surface gradient beginning to tighten?	As the leeside trough deepens, gradient will tighten and wind speed will increase from the south/southwest.	Y N
Warm front going to affect Vance?	Front associated with nimbostratus, widespread light rain or snow, and occasional low visiblities. Warm sector winds may be strong out of the south/southwest 30-35 knots.	Y N
Instability line near Vance?	This must be watched for afternoon development. This is a prime area for severe weather formation. The instability line may precede the actual cold front by several hours.	Y N
Low-level convergent zone west of Vance?	Southeasterly winds, deep moisture layer, dew points increasing throughout the day.	Y N
Low ceilings and moderate precip evident in central Texas? Monitor height falls to determine surface movement.	Expect low/cigs and precip until low is east of Vance. Backwash stratus may occur and wind will become NW. Light snow and freezing rain possible in winter.	Y N
If low passes south of station consider significant snow if closed system aloft follows.	In winter, when a Texas low develops in the Panhandle, a preferred location for warm-frontal development is the snow line and where the temperatures are near 25-35 F.	Y N
Locate dryline 55 F isodrosotherm	Monitor for possible afternoon supercell activity.	Y N
Monitor surface height falls.	Is the low moving towards southeast OK? Could produce heavy precip for Vance.	Y N

FORECAST SKEW-T (Use icing worksheet if freezing level less than 15,000 feet)

Were colder temperatures forecast to move into the area?	Stability will decrease. Will create height falls in the upper levels.	Y N
Strong veering evident throughout the column?	A strong veering environment increases helicity and the possiblity of severe weather.	Y N
Warm air advection or moisture values forecast to increase in the low levels?	Will decrease stability.	Y N
Temperatures at 10,000 feet 12 C or higher?	This could cap TSTM development.	Y N

SATELLITE (MB CURVE) OR VISUAL

Cloud tops becoming colder on MB shot?	Indicates possible thunderstorm development.	
Short wave evident upstream?	Could be trigger for later development.	
Jet max moving into the region?	Could trigger convection.	
Long-wave trough west of Oklahoma?	Creates diffluent area for Oklahoma.	
Arc clouds evident in SW Oklahoma?	Outflow boundary signature.	
Enhanced cloudiness evident on visual?	Could be short wave moving through the area.	
Line of convection firing in TX panhandle?	Determine if it's associated with the dryline.	

NEXRAD RPS LIST

Base Reflectivity Product	Look for convergence zones outflow boundaries.
Base Velocity Product	Look for areas of divergence, thermal advection patterns, shear and turbulence areas.
Base Spectrum Width Product	Identify first clue for convective areas, identifies areas of embedded convection.
Composite Reflectivity	Displays max dbZ over given area.
LRM Product	Good briefing tool, picks out strong storms.
VIL	Identifies hail bearing storms.
Echo Tops	Identify with -20 C height/TSTMS possible at that height.
VAD	Look for veering environment/SVR WX.
RCS	Look for strong updraft areas.

Complete SOF worksheet when changes to your TAF or weather changes in the military flying area are taking place.

LAWC	1	2	3	4
METSAT				
NEXRAD				

LAWC	5	6	7	8
METSAT				
NEXRAD				

The boxes will be filled out hourly when the produts are reviewed. If you have any questions refer to the LAFP or the forecaster SOPs for further guidance.

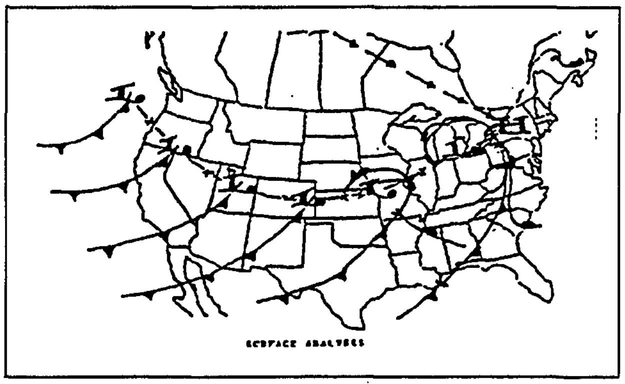
APPENDIX G

COLORADO LOW

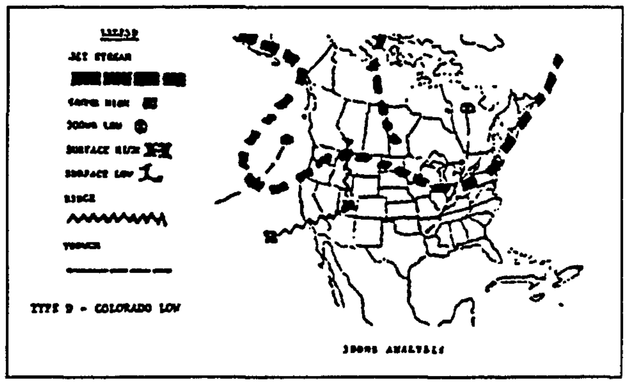
(Spring/Severe Weather Pattern) (Winter Freezing/Snow Producer)

Weather. Leeside trough will be evident. Winds of 25-35 knots from the southwest are not uncommon. Blowing dust will be evident in the Texas Panhandle, reducing visibilities to 1-3 miles. Winds will diminish slightly before frontal passage but will pick up speed and shift to the west as the front passes. Several hours after frontal passage winds shift slowly to the north and gust for less than 12 hours. Low cloudiness is usually scarce with this system.

Colorado Low Surface Weather Pattern



Colorado Low 500 MB Pattern



LAWC PRECIP

Westerly flow over the central United States?	This must be present to form the leeside trough in eastern Colorado. **(Favored place for development)**	Y N
Surface gradient beginning to tighten?	As the leeside trough deepens, gradient will tighten and wind speed will increase from the south/southwest.	Y N
Significant height falls evident in Colorado, Texas Panhandle?	Colorado Low may be developing. Look for cyclonic flow at the surface and check geostophic winds (cyclogenesis).	Y N
Low-level convergent zone east of Vance?	Southwest winds, precipitation not likely. Must monitor the local area observations for possible warning level winds moving in from the west/southwest	Y N
Low-level convergent zone west of Vance?	Southeasterly winds, deep moisture layer, dew points increasing throughout the day.	Y N
55 F isodrosotherm?	Usually associated with the dry line.	Y N
Moisture tongue evident over or to the west of Vance?	This will provide the fuel for the possible development of severe weather.	Y N
Thermal ridge evident to the west of the moisture tongue?	This is a favorable pattern for severe weather development.	Y N
Weak discontinuity boundary evident?	This could be a favorable area for thunderstorm development. Reaching convective temp could start TSTM.	Y N

Complete Thunderstorm Worksheet (March-November). Complete Winter Precipitation Worksheet (December-February). If you're unsure of which worksheet to fill out, consider the following items: forecast surface temperature, depth of the cold layer, veering throughout the column, veering/backing winds with height on skew-T or dry air at 700 mb.

FORECAST SKEW-T (Use icing worksheet if freezing level is less than 15,000 feet.)

Were colder temperatures forecast to move into the area?	Stability will decrease. Will create height falls in the upper levels.	Y N
Strong veering evident throughout the column?	A strong veering environment increases helicity and the possiblity of severe weather.	Y N
Warm air advection or moisture values forecast to increase in the low levels?	Will decrease stability.	Y N
Temperatures at 10,000 feet 12 C or higher?	This could cap TSTM development.	Y N

SATELLITE (MB CURVE) OR VISUAL

Cloud tops becoming colder on MB shot?	Indicates possible thunderstorm development.	
Short wave evident upstream?	Could be trigger for later development.	
Jet max moving into the region?	Could trigger convection.	
Long-wave trough west of Oklahoma?	Creates diffluent area for Oklahoma.	
Arc clouds evident in SW Oklahoma?	Outflow boundary signature.	
Enhanced cloudiness evident on visual?	Could be short wave moving through the area.	
Line of convection firing in TX panhandle?	Determine if it's associated with the dryline.	

NEXRAD RPS LIST COLORADO

Base Reflectivity Product	Look for convergence zones outflow boundaries.
Base Velocity Product	Look for areas of divergence, thermal advection patterns, shear and turbulence areas.
Base Spectrum Width Product	Identify first clue for convective areas, identifies areas of embedded convection.
Composite Reflectivity	Displays max dbZ over given area.
LRM Product	Good briefing tool, picks out strong storms.
VIL	Identifies hail bearing storms.
Echo Tops	Identify with -20 C height/TSTMS possible at that height.
VAD	Look for veering environment/SVR WX.
RCS	Look for strong updraft areas.

Complete SOF worksheet when changes to your TAF or weather changes in the military flying area are taking place.

LAWC	1	2	3	4
METSAT				
NEXRAD				

LAWC	5	6	7	8
METSAT				
NEXRAD				

The boxes will be filled out hourly when the produts are reviewed. If you have any questions refer to the LAFP or the forecaster SOPs for further guidance.

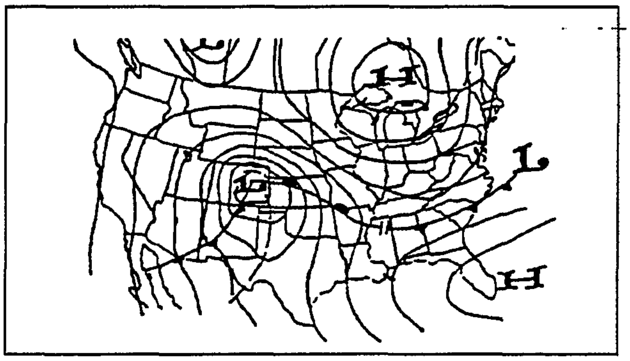
APPENDIX H

SEVERE WEATHER PATTERN

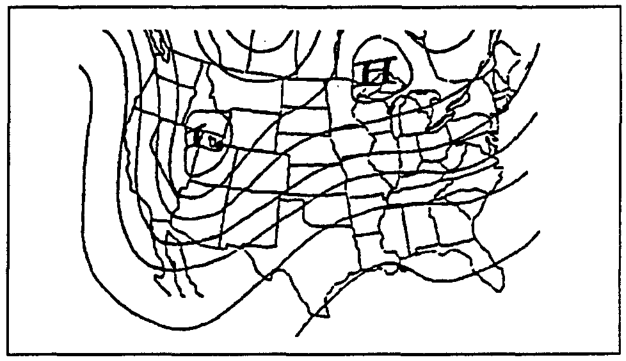
(Spring) (Winter) (Fall)

Upper-Air Pattern. A high amplitude trough exists over the Rockies with a suppressed ridge over the Mississippi Valley. This is similar to the Colorado low pattern. The trough is usually oriented slightly northeast-southwest and is slowly progressive. The polar jet lies from Arizona to western Oklahoma to the Great Lakes. A cut-off low may develop over the northern Rockies. Key features to look at 500/300 mb: height falls, temperature troughs, and divergence. The upper-level jet is a key feature and one of the most important for the development of thunderstorms that produce large hail and tornadoes. Speeds of more than 100 knots should alert forecasters of the high potential for tornadoes.

Severe Weather Surface Weather Pattern



Severe Weather 500 MB Pattern



LAWC PRECIP

Surface gradient beginning to tighten?	As the leeside trough deepens, gradient will tighten and wind speed will increase from the south/southwest.	Y N
Significant height falls evident in Colorado, Texas Panhandle?	Colorado low may be developing. Look for cyclonic flow at the surface and check geostophic winds (cyclogenesis).	Y N
Low-level convergent zone east of Vance?	Southwest winds, precipitation not likely. Must monitor the local area observations for possible warning level winds moving in from the west/southwest	Y N
Low-level convergent zone west of Vance?	Southeasterly winds, deep moisture layer, dewpoints increasing throughout the day.	Y N
55 F isodrosotherm?	Usually associated with the dry line.	Y N
Moisture tongue evident over or to the west of Vance?	This will provide the fuel for the possible development of severe weather.	Y N
Thermal ridge evident to the west of the moisture tongue?	This is a favorable pattern for severe weather development.	Y N
Weak discontinuity boundary evident?	This could be a favorable area for thunderstorm development. Reaching convective temp could start TSTM.	Y N

Complete Thunderstorm Worksheet (March-November). Complete Winter Precipitation Worksheet (December-February). If you're unsure of which worksheet to fill out, consider the following items: forecast surface temperature, depth of the cold layer, veering throughout the column, veering/backing winds with height on Skew-T or dry air at 700 mb.

FORECAST SKEW-T (Use icing worksheet if freezing level is less than 15,000 feet.)

Were colder temperatures forecast to move into the area?	Stability will decrease. Will create height falls in the upper levels.	Y N
Strong veering evident throughout the column?	A strong veering environment increases helicity and the possiblity of severe weather.	Y N
Warm air advection or moisture values forecast to increase in the low levels?	Will decrease stability.	Y N
Temperatures at 10,000 feet 12 C or higher?	This could cap TSTM development.	Y N

SATELLITE (MB CURVE) OR VISUAL

Cloud tops becoming colder on MB shot?	Indicates possible thunderstorm development.	
Short wave evident upstream?	Could be trigger for later development.	
Jet max moving into the region?	Could trigger convection.	
Long-wave trough west of Oklahoma?	Creates diffluent area for Oklahoma.	
Arc clouds evident in SW Oklahoma?	Outflow boundary signature.	
Enhanced cloudiness evident on visual?	Could be short wave moving through the area.	
Line of convection firing in TX Panhandle?	Determine if it's associated with the dryline.	

NEXRAD RPS LIST COLORADO

Base Reflectivity Product	Look for convergence zones outflow boundaries.
Base Velocity Product	Look for areas of divergence, thermal advection patterns, shear and turbulence areas.
Base Spectrum Width Product	Identify first clue for convective areas, identifies areas of embedded convection.
Composite Reflectivity	Displays max dbZ over given area.
LRM Product	Good briefing tool, picks out strong storms.
VIL	Identifies hail bearing storms.
Echo Tops	Identify with -20 C height/TSTMS possible at that height.
VAD	Look for veering environment/SVR WX.
RCS	Look for strong updraft areas.

Complete SOF worksheet when changes to your TAF or weather changes in the military flying area are taking place.

LAWC	1	2	3	4
METSAT				
NEXRAD				

LAWC	5	6	7	8
METSAT				
NEXRAD				

The boxes will be filled out hourly when the produts are reviewed. If you have any questions refer to the LAFP or the forecaster SOPs for further guidance.

APPENDIX I

THUNDERSTORM CRITERIA/DETERMINATION

THUNDERSTORM CHECKLIST

PARAMETER	WEAK	MODERATE	STRONG
500mb Vort	Neutral/Neg advection	Contours cross at 30 degrees	Contours cross > 30 degrees
Lifted Index	-2	-4	-6
Total Totals	50	50 to 55	>55
Cross Totals	25	25 to 30	>30
K Index	30	35 to 40	>40
KO Index	> 12	4 to 12	< 4
CAPE	300-1,000	1,000-2,500	2,500-5,300
Mid-level jet	35 knots	35-50 knots	> 50 knots
Shear	15 knots/90nm	15-30 knots 90nm	> 30 knots/90nm
Upper-level jet	55 knots	55-85 knots	> 85 knots
Low-level jet	20 knots	25-35 knots	> 35 knots
850 dew point	8 degrees Celsius	8 to 10 degrees Celsius	> 12 degrees Celsius
850 max temp	East of ridge axis	Over moist ridge	West of moist ridge
700 no change line	Winds cross at 20 degrees	Winds cross at 20-40 degrees	Winds cross at 40 degrees
700 dry air intrusion	N/A or weak	Winds 10-40 degrees at 15 knots	Winds > 40 degrees at 25 knots
12 hour sfc pressure falls	< 1 mb	1 to 5 mb	> 5 mb
500mb height change	30 meters	30-60 meters	> 60 meters
WBZ (hundreds of feet)	> 110 or < 050	090-110 or 050-070	070-090
Sfc dew point	13 degrees Celsius	13 to 18 degrees Celsius	> 18 degrees Celsius
Sfc pressure	1,010 mb	1,010 to 1,005 mb	1,005 mb

Wet-bulb zero height ______ Forecast hail size ________ If WBZ is > 12,500 feet = heavy rain/hail 1/4 inch
T1 Gust method _____ T2 Gust method ______ VIL of the day value ____ Veering vertical environment Y/N

THUNDERSTORM CHECKLIST

STORM RELATIVE HELICITY (SRH)	MEAN STORM INFLOW	ENERGY HELICITY INDEX (EHI)
120-150 supercell 150-299 weak tornadoes 300-499 strong tornadoes > 450 violent tornadoes	20 mesocyclone possible	1.0 strong tornadoes 5.0 violent tornadoes

Answer the following questions to determine initial thunderstorm outbreak locations:
Do we have moist, conditionally unstable air over the forecast area? Y/N
Are there any boundaries in the area (fronts, outflows, washed out cold fronts, troughs)?
Is strong upper-level cold air advection occurring over the area or upstream? Y/N
Is strong low-level warm/moist advection taking place?
Locate intersection of warm, moist low-level air and strong 500 mb cold air advection. ________
--The location depends on the speed of the cold front and the dry surge into the moist air.
The area extends along 200 miles to the right of the 500 mb jet (in the diffluence)
From the dry intrusion to where the low-level moisture decreases
Locate the intersection of the low-level jet and the warm front.
Locate the intersection of the low-level jet and the 500 mb jet.
Severe weather extends along and south single updraft and downdraft core of the 500 mb jet but will be north of the 850 mb warm front.

Rule of Thumb for Severe Pulse Thunderstorms
Single updraft and downdraft core.
Short-lived (about 1/2 hour to an hour).
Single-cell thunderstorms develop in a weak vertical shear environment.
--This allows the precipitation and downdraft to fall directly back into the updraft.
Echoes first appear aloft and continue to grow vertically as precipitation starts descending.
Severity of the pulse thunderstorm is entirely dependent upon the updraft strength.
--The first echo of a severe cell develops higher and stays aloft longer than non-severe.
Wind gusts associated with outflow boundaries are the most frequent form of severe weather.
Only way to warn for a pulse storm wind gust is to anticipate development.
This can be done by recognizing the following:
--Weak vertical shear in the lowest 12,000 feet (VWP).
--Along with high CAPE values (positive energy areas on the Skew-T).
--A forcing mechanism to create a strong updraft.
WARNINGS SHOULD BE CONSIDERED WHENEVER 50dbZ extends above 30,000 feet.
IF THE WORKSHEET LEADS TO THE CONCLUSION THAT SEVERE WEATHER IS PROBABLE, FOLLOW THE SEVERE WEATHER CHECKLIST INSTEAD OF THIS THUNDERSTORM CHECKLIST!
(Severe checklist must be used if the MWA has Vance in a RED or BLUE area.)

APPENDIX J

FOG/STRATUS DETERMINATION

FOG/STRATUS CHECKLIST

Conditions favorable for fog information

- Winds of 3 to 7 knots
- Constant/increasing dew- point temperature with height in the lower 200 feet of the atmosphere
- Cloud-free skies or only high, thin cirriform clouds
- Moisture-free skies on the water vapor image
- Air with a dew-point temperature high enough that radiation will lower air temperature below this value
- Liquid precipitation increases the likelihood of fog
- Wet ground increases the probability
- Clearing at night after frontal passage

Rules of Thumb for Radiation Fog

- Clear skies at night
- Moist ground
- Light winds
- Cloudy conditions (During day)
- Late aftn dpd of < 10 C
- Cool rain (day)
- 48 hours after rain producing cold front

RADIATION FOG CHECKLIST

	Good Chance	Possible	Little Chance
Sky Condition	Clear	Scattered/broken	Overcast
Water Vapor	Black (dry)	Gray	White (moist)
Radiational Inversion	Yes		No
Ground Moisture	Puddles	Rain recently	Dry
Fog point/Min Temp	Saturation	< 2 C from saturation	> 3 C from saturation
Wind Speed	2-5 knots	0-1 or 6-8 knots	> 8 knots
1,000 mb DPD	< 2 C	2 C or 3 C	> 3 C
Fog stability Index	< 31	31-55	> 55
Model R1	> 90	80-90 or 70-80	< 70
VAD	Weak convergence	Weak divergence or Strong convergence	Strong divergence

Helpful Hints:

- Advection fog over the Vance AFB area will come from the southeast or south. Look for wind speed to increase in the lower levels (S-SE) during the night. The low-level jet is usually at its maximum intensity at night.
- Keep track of the dew-point spread trend during the last six hours. Dew-point spreads of 3 C / 5 F or less are a good indicator that fog could possibiy occur.
- Make sure no cold air advection is taking place. **Cold air advection is the greatest inhibitor of fog formation.**

NUMERICAL DATA

ETA 6 HOURS	ETA 12 HOURS	ETA 24 HOURS	NGM 6 HOURS	NGM 24 HOURS
R1				
WND				
T1				
Heights				

Look for R1 values of greater than 80 percent and southeast flow (indicates Gulf is open to moisture advection). Seriously consider fog if values are 80 percent or higher.

Fog Stability Index	FSI Value	Forecast FSI Value	Low Probability
FSI = 4(Tsfc)-2(T850 + Tdsfc) + W850			FSI > 55
	Fog-point Temperature		Fcst 12 hour fog point temp

STEPS TO ESTIMATE "FOG-POINT TEMPERATURE"

(1) Lift the parcel of air at the surface temperature and pressure up the dry adiabat until the adiabat crosses the same mixing ratio that intersects the surface dew point.

(2) Starting with the dew point at the pressure level of the LCL, follow the saturation adiabat down until it reaches the surface-pressure level.

(3) Read the value of the isotherm that intersects where the surface pressure level and saturation adiabat meet. This is the fog-point temperature.

Formation checklist / Base Tops	Dissipation checklist / Dissipation temperature
(1) Find the avg mixing ratio between sfc and base inversion (2) Project this avg mixing ratio line up through the sounding (3) The intersection of avg mixing ratio line and the temperature curve. Gives the height and base of stratus layer. For further INFO refer to METTIS. Click forecast development, sky condition, checklists, stratus formation.	After completing formation checklist: (1) Follow the dry adiabat from base of deck to the surface. **SFC TEMP to start dissipation.** (2) Follow the dry adiabat from the top of the deck to the surface. **SFC TEMP required for complete dissipation.**

Products to Use and Questions to Consider:

LAWC
- Has moisture been increasing in the lower levels?
- Has it rained today or are there puddles of water in the area?
- Will the skies be clear tonight?
- Was it cloudy all day long?

SKEW-T
- Is moisture increasing in the lower levels?
- Is there a strong inversion present?
- Is there CAA taking place? Backing winds with height.
- Cold air is an inhibitor of fog!

SATELLITE
- Is there black stratus evident in Texas?
- Is there a dark slot located over the Oklahoma area?
- Is low-level cloudiness evident on the LC curve?

Use the following graphic/alphanumeric sequences, RPS list and satellite image during this weather pattern:

Satellite:

NEXRAD:

LAWC:

APPENDIX K

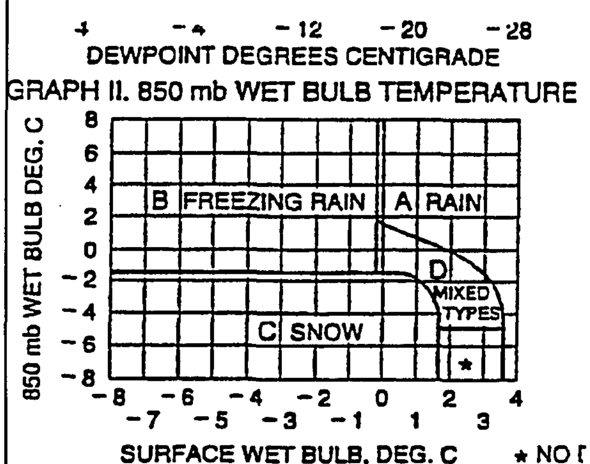
WINTER PRECIP WORKSHEET

1. What is the current/fcst temperature at 850 mb and the Sfc (see "obtaining upper-air tmp, dpt" on back)
850 mb
Current___/3hr___/6hr___/9hr___/12hr___/15hr___/
18hr___/24hr___
SFC (see "obtaining sfc tmp, dpt" on back)
Current___/3hr___/6hr___/9hr___/12hr___/15hr___/
18hr___/24hr___
Plug numbers into winter precip decision graph, below, and enter type precip expected.
Precip
Current___/3hr___/6hr___/9hr___/12hr___/15hr___/
18hr___/24hr___

2. What is the current/fcst thickness over Vance?
1,000-500 (threshold 5,400 meters) (use sfc NGM)
Current_______/12hr_______/24hr_________
1,000-850 (threshold 1,300 meters) (use low-level thickness cs)
Current_______/12hr_______/24hr_________

Layer	Flurries	Snow	Threshold	Rain
850-500mb			4050	
850-700mb		1520	1540	1555
1000-500mb	5240	5360	5400	5490
1000-700mb		2800	2840	2870
1000-850mb			1300	1325

3. What is the current/fcst wet-bulb at SFC and 850 mb? Use an upstream Skew-T and stratus icing cs (dist_logp).
SFC
Current_______/12hr_______/24hr_________
850
Current_______/12hr_______/24hr_________
Plug numbers into wet-bulb graph and enter type precip expected.
Precip
Current_______/12hr_______/24hr_________



GRAPH III. TYPE OF PRECIPITATION

	Rain	Mixed	Snow
SFC TMP	> 40F	35 to 40F	< 35F
SFC DPT	> 35F	25 to 35F	< 25F
850 TMP	> 5C	1 to 5C	< 1C
700 TMP	> -5C	-5 to -9C	< -9C
500 TMP	> -15C	-15 to -19C	< -19C

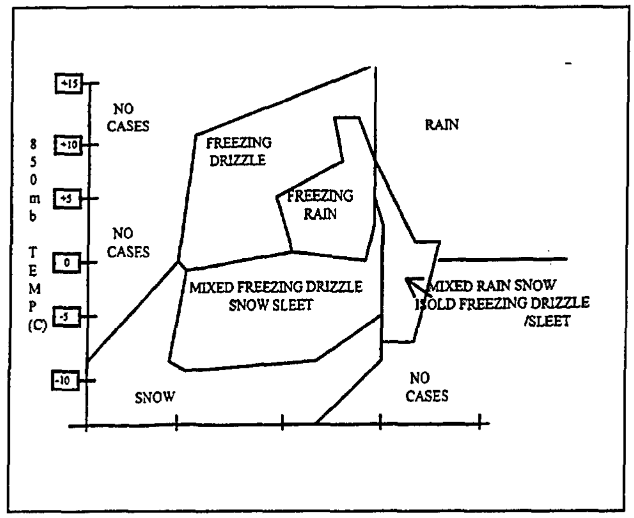
4. Evaluate temperature and dewpoint on sfc and temps at 850, 700, and 500. Using table below determine possible precip type.
Current_______/12hr_______/24hr_________

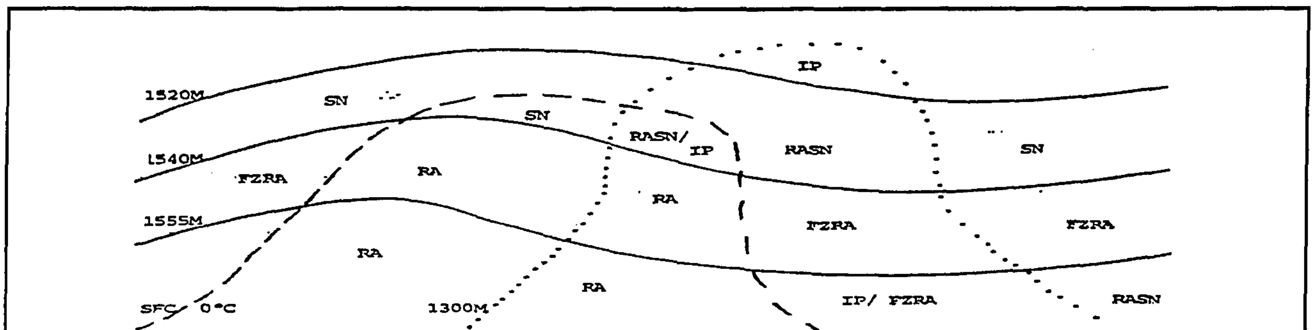
5. Determine mid-level and low-level thickness (optional).

Run the Winter_precip command sequence (see AWDS SOPs for instructions on using this command sequence).

Determine the mid-level and low-level thickness values over Vance and the sfc temp at Vance. Plug the numbers into the composite chart below.

Warning: *Only use this chart in conjunction with other indicators and look for trends, not specific values.*

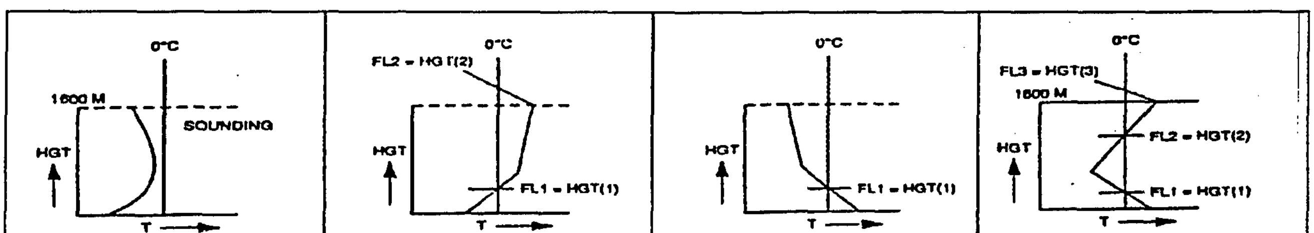




LLT/ MLT Composite Chart

6. What is the current/fcst freezing level?
Current_______/12hr______/24hr_________
If freezing level is > 2,000 forecast R, if < 1,000 forecast S.

7. Are there mutiple freezing levels? Yes__No__
If yes, use chart below to determine possible precip type.



FREEZING LEVEL SFC Below Freezing (BF)	FREEZING LEVEL 2 = FL2 = HGT(2) FREEZING LEVEL 1 = FL1 = HGT(1) SFC BF	FREEZING LEVEL 1 = FL1 = HGT(1)	FREEZING LEVEL 3 = FL3 = HGT(3) FREEZING LEVEL 2 = FL2 = HGT(2) FREEZING LEVEL 1 = FL1 = HGT(1)

PRECIP TYPE Snow (S)	If FL1 > 1000' and (FL2 - FL1) > 500' = Ice Pellets (IP)
	If FL1 <1000' and (FL2 - FL1) >500' = Freezing Rain (Z)
	If (FL2 -FL1) <500' = Snow (S)
		If FL1 <2000 FT = Mixed Rain/Snow
		If FL1 >2000FT = Rain (R)
			If (FL3 - FL2)<500' and FL1 <1200 FT and SFC Temp <36°F = Snow (S)
			If (FL3 - FL2)> 1000' and (FL2 - FL1)>500' and FL1 <1000' = Ice Pellets (IP)
			If (FL3 - FL2)>500' and <1000' and (FL2 - FL1) <500' and FL1 >1000' = Mixed Rain/Snow (M)

APPENDIX L

WIND STUDY WORKSHEET

1. Look at the current SURFACE, GEOSTROPHIC and 850-MB charts to determine the wind pattern in the lower levels.

2. Determine direction of the low-level wind flow pattern moving into the area.

3. Then pick out the two stations on that line. Stations to look at are, **NW-NE** KDDC-KOUN, **ESE-S** KOUN-KFWD, **SE-SW** KFWD-KAMA, **SSE-SSW** KOUN-KAMA, WNW-N KAMA-KDDC, **NW-NE** KDNR-KDDC.

4. Determine the DELTA H and highest wind in the lower 6,000 feet for the two stations.

a. Delta H found by looking at the 850-mb level heights. ex. KAMA 72363 85148 1480 is the height. KFWD 72249 85140. 1480-1400 = 80. The Delta H between these two stations is 80.

b. Delta H values of 60 or higher are the values to key in on.

c. Delta H of 60 or higher use the values. Forty-five percent for max wind of the day; 85 percent for peak wind.

5. Next determine the highest winds in the lower 6,000 feet.

a. This is found in the PPBB group. ex. PPBB 72363 90345 19027 19032 20043 it would be 200/43 knots PPBB 72249 90345 18026 19033 19045. it would be 190/45 knots. Add them together Drctn 200 + 190 = 390. Divide by 2 = 195. Speed 43 knots + 45 knots = 88 knots divided by 2 = 44 knots.

DELTA H ____________ LOWER 6,000-FOOT HIGH WINDS ____________

____________ ____________

____________ ____________ SUM DIVED BY 2 ____________

VALUE ____________ X 45% = MAX WIND FOR DAY ____________

____________ X 85% = PEAK WIND FOR DAY ____________

6. Refine time of day by doing the lapse rate wind study. Data off FJUM46 KGWC and FOUM03 KWBC.

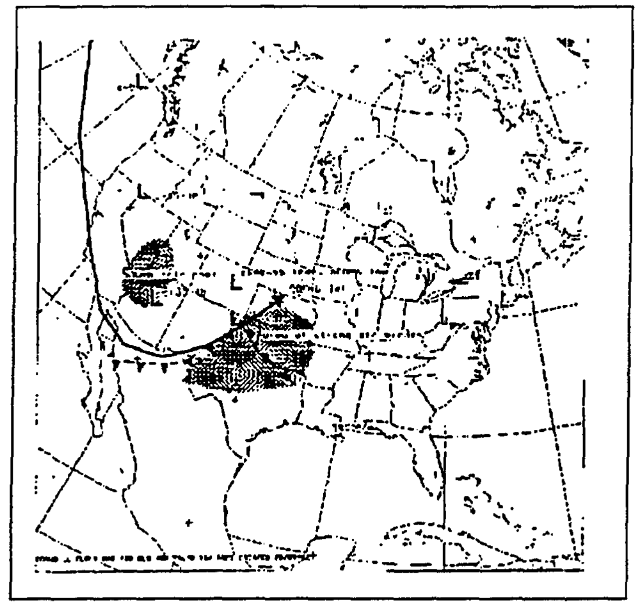
	CURRENT TIME	+6 HOURS	+12 HOURS	+18 HOURS	+24 HOURS
LAPSE RATE					
WIND					
FCST WIND					

LAPSE RATE = CURRENT TEMP—6,000FEET (MSL) TEMP.

RULES OF THUMB FOR WINDS:

1. Clear skies max wind same for surface and lower 6,000 feet.
2. Low clouds need 50 knots or better lower 6,000 feet to get 35 knots at surface.
3. Rain occuring not thunderstorms, rarely get 35 knots even with a tight gradient and strong low-level jet.

1. **DUSTY WIND BOX**



A. LATE FALL TO EARLY SUMMER

B. STRONGEST IN LATE FALL TO LATE SPRING

C. 500 MB LOW MOVES DOWN NW PAC TO CENTRAL AZ. GOOD COLD POOL WITH THIS TYPE

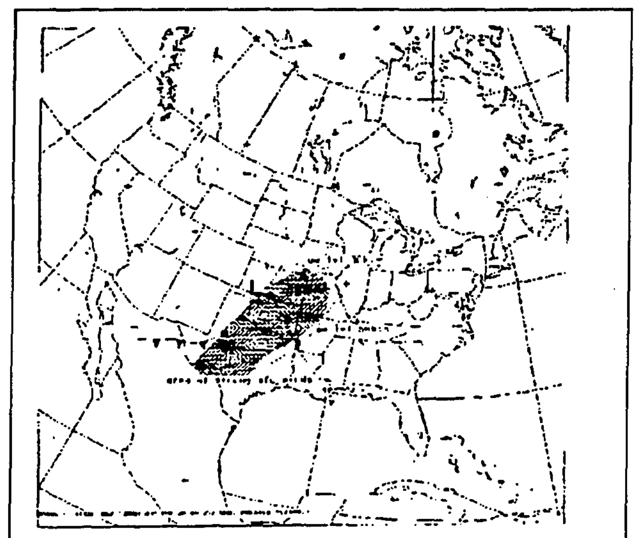
D. 700 MB JET MORE INLAND THAN 500 MB JET

F. DUAL SFC LOWS FORM IN AZ MOVING NE INTO W TX

G. OCCURS OFF LOW-LATITUDE IMPULSES ROUNDING BASE OF UPPER TROF COMING OUT SRN AZ-NM TURNING NE INTO W TX AND NW OK

H. SFC WINDS OF 45 KNOTS POSSIBLE. SFC VIS UNDER A MILE DUE TO BLOWING DUST FROM KLBB-KLTS-KEND LINE. UP TO 150 NM EACH SIDE OF THE LINE POSSIBLE.

2. **CENTRAL PLAINS WPID BOX**



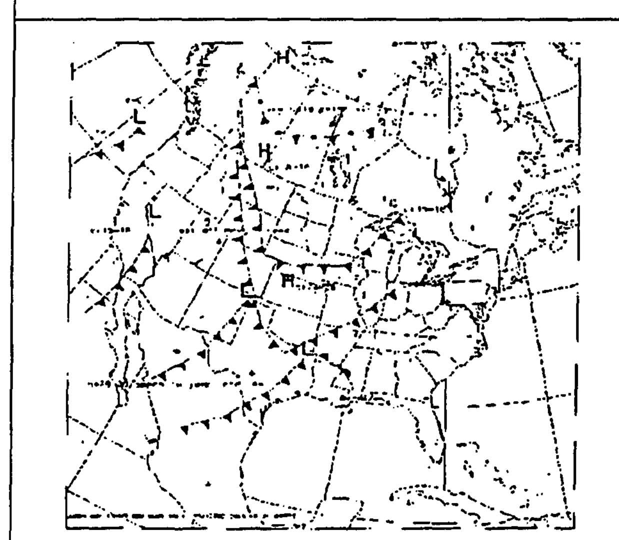
A. LATE FALL TO EARLY SUMMER

B. SFC LOW ON COLD FRONT MOVING FROM NW, SFC TROF FROM LOW CO ALONG E CO INTO E NM

C. STRONG LOW-LEVEL GRADIENT

D. GOOD CORRELATION BETWEEN SFC WINDS AND LOW-LEVEL WINDS

3. **JUMP SYSTEM WIND BOX**



A. LATE FALL TO LATE SPRING

B. STRONGEST LATE FALL TO LATE WINTER

C. THERE ARE TWO WIND FIELDS WITH THIS SYSTEM. FIRST AHEAD TROF/FRONT PAC SYSTEM WINDS SE-SW. SECOND UP 3-5 HOURS AFTER WINDS SHIFT TO NW-NE BEHIND COLD FRONT. BOTH RATED AT 100 PERCENT OF THE LOW- LEVEL WIND FIELD

D. THIS IS A HEAVY SNOW PRODUCER . LOOK FOR NOCTURNAL SNOWS/WINDS IN COLD AIR BEHIND FRONT. IT WILL BE SPREADING SOUTHWARD AND EASTWARD. USUALLY THESE SYSTEM TAKE ONLY 48 HOURS TO DROP FROM CANADA TOOK.