NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington D.C. 20594

Meteorological Factual Report
DCA01MA034

A. ACCIDENT

Location: Aspen, Colorado (KASE)
Date: March 29, 2001
Time: 1902 Mountain Standard Time (MST)
Aircraft: Gulfstream III, N303GA

B. WEATHER GROUP

A Weather Group was not established.

C. SUMMARY

On March 29, 2001, at 1902 Mountain Standard Time (MST) time, a Gulfstream III, registration number N303GA, operated by AVJET Corp., collided with terrain about 0.4 miles northwest of the Aspen-Pitkin County Airport, Aspen, Colorado. The airplane was destroyed and the flight crew of 2, one flight attendant, and all 15 passengers were fatally injured during impact with sloping terrain. The accident site was about 100 feet above the airport elevation of 7,815 feet. The flight had arrived under Instrument Flight Rules and had reported the airport in sight. The flight was operating as an IFR flight under FAR Part 135 operations. The weather at 1853 was wind 250 degrees at 3 knots, visibility 10 miles, light snow, few clouds at 1,500 feet, ceiling 2,500 feet broken, 5,000 feet broken. Approximately 10 minutes after the accident the visibility decreased to 1¾ miles in light snow.

D. DETAILS OF INVESTIGATION

Note: All times are stated as Mountain Standard Time (MST) based on the 24-hour clock unless otherwise noted. All heights above mean sea level (MSL) unless noted. Heights in surface weather observations and terminal forecast above ground level (AGL). All directions with reference to true north unless noted. Z = Coordinated Universal Time.
Z = MST + 7 hours. All distances in statute miles unless noted.

McIDAS - **M**an **c**omputer **I**nteractive **D**ata **A**ccess **S**ystem. McIDAS is an interactive meteorological analysis and data management computer system. McIDAS is administered by personnel at the Space Science and Engineering Center at the University of Wisconsin at

Madison. Data are accessed and reviewed on a Hewlett Packard 9000/C110 Workstation running McIDAS-X software.

Accident location: North latitude 39 degrees 14.278 minutes and west longitude 106 degrees 52.621 minutes.

Synoptic Situation

The National Weather Service (NWS) Surface Analysis for March 29, 2001 at 1700 MST showed a weak cold front extending from southwest Colorado through northeast Colorado. KASE was located to the west of the front. The NWS Surface Analysis for March 29, 2001 at 2000 MST showed this weak cold front decreasing in intensity. High pressure was located in north central Colorado.

Attachments 1 and 2 … NWS Surface Weather Analysis charts.

Weather Depiction Charts

National Weather Service Weather Depiction Charts for March 29, 2001 at 1200 MST, 1500 MST, 1800 MST, and 2100 MST are contained as Attachments 3 – 6.

Surface Weather Observations

There is an Automated Surface Observing System (ASOS) at KASE. The ASOS Sensors Group is located just to the east of the approach end of runway 15; about 3,396 feet southeast of the accident site. The ASOS pressure sensors are located in the ASOS Acquisition Control Unit (ACU) in the KASE Air Traffic Control Tower. Backup and augmentation of the ASOS observations are made by weather observation certified Air Traffic Control personnel in the KASE Air Traffic Control Tower. KASE is a Service Level C ASOS site.

Definition of Service Levels …(source: http://www.faa.gov/asos/asosserv.htm)
Service Level D. This level of service consists of an ASOS continually measuring the atmosphere at a point near the runway. The ASOS sense and measures the following weather parameters: Wind, Visibility, Precipitation/Obstructions to Vision, Cloud Height, Sky Cover, Temperature, Dew Point and Altimeter.

Service Level C. This level consists of all the elements of Service Level D, plus augmentation and backup by a human observer on location nearby. Backup consists of inserting the correct value if the system malfunctions or is unrepresentative. Augmentation consists of adding the following elements, if observed: Thunderstorms, Tornadoes, Hail, Virga, Volcanic Ash, Tower Visibility, any operationally significant

remarks as deemed appropriate by the observer. During the hours that the observing facility is closed, the site reverts to Service Level D.

The KASE ASOS was inspected by the NWS (Grand Junction, Colorado, Office) on November 21, 2000. The site was rated as satisfactory. See Attachments 7 – 10 for Inspection Reports.

The Maintenance Activity Report (EMRS) for the KASE ASOS covering the period April, 2000, through March, 2001 was reviewed. The last corrective maintenance action prior to the accident was opened on March 21, 2001. The action dealt with a dewpoint error which was cleared on March 22, 2001.

See Attachments 11 - 14 for the Maintenance Activity Report (EMRS) for KASE.

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The following are the KASE ASOS observations for March 29, 2001 …

1753:26 MST … METAR … Winds 030 degrees at 4 knots; visibility 10 miles; 2,000 feet scattered, ceiling 5,500 feet broken, 9,000 feet broken; temperature 2 degrees C; dew point –3 degrees C; altimeter setting 29.86 inches of Hg.; rain ended 1750 MST; a trace of precipitation (< 0.01 inch) recorded between 1653:26 MST and 1753:26 MST.

1853:26 MST … METAR … Winds 250 degrees at 3 knots; visibility 10 miles; light snow; few clouds (> 0 to 2 octas cloud coverage) at 1,500 feet, ceiling 2,500 feet broken, 5,000 feet broken; temperature 1 degree C; dew point –3 degrees C; altimeter setting 29.88 inches of Hg.; snow began 1851 MST; visibility to the north 2 miles (the restriction to visibility was due to snow showers … from Air Traffic Controller interview); a trace of precipitation recorded between 1753:26 MST and 1853:26 MST.

1912:26 MST … SPECI … Winds 060 degrees at 3 knots; visibility 1 ¾ miles; light snow; few clouds at 1,500 feet, ceiling 2,500 feet broken, 5,500 feet broken; temperature 1 degree C; dew point –2 degrees C; altimeter setting 29.89 inches of Hg.; visibility to the north 2 miles; a trace of precipitation recorded between 1853:26 MST and 1912:26 MST.

1920:26 MST … SPECI … Winds calm; visibility 3 miles; light snow, mist; few clouds at 1,500 feet, ceiling 2,500 feet broken, 5,500 feet broken; temperature 0 degree C; dew point –2 degrees C; altimeter setting 29.89 inches of Hg.; visibility to the north 2 miles; a trace of precipitation recorded between 1853:26 MST and 1920:26 MST.

METAR … Aviation Routine Weather Report.
SPECI … Aviation Selected Special Weather Report.

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The following was obtained from a review of the ASOS Observations and Edit Log by an individual of the National Weather Service (see Attachments 15 and 16):

3/29/2001 1753:26 MST … **METAR KASE 300053Z** … Winds 030 degrees at 4 knots; visibility 10 miles; 2,000 feet scattered, ceiling 5,500 feet broken, 9,000 feet broken; temperature 2 degrees C; dew point –3 degrees C; altimeter setting 29.86 inches of Hg.; rain ended 1750 MST; a trace of precipitation (< 0.01 inch) between 1653 MST and 1753 MST. (KC).

3/29/2001 1817:05 MST … KC logged off as observer from OID#2 (Operator Interface Device #2).
3/29/2001 1817:05 MST … LG logged on as observer from OID#2.
3/29/2001 1845:41 MST … Reset Sky edit auto 3,800 feet scattered, 4,900 feet broken, 6,000 feet overcast.
3/29/2001 1850:29 MST … Edited manual Remarks visibility north 2 miles.
3/29/2001 1850:33 MST … Edited Sky auto 3,800 feet broken, 5,000 feet overcast to few clouds at 1,500 feet, 2,500 feet broken, 5,000 feet broken.
3/29/2001 1850:33 MST … Edited Present Weather null auto null to new light snow.

3/29/2001 1853:26 MST … **METAR KASE 300153Z** … Winds 250 degrees at 3 knots; visibility 10 miles; light snow; few clouds at 1,500 feet, ceiling 2,500 feet broken, 5,000 feet broken; temperature 1 degree C; dew point –3 degrees C; altimeter setting 29.88 inches of Hg.; snow began 1851 MST; visibility to the north 2 miles; a trace of precipitation between 1753 MST and 1853 MST. (LG).

Discussion: After the hourly-METAR report is transmitted, the Sky and Remarks fields are reset to automated mode. The Present Weather field is not reset and remains in manual mode.

3/29/2001 1855:58 MST … Edited manual Remarks visibility north 2 miles.
3/29/2001 1856:01 MST … Edited Sky auto few clouds at 3,100 feet, 3,800 feet broken, 5,500 feet overcast to few clouds at 1,500 feet, 2,500 feet broken, 5,500 feet broken.
3/29/2001 1856:22 MST … Auto special observation cancelled **SPECI KASE 300155Z** … Winds calm; visibility 10 miles; light snow; few clouds at 3,100 feet, 3,800 feet broken, 5,500 feet overcast; temperature 1 degree C; dew point –3 degrees C; altimeter setting 29.88 inches of Hg.

Discussion: The observer re-edits the manual Remarks field and changes the Sky field from few clouds at 3,100 feet, 3,800 feet broken, 5,500 feet overcast to few clouds at 1,500 feet, 2,500 feet broken, 5,500 feet broken. This cancels the pending special (SPECI) since the hourly-METAR had a ceiling of 2,500 feet broken, the automated ceiling was 3,800 feet broken which generated the SPECI, and the observer returns the ceiling to 2,500 feet broken.

3/29/2001 1912:26 MST … **SPECI KASE 300212Z** … Winds 060 degrees at 3 knots; visibility 1 ¾ miles; light snow; few clouds at 1,500 feet, ceiling 2,500 feet broken, 5,500

feet broken; temperature 1 degree C; dew point –2 degrees C; altimeter setting 29.89 inches of Hg.; visibility to the north 2 miles; a trace of precipitation between 1853 MST and 1912 MST. (LG).

3/29/2001 1916:13 MST … LG logged off as observer from OID#2.

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Five Minute KASE ASOS observations ….

1855:31 MST … Winds calm; visibility 10 miles; light snow; few clouds at 3,100 feet, ceiling broken at 3,800 feet, 5,500 feet overcast; temperature 1 degree C; dew point –3 degrees C; altimeter setting 29.88 inches of Hg.

1900:31 MST … Winds calm; visibility 9 miles; light snow; few clouds at 1,500 feet, ceiling 2,500 feet broken, 5,500 feet broken; temperature 1 degree C; dew point –3 degrees C; altimeter setting 29.88 inches of Hg.; visibility to the north 2 miles.

1905:31 MST … Winds 030 degrees at 6 knots; visibility 6 miles; light snow; few clouds at 1,500 feet, ceiling broken at 2,500 feet, 5,500 feet broken; temperature 1 degree C; dew point –3 degrees C; altimeter setting 29.88 inches of Hg.; visibility to the north 2 miles.

Attachments 17 - 33 … KASE ASOS Surface Weather Observations data, Edit Log, and Systems Log.

Attachments 34 - 38 … KASE Surface Weather Observations forms.

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1-Minute KASE ASOS Visibility Values and Extinction Coefficients (EC) … From the National Weather Service (Table A).

See Attachments 39 and 40.

Table A

Time (MST)	ASOS Visibility (miles)	EC (per kilometer)
18:55	10	0.069
18:56	9	0.073
18:57	9	0.070
18:58	9	0.084
18:59	9	0.129
19:00	9	0.181
19:01	9	0.306
19:02	8	0.328

19:03	8	0.220
19:04	7	0.673
19:05	6	1.304
19:06	4	1.764
19:07	4	1.829
19:08	3	1.911
19:09	2 ½	2.105
19:10	2	1.900
19:11	2	2.040
19:12	1 ¾	1.613
19:13	1 ¾	1.329
19:14	1 ¾	1.121
19:15	1 ¾	0.848
19:16	1 ¾	0.693
19:17	2	0.585

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The NTSB requested that the National Weather Service (NWS) derive the visibility for the period 1855 MST through 1905 MST. The NWS notes that the results below (Table B) are the 1-minute visibility value, in miles, for each 1-minute extinction coefficient and not the ASOS values that would have been reported for each minute using the ASOS algorithms (see Table A above). ASOS uses a 10-minute sampling period to compute a reportable value.

Table B

Time (MST)	1-Minute Derived Visibility (miles) from Extinction Coefficient
18:55	9.0
18:56	9.0
18:57	9.0
18:58	9.0
18:59	9.0
19:00	9.0
19:01	6.73
19:02	6.37
19:03	8.71
19:04	3.58
19:05	2.08

Attachment 41 … NWS derived visibility data from 1-minute ASOS extinction coefficients..

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NTSB calculations of visibility values based on 1-minute KASE ASOS extinction coefficients (see Table C).

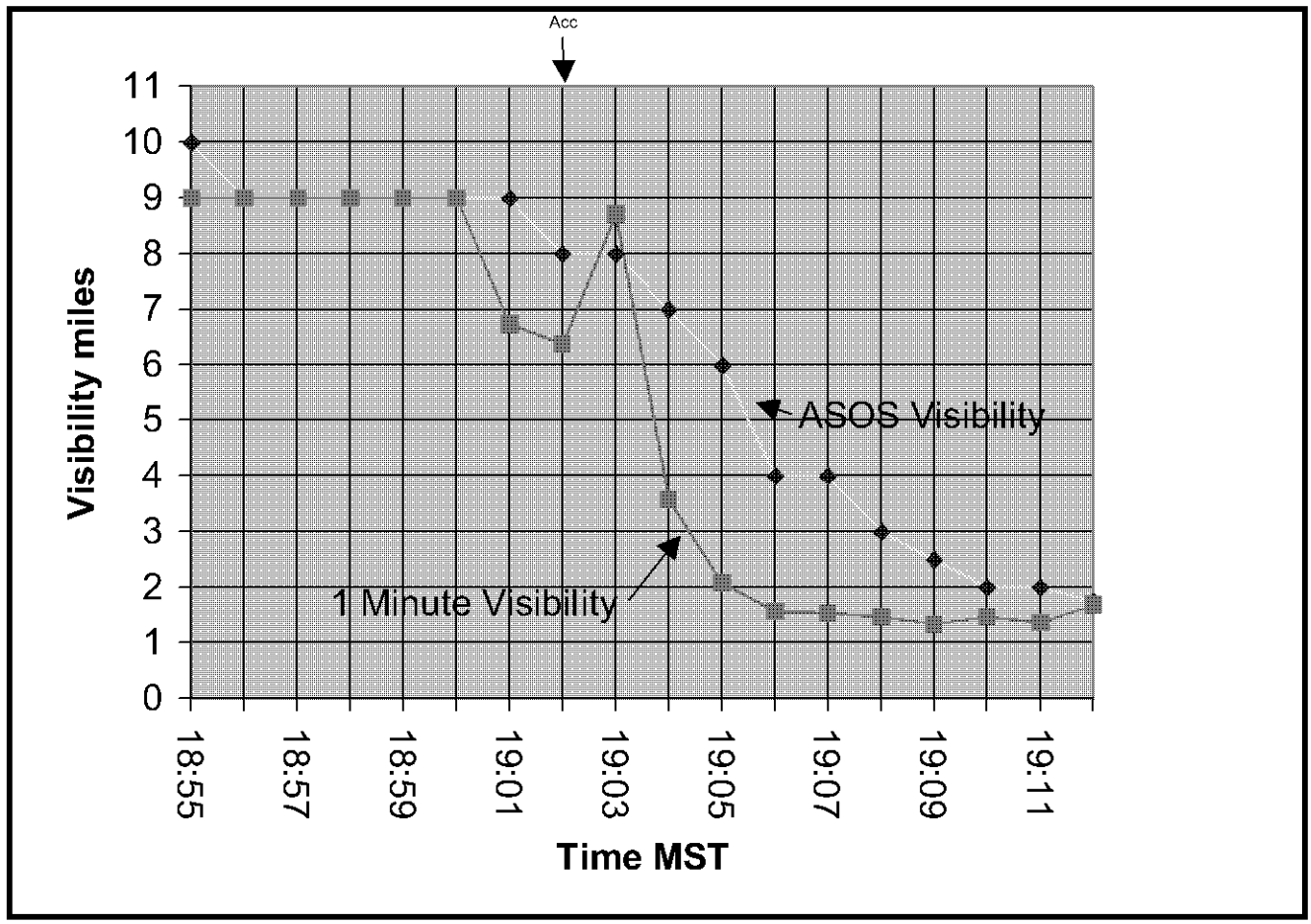
Method of calculation:

Estimated visibility values (miles) based on 1-minute KASE ASOS extinction coefficients.
Equation (night): 0.0036*V = exp(-EC*V).
V = Visibility in miles.
EC = Extinction Coefficient per kilometer (divide EC by .62137 kilometer per mile to get EC per mile).
Equation cannot be solved exactly. Values of V as a function of EC were estimated using a Graphics Calculator (http://id.mind.net/~zona/ezGraph/ezGraph.html). Method: Find the intersection of the point of the line y = 0.0036*x with the curve y = exp(-EC*x). Specify values of EC and read off values of x. Multiply values by 0.9 (light snow reported). Table C lists V and Times.

Table C

Time (MST)	Estimated Visibility from 1-Minute Extinction Coefficients
19:06	1.57
19:07	1.53
19:08	1.47
19:09	1.34
19:10	1.47
19:11	1.37
19:12	1.69

Plot A
ASOS Visibility and 1-Minute Derived Visibility as a Function of Time



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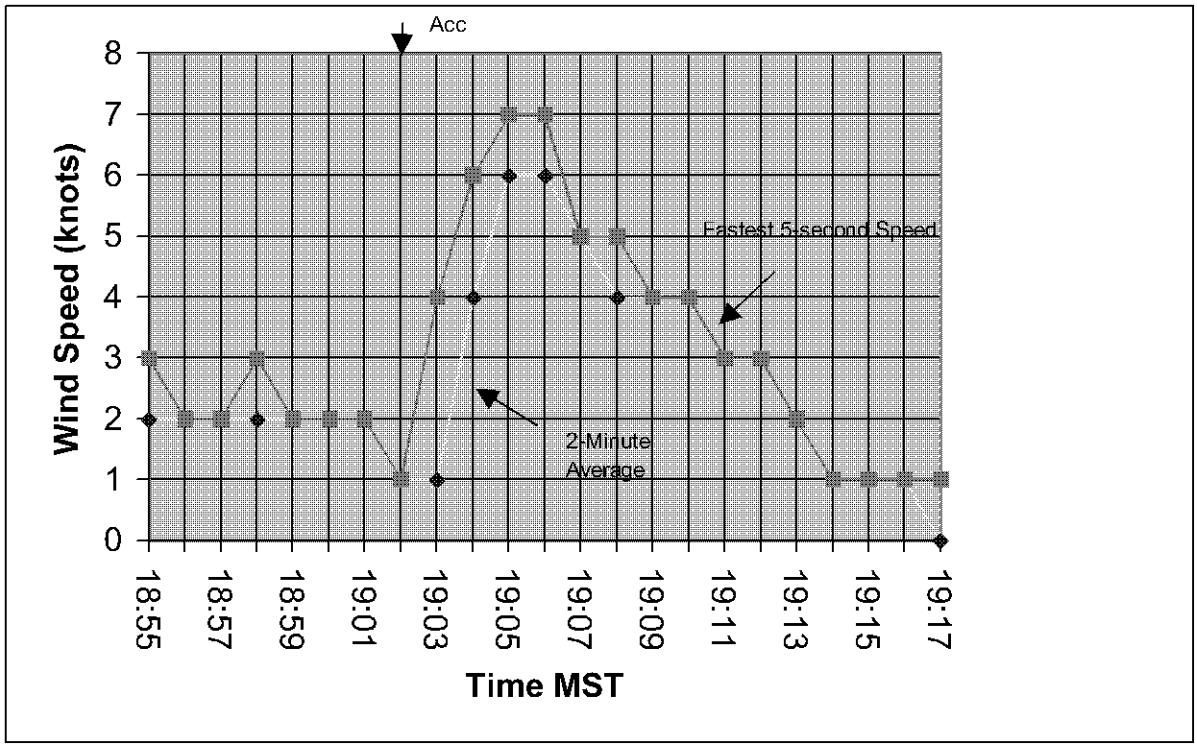
1-Minute KASE ASOS Wind Data (2-minute average wind direction and wind speed reported every minute … Table D).
Wnd Dir … Wind Direction (degrees true)
Wnd Spd … Wind Speed (knots)
* Fastest 5 second wind direction and wind speed in each minute (12 samples per minute).
*Wnd Dir … Wind Direction (degrees true)
*Wnd Spd … Wind Speed (knots)

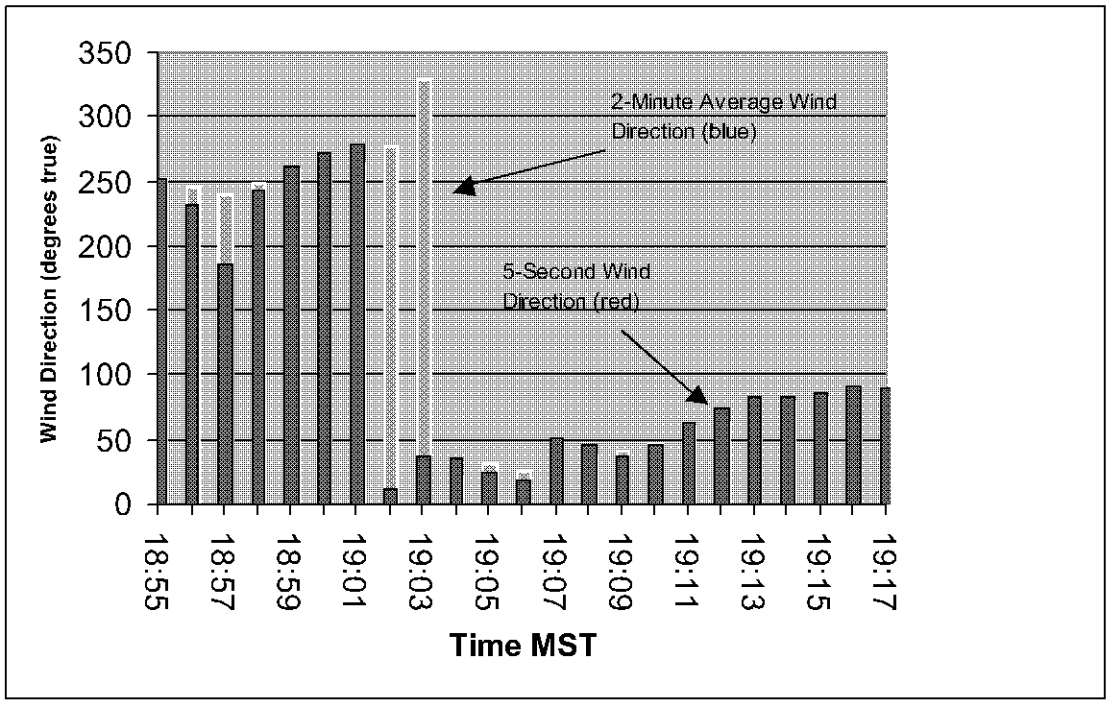
Table D

Time (MST)	Wnd Dir	Wnd Spd	*Wnd Dir	*Wnd Spd
18:55	253	2	253	3
18:56	246	2	232	2
18:57	240	2	186	2
18:58	249	2	243	3
18:59	260	2	262	2
19:00	265	2	272	2
19:01	265	2	279	2
19:02	277	1	013	1
19:03	330	1	037	4
19:04	022	4	035	6
19:05	032	6	025	7
19:06	026	6	019	7
19:07	028	5	051	5
19:08	039	4	047	5
19:09	042	4	037	4
19:10	048	4	046	4
19:11	060	3	063	3
19:12	063	3	074	3
19:13	070	2	083	2
19:14	081	1	083	1
19:15	084	1	086	1
19:16	087	1	092	1
19:17	090	0	090	1

Plot B
ASOS 2-Minute Average Wind Speed and Fastest 5-Second Wind Speed as a Function of Time



Plot C
ASOS 2-Minute Average Wind Direction and 5-Second Wind Direction as a Function of Time



Attachments 42 - 44 … KASE ASOS 1-minute extinction coefficient and wind data.

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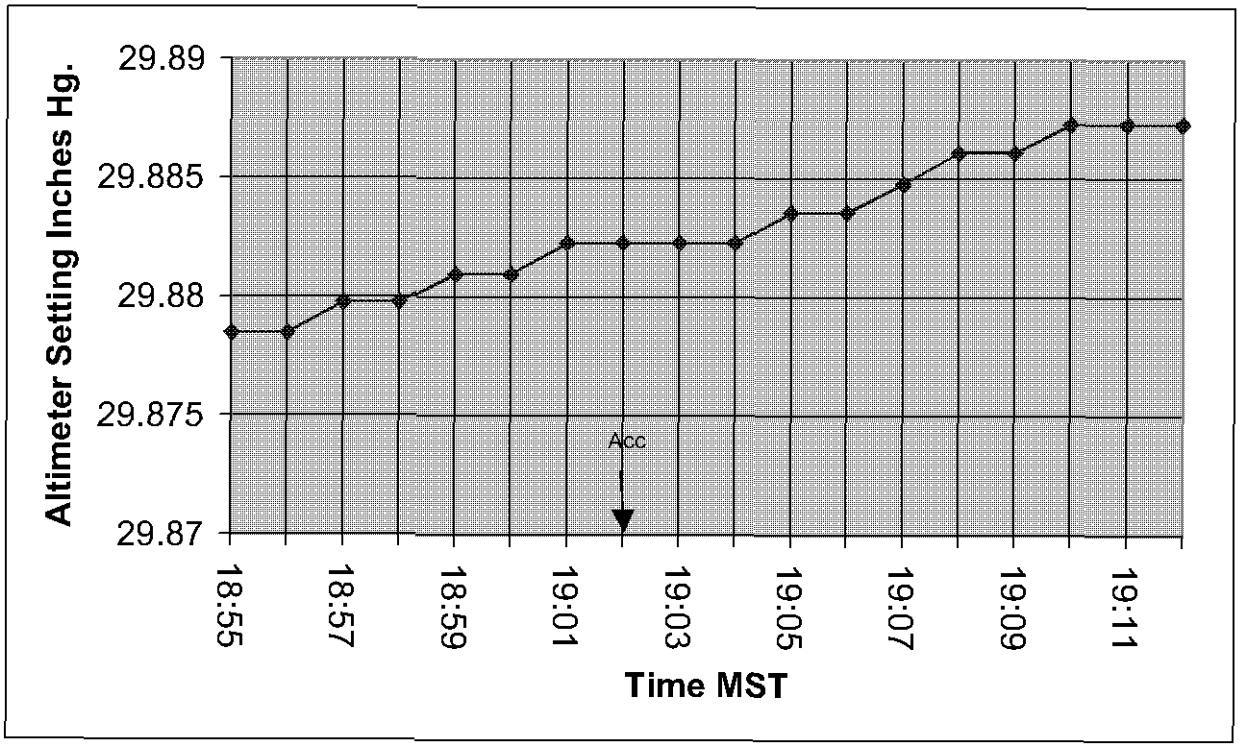
1-Minute ASOS KASE atmospheric pressure sensor data (Table E).
Press1 … Pressure sensor 1
Press 2 … Pressure sensor 2
Press 3 … Pressure sensor 3
The pressure sensor elevation is 7,725 feet. The pressure sensors are located in the first floor equipment room of the KASE Air Traffic Control Tower. The Tower is located about 5,176 feet southeast of the accident site.

**Alt Setting … Altimeter setting calculated using the NTSB Program ALTGND. Input: the lowest pressure sensor value and pressure sensor elevation of 7,725 feet.

Table E

Time (MST)	Press1 (in Hg)	Press2 (in Hg)	Press3 (in Hg)	**Alt Setting (in Hg)
18:55	22.427	22.430	22.423	29.8785
18:56	22.427	22.431	22.423	29.8785
18:57	22.427	22.431	22.424	29.8798
18:58	22.428	22.432	22.424	29.8798
18:59	22.428	22.432	22.425	29.8810
19:00	22.429	22.433	22.425	29.8810
19:01	22.429	22.433	22.426	29.8823
19:02	22.429	22.433	22.426	29.8823
19:03	22.430	22.434	22.426	29.8823
19:04	22.430	22.434	22.426	29.8823
19:05	22.431	22.434	22.427	29.8836
19:06	22.431	22.435	22.427	29.8836
19:07	22.432	22.436	22.428	29.8848
19:08	22.432	22.436	22.429	29.8861
19:09	22.433	22.437	22.429	29.8861
19:10	22.433	22.437	22.430	29.8873
19:11	22.434	22.437	22.430	29.8873
19:12	22.434	22.438	22.430	29.8873

Plot D
Calculated Altimeter Setting as a Function of Time
(From Lowest ASOS Pressure Sensor Values)



Attachments 45 - 47 … KASE ASOS 1-minute pressure sensor data.

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According to an official of the National Weather Service who reviewed the KASE ASOS data, the KASE sensors looked good and there did not seem to be any ASOS issues (phone conversation 4/3/2001).

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Weather observations for Rifle, Colorado (KRIL) … March 29, 2001 ..

1753 MST … AUTO (Automated Observation) ... METAR … Winds 320 degrees at 3 knots; visibility 10 miles; 3,700 feet scattered; temperature 7 degrees C; dew point 2 degrees C; altimeter setting 29.84 inches of Hg.; rain began 1818 MST and ended 1845 MST.

1853 MST … AUTO ... METAR … Winds 190 degrees at 5 knots; clear at or below 12,000 feet; visibility 10 miles; temperature 4 degrees C; dew point 2 degrees C; altimeter setting 29.86 inches of Hg.

1953 MST ... AUTO … METAR … Winds 270 degrees at 4 knots; visibility 10 miles; clear at or below 12,000 feet; temperature 3 degrees C; dew point 1 degree C; altimeter setting 29.89 inches of Hg.

Attachments 48 - 52 … Surface Weather Observations for Rifle, Colorado.

Upper Air Data

Grand Junction, Colorado (GJT)
March 29, 2001 at 1700 MST
GJT is located about 77 nautical miles west of the accident site.

Data Interpolated to 1,000 feet Intervals (Values generated using McIDAS)

Height feet	Temperature C	Dew Point C	Wind Direction degrees	Wind Speed knots
5,000	7.9	1.6	023.3	4.3
6,000	3.9	1.0	345	14.0
7,000	1.5	-0.7	349.9	10.9
8,000	-0.8	-2.4	354.9	15.7
9,000	-3.1	-4.1	004.9	19.8
10,000	-4.9	-5.9	360	22.0
11,000	-6.6	-7.4	345.3	18.1
12,000	-8.3	-8.9	325	15.9
13,000	-10.0	-10.6	322.4	16.3
14,000	-12.2	-13.0	320	16.7

15,000	-14.4	-15.4	320	17.7
16,000	-16.6	-17.8	320	18.6
17,000	-18.9	-20.2	315.7	18.3
18,000	-21.0	-22.6	311.3	17.9

Attachments 53 and 54 … Grand Junction upper air interpolated data for March 29, 2001, at 1700 MST (March 30, 2001, at 0000Z).

Attachment 55 … Grand Junction Skew T Log P plot for March 29, 2001, at 1700 MST (March 30, 2001, at 0000Z).

Weather Radar Data from Grand Junction, Colorado (GJX)

The following GJX Doppler Weather Radar images were generated from data downloaded from Unidata** and displayed using McIDAS …

** WSR-88D Doppler Weather Radar Level III products were acquired using tools made available to the research and education communities through the University Corporation for Atmospheric Research's (UCAR) Unidata Program, funded by the National Science Foundation. These data originated in the U.S. National Weather Service.

Attachments 56 - 58 … GJX Base Reflectivity Weather Radar Images for March 29, 2001, at 1857 MST, 1902 MST, and 1908 MST (0157Z, 0202Z, and 0208Z on March 30); 0.5 degree elevation angle; weather radar echo intensities in dBZ (see color bar on right side of the images); track of N303GA plotted on image (start time 1857:07.31 MST --- end time 1902:50.21 MST); image magnification = 10X; on images all directions relative to true north; distances in nautical miles; times are times of the beginning of the 0.5 degree elevation scan; location of approach end of runway 15 noted.

Note: At 1857:07.31 MST the aircraft was at 14,800 feet. At 1902:50.21 MST the aircraft was at 8,000 feet.

At 1857 MST and 1902 MST weak weather radar echoes were seen at or near DBL (Red Table VOR) and along the track of N303GA from about 8 miles from the approach end of runway 15 to about 4 miles from the approach end of runway 15. At 1908 MST weak weather radar echoes were seen at or near DBL and along the track of N303GA from about 7.5 miles from the approach end of runway 15 to about 2 miles from the approach end of runway 15.

Attachments 59 - 63 …. Track data for N303GA.

Animation of the images for 1857 MST to 1908 MST indicated that the weak weather radar echoes in the KASE area were moving to the southeast.

At the accident site the GJX Weather Radar beam width is about 6,367 feet and the beam center is about 16,054 feet. The accident site is located about 081 degrees at 63.2 nautical miles from GJX.

VIP/DBZ Conversion Table

NWS VIP … National Weather Service Video Integrator and Processor Level.
WSR-88D LVL … WSR-88D Doppler Weather Radar Level.
PREC MODE dBZ … Precipitation Mode dBZ.
RAINFALL .. Rainfall in inches per hour.

NWS VIP	WSR-88D LVL	PREC MODE DBZ	RAINFALL
0	0 1 2	<5 5 to 9 10 to 14	
1 Very Light	3 4 5	15 to 19 20 to 24 25 to 29	.01 in/hr .02 in/hr .04 in/hr
2 Light to Moderate	6 7	30 to 34 35 to 39	.09 in/hr .21 in/hr
3 Strong	8	40 to 44	.48 in/hr
4 Very Strong	9	45 to 49	1.10 in/hr
5 Intense	10	50 to 54	2.49 in/hr
6 Extreme	11 12 13 14 15	55 to 59 60 to 64 65 to 69 70 to 74 GTE 75	>5.67 in/hr

The GJX VAD Wind Profile for 1902 MST showed northerly winds at about 15 knots for heights of 11,000 feet to 14,000 feet.

See Attachment 64 for GJX VAD Wind Profile.

Satellite Data

Geostationary Operational Environmental Satellite (GOES) 10 data were reviewed using McIDAS.

Attachments 65 and 66 … GOES 10 infrared images (band = 4); 2 kilometers (blow up) resolution; March 29, 2001 at 1900 MST and 1915 MST (March 30, 2001 at 0200Z and 0215Z); images are color enhanced (see color bar on the right side of the images).

The images showed a mean radiative temperature in the area of the accident (5 pixel by 5 pixel box centered at KASE … 4 kilometers resolution image) for 1900 MST of 259.0 degrees K and at 1915 MST of 258.5 degrees K. Using upper air data from Grand Junction for March 29, 2001 at 1700 MST indicated that these mean radiative temperatures would correspond to cloud tops of about 15,000 feet.

Area Forecast (FA)

The following information was contained in the National Weather Service FA issued March 29, 2001 at 0445 MST and valid until March 29, 2001 at 1700 MST (SLCC FA 1145):

Colorado …
Mountains and West … Clouds 12,000 feet broken to scattered, 16,000 feet broken. March 29, 2001 at 0800 MST to March 29, 2001 at 1100 MST clouds 9,000 feet to 10,000 feet broken, 14,000 feet overcast. Tops to Flight Level 20,000 feet (FL200). Occasional visibility 3 to 6 miles in light rain showers. Light snow showers above 8,000 feet. Outlook (March 29, 2001 at 1700 MST to March 29, 2001 at 2300 MST) … Marginal VFR ceiling in moderate rain showers and moderate snow showers.

Marginal VFR … Ceiling greater than or equal to 1,000 feet to less than or equal to 3,000 feet and / or visibility greater than or equal to 3 to less than or equal to 5 miles.

The following information was contained in the National Weather Service FA issued March 29, 2001 at 1345 MST and valid until March 30, 2001 at 0200 MST (SLCC FA 2045):

Colorado …
Mountains and West … Clouds 8,000 to 10,000 feet broken to overcast. Tops to FL180. Broken cirrus. Widely scattered light rain and snow showers / isolated thunderstorms light rain lowering ceilings / visibilities 1,500 feet overcast to 2,500 feet overcast with

visibility 3 to 5 miles. Becoming March 29, 2001 at 2000 MST to March 30, 2001 at 0200 MST isolated light rain and snow showers. Cumulonimbus tops to FL310.

The FA was issued by the Aviation Weather Center in Kansas City, Missouri.

Attachments 67 – 69 National Weather Service FAs.

In-flight Weather Advisories

The following AIRMETs encompassed an area that included the accident site.

The AIRMETs were issued March 29, 2001 at 1345 MST and were valid until March 29, 2001 at 2000 MST.

AIRMET Mountain Obscuration (SLCS WA 292045) …
Mountains occasionally obscured in clouds and precipitation.
See Attachment 70 for AIRMET area.

AIRMET Icing (SLCZ WA 292045) …
Occasional moderate rime or mixed icing in cloud and in precipitation above the freezing level to FL180.
Freezing level surface to 8,000 feet northern portions of the area.
See Attachment 71 for AIRMET area.

There were no SIGMETs or Convective SIGMETs in effect for the time and area of the accident.

AIRMETs, SIGMETs, and Convective SIGMETs are issued by the National Weather Service Aviation Weather Center in Kansas City, Missouri.

There were no Center Weather Advisories prepared by the Los Angeles, California or Denver, Colorado, Center Weather Service Units valid during the period from 1100 MST March 29, 2001, to 2000 MST March 29, 2001, inclusive.

See Attachments 72 - 74 for text of AIRMETs.

Terminal Aerodrome Forecast (TAF)

KASE TAF Issued March 29, 2001 at 1620 MST …

From March 29, 2001 at 1700 MST to March 29, 2001 at 1900 MST … Winds variable at 3 knots; visibility greater than 6 miles; showers in the vicinity; 3,000 feet scattered, ceiling 5,000 feet broken.

Temporary Conditions (TEMPO) March 29, 2001 at 1700 MST to March 29, 2001 at 1900 MST … Winds variable at 10 knots gusts to 15 knots; visibility 5 miles; light snow showers; 1,200 feet scattered, ceiling 2,500 feet broken, 5,000 feet overcast.

From March 29, 2001 at 1900 MST … Winds 020 degrees at 5 knots; visibility greater than 6 miles; showers in the vicinity; 3,000 feet scattered, ceiling 6,000 feet broken.

Temporary Conditions (TEMPO) March 29, 2001 at 1900 MST to March 29, 2001 at 2200 MST … Visibility 6 miles; light snow showers; ceiling 3,000 feet broken.

The TAF was issued by the National Weather Service Forecast Office in Grand Junction, Colorado.

See Attachments 75 and 76 for KASE TAFs.

The National Weather Service does not prepare a TAF for Rifle, Colorado (KRIL).

Weather Briefing

A review of the audio tape (HHR AFSS ASE –ATCT-029 N303GA PH16) of the weather briefing involving N303GA was done on April 9, 2001. The briefing was provided by a specialist at the Hawthorne, California, Automated Flight Service Station (AFSS) at about 1100 Pacific Standard Time (PST). The briefing was for the flight from Burbank, California (KBUR) to KASE.

The following are summarized excerpts of information provided during the briefing:

An AIRMET for occasional moderate turbulence pertinent to departure from KBUR.

AIRMETs for icing and mountain obscuration pertinent to arrival at KASE.

The KASE weather observation (1041 PST) of winds variable at 3 knots; visibility 7 miles; light snow; few clouds at 1,100 feet, 1,600 feet scattered, ceiling 3,000 feet overcast; temperature 1 degree C; dew point –2 degrees C; altimeter setting 29.85 inches of Hg. The specialist noted that visibility was up "from 1 mile in heavier snow showers at about 10 minutes past the hour at KASE."

The KASE forecast for 1300 MST to 1900 MST of winds 330 degrees at 10 knots; visibility greater than 6 miles; showers in the vicinity; 3,000 feet scattered, ceiling 5,000

feet broken; temporary (TEMPO) conditions winds variable 10 knots gusts to 15 knots; visibility 3 miles; light snow showers; ceiling 2,500 feet broken, 5,000 feet overcast.

Upper winds for Flight Level 39,000 feet (FL390) of 320 degrees at 65 knots at Lancaster, California; 330 degrees at 76 knots at Las Vegas, Nevada; and 330 degrees at 54 knots at Grand Junction, Colorado.

Astronomical Data

For KASE (accident location) … March 29, 2001 .. Elevation = 0 feet.
Sunset … 1828 MST
End of Civil Twilight … 1855 MST
End of Nautical Twilight … 1927 MST
End of Astronomical Twilight … 1959 MST
Altitude of Sun at 1902 MST … -7.3 degrees
Bearing to Sun at 1902 MST … 280.7 degrees
Altitude of Moon at 1902 MST … 47.4 degrees
Bearing to Moon at 1902 MST … 254.3 degrees
Illumination of Moon … 25%

"Twilight: Before sunrise and again after sunset there are intervals of time, twilight, during which there is natural light provided by the upper atmosphere, which does receive direct sunlight and reflects part of it toward the Earth's surface. Some outdoor activities may be conducted without artificial illumination during these intervals, and it is useful to have some means to set limits beyond which a certain activity should be assisted by artificial lighting. The major determinants of the amount of natural light during twilight are the state of the atmosphere generally and local weather conditions in particular. Atmospheric conditions are best determined at the actual time and place of events. Nevertheless, it is possible to establish useful, though necessarily approximate, limits applicable to large classes of activities by considering only the position of the Sun below the local horizon. Reasonable and convenient definitions have evolved.

Civil twilight is defined to begin in the morning, and to end in the evening when the center of the Sun is geometrically 6 degrees below the horizon. This is the limit at which twilight illumination is sufficient, under good weather conditions, for terrestrial objects to be clearly distinguished; at the beginning of morning civil twilight, or end of evening civil twilight, the horizon is clearly defined and the brightest stars are visible under good atmospheric conditions in the absence of moonlight or other illumination. In the morning before the beginning of civil twilight and in the evening after the end of civil twilight, artificial illumination is normally required to carry on ordinary outdoor activities. Complete darkness, however, ends sometime prior to the beginning of morning civil twilight and begins sometime after the end of evening civil twilight.

Nautical twilight is defined to begin in the morning, and to end in the evening, when the center of the sun is geometrically 12 degrees below the horizon. At the beginning or end of nautical twilight, under good atmospheric conditions and in the absence of other illumination, general outlines of ground objects may be distinguishable, but detailed outdoor operations are not possible, and the horizon is indistinct.

Astronomical twilight is defined to begin in the morning, and to end in the evening when the center of the Sun is geometrically 18 degrees below the horizon. Before the beginning of astronomical twilight in the morning and after the end of astronomical twilight in the evening the Sun does not contribute to sky illumination; for a considerable interval after the beginning of morning twilight and before the end of evening twilight, sky illumination is so faint that it is practically imperceptible."

From: ***U.S. Naval Observatory ...Astronomical Applications Department***
http://aa.usno.navy.mil/AA/faq/docs/RST_defs.html#top

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