NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 30, 2013

Factual Report

METEOROLOGY

CEN13FA327

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A. ACCIDENT

Location: Mosca, Colorado
Date: June 8, 2013
Time: about 1050 mountain daylight time (1650 UTC[1])
Aircraft: Piper PA-28-140, registration: N7147R

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, DC 20594

C. SUMMARY

On June 8, 2013, at 1050 mountain daylight time, a Piper model PA-28-140 airplane, N7147R, was substantially damaged during a collision with terrain near the summit of Medano Pass, located within the Great Sand Dunes National Park and Preserve, near Mosca, Colorado. The commercial pilot was fatally injured during the accident. One passenger died on June 18, 2013, while being treated for her injuries sustained during the accident. The other passenger sustained serious injuries. The airplane was registered to and operated by a private individual, under the provisions of 14 Code of Federal Regulations Part 91, without a flight plan. The pleasure flight departed Monte Vista Municipal Airport (KMVI), Monte Vista, Colorado, about 1015, and was en route to Fremont County Airport (1V6), Cannon City, Colorado.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorological specialist was not on scene and gathered weather data for this investigation from the Washington D.C. office from official National Oceanic and Atmospheric Administration (NOAA)'s National Weather Service (NWS) sources including the National Climatic Data Center (NCDC), except where noted. All times are in mountain daylight time (MDT) on June 8, 2013 - based upon the 24-hour clock. Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Distances along the surface of the earth are calculated using the "Great Circle" formula.

Coordinates used for the accident locations: 37.85022° North latitude, -105.43528° West longitude.

[1] UTC – abbreviation for Coordinated Universal Time

E. FACTUAL INFORMATION

1. Synoptic Conditions

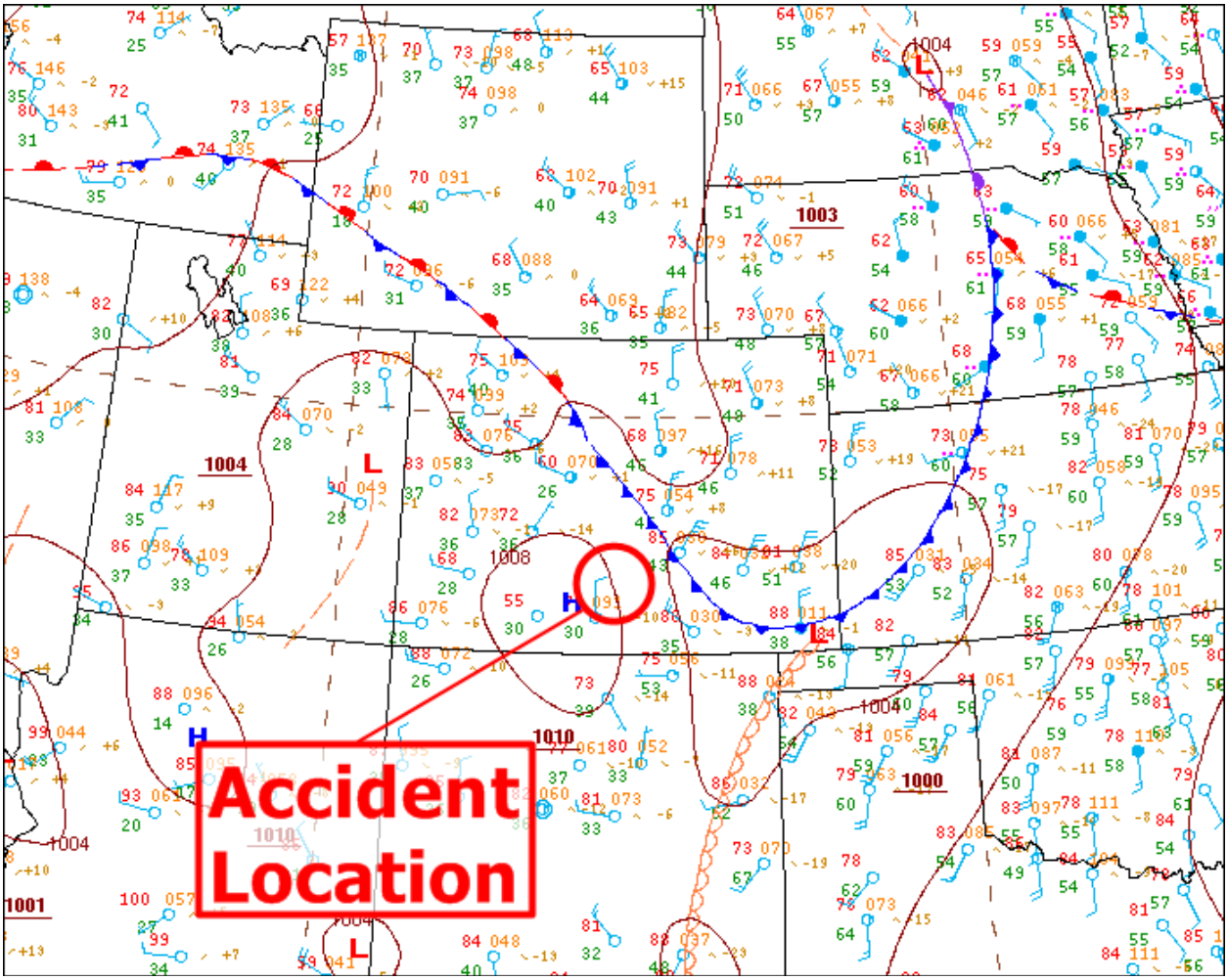

Figure 1 – NWS Surface Analysis Chart for 1200 MDT.

The NWS Surface Analysis Chart for 1200 MDT (figure 1) depicted a high-pressure center in south-central Colorado, close to the accident location. A cold front was advancing south-westward immediately northeast of the accident location. Station models ahead of the cold front depicted a relatively light and variable wind, with magnitudes on the order of 5-10 knots at many stations. Behind the cold front, station models depicted the wind from the north-northeast with magnitudes of 15-20 knots or greater.

A regional Next-Generation Radar (NEXRAD) mosaic (figure 2) obtained from the NCDC for 1050 EDT did not identify significant areas of reflectivity in the immediate vicinity of the accident site.

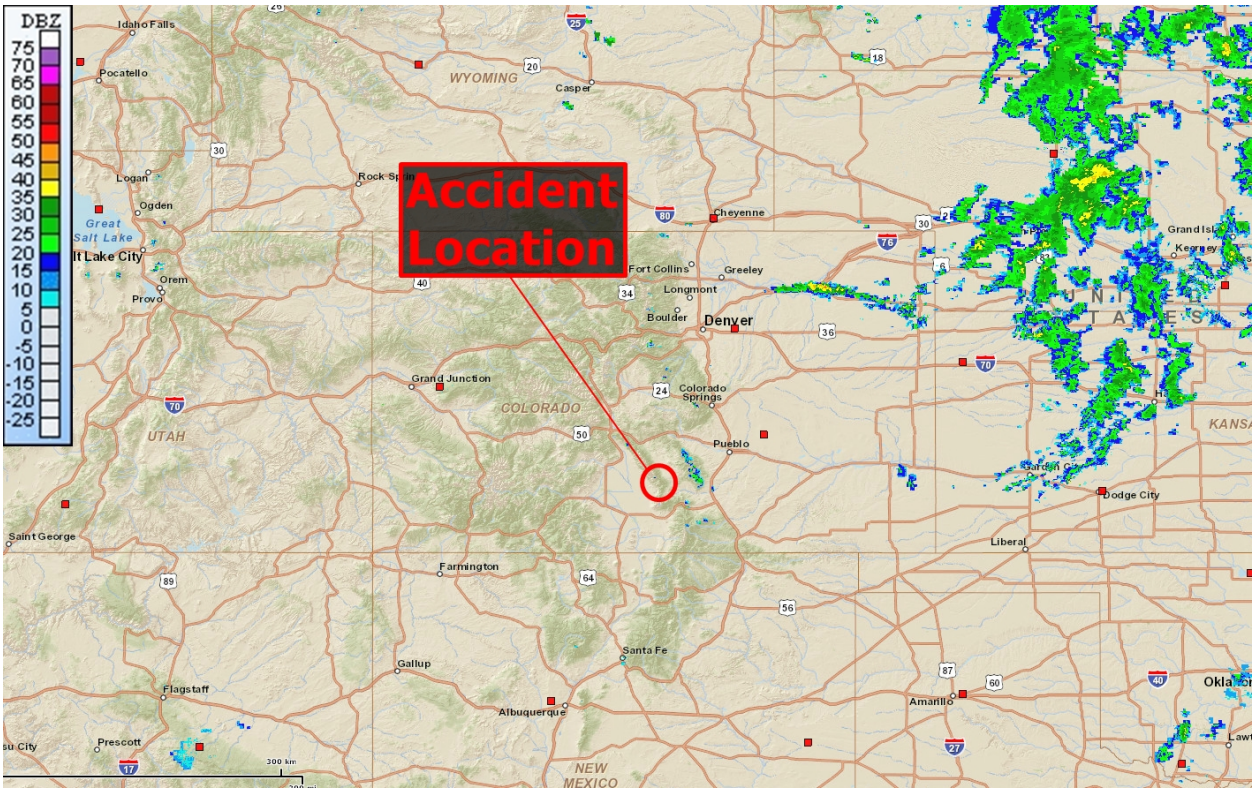

Figure 2 – NCDC NEXRAD mosaic from 1050 MDT.

2. Surface Observations

Surface wind information was gathered from official and unofficial sources in the accident region via MesoWest.[2] Note that unofficial sources have unknown maintenance and calibration. Figure 3 presents each station's most recent surface wind observations prior to 1100 MDT, and observation locations are denoted by black wind barbs. Where available, the most recent sustained wind value for a station is found as the number to the left of the station model, and wind gust magnitude is found to the right of the station model. These wind magnitude units are miles-per-hour (mph). The Real-Time Mesoscale Analysis (RTMA) 10-meter sustained wind magnitude product valid for 1100 MDT is overlaid in the bottom panel of Figure 3. The RTMA wind product only considers wind observations made within +/- 12 minutes around the product's valid time. These wind magnitude units are meters-per-second (ms^{-1}).

Wind observations in the region identified a sustained wind of 10 mph (9 knots) or less, with the station immediately to the east of accident site reporting a wind gust of 16 mph (14 knots). Wind gusts farther northeast reached 32 mph (28 knots). RTMA sustained wind magnitudes in the immediate vicinity of the accident site ranged from about 2.5 ms^{-1} (5 knots) to 5 ms^{-1} (10 knots).

[2] MesoWest is a cooperative project between researchers at the University of Utah, forecasters at the Salt Lake City NWS office, the NWS Western Region Headquarters, and personnel of participating agencies, universities, and commercial firms. Support for this project is being provided by the NWS.

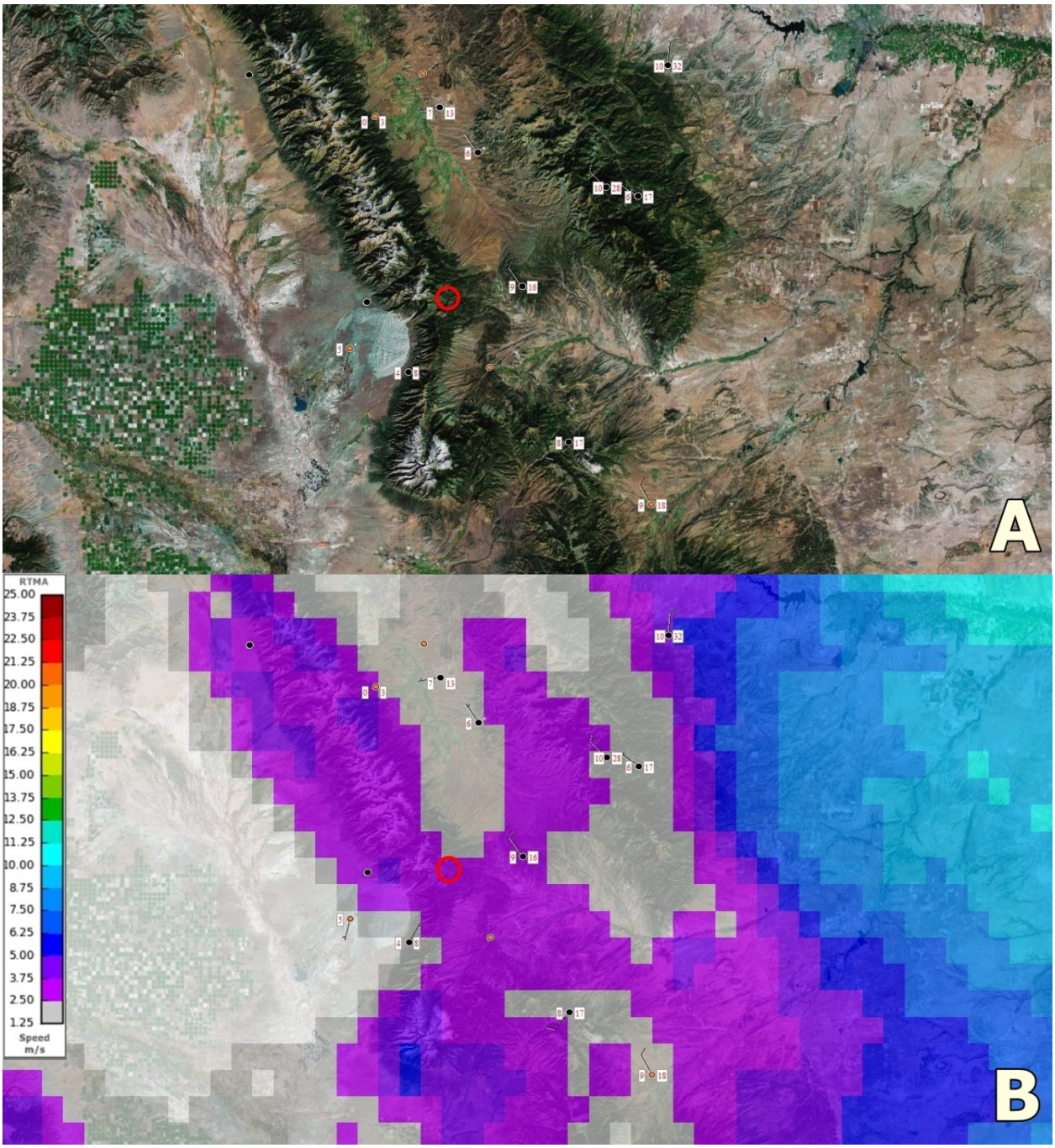

Figure 3 – [Top Panel] Plot of most recent surface wind observations from weather stations in the accident region prior to 1100 MDT. Sustained wind magnitudes are found to the left of the station models, wind gust magnitudes are found to the right where available (sustained and gust values in units of mph). [Bottom Panel] Color overlay of RTMA wind magnitudes at 1100 MDT (units of ms^{-1}). Accident location is indicated by the red circles.

San Luis Valley Regional Airport/Bergman Field (KALS) in Alamosa, Colorado, was located approximately 32 miles southwest of the accident site at an elevation of 7,539 feet. The following automated reports were issued from KALS during the time period surrounding the accident time:

[0852 MDT] METAR KALS 081452Z AUTO 00000KT 10SM CLR 11/02 A3010 RMK AO2 SLP123 T01060022 53005=

[0952 MDT] METAR KALS 081552Z AUTO 00000KT 10SM CLR 16/03 A3010 RMK AO2 SLP112 T01610028=

[1052 MDT] METAR KALS 081652Z AUTO 35007KT 10SM CLR 21/00 A3008 RMK AO2 SLP098 T02110000=

[1152 MDT] METAR KALS 081752Z AUTO 36009G15KT 10SM CLR 24/M01 A3006 RMK AO2 SLP091 T02391011 10244 20044 58010=

At 1052 MDT, KALS reported a wind of 7 knots from 350°, visibility of 10 miles or greater, clear sky conditions, temperature of 21º Celsius (C), dew point temperature of 0ºC, altimeter setting 30.08 inches of mercury. Remarks: station with a precipitation discriminator, sea-level pressure of 1009.8 hectopascals (hPa), hourly temperature of 21.1ºC and hourly dew point temperature of 0.0ºC.

Pueblo Memorial Airport (KPUB) in Pueblo, Colorado, was located approximately 52 miles northeast-east of the accident site at an elevation of 4,729 feet. The following human-augmented reports were issued from KPUB during the time period surrounding the accident time:

[0853 MDT] METAR KPUB 081453Z 28011G14KT 10SM CLR 25/04 A2980 RMK AO2 SLP025 T02500039 56007

[0913 MDT] SPECI KPUB 081513Z 28020G25KT 10SM CLR 29/01 A2979 RMK AO2 WSHFT 1453

[0953 MDT] METAR KPUB 081553Z 31019G25KT 10SM CLR 31/M01 A2979 RMK AO2 PK WND 29029/1532 WSHFT 1453 SLP018 T03061006

[1012 MDT] SPECI KPUB 081612Z 36017G25KT 10SM CLR 31/M01 A2979 RMK AO2 WSHFT 1552

[1053 MDT] METAR KPUB 081653Z 01020G27KT 10SM CLR 32/01 A2980 RMK AO2 PK WND 02027/1653 WSHFT 1552 SLP020 T03170006

[1153 MDT] METAR KPUB 081753Z 03025G31KT 10SM CLR 29/06 A2982 RMK AO2 PK WND 02032/1742 SLP030 T02940061 10317 20117 53006

1253 MDT] METAR KPUB 081853Z 03020G32KT 10SM CLR 29/07 A2983 RMK AO2 PK WND 03035/1834 SLP041 T02890067

At 1053 MDT, KPUB reported a wind of 20 knots from 010° with gusts to 27 knots, visibility of 10 miles or greater, clear sky conditions, temperature of 32ºC, dew point temperature of 1ºC, altimeter setting 29.80 inches of mercury. Remarks: station with a precipitation discriminator,

peak wind of 27 knots from 020° at 1053 MDT, wind shift at 0952 MDT, sea-level pressure of 1002.0 hPa, hourly temperature of 31.7ºC and hourly dew point temperature of 0.6ºC.

3. Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-15 visible (0.65µm) data were obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison (UW) in Madison, Wisconsin, and processed using the Man computer Interactive Data Access System (McIDAS). Imagery from 1045 MDT is presented in figure 4. This imagery identified generally clear conditions at the accident location. A loop of satellite imagery over the previous hour indicated the potential for some very thin cloud in the area of the accident location. Height of this thin cloud was not determined. It should be noted that satellite data presented in this section have not been corrected for any parallax error.

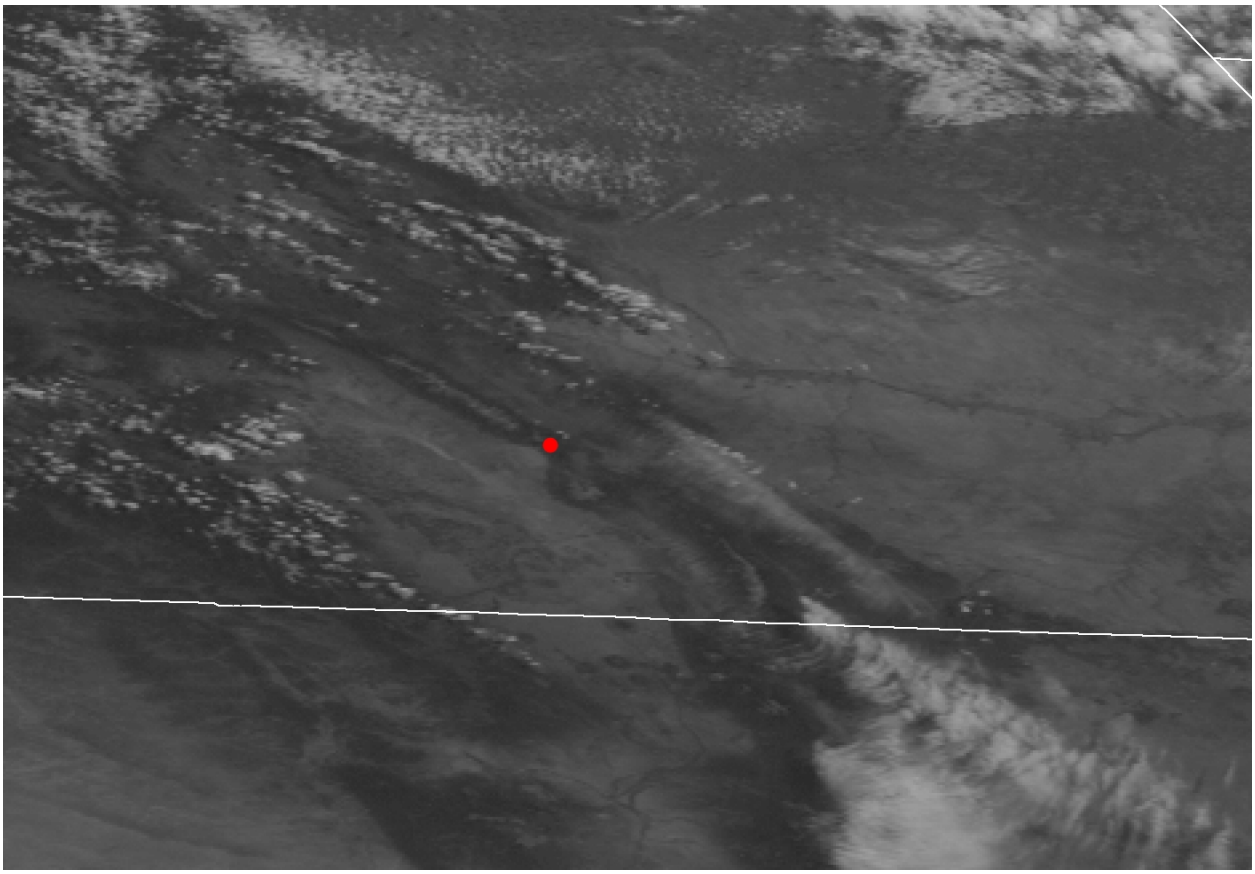

Figure 4 – GOES-15 0.65µm (visible) grayscale imagery from 1045 MDT. Red dot denotes accident location.

4. Model Data

A Weather Research and Forecasting Model (WRF) simulation was run to estimate wind magnitudes (knots), and turbulence (Richardson number [*Ri*]) in the area of the accident. These data are presented in figures 5 and 7. Advanced Research WRF version 3.2.1.5 was run with 3 domains with horizontal grid spacing of 8 kilometers (km), 1.6 km, and 320 meters over the accident site. Other WRF simulation parameters included: 50 vertical levels, a Lin et al. microphysics scheme, a Yonsei University boundary layer scheme, and Noah land surface physics. A Kain-Fritsch cumulus parameterization scheme was used on the 8-km domain.

Figure 5 presents WRF simulated horizontal components of sustained wind magnitude and wind direction at 710 hPa for the accident region. According to the International Standard Atmosphere (ISA), 710 hPa is located at approximately 9,500 feet above msl. At 710 hPa above the accident location, the wind was from the west between 20-24 knots. Of note is the increase of the horizontal wind vector as one passes from the west side to the east side of the mountain range (figure 6).

Figure 7 presents a southwest-to-northeast vertical cross-section of *Ri* through a mountain pass and close to the accident site. In general, values of *Ri* below 700 hPa (about 10,000 feet msl according to the ISA) indicated a significant potential for turbulence in, and downwind of the pass. While specific values of *Ri* cannot be equated with certain severities of aircraft-scale turbulence and scientific literature does suggest varying thresholds of *Ri* for onset of turbulence, it is generally accepted that values of *Ri* less than 1.0 indicate a potential for turbulence while values less than 0.25 suggest a likelihood for turbulence. Boundaries of the vertical slice (points A and B in figure 7) are presented in figure 8.

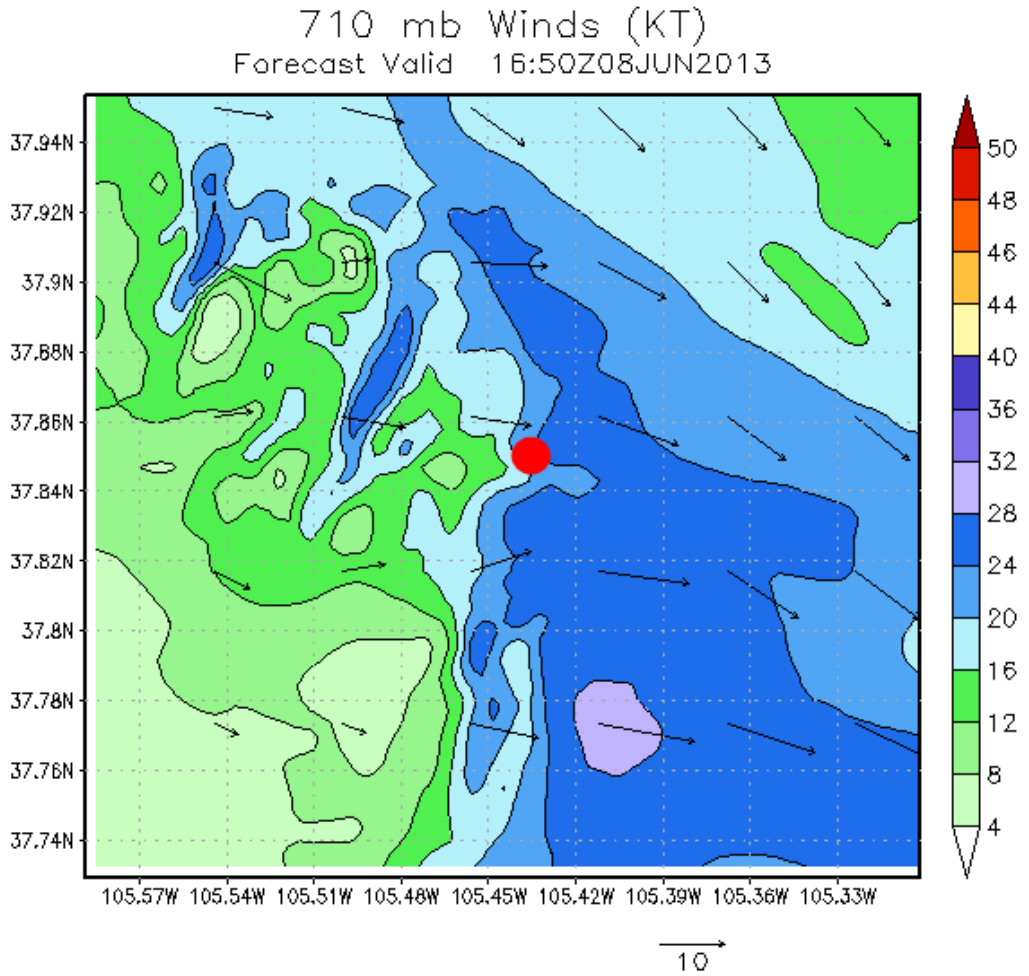

Figure 5 – WRF 710 hPa sustained wind magnitude and direction at 1050 MDT. Accident site denoted by red circle.

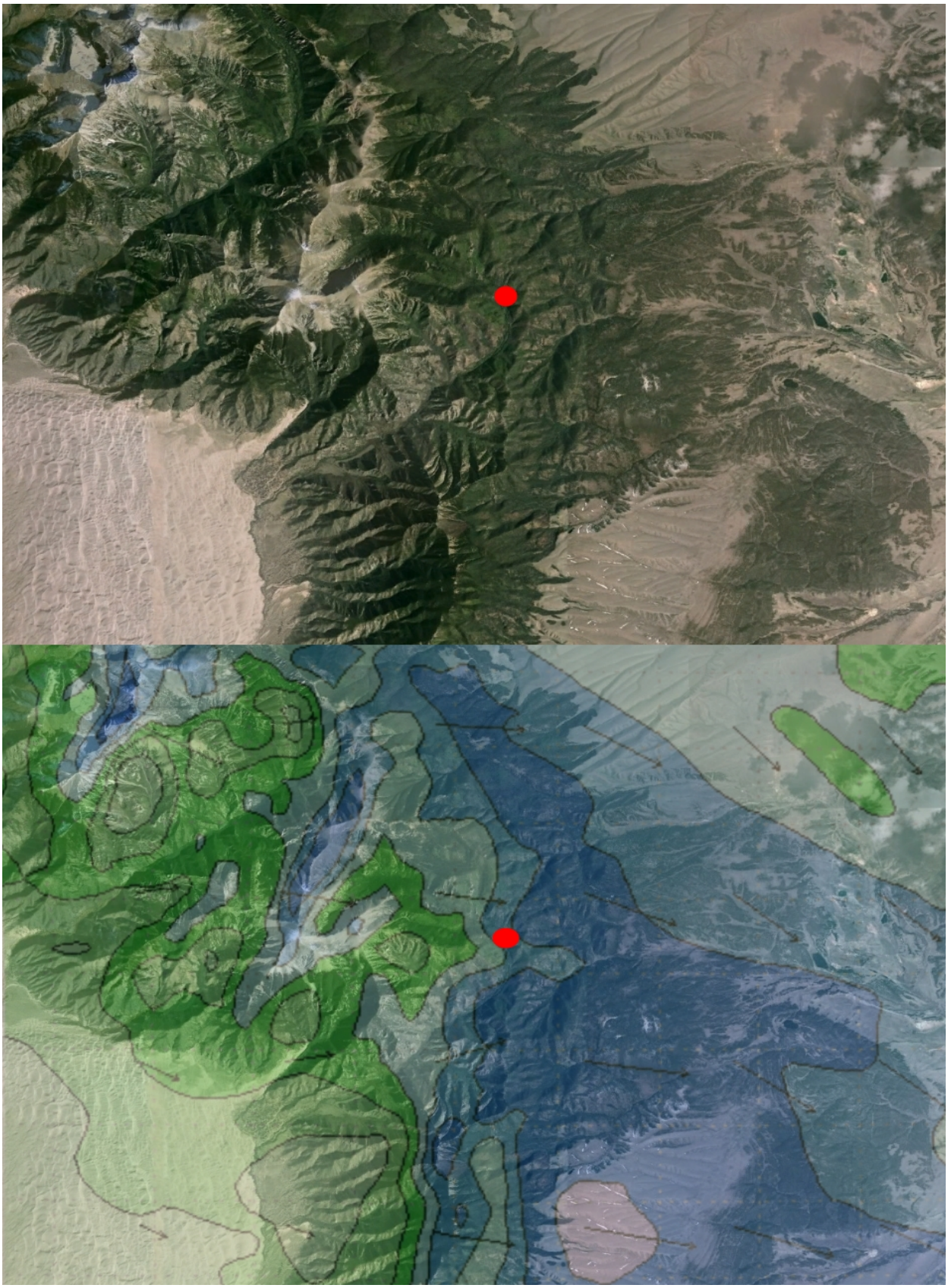

Figure 6 – Accident location terrain (top). Image in figure 5 overlaid onto terrain (bottom).

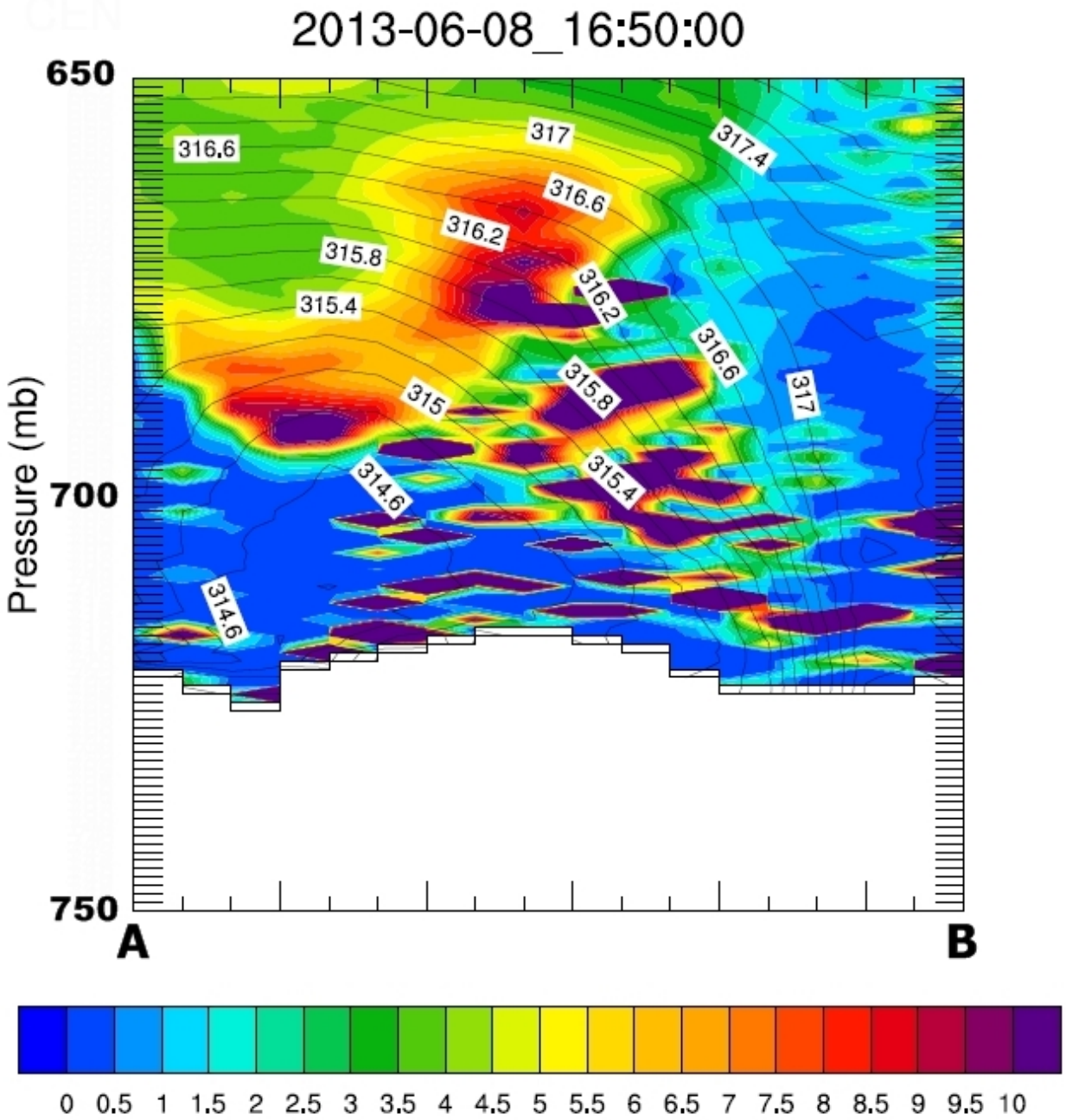

Figure 7 – WRF vertical cross-section of *Ri* (colors) and potential temperature (contours in units Kelvin) at 1050 MDT. Boundaries plotted in figure 8.

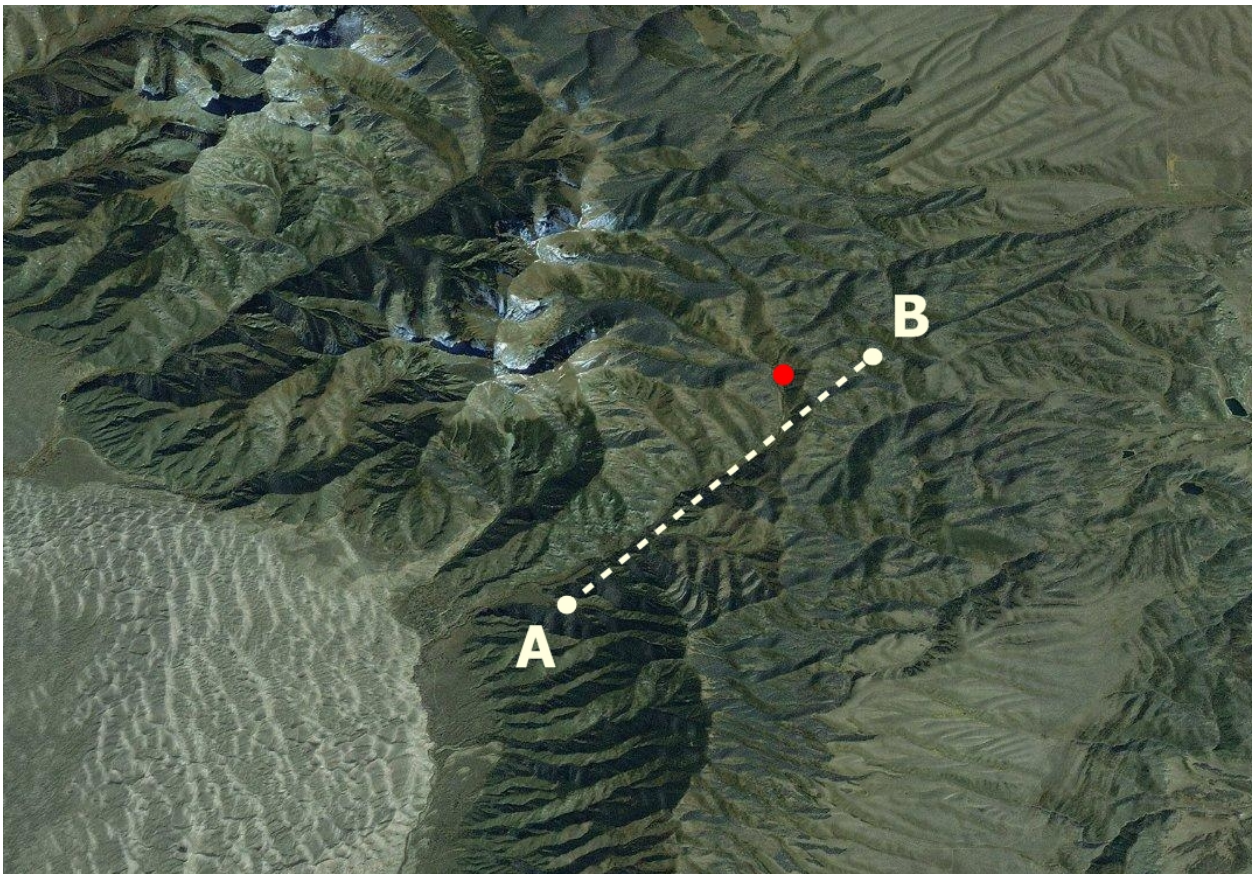

Figure 8 – Boundaries of vertical cross-section in figure 7. Accident location denoted by red circle.

5. Pilot Reports

Publically disseminated pilot reports[3] made within about three hours of the accident time and about 100 miles of the accident location are presented here. Of note are several reports of wave action in the region.

GUC UA /OV HBU005035/TM 1351/FL380/TP CRJ7/TB LGT /RM MOD MTN WAVE + - 100 FPM ZDV=

LIC UA /OV DEN135045 /TM 1430 /FLUNKN /TP B737 /TB MOD 210-150 /RM DURD=

COS UA /OV BRK 270040/TM 1435/FL380/TP B757/TB MOD/RM ZDV=

ALS UA /OV ALS360015/TM 1453/FL380/TP A319/TB MOD TURB/RM ZDV=

CEZ UA /OV DVC/TM 1454/FL370/TP B737/TB SMTH/RM REPORTED 25W DVC AWC-WEB:SWA=

[3] Only pilot reports distributed with the UBCO** and UBNM** headers were considered.

ALS UA /OV ALS080030/TM 1454/FL400/TP B737/TB MOD CHOP/RM ZDV=

COS UA /OV BRK/TM 1528/FL370/TP B737/TB SMTH/RM REPORTED 10S BRK AWC-WEB:SWA=

ALS UA /OV ALS004030/TM 1626/FL380/TP B737/TB OCNL LGT CHOP 380/RM AWC-WEB:SWA=

GUC UA /OV HBU/TM 1648/FL450/TP C750/TB OCNL LGT-MOD TURB/RM CONDITIONS EXIST FROM HBU-BRK270025.....ZDV.....ZDV=

PUB UA /OV DVC270030-HBU090130 /TM 1652 /FL450 /TP C750 /TA M54 /WV 35035KT /TB LGT-MOD /RM CONS /SCT LYR BLO=

PUB UA /OV PUB/TM 1718/FL390/TP B737/TB SMTH/RM REPORTED 25N PUB..VERY LGT WAVE OV MTNS +/-60FT..A FEW BUMPS AWC-WEB:SWA=

DEN UA /OV DEN250045/TM 1745/FL170/TP CRJ2/TB LGT-MDT/RM DURC FL170-FL220 FM ZDV=

AKO UA /OV AKO270020/TM 1750/FL180/TP B190/TA -8/IC LGT RIME/RM ZDV.....ZDV=

PUB UA /OV PUB250025/TM 1905/FL190/TP BE40/TA 02/IC LGT RIME/RM ZDV=

6. Area Forecast

An Area Forecast that included Colorado was issued at 0445 MDT. The portion of the Area Forecast directed toward the southern half of Colorado forecasted for the accident time: scattered cirrus. The portion of the Area Forecast directed toward the mountains east of the Continental Divide in the southern one-third of the state forecasted for the accident time: scattered clouds at 12,000 feet msl and scattered cirrus.

FAUS45 KKCI 081045
FA5W
_SLCC FA 081045
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 090500
CLDS/WX VALID UNTIL 082300...OTLK VALID 082300-090500
ID MT WY NV UT CO AZ NM
.
SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.
.
SYNOPSIS...ALF..11Z NWLY MOD-STG JTST FLOW CONTS ACRS NRN PTNS RGN DUE TO PERSISTENT UPR RDG OVR PAC NW. SEVERAL SHRTWV TROFS WL CONTINUE TO TRANSIT N AND ERN PTNS OF RGN. UPR TROF

EXTDG FM SERN MAN SEWD THRU CNTRL PLAIN STATES. BY 05Z RDG SLOWLY BLDS EWD ACRS CNTRL-SRN SXNS...SFC..11Z HI PRES BLDG ACRS ID-MT-WY AS CDFNT AND ASSOC FNTL SYS CONTS EWD. CDFNT ALG BIS-RAP-OCS-BVL LN. SFC TROF ALG CO/NM ERN PLAINS. LOW PRES SWRN AZ. BY 05Z HI PRES DMNT ACRS MOST RGN WITH CDFNT DRAPED ACRS NRN NM.
.
CO
PLAINS
N HLF...SCT CI. OTLK...VFR.
S HLF...BKN120 LYRD FL240. **14Z SCT CI.** 21Z BKN150 TOP FL330.
OTLK...VFR TSRA...03Z VFR.
MTNS E OF CONTDVD
N 2/3...SCT CI. 17Z SCT150. OTLK...VFR.
S 1/3...SCT120 SCT CI. 23Z BKN120 LYRD FL300. WDLY SCT -SHRA/ISOL -TSRA. CB TOP FL410. OTLK...VFR TIL 03Z SHRA.
MTNS W OF CONTDVD...SKC OR SCT CI. 18Z SCT170. WND NW G25KT. OTLK...VFR.

7. Aviation Section of the Area Forecast Discussion

An Area Forecast Discussion (AFD) was issued at 0357 MDT by the NWS Weather Forecast Office (WFO) in Pueblo, Colorado (KPUB). The aviation portion of the AFD, which was issued at 0303 MDT, is presented here.

FXUS65 KPUB 080957
AFDPUB
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE PUEBLO CO
357 AM MDT SAT JUN 8 2013

.AVIATION...(FOR THE 12Z TAFS THROUGH 12Z SUNDAY MORNING)
ISSUED AT 303 AM MDT SAT JUN 8 2013
VFR CONDITIONS ARE EXPECTED AT KCOS...KPUB AND KALS TODAY AND TONIGHT. ISOLD SHOWERS/TSTMS COULD MOVE INTO THE VCNTY OF KCOS AND KPUB THIS AFTERNOON/EARLY EVENING...WHICH COULD BRING SOME ERRATIC GUSTY OUTFLOW WINDS.

8. AIRMETs

There were no Airmen's Meteorological Information (AIRMET) advisories active below FL180[4] for the accident location at the accident time.

[4] Flight Level (FL) - standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the

9. SIGMETs

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories active for the accident location at the accident time.

10. Additional NWS Products

There were no additional applicable watches, warnings or advisories issued by the KPUB WFO.

11. CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the Center Weather Service Unit (CWSU) at the Denver Air Route Traffic Control Center that were applicable to the accident location at the accident time.

12. Astronomical Data

The astronomical data obtained from the United States Naval Observatory for 37.9°N and 105.4°W, indicated the following:

SUN	
Sunrise	0539 MDT
Sunset	2023 MDT
MOON	
Moonrise	0548 MDT
Moonset	2028 MDT

Submitted by: Mike Richards
NTSB, AS-30

International standard atmosphere using 1013.25 hPa (29.92 in Hg) for surface pressure.