Aviation Investigation Final Report

Location:	Mountain Home, Idaho	**Accident Number:**	WPR18LA163
Date & Time:	June 2, 2018, 13:38 Local	**Registration:**	N62073
Aircraft:	North Wing Pulse	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Air race/show		

Analysis

The hang glider pilot was performing a routine in an airshow that included the hang glider being towed to altitude by a truck-driven winch trailer. The truck and hang glider typically needed to make three passes along the runway in order to gain the altitude required for the routine; however, at the beginning of the third pass, the hang glider appeared to descend and then made an aggressive turning maneuver. The hang glider then stabilized for a few seconds before rolling to a nose-down attitude and striking the ground.

Postaccident examination did not reveal any anomalies with the airframe or the tow system that would have precluded normal operation.

Multiple witnesses reported seeing at least one dust devil on the airfield about the time of the accident. Review of video footage confirmed the presence of a dust devil about the time of the accident along with evidence of low-level wind shift activity.

A grass fire on the airfield earlier in the day had resulted in the temporary suspension of the airshow. By the time the accident routine had begun, the fire had been extinguished; however, smoldering areas and hot spots were still present and were being monitored by the fire department. All of the criteria for the development of dust devils were present at the time of the accident except for temperatures above 90°F; however, the burn area from the fire would have resulted in locally warmer temperatures in the vicinity of the accident site and increased the likelihood of eddy or vortices in the area of the accident site. Additionally, while the routine was progressing, a military fighter jet was idling on the ramp with its hot exhaust gases facing the runway toward the location of the ground impact. The jet began to taxi during the hang glider routine, and it is possible that the exhaust gases further exacerbated the conditions and created sufficient eddies to trigger a dust devil event.

Based on the available evidence, it is likely that the hang glider encountered dust devil activity while being towed to altitude.

The 62-year-old pilot had been paralyzed from the shoulders down due an accident about 40 years prior. He had accumulated extensive hang gliding experience since then and had performed the airshow routine many times before. However, the pilot had been suffering from arthritis in his left shoulder, which in recent months had resulted in a significant decrease in its range of movement. As such, he was experiencing difficulties getting into the hang glider harness, operating his wheelchair, and performing routine daily tasks, and he had discussed the possibility of retiring at the end of the airshow season. Although the autopsy identified evidence of mild coronary artery disease, there was no evidence he ever had any symptoms of ischemia, and it is unlikely that his heart disease contributed to the accident.

The pilot's recently degraded shoulder function due to arthritis, likely reduced his ability to perform the control inputs required to recover from the dust devil encounter or release the hang gliders airframe parachute.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The hang glider's encounter with a developing vortex or dust devil while maneuvering during an airshow routine, which resulted in a loss of control at an altitude that precluded recovery. Contributing to the accident was the pilot's preexisting and worsening arthritis in his left shoulder, which inhibited his range of motion and resulted in a reduced ability to control and recover the hang glider during the encounter.

Findings

Environmental issues	Dust devil/whirlwind - Effect on equipment
Aircraft	Altitude - Not attained/maintained
Aircraft	(general) - Not attained/maintained
Personnel issues	Physical limitation - Pilot
Personnel issues	Aircraft control - Pilot

Factual Information

History of Flight

Maneuvering-low-alt flying	Other weather encounter
Maneuvering-low-alt flying	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On June 2, 2018, about 1338 mountain daylight time, an experimental, amateur-built North Wing Pulse 10M hang glider, N62073, collided with the ground while participating in an airshow at Mountain Home Air Force Base (KMUO), Mountain Home, Idaho. The commercial pilot sustained fatal injuries and the hang glider sustained substantial damage. The hang glider was registered to and operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91 flight. Visual meteorological conditions prevailed, and no flight plan was filed for the local flight, which departed KMUO about 1332.

The premise of the pilot's airshow routine was a comedy act in which he would simulate inadvertently flying the hang glider into an active airshow, interrupting another airplane that was performing an aerobatic routine. The plan was for the hang glider, which was equipped with smoke canisters and a series of trailing streamers, to be towed past show center while the aerobatic airplane made a series of close passes, eventually cutting the streamers. Throughout the routine, the rehearsed radio interactions between the hang glider pilot, aerobatic pilot, and the show announcer were transmitted over the public address system.

During a typical airshow, the hang glider was launched by a moving tow-launch system composed of a winch trailer pulled by a truck. The truck and trailer then travelled back and forth down the runway spinning out the tow line while the winch operator maintained line tension as the hang glider climbed to the desired altitude (usually 1,500 ft). The pilot typically released the line once the truck had turned around after the third pass. The pilot would then begin to perform a series of gliding maneuvers down to the ground, while the line, which was equipped with a parachute, was rewound back into the winch spool as it descended.

Most of the accident sequence was recorded on a security camera located on the KMUO control tower in the center of the airport, about 2,100 ft south of runway 12/30, and directly across from show center. Footage from the camera was provided by the United States Air Force (USAF).

On the day of the accident, the performance began and progressed uneventfully until the end of the truck and winch trailer's second runway pass. After being given the all-clear by the hang glider pilot, the truck and winch trailer turned around as planned and began to accelerate along runway 12 in anticipation of the pilot releasing the line. (See figure 1.) The winch operator stated that, a few seconds after the turn, he looked up and noticed that the hang glider was about 500 ft below the altitude at which he would typically expect to see it. The hang glider then performed an aggressive turning maneuver (see figure 2) and descended another 500 ft. The winch operator then released the winch pressure to supply the hang glider with more slack and prevent it from being impeded by line tension. The hang glider then entered a climb, rolled to the left, descended, and impacted the ground in a nose-down attitude. (See figures 3 and

4.)

Figure 1. Hang glider (red circle) and tow truck (green circle) beginning the final pass along runway 12

Figure 2. Hang glider performing aggressive turning maneuver

Figure 3. Hang glider rolling left

Figure 4. Hang glider striking the ground

Multiple witnesses recounted a similar sequence of events, stating that the maneuvers after the second pass were completely unconventional and not part of the routine. The airshow coordinator (air boss), who had seen the routine performed many times before, stated that the performance appeared to be going well and the streamers were cut during the second lap as planned. However, during the final turn, the hang glider was a little lower than normal and it performed a sudden circling maneuver, which he described as a "pinwheel." He commented to one of the crew that something was not right. The hang glider appeared to stabilize and descend, and then performed another pinwheel maneuver before it impacted the ground in a nose-down attitude. A witness saw the hang glider suddenly pitch up before the impact, and based on his experience, assumed that it had encountered a strong wind.

Neither the air boss nor the winch operator saw the line parachute deploy, and when the winch operator arrived at the accident site, the parachute and line were in the immediate vicinity of the main wreckage,

appearing to have detached on impact. Multiple airshow attendees reported to news media that the tow line was cut by the aerobatic airplane during the routine, however, examination revealed that the line was intact and undamaged.

Pilot Information

Certificate:	Commercial	**Age:**	62,Male
Airplane Rating(s):	None	**Seat Occupied:**	Single
Other Aircraft Rating(s):	Glider	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Unknown	**Last FAA Medical Exam:**	March 18, 1996
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 2000 hours (Total, all aircraft), 1500 hours (Total, this make and model)		

The 62-year-old pilot had broken his neck in a hang-gliding accident in 1981 and had been a C7 quadriplegic, paralyzed from the shoulders down, since then. He was issued a commercial pilot certificate with a glider rating in February 1996, with limitations for "aero tow" and "hand controls" only.

Federal Aviation Administration (FAA) records indicated that the pilot had undergone an FAA medical examination in March 1996, and subsequently was scheduled for a medical flight test in May of that year, but it was not clear if he completed the test or if a medical certificate was ultimately issued.

FAA regulations do not require the pilot of a hang glider to hold a pilot or medical certificate.

Aircraft and Owner/Operator Information

Aircraft Make:	North Wing	**Registration:**	N62073
Model/Series:	Pulse 10M	**Aircraft Category:**	Weight-shift
Year of Manufacture:	1995	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	53201
Landing Gear Type:	Tandem	**Seats:**	1
Date/Type of Last Inspection:	Unknown	**Certified Max Gross Wt.:**	269 lbs
Time Since Last Inspection:		**Engines:**	0
Airframe Total Time:		**Engine Manufacturer:**	
ELT:	Not installed	**Engine Model/Series:**	
Registered Owner:	On file	**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	None

The hang glider was composed of a North Wing Pulse 10M wing and a Moyes Delta Gliders Contour model harness. The system was configured with a "softpack" style BRS Aerospace aircraft parachute rescue system mounted to the harness.

The harness was connected to the tow line using a two-point strap, which incorporated a barrel-type quick release on the right side next to the pilot's chest. Operation of the quick release would have required pulling the barrel toward the harness while the strap was still under tension. The strap was connected to the tow line with a weak link, and a small parachute was connected to the end of the tow line.

The winch system included a spool of ultra-high molecular weight polyethylene cord (tow line), which was driven by an electrical motor. The speed of the spool during the towing process was maintained by a hydraulically-controlled automotive disk brake system, the pressure of which was governed by the tow operator.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KMUO,2996 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	19:38 Local	**Direction from Accident Site:**	22°
Lowest Cloud Condition:	Clear	**Visibility**	4 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	40°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.25 inches Hg	**Temperature/Dew Point:**	24°C / 1°C
Precipitation and Obscuration:	Moderate - None - Haze		
Departure Point:	Mountain Home, ID (MUO)	**Type of Flight Plan Filed:**	None
Destination:	Mountain Home, ID (MUO)	**Type of Clearance:**	None
Departure Time:	13:32 Local	**Type of Airspace:**	Class D

A ground pyrotechnic display was scheduled to begin as the show opened, with more pyrotechnics progressively ignited during the day in coordination with approaching aircraft to simulate bombing runs. However, according to the air boss, due to a shift in wind direction, fire from the initial display landed in the other pyrotechnic staging area. Therefore, the decision was made to expend the entire remaining pyrotechnic load in a controlled manner rather than risk it igniting by accident. The subsequent controlled explosion at 1115 started a grass fire on the airfield, and the show was put on hold while the fire was extinguished. During that period the control tower was evacuated, but by 1132, fire command advised that the show could resume. Fire crews continued to extinguish flare-ups and monitor the area for hotspots, and by 1333, 5 minutes before the accident, one of the engines on the field reported that all the fires had been extinguished.

Two witnesses provided statements regarding the weather conditions over the area at the time of the accident. The first was a working volunteer who was also a hang glider pilot, and the second was a pilot who had just been flying a P-51 Mustang in the airshow, and was located immediately east of the accident site, and still in his airplane. Both witnesses described seeing dust devils over the area before and immediately after the accident.

The first witness, who was located about show center, indicated that before the accident pilot started his routine, he observed a dust devil to the west of the runway in a location past the air traffic control tower. He identified that the dust devil had a well-defined vortex and extended to about 200 ft above the ground. He stated that only a small amount of dust outlined the vortex's shape, and that he pointed out the dust devil to a friend who also witnessed the event.

The second witness saw several large dust devils over the airport area during the accident period. He indicated that the winds were light and variable until the pyrotechnic display and related fire started, after which strong vertical wind flows followed. Immediately after the accident, he noticed a dust devil to the south of his position travel across the audience. He described it as a large "lumbering" dust devil

with a diameter of 40 to 80 ft that extended from 300 to 1,000 ft high. He noticed it blowing dust and disturbing papers, and people in the audience were holding their hats due to the sudden winds. He was able to observe the dust devil for about 5 to 10 minutes before he lost sight of it. Based on the movement and location of the dust devil, he extrapolated that it was likely over the area of the accident at the time of the event.

The air boss stated that at no time during the show did he see any dust devils, and it was not until the next day that he was told they were present.

Synoptic Conditions

The northwest section of the National Weather Service (NWS) Surface Analysis Chart for 1200 MDT on June 2, 2018, depicted two high pressure systems over Idaho and western Wyoming at 1028- and 1030-hectopascals (hPa) respectively, dominating over the area with a weak pressure gradient. No other significant boundaries were identified over the area.
The station models surrounding the accident site depicted clear skies and temperatures in the 70º F range with surface wind from the east to northeast at 5 knots or less.

A review of the NWS Boise (KCBX) WSR-88D radar imagery surrounding the period did not detect any significant meteorological echoes or boundaries over the area.

Surface Observations

KMUO, located at an elevation of 2,996 ft mean sea level, had an automated weather observation system which was supplemented by Air Force weather observers.

The automated observation issued at 1258 indicated a 2-minute average wind from 070º at 4 knots, 10 miles or more visibility, skies clear, temperature of 73ºF, dew point of 34ºF, and an altimeter setting of 30.27 inches of mercury (Hg). The remarks included that drizzle was reported within the hour, which was likely from water spray used by the fire department to extinguish the grass fire after the pyrotechnics display.

A review of the 1-minute observations indicated that the 2-minute average winds were 7 knots or less between 1307 and 1344; at the time of the accident, winds were reported from 040º at 4 knots. The 1-minute observations also showed a significant variation in visibility during the period, with visibility at and below 5 miles or in haze (most likely smoke) between 1313 and 1344, with visibility decreasing below 3 miles between 1316 and 1325.

A special observation made by a weather observer was issued at 1349. At that time, the wind was reported from 230º at 3 knots; visibility was 10 miles or more with a few clouds less than 100 ft above ground level. The temperature was 75ºF, and the altimeter setting was 30.25 inches Hg. The remarks section noted the presence of smoke.

Video

The NTSB received five videos of the accident sequence taken by airshow attendees. These videos,

along with the KMUO tower video, were reviewed for any additional meteorological information such as wind or dust devil activity.

All the videos depicted clear skies over the area with visibility generally unrestricted in the vicinity of the accident site. Several of the videos confirmed lower visibility in haze or smoke to the north-northwest through the northeast. At least three videos captured a dust devil, which extended vertically several hundred feet high on the field and south of the control tower.

The KMUO tower video revealed that as the hang glider began its first pass to the southeast after takeoff, the smoke from smoldering grass was moving to the southeast as well. About two minutes 30 seconds later, as the hang glider came back for its second pass the smoke stopped and then began to change direction, drifting northwest. About that time, a USAF F-22 Raptor was on the ramp, adjacent to show center with its exhaust facing the runway almost directly adjacent and below the hang glider's location. The F-22 then began to move forward and turn north to taxi along the adjacent ramp as the hang glider routine progressed.

Several of the videos captured the hang glider become airborne after impacting the ground and move a short distance south. After impact, the smoke from the hang gliders smoke canisters appeared to drift to the south, in the same direction as dust generated by approaching Aircraft Rescue and Firefighting (ARFF) trucks. At the same time, smoke from smoldering grass about 750 ft southwest appeared to be drifting north. A few minutes later, while the ARFF personnel were attending to the wreckage, the smoke from the hang glider began to drift vertically and toward the northwest.

After the accident occurred, the KMUO tower video captured multiple ARFF vehicles approaching from different directions on the field. Dust from vehicles approaching the accident site from the northwest moved in a northwest direction, while dust from vehicles approaching from the south moved in a southeast direction. As the first ARFF truck arrived at the accident site, its dust appeared to be pulled directly upward into a column shape.

Dust Devils

According to the American Meteorological Society, a dust devil is defined as, "a well-developed dust whirl; a small but vigorous whirlwind, usually of short duration, rendered visible by dust, sand, and debris picked up from the ground."

Accordingly, wind speed ranges from an average of 40 knots and can exceed 50 knots in intense dust devils, which can be occasionally strong enough to cause minor structural damage. Diameters range from about 10 ft to greater than 100 ft; their average height is about 600 ft, but a few have been observed as high as 3,000 ft or more. Although the vertical velocity is predominantly upward, the flow along the axis of large dust devils may be downward. Large dust devils may also contain secondary vortices. Dust devils are best developed on a hot, calm afternoon with clear skies, in a dry region when intense surface heating causes a very steep lapse rate of temperature in the lowest 3,000 ft of the atmosphere. In the United States, dust devils have been reported in every state but are most frequently reported in the deserts and flat terrain of the southwest.

The atmospheric conditions that commonly increase the likelihood of dust devil formation include flat

barren terrain, clear skies, calm to light winds under 10 knots, and surface air temperatures over 90°F. Since dust devils are associated with intense solar heating, the maximum occurrence typically occurs between 1300 and 1400 local, at the time of maximum soil temperatures and the convective heat flux.

The creation of eddies of sufficient magnitude have also been documented to trigger dust devil formation due to the increase in relative vorticity. Such eddies could come from hot aircraft exhaust, local grass fires, or from emergency response vehicles.

According to the United States Parachute Association, dust devils are also considered major hazards among skydivers and paragliding pilots, as they can cause a parachute or a glider to collapse with little to no warning at altitudes considered too low to cut away, and contribute to the serious injury or death of many parachutists.

A complete meteorology report, along with videos, witness locations, and statements is available in the public docket.

Airport Information

Airport:	MOUNTAIN HOME AFB MUO	**Runway Surface Type:**	Asphalt
Airport Elevation:	2996 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	12	**IFR Approach:**	None
Runway Length/Width:	13510 ft / 200 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	43.041667,-115.871665

The hang glider came to rest about 250 ft southwest of the right edge of runway 12, perpendicular to show -center and about midway down the runway.

The primary airframe structure, including the king post, keel beam, and leading edge tubes were intact. The bridles and support cables were intact and remained connected at their respective fittings. With the exception of scratches and serrations at the nose, the sail was intact and remained attached to both the left and right leading edge tubes and all ribs.

The damage appeared to be impact-related and focused at the forward end of the wing structure at the nose plate junction assembly. Similar bending damage was present on the downtubes leading to the

crossbar assembly, and both plastic main wheels had shattered.

The harness remained attached to the slider bar through the main suspension strap. The tilt rope loop was intact at the top of the harness and continuous around the pulley to the adjustable tilt cleat. The right side of the towing strap remained attached to the harness; the left side had been detached from the harness by first responders. The tow line quick-release tube was in the locked (unreleased) position. Examination of the quick-release mechanism revealed that it could be activated normally by hand.

There were no indications that the pilot had deployed the BRS parachute or released the tow line.

Both the spool and brake system of the winch operated when tested.

Examination did not reveal any anomalies with the airframe that would have precluded normal operation. Refer to the airframe examination report included in the public docket for further details.

Medical and Pathological Information

According to the autopsy performed at the request of the Elmore County Coroner's Office, Mountain Home, Idaho, the pilot's cause of death was traumatic blunt force injuries. Mild coronary artery disease was also found.

Toxicology testing performed by the FAA Forensic Sciences Laboratory did not identify any tested-for substances.

The pilot's personal medical records indicated that, during the week before the accident, he had visited an orthopedic specialist for an evaluation after several months of significantly decreased range of motion and limited function of his left shoulder that made it harder for him to operate his wheelchair. The diagnosis was primarily arthritis, and they discussed a future joint replacement, but no definitive treatment was performed.

According to the winch operator, who helped the pilot with day-to-day operations, the pilot had longstanding issues with mobility in his left shoulder, which was progressively deteriorating. As such, the pilot was finding it harder to perform basic tasks such as showering or getting in and out of his truck, and the winch operator had been helping him more with physical tasks. Although the last practice flight occurred 2 days before the accident, the pilot had decided to curtail future flights due to the pain he endured getting in and out of the harness and in order to reduce wear and tear on his shoulder.

The pilot stated to the winch operator that his goal was to get through the 2018 show season and decide the future of the operation at the end of the year.

Additional Information

The winch operator and pilot had driven to Idaho from Dayton, Nevada, a few days before the accident. The pilot had been scheduled to perform at the airshow the day before the accident but had cancelled due to strong wind conditions. They were staying in a local hotel, and the pilot went to bed about midnight the night before the accident, which was his normal routine. On the day of the accident, they departed for the airport at 0650, and the airshow briefing started at 0800.

The winch operator stated that the briefing was routine, and the pilot, driver, and himself met with the air boss and announcer. The group then drove the flight line, established show center, checked the wind, and discussed the various launch, turn, and release points. They arrived back at the hangar at 0930, and then did a "meet and greet" with the attendees. The pilot seemed in good spirits and wanted to watch the upcoming pyrotechnics show.

About 1215, the pilot performed his preflight checks. He carried a water bottle and was drinking from it throughout the morning. Once the check was complete, the group assisted the pilot with getting into the hang glider, and about 1300, they drove to the taxiway, where they waited for the previous act to finish. The winch operator stated that the time the pilot spent in the harness was not excessively long and was typical for most airshows.

Administrative Information

Investigator In Charge (IIC):	Simpson, Eliott
Additional Participating Persons:	Kenneth Hawkins; Federal Aviation Administration FSDO; Boise, ID
Original Publish Date:	April 8, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=97395