Aviation Investigation Final Report

Location:	Boulder, Colorado	**Incident Number:**	CEN13IA349
Date & Time:	June 8, 2013, 08:54 Local	**Registration:**	N201FW
Aircraft:	ULTRAMAGIC SA T210	**Aircraft Damage:**	Minor
Defining Event:	Hard landing	**Injuries:**	2 Minor, 10 None
Flight Conducted Under:	Part 91: General aviation		

Analysis

The pilot reported that he checked the weather forecast before takeoff and received a briefing from flight service. He and the other balloon pilots flying that day compared the weather information and determined that the weather was good enough to fly. About 45 minutes into the flight, at 3,000 feet above ground level, the pilot noticed that the other balloons flying nearby were "screaming up and down" and that, within 5 minutes, the wind, which had been carrying them easterly at 6 to 8 knots, shifted to the southwest at 30 knots or more. The balloon was getting bounced around, and the wind was not subsiding, so the pilot decided to immediately land the balloon. The pilot briefed the passengers for a high-wind landing and landed the balloon in a conservation area. The basket tipped over and was dragged for about 50 to 60 yards until a wind gust lifted the balloon about 5 feet above the ground. The pilot pulled in the top vent, which put the balloon back on the ground, and it finally stopped moving.

A review of meteorological data available at the time of the preflight briefing indicated, in part, that wind from the west existed at 10 knots or less before takeoff. The National Weather Service (NWS) terminal area forecast expected easterly wind shifting to the northwest during the anticipated flight at 13 knots with wind from the north gusting to 23 knots after 1000 mountain daylight time. The NWS area forecast did not expect any high winds across Colorado. The NWS Aviation Forecast Center had no advisories current for low-level turbulence or high winds over Colorado surrounding the anticipated flight. However, shortly after takeoff a sudden increase in windspeed occurred across the region with wind gusts from 20 to 38 knots. The NWS misjudged the timing and underestimated the magnitude of the frontal boundary moving across the region. It is likely that, if the pilot had known about the gusting wind at the time of takeoff, he may not have chosen to fly that day.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be:

The balloon's encounter with unforecast strong gusting wind, which resulted in a high-wind landing. Contributing to the accident was the National Weather Service's misjudgment of the timing and underestimation of the magnitude of the frontal boundary moving across the region.

Findings

Environmental issues	High wind - Availability of related info
Aircraft	(general) - Not specified
Organizational issues	(general) - Meteorological service
Environmental issues	High wind - Timing of related info
Environmental issues	High wind - Accuracy of related info
Environmental issues	High wind - Effect on operation

Factual Information

History of Flight

Landing	Hard landing (Defining event)

On June 8, 2013 at 0854 mountain daylight time, an Ultramagic T210 hot air balloon, N201FW, impacted in an open space during a high wind landing near Boulder, Colorado. Two of the passengers on board sustained minor injuries. The commercial rated pilot and 9 remaining passengers were uninjured. The balloon sustained minor damage. The balloon was registered to and operated by Fair Winds, Incorporated under the provisions of 14 Code of Federal Regulations Part 91 as a business flight. Visual meteorological conditions prevailed for the flight, which operated without a flight plan. The flight originated from Gunbarrel, Colorado, about 0715.

The pilot reported that prior to the flight he checked the weather forecast and received a briefing from Flight Service. He got together with the other balloon pilots flying that day and compared the weather information they had received. They all determined the weather was good enough to fly.

The weather was good when they took off. About 45 minutes into the flight, at 3,000 feet above ground level, the pilot noticed that the other balloons flying nearby were "screaming up and down" and that within 5 minutes, the wind, which had been carrying them easterly at 6 to 8 knots, became a southwest wind of 30 knots or more. The balloon was getting bounced around and the wind was not subsiding, so the pilot made the decision to land immediately.

The pilot briefed the passengers for a high wind landing and got them into the bottom of the basket. He then descended to find a suitable place to land. He leveled off over a lake and flew over a swell. He saw that he was headed toward a windmill farm and needed to get on the ground before reaching it. He pulled on the vent line and the balloon touched down in a conservation area. The wind speed was about "31 to 32 miles per hour". The basket tipped over and began dragging. After being dragged about 50 to 60 yards a gust lifted the balloon about 5 feet above the ground. The pilot continued to pull the in the top vent, which put the balloon back on the ground and finally to a stop.

The National Weather Service (NWS) Surface Analysis Chart at 0600 MDT depicted a low pressure system over North Dakota with an associated occluded front al system extending from the low south-southeast to another low pressure system over South Dakota where the triple point of the front was located. There it split into a warn front to the southeast and a cold front to the southwest across Nebraska and northern Colorado, and then west-northwest back into Wyoming. Two high pressure systems were located over western Colorado and two low pressure systems were located over eastern Colorado with a trough of low pressure extending between the lows into New Mexico. The resultant pressure systems created a light westerly wind component over the region with wind speeds of 10 knots or less, with the cold front oriented in an east-to-west direction over northern Colorado south of the cold front.

The station model for Denver International Airport depicted a wind from the west-southwest at approximately 10 knots. The station model for Cheyenne, Wyoming, 78 miles north of Denver depicted

a northerly wind sustained at approximately 25 knots. Several stations over Wyoming and Nebraska behind the cold front depicted northerly winds at 15 to 20 knots.

At 0900, the low pressure system over South Dakota became the primary system with the cold front extending south-southwestward across Nebraska and into central Colorado. The station model for Denver depicted a wind from the north at 15 knots. Several other stations in northeast Colorado depicted northerly winds sustained at 15 to 35 knots, with stations south of the front reporting westerly winds at 10 knots or less.

At 0655, the weather conditions at Erie, Colorado (KEIK), 12 miles east-northeast of the accident scene were wind 300 degrees at 4 knots, clear skies, visibility 10 miles, temperature 66 degrees Fahrenheit (F), dew point 43 degrees F, and altimeter 29.81 inches.

At 0855, the weather conditions at KEIK were wind 020 degrees at 14 knots, gusts to 22 knots, clear skies, visibility 10 miles, temperature 66 degrees Fahrenheit (F), dew point 49 degrees F, and altimeter 29.94 inches.

The first weather observation for the area that indicated a frontal passage was at Cheyenne Regional Airport, Wyoming. At 0453, automated wind was reported as 270 degrees at 9 knots. At 0549 the automated wind was from 350 degrees at 23 knots gusting to 38 knots.

Wind conditions at Fort Collins-Loveland Municipal Airport, 38 miles north of Denver, at 0635 were calm. At 0655 when the front passed through, the wind was 020 degrees at 13 knots gusting to 25 knots. By 0815, the wind was gusting to 35 knots.

The front moved through Denver International Airport at 0744, when a squall or sudden increase in wind speed was reported from 020 degrees at 24 knots gusting to 34 knots. Wind gusts would continue for the next few hours with gusts of 36 knots reported at 0753 and gusts of 24 knots at 0853.

The front continues to south reaching Front Range Airport, 19 miles east of Denver, at 0755 and Centennial Airport, 15 miles southeast of Denver, at 0834 and producing gusts to 30 and 35 knots respectively.

The Denver upper air sounding or rawinsonde observation at 0800 depicted a surface-based temperature inversion due to radiational cooling from the surface to approximately 500 feet agl with light winds below and winds from the west immediately above the inversion through 10,000 feet and veering to the northwest with wind speeds increasing with height. A low-level wind maximum was identified at 7,000 feet from 270 degrees at 30 knots. A mean 18,000 feet wind was from 308 degrees at 31 knots, and the level of maximum wind at 35,000 feet was from 330 degrees at 80 knots. The sounding depicted a stable atmosphere with a Lifted Index of 5. The lifted condensation level wat identified at 5,055 feet agl with a convective condensation level at 12,226 feet agl. The equilibrium level or expected top of convective clouds was at 37,000 feet. The freezing level was identified at approximately 14,801 feet.

The sounding wind and temperature profile supported mountain wave conditions with waves at 12,000, 15,000, and 19,000 feet.

The NWS Terminal Aerodrome Forecast (TAF) was issued by the Denver/Boulder Weather Service Forecast Office located in Boulder, Colorado. The TAF for Denver International Airport during the period in which the accident took place were as follows:

Denver Terminal Area Forecast, July 8, 2013 at 1139 UTC (0539 MDT,) wind 210 degrees at 13 knots, visibility more than 6 statute miles, few clouds at 8,000 feet mean sea level (MSL), scattered clouds at 12,000 feet MSL

From 0800, wind 310 degrees at 11 knots, visibility more than 6 statute miles, few clouds at 8,000 feet MSL

From 1000, wind 020 degrees at 13 knots, gusts to 23 knots, visibility more than 6 statute miles, few clouds at 8,000 feet MSL

From 1700, wind 060 degrees at 13 knots, visibility more than 6 statute miles, few clouds at 8,000 feet MSL, broken ceiling at 15,000 feet MSL

From 2000, wind 140 degrees at 5 knots, visibility more than 6 statute miles, few clouds at 8,000 feet MSL

From 0000 on June 9, 2013, wind 200 degrees at 7 knots, visibility more than 6 statute miles, few clouds at 10,000 feet MSL

From 0700 on June 9, 2013, wind 270 degrees at 5 knots, visibility more than 6 statute miles, few clouds at 10,000 feet MSL

An amended TAF was issued for KDEN at 0652, with forecast wind 210 degrees at 13 knots, visibility more than 6 statute miles, few clouds at 8,000 feet MSL, scattered clouds at 12,000 feet MSL, and scattered clouds at 22,000 feet MSL

From 0830, wind 010 degrees at 18 knots, gusts to 30 knots, visibility more than 6 statute miles, scattered clouds at 8,000 feet MSL, scattered clouds at 12,000 feet MSL

From 1300, wind 020 degrees at 15 knots, gusts to 25 knots, visibility more than 6 statute miles, scattered clouds at 8,000 feet MSL, scattered clouds at 12,000 feet MSL

From 1600, wind 060 degrees at 13 knots, visibility more than 6 statute miles, scattered clouds at 8,000 feet MSL, and broken ceiling at 15,000 feet MSL

From 2000, wind 140 at 5 knots, visibility more than 6 statute miles, scattered clouds at 8,000 feet MSL

From 0000 on June 9, 2013, wind 200 degrees at 7 knots, visibility more than 6 statute miles, few clouds at 10,000 feet MSL

From 0700 on June 9, 2013, wind 270 degrees at 5 knots, visibility more than 6 statute miles, few clouds at 10,000 feet MSL

The TAF issued at 0539 expected VMC conditions to prevail with a wind from the southwest or 210 degrees at 13 knots shifting northwest or 310 degrees at 11 knots at 0800. After 1000 through 1700, the wind was expected from the north at 020 degrees at 13 knots with gusts to 23 knots.

The forecast was amended at 0652 with the primary change being the wind shift occurring at 0830 with the wind from the north or 010 degrees at 18 knots gusting to 30 knots, with gusts continuing through 1700.

According to NWS forecast directives, the decision to amend the TAF relies on the forecaster's assessment of existing conditions and expectations. If the conditions change earlier or later than forecast, but the TAF shows the expected trend and will soon recover, an amendment may not be needed. Small fluctuation in the observed conditions should not result in a minor adjustment to the TAF, unless an improving weather conditions occur sooner than forecast, then an amended TAF is necessary. The prevailing wind direction will be forecast for any speed greater than or equal to 7 knots. The TAF should be amended if the mean wind direction differs by 30 degrees or more with a mean wind speed greater than or equal to 12 knots, or the forecast/actual mean wind speed differ more than (or equal to) 10 knots and the mean wind is expected to be greater than or equal to 12 knots.

A review of the NWS forecast discussion issued 0430 indicated that the cold front was expected to drop across Colorado during the middle of the day and that the NWS aviation forecaster was expecting a wind shift to the west-northwest during the morning and then north to northeast with the passage of the front before 1200, with wind gusts possible in the 20 to 30 knot range for a couple of hours behind the front. No weather warnings or high wind advisories were in effect during the period.

The area forecast is a forecast of VFR clouds and weather conditions over an area the size of several states. The Salt Lake City regional forecast was issued at 0445 and was valid through 1700. The synoptic section discussed a moderately strong northwesterly jet stream over the region with a surface cold front moving eastward through the region. The forecast for the northern plains expected scattered high cirrus clouds with no obstructions to visibility. Northwesterly winds of 20 knots gusting to 30 knots were expected over Wyoming, but there was no mention of wind in the forecast for Colorado. NWS guidelines require a forecaster to include wind information whenever winds of 20 knots or more are expected.

During the period the NWS had no Severe Weather Forecast Alerts, Convective SIGMETs (Significant Meteorological Information), SIGMETs, or Center Weather Advisories for high winds over Colorado outside of thunderstorm activity. AIRMET (Airmen's Meteorological Information) TANGO was in effect for Montana, Wyoming, and Colorado, for moderate turbulence between flight levels 280 and 380, and an advisory for low-level turbulence over Wyoming. The Denver Center Weather Service Unit did not issue any Center Weather Advisories for high winds or squalls impacting the area.

The pilot reported that after the incident, he got together with some of the other pilots who were flying at the time the wind increased. They discovered that a frontal boundary wind from thunderstorms over Nebraska had moved into the area bringing 30 knot winds out of the north-northeast. The pilot reported that his company prides itself on its weather planning. "If it's (the weather conditions) [are] on the edge, we don't go. They [National Weather Service] missed this one." The pilot also reported that the wind did not decrease. It remained high for an hour and a half after they had landed.

Pilot Information

Certificate:	Commercial	**Age:**	57
Airplane Rating(s):	None	**Seat Occupied:**	Center
Other Aircraft Rating(s):	Balloon	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	October 21, 2011
Flight Time:	(Estimated) 2000 hours (Total, all aircraft), 250 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	ULTRAMAGIC SA	**Registration:**	N201FW
Model/Series:	T210 NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Balloon	**Serial Number:**	210/72
Landing Gear Type:		**Seats:**	
Date/Type of Last Inspection:	September 19, 2012 100 hour	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Unknown
Airframe Total Time:	230 Hrs at time of accident	**Engine Manufacturer:**	
ELT:		**Engine Model/Series:**	
Registered Owner:	FAIR WINDS INC	**Rated Power:**	
Operator:	FAIR WINDS INC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KEIK	**Distance from Accident Site:**	12 Nautical Miles
Observation Time:	08:55 Local	**Direction from Accident Site:**	70°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	14 knots / 22 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	20°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.94 inches Hg	**Temperature/Dew Point:**	19°C / 9°C
Precipitation and Obscuration:			
Departure Point:	Gunbarrel, CO	**Type of Flight Plan Filed:**	None
Destination:	Boulder, CO	**Type of Clearance:**	None
Departure Time:	07:15 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Minor
Passenger Injuries:	2 Minor, 9 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Minor, 10 None	**Latitude, Longitude:**	39.924999,-105.225555

Administrative Information

Investigator In Charge (IIC):	Bowling, David
Additional Participating Persons:	
Original Publish Date:	February 10, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=87189