National Transportation Safety Board
Office of Aviation Safety
Washington, DC 20594

RRD25FR022

METEOROLOGY

Environmental Conditions

August 5, 2025

A. ACCIDENT

Date: August 5, 2025
Time: 0015 mountain daylight time (MDT)
0615 coordinated universal time (UTC)
Location: Denver, Colorado
Operator: BNSF Railroad

B. METEOROLOGY SPECIALIST

Donald Eick
Senior Meteorologist
National Transportation Safety Board
Washington, DC

C. FACTUAL INFORMATION

1.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METAR) and Aviation Selected Special Weather Reports (SPECI) identified in the area. Cloud heights are reported above ground level (agl) in the following section.

1.1 Aurora, Colorado

The closest weather reporting facility to the accident site was from Buckley Space Force Base (KBKF), Aurora, Colorado, located about 11 miles east at an elevation of 5,663 ft. The airport had a military type of Automated Surface Observation System (ASOS) and reported the following conditions.

> *KBKF weather at 2358 MDT, wind from 170˚ at 21 knots gusting to 28 knots, visibility 10 miles or more, scattered clouds at 22,000 ft agl, temperature 71˚F (22˚C), dew point temperature 59˚F (15˚C), and altimeter 30.07 inches of mercury (inHg). Remarks, automated system with a precipitation sensor, peak wind from 160˚ at 35 knots recorded at 2315 MDT, sea-level pressure 1008.3-hectopascals (hPa), temperature 21.9˚C, dew point temperature 15.2˚C, 6-hour maximum temperature 33.8˚C, 6-hour minimum temperature 21.9˚C, 3-hour pressure tendency risen 1.2-hPa.*

The observations in tabular format surrounding the period were as follows:

Date	Time (mdt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (°F)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in)		
						Air	Dwpt	6 hour					altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
								Max.	Min.								
05	08:58	SW 9	10.00	Mostly Cloudy	SCT160 BKN220	80.2	28.4			15%		78	30.13	1010.7			
05	07:58	S 13	10.00	Mostly Cloudy	SCT160 BKN220	73.4	29.8			20%			30.1	1010.1			
05	06:58	S 8	10.00	Mostly Cloudy	SCT160 BKN220	66.2	32.2			28%			30.09	1009.3			
05	05:58	S 12	10.00	Mostly Cloudy	SCT160 BKN220	65.5	39.2	71.4	64.2	38%			30.07	1008.6			
05	04:58	S 10	10.00	Mostly Cloudy	BKN220	65.8	46.2			49%			30.06	1007.9			
05	03:58	S 13	10.00	Mostly Cloudy	FEW120 BKN220	67.5	52.2			58%			30.05	1007.6			
05	02:58	S 18	10.00	Partly Cloudy	FEW120 SCT220	68.2	56.8			67%			30.05	1007.6			
05	01:58	S 22	10.00	Mostly Cloudy and Breezy	BKN220	68.9	58.6			70%			30.06	1007.5			
05	00:58	S 26 G 36	10.00	Mostly Cloudy and Windy	BKN220	70	59.4			69%			30.06	1007.9			
04	23:58	S 24 G 32	10.00	Partly Cloudy and Breezy	SCT220	71.4	59.4	92.8	71.4	66%			30.07	1008.3			
04	22:58	S 24 G 35	10.00	Partly Cloudy and Breezy	SCT220	72.9	58.6			61%			30.08	1008.6			
04	21:58	S 28 G 35	10.00	Partly Cloudy and Windy	SCT220	74.7	56.8			54%			30.07	1008.3			
04	20:58	SE 26 G 35	10.00	A Few Clouds and Windy	FEW200	77.5	57.9			51%		79	30.03	1007.6			

1.2 Denver, Colorado

The next closest official weather reporting was from Denver International Airport (KDEN), Denver, Colorado, located 15.5 miles east-northeast of the accident site at an elevation of 5,434 ft. The airport had an ASOS and was augmented by certified

weather observations. The following table of the conditions surrounding the period were reported.

Date	Time (mdt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (°F)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in)		
						Air	Dwpt	6 hour					altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
								Max.	Min.								
05	06:53	W 10	10.00	Mostly Cloudy	SCT200 BKN250	66	48			52%			30.08	1009.3			
05	05:53	W 14	10.00	Mostly Cloudy	BKN250	66	46.9	71.1	66	50%			30.06	1008.6			
05	04:53	SW 9	10.00	Mostly Cloudy	BKN250	68	48.9			51%			30.05	1007.6			
05	03:53	SW 17	10.00	Mostly Cloudy	BKN250	71.1	53.1			53%			30.04	1007.5			
05	02:53	S 10	10.00	Partly Cloudy	SCT250	66.9	57			71%			30.05	1007.7			
05	01:53	S 17	10.00	Fair	CLR	69.1	59			70%			30.06	1008.1			
05	00:53	S 24 G 38	10.00	Mostly Cloudy and Breezy	BKN250	70	60.1			71%			30.07	1008.5			
04	23:53	S 29 G 46	10.00	Partly Cloudy and Windy	SCT250	70	60.1	93.9	70	71%			30.08	1009.2			
04	22:53	S 31 G 41	10.00	A Few Clouds and Windy	FEW250	72	60.1			66%			30.08	1009.2			
04	21:53	SE 30 G 45	10.00	A Few Clouds and Windy	FEW250	75	60.1			60%		77	30.06	1008.6			
04	20:53	SE 28 G 44	10.00	Mostly Cloudy and Windy	BKN250	78.1	59			52%		79	30.03	1007.6			

1.3 NWS Aviation Weather Center Depiction of Observations

A depiction of the conditions from the NWS Aviation Weather Center's (AWC) website of observations with the regional composite radar and primary surface features overlaid for 0015 MDT is included as figure 3 with the approximate accident site marked by the red star. The regional radar depicted no meteorological echoes over the region during the period with general southerly winds at 10 to 25 knots with gusts

to 32 knots over the area. Scattered to broken clouds with visibility unrestricted at 10 miles or more were reported.

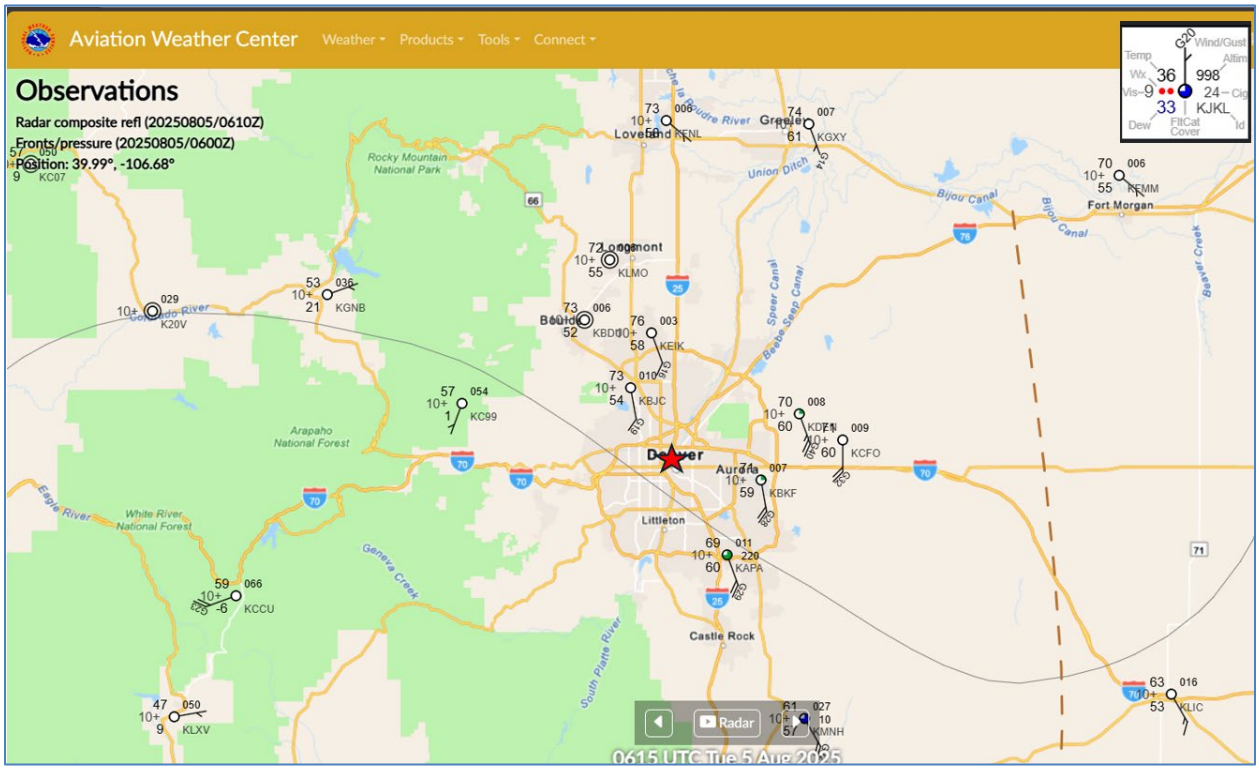

Figure 1 - NWS Aviation Weather Center's observations for 0015 MDT with surface features and regional radar mosaic overlaid.

2.0 NWS Forecasts and Advisories

2.1 Zone Forecast

The NWS Boulder (KBOU), Colorado, Weather Forecast Office (WFO) was responsible for providing weather forecast, warnings, and advisories for the region. The zone forecast for Denver was issued at 2038 MDT on August 4, 2025, current for the period was as follow:

FPUS55 KBOU 050238
ZFPBOU

Zone Forecast Product for Northeast Colorado
National Weather Service Denver/Boulder CO
838 PM MDT Mon Aug 4 2025

COZ040-051700-

North Douglas County Below 6000 Feet/Denver/West Adams and Arapahoe Counties/East Broomfield County-Including Aurora, Brighton, City of Denver, Denver International Airport, Highlands Ranch, Littleton, and Parker
838 PM MDT Mon Aug 4 2025

.REST OF TONIGHT...Mostly clear. Lows in the lower to mid 60s. South winds 10 to 15 mph with gusts up to 25 mph.

.TUESDAY...Areas of smoke in the morning. Partly cloudy. Highs in the mid 90s.

.TUESDAY NIGHT...Mostly clear. Lows in the lower to mid 60s.

.WEDNESDAY...Partly cloudy. Highs in the mid to upper 90s.

.WEDNESDAY NIGHT...Mostly clear. Lows in the mid 60s. Southwest winds 10 to 15 mph with gusts up to 20 mph.

.THURSDAY AND THURSDAY NIGHT...Partly cloudy. Highs in the upper 90s. Lows in the mid 60s.

.FRIDAY AND FRIDAY NIGHT...Mostly cloudy. Highs in the upper 90s. Lows near 60.

.SATURDAY...Mostly cloudy with a 20 percent chance of thunderstorms. Highs in the mid 80s.

.SATURDAY NIGHT AND SUNDAY...Partly cloudy with a 20 percent chance of thunderstorms. Lows around 60. Highs in the lower 90s.

.SUNDAY NIGHT...Partly cloudy with a 10 percent chance of thunderstorms. Lows near 60.

.MONDAY...Partly cloudy. Highs in the upper 80s.

2.2 Area Forecast Discussion

The NWS Area Forecast Discussions (AFD) are issued by each WFO to describe the short-term weather conditions within their region with an aviation section that includes the general conditions as they relate to the creation of the TAF. These are useful for additional aviation-related issues that cannot be encoded into the TAF and provide some reasoning behind the forecast. The NWS KBOU AFD issued at 2345 MDT was as follows:

FXUS65 KBOU 050545
AFDBOU

Area Forecast Discussion
National Weather Service Denver/Boulder CO
1145 PM MDT Mon Aug 4 2025

.KEY MESSAGES...

- Critical fire weather conditions for mountains and high valleys through much of the week.

- Hot and dry all areas through Friday, likely peaking Thursday with potential for Heat Advisory. Some relief this weekend.

.DISCUSSION /Through Monday/...
Issued at 202 PM MDT Mon Aug 4 2025

A very dry airmass prevails over the mountains this afternoon, while low level moisture is holding over portions of the plains, increasing toward the eastern border. MLCAPE was holding strong over the northeast plains into the Nebraska panhandle/far eastern Wyoming, where values were approaching 1500-2000 J/kg. There was still a fair amount of CIN noted (25-50 J/kg) but full sunshine was steadily weakening that cap. Bulk shear was more than plentiful for rotating updrafts and supercells with large hail and damaging winds the main threat, but this is a conditional risk upon breaking the cap. Given the diminishing CIN, we do think that's fairly likely somewhere in the MLCAPE ridge previously mentioned. Storms would move southeast across the plains this evening. While there's still some uncertainty, it was also interesting to see a couple CAMs that even had two rounds of storms late this afternoon and evening - possibly til the midnight hour depending on evolution. The most likely location for the strongest storms would be along/east of a line from Sterling to Akron, but also a low chance back to Fort Morgan where satellite shows cap is already eroding.

The main attention for the rest of the week then shifts to fire weather and heat. We'll address the fire weather situation in the Fire Weather section below. With regard to heat, the center of a 600dm 500 mb high will remain anchored over New Mexico through Friday. This, along with passing shortwaves through the Northern Rockies, keeps a fairly robust (for this time of year) west/southwest flow aloft across the forecast area. That spells strengthening downslope flow while 700 mb temperatures warm to around 20C each afternoon. As a result, high temperatures will soar well above normal into the upper 90s/near 100F across the plains each day through Friday. It appears Thursday is shaping up to be the hottest day, with record or near record temperatures expected (e.g. Denver's record is 99F set in 1980). That also means we'll be pushing near Heat Advisory for that day.

We'll see some relief by Saturday, as a backdoor front arrives late Friday or Friday night. That should shave a good 10 degrees or more off highs, and bring us closer to or below normal for the weekend.

With regard to precipitation chances, a very dry airmass will remain in place through most of this forecast period. However, by Wednesday and Thursday a little moisture will start to sneak under the ridge allowing a small chance of sprinkles/virga in/near the mountains. Then we'll have a 20-30% chance of storms in the post frontal airmass Saturday into Sunday.

.AVIATION /06Z TAFS through 06Z Wednesday/...
Issued at 1135 PM MDT Mon Aug 4 2025

Strong S/SE will continue through 09Z for all TAF sites before weakening and turning to drainage. By Tuesday morning, we will see an increase in smoke in the atmosphere which

will cause slant-range visibility issues especially during sunrise and sunset. Generally light westerly winds will dominate the TAF period, except for 18Z/19Z through 00Z/01Z where wind gusts up to 25 kts are expected.

.FIRE WEATHER...
Issued at 202 PM MDT Mon Aug 4 2025

Concern is for an extended period of critical fire weather conditions Tuesday through the end of the week. For Tuesday, the flow aloft strengthens as the upper level ridge flattens in response to a stronger shortwave moving through the Northern Rockies. Thus, gusts around 30-35 mph can be expected in the mountains and high valleys. In addition, an extremely dry airmass will prevail Tuesday, with minimum humidity readings expected to drop into the single digits in all but the higher mountains and eastern plains. Thus, we've issued Red Flag Warnings where the combination of gusty winds and very low RH occur, and fuels warrant (essentially all of the mountains and high valleys of north central Colorado). With regard to the foothills, winds will be a little lighter but another area of concern is the foothills of northern Larimer County which is more prone to stronger winds in this pattern. That seems to be a smaller percentage of that zone, and a few of the foothill locations have also seen better rains and lower ERC percentiles so we'll monitor those locations further.

Winds should relax slightly for Wednesday as the ridge buckles ever so slightly. However, it will still be very warm/hot and dry in this flow pattern, and some potential for another Red Flag. Thursday and Friday are both shaping up to be critical fire weather days for the mountains and high valleys as flow aloft strengthens again. That occurs as yet another shortwave moves across the Northern Rockies and tightens the mid level pressure gradients. Some relief should eventually come by this weekend with a lighter and slightly cooler WNW flow aloft. However, the chance of any meaningful precipitation stays low.

.BOU WATCHES/WARNINGS/ADVISORIES...
Red Flag Warning from 11 AM to 8 PM MDT Tuesday for COZ211>214-217-218.

DISCUSSION...Barjenbruch
AVIATION...Ideker
FIRE WEATHER...Barjenbruch

3.0 Astronomical Conditions

The United States Naval Observatory website[1] provided the following astronomical data on August 5, 2025, for the approximate accident site. The time of the accident has been added in blue italic type for reference.

Sun	Time (MDT)
Sunset	2009
End civil twilight	*2039*

[1] https://aa.usno.navy.mil/data/index

Accident	*0015*
Begin civil twilight	0533
Sunrise	0603

Moon	Time (MDT)
Moonrise	1710
Upper transit	2133
Accident	*0015*
Moonset	0154

The phase of the Moon was a waxing Gibbous with 75% of the Moon's visible disk illuminated. At the time of the accident the Moon was 11.8˚ above the horizon at an azimuth of 214˚. A depiction of the Moon's position is included as figure 2.

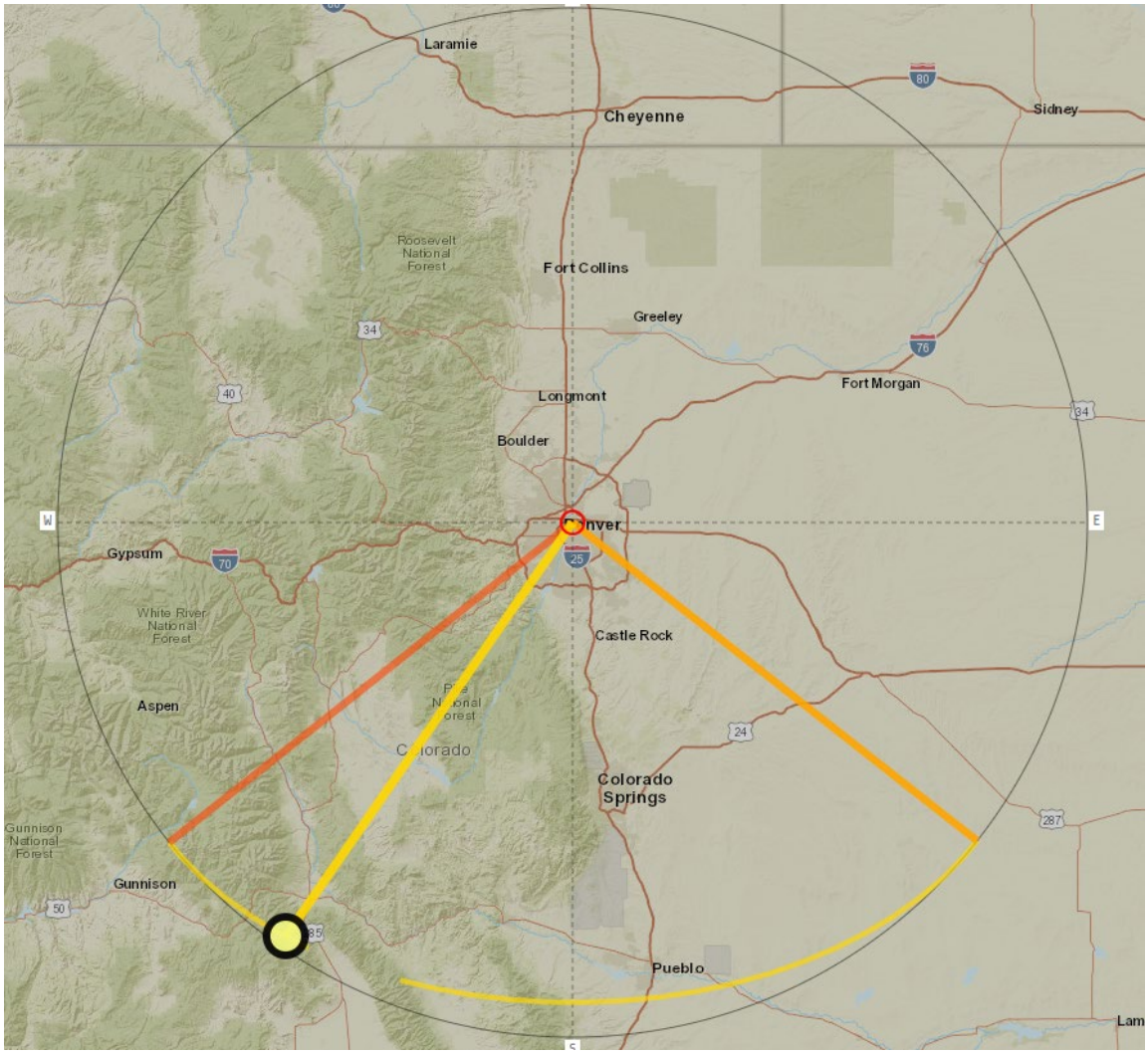

Figure 2 - Position of the Moon at 0015 MDT on August 5, 2025.

Submitted by:

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