National Transportation Safety Board

Office of Aviation Safety
Washington, D.C. 20594-2000
October 4, 2017

ATTACHMENT 8 to the METEOROLOGY FACTUAL REPORT
CEN17FA168

Statements from three AWC forecasters on duty the night of the accident.

Submitted by: Mike Richards
NTSB, AS-30

Accident Review of Air Ambulance over Amarillo TX, 29 April, 2017, approximately 05Z.

Area Forecast (FA) - West

Forecaster: Bradley T. Regan

Title: Senior Aviation Meteorologist

Duty Hours: 3PM-11PM – Q shift

Job Responsibilities:

- Maintain a continuous weather watch and diagnosis for the Western United Sates (US) regarding cloud cover, visibilities, icing, turbulence, convection and prevailing weather conditions in support of the National Airspace System (NAS).

- Amend service product suite as necessary for representation regarding category threshold changes or possibly severe weather.

- Domain of interest includes the Rocky Mountain Front Range/eastern plains-westward to include the western US coastal waters. Service ceiling is the surface to Flight Level 450.

- Construct and issue Aeronautical Meteorological Advisories (AIRMETS) for possible areas of icing (ZULU), turbulence (TANGO), low clouds, poor visibilities and mountain obscuration (SIERRA).

- Issue Significant Meteorological Advisories (SIGMETs) to include volcanic ash for ZULU, TANGO and SIERRA AIRMETS.

- Develop a low level Nephanalysis (cloud depiction) chart Surface-fl240, depicting Visual Flight Rules (VFR), Marginal VFR (MVFR), and Instrument Flight Rules (IFR). Also included on the chart are areas of turbulence. The chart valid period being F00 + 12 hours, and F00 + 24 hours.

- Develop and Area forecast for each state and respective coastal waters for the western US . Forecast parameters to include sky cover (clouds) MVFR restrictions and prevailing weather

conditions for each geographical area. Forecast valid time F00 + 12 hours with an outlook F12 + 6 hours.

Methodology:

I employ a top down forecasting approach during the analysis phase of my product suite development. I use a forecast funnel of weather diagnosis information. I assess satellite imagery, radar, lightning fields, numerical weather guidance, observational data feeds, pilot reports (PIREPS) and pattern recognition techniques during forecast production.

I place emphasis on the problem of the day in regard to possible SIGMET issuance, high traffic areas of concern, dynamic weather systems or rapidly changing weather conditions as the situation dictates.

In regard to atmospheric turbulence, I analyze momentum fields from Jet stream level and below to gain insight toward the planetary general circulation of the day. I transition between atmospheric scales of motion and interpret Earth's cascade of energy during AIRMET TANGO development.

I analyze the most recent Numerical Weather Model Guidance fields available during AIRMET construction. Specific model algorithms used for AIRMET TANGO include the ELLROD Index, Turbulent kinetic energy fields, ULTURB which incorporates divergent tendencies, Richardson number and absolute vorticity. Also, I construct cross sections to further concentrate on altitude levels of interest.

Topography plays a major role for the western US in TANGO development. Mountainous terrain, channeling effects and the overall wind flow directions are major considerations in forecasting turbulence.

Events of concern 28 and 29 April 2017:

28 and 29 April were high impact days of concern regarding turbulence and PIREPS from the field. A dynamic weather system was migrating slowly across the western us. The energy cascade and momentum transfer were high throughout atmospheric scales of motion during this period. Eddy available potential energy was being disseminated through Eddy kinetic energy throughout the forecast domain. A deep closed Low pressure system across the Central Rockies was slowly spreading southward through 29/06z. A Jet stream core was moving across the Sierras and northern Arizona in cyclonic flow toward New Mexico the afternoon and evening of 28 April. Short wave impulse energy continued across the central and southern Rockies throughout the day as the upper level trough was migrating southward over the Four-Corners area. A 993 millibar (MB) surface low over southeast New Mexico was moving across the southern plains of the Texas Panhandle strengthening the pressure gradient.

ULTURB indices were above average indicative of moderate or greater turbulence throughout the central/southern Front Range moving into the west central Plains the evening of 28 April. ELLROD Knox guidance fields between the 700-500 MB (10,000-18,000 ft MSL) and 400-500 MB (18,000-24,000 ft MSL) layers, which take into account the wind shear production divided by air parcel buoyancy, were well above average indicative of greater than moderate turbulence in these layers across south central New Mexico spreading northeastward across the west central Plains and the Oklahoma/Texas Panhandles through 29/06Z. Turbulent Kinetic Energy (TKE) fields were also quite high over portions of eastern Colorado and the west central plains indicative of possible severe turbulence over those areas for the layers in question. The TKE and ELLROD Knox fields both strengthened 29/00Z-29/06Z for those regions outlined above.

Momentum fields (winds) for 700 MB (10,000 ft MSL) were quite strong indicating a low pressure center over central CO and a secondary Low over northern NM. The tight pressure gradient resulted in wind fields of 30-40knots across southern NM moving northeast becoming 50+kts across the northern Texas Panhandle through 29/06Z. The 850 MB (5,000 ft MSL) wind field indicated a Low pressure center over northern NM moving northeast through the period and approaching the north central TX panhandle with speeds of 40-60kts through 06Z.

The TANGO AIRMET for low level turbulence across New Mexico extended to the surface to provide situational awareness for this energy transfer. Also, I did not want any gaps in altitude coverage between high and low turbulence due to the dynamic nature of this powerful weather system (closed upper low), changing atmospheric conditions and terrain features.

Throughout the duty shift, new observational and model data updates are being continuously monitored and assessed to provide the most accurate weather intelligence available to the customer base. The entire forecast process and meteorological watch (METWATCH) responsibilities are complex issues and involve rapidly changing weather conditions, situational reports (PIREPS), collaboration and product suite updates.

The Aviation Weather Center is a World Area Forecast Center and composed of a Cadre of professionals that provide superior weather intelligence data for public dissemination. Our job is to provide public safety and resource protection on a global scale for the benefit of our partners/shareholders in aviation, the FAA and general public. To this end, we excel at our mission!

Bradley Todd Regan

Senior Aviation Meteorologist

Dennis S Nelson...Aviation Meteorologist AWC. Duty Hrs..11pm to 7am..0400-1200Z.

Job responsibilites..receive briefing from evening shift. durg first 45 min or so..look at wx info and prepare low lvl graphic for cntrl us area of responsibility. After this is done..review synoptic situation for cntrl fa area. and look at any pireps on Awips from previous shift. Review all raobs and previous fa ovr cntrl fa area. .also review airmets from evening shift valid 0300z to 0900z. Begin preparing cntrl FA fcst product around 0630z..transmit at 0945z. This was a busy night with wdsprd active wx ovr a lrg area. Prepare and transmit airmets arnd 0830z..valid 0900z to 1500z. Outside these duties maintain metwatch for cntrl fa area throughout the shift.

Sources of data for identifying turb below 10,000 ft msl btn ddc and lbb..mainly eve raobs and Nam and Ruc fcst low lvl wnds.

Since there was active tstms ovr the tx pnhdl and a convective sigmet was in effect at 0400z and 0500z..sev turb was implied and a low lvl turb airmet below 10,000 ft msl was not necesssary. When I was briefed by the previous shift..felt airmets looked good..since he was watching the wx for 8 hrs and had a good handle on things. I had no new data to justify amending the airmets from 0300z.

I dont believe NWS provides any specific guidance regarding issuance of low or hi turb airmets. Past practices and forecaster judgement both come into play when issuing airmets. Time of day..synoptic situation..terrain..;lapse rates... areas of vertical motion as well as forecaster experience all have a bearing on airmet issuance.

Declan Cannon

Aviation Meteorologist

3pm-11pm Shift

April 28, 2017

My core responsibilities during this shift included; the QC and publishing of the 21z AIRMET products, the composition of the low level prognostic chart, the composition of the FA text products for the Chicago and Dallas FA regions, and the issuance of the 03z AIRMET products. Over the course of the shift, as time allowed, I conducted a “met watch”, or monitoring, of existing products. On this particular night, an amendment was required for AIRMET Sierra around 0000z. Additionally, severe high-level turbulence was indicated over parts of the Northern Plains. A SIGMET was issued around 0120z.

The synoptic pattern featured an amplifying closed low over the four corners in the southwest CONUS. This created a pronounced mid level flow from the southern Rockies into the central plains. Below that level, a relatively benign flow existed near 10,000 ft MSL. The surface map featured a frontal boundary from the Ohio Valley to the southern TX panhandle. Several severe thunderstorm watches were issued just east and north of the region during the shift.

In the determination of low-level turbulence, I viewed several indices from the Ellrod, Ellrod-Knox, and GTG3 guidance. Although these indices are not always the best for diagnosing turbulence in the lowest layers, there was above average consensus in forecasting a pronounced area of turbulence within the 18,000 to 10,000 layer from the TX Panhandle into the central plains. Below that level, the GTG3 in the surface to 10,000 ft layer was not indicating significant turbulence. To assess the below 10,000 MSL layer I viewed soundings from several models. An inversion was evident near 6,000 to 7,000 feet over KAMA. There was a shift from NELY to SELY flow from below to above the inversion. The directional shear was somewhat greater than the forecast speed shear. My assessment of the inversion was that it was comparatively weak and therefore I was not anticipating significant turbulence. I had no pireps to indicate otherwise. The 12 hr forecast showed a pronounced directional shear below 70H by 12z the next morning. This was my reason to lower my base altitude on the AIRMET to 8000ft MSL in the outlook period. In the near surface layer, a pronounced NELY flow was well established in the cold dome behind the surface front. The latest TAF from KAMA indicated surface winds gusting to 30kts at 09z with showers and light rain developing. No thunderstorms were forecast with this TAF issuance. Although turbulence can be expected in the frontal zone it is usually more prominent when thunderstorms develop.

My contention in looking at the forecast soundings and 70/85H RAP pressure charts was that the highest threat for MDT turbulence would occur above 10k initially…and then lower to 8K ft towards the outlook part of the forecast. The short term NWP indicated strong 85H frontogenesis developing overnight south

and east of the region. My suspicion was that eventually a trend in convective development would occur in that direction in the forecast period (12 hrs). I was expecting the higher probability of convection southeast of KAMA where the low level instability was maximized according to the 85H thetae advection signals. As the forecast cycle lengthened it appeared that convection may become more elevated across the TX panhandle as height falls approached from the parent trough in the four corners and a deeper column became more unstable. The latest SWODY1 from SPC was indicating warm advection would eventually initiate development along the border between Oklahoma and the Texas panhandle.

Convective SIGMETs in the region did not play a role in the issuance of the AIRMET for turbulence since my initial thoughts were that convection would be focused south and east of the KAMA site. Generally speaking, once a convective SIGMET is warranted across a given area, the implied conditions within that product would preclude a necessity for a separate AIRMET for turbulence. As stated in the description of a convective SIGMET, *" Any convective SIGMET implies severe or greater turbulence, severe icing, and low level wind shear".*

I issued the AIRMETS around 0245z and continued to monitor PIREPS via the PIREP chat room, AWIPS alarm and NAWIPS. I do not recall any low level turbulence pireps in the Texas Panhandle. The majority of reports were high level turbulence over Kansas and Oklahoma. No amendments were issued by the AMA WFO for the existing TAF. A convective SIGMET was issued after the 0245z AIRMET for a region north and west of KAMA. Little movement was detected on the activity.