



United States Department of the Interior  
Serious Accident Investigation Report

**Factual Report**

David J. Liston  
Smokejumper Fatality

Thomas O. Roach  
Smokejumper Non-injury  
Parachute Malfunction

Bureau of Land Management  
Alaska Fire Service  
Ft. Wainwright, Alaska

April 29, 2000

Factual Report

U.S. DEPARTMENT OF THE INTERIOR

FACTUAL REPORT

FATAL INJURY TO DAVID J. LISTON

SMOKEJUMPER, ALASKA FIRE SERVICE

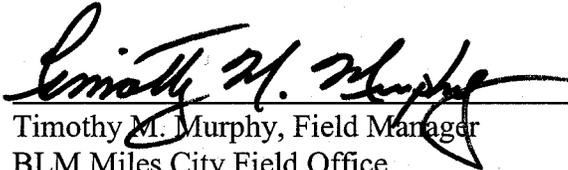
PARACHUTE MALFUNCTION INVOLVING THOMAS O. ROACH

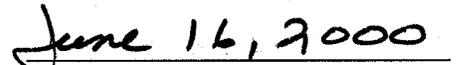
SMOKEJUMPER, ALASKA FIRE SERVICE

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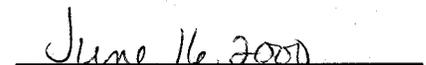
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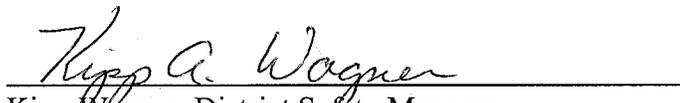
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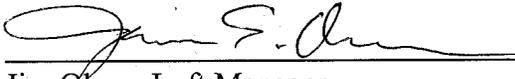
  
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(Chief Investigator)

  
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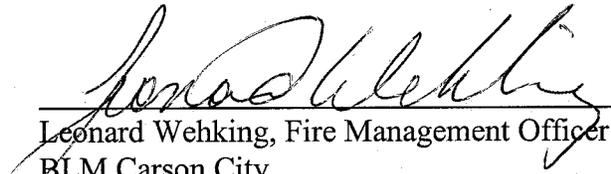
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Jim Olson, Loft Manager  
BLM Boise Smokejumpers  
(Technical Specialist)

6-19-00

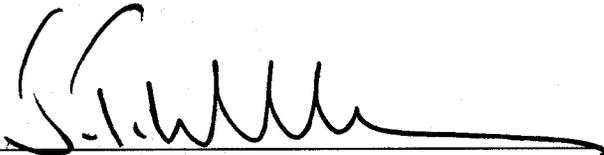
Date



Leonard Wehking, Fire Management Officer  
BLM Carson City  
(Technical Specialist)

June 19, 2000

Date



Jerry Williams, Director, Fire Management Staff  
U.S. Forest Service, Northern Region  
(Interagency Representative)

6.19.2000

Date



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NOTE: The Factual Report is prepared for a bureau head and bureau DASHO, by the Serious Accident Investigation Team, which is completed within 45 calendar days of an accident. The Factual Report contains only the essential facts related to the serious accident without any inferences, conclusions, or recommendations. The Department of the Interior Office of Managing Risk and Public Safety (MRPS) may distribute copies of the Factual Report or factual information gleaned from the Report to other bureaus and agencies.



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### Preface

Smokejumpers engage in work that involves risk, including the risks inherent in air operations. These individuals receive training and equipment necessary to mitigate the risks. The incident regarding this fatality involved multiple interactive equipment failures.

The Serious Accident Investigation Team was formed within hours of David Liston's death and assembled at Fairbanks within 24 hours of notification. The team is deeply committed to the objective identification of the causes of Liston's death, and identification of actions that will prevent such an accident from occurring again.

The Investigation Team acknowledges the cooperation of the men and women of the Alaska Smokejumpers and many other individuals at the Alaska Fire Service (AFS), Northern Field Office and Alaska State Office throughout the investigative effort. In the face of a tragic incident involving a colleague, smokejumpers on the scene at the time of the incident took steps to protect the physical evidence. Local office personnel assembled equipment and material while the team traveled to Fairbanks and provided operational support throughout the investigation. The team is grateful for these contributions. The U.S. Army personnel at Fort Wainwright, Fairbanks Police Department, and the Federal Aviation Administration were supportive and cooperative throughout the effort. The team sincerely thanks each person who contributed to the investigation.

The medical examiner's report and the Federal Bureau of Investigation (FBI) video enhancement are pending. Any new information from these items of evidence may change the findings of this investigative report. A negative toxicology report has been verbally provided to the Investigation Team.

This report is presented to the Director, National Office of Fire and Aviation.



## Factual Report

Smokejumper Fatality David J. Liston  
Parachute Malfunction Thomas O. Roach

### EXECUTIVE SUMMARY

On April 29, 2000, David J. Liston, a temporary forestry technician (smokejumper) with the Bureau of Land Management (BLM), AFS, at Ft. Wainwright, Alaska, was fatally injured in a pre-season refresher qualification jump. Liston, 28, worked with the BLM as a smokejumper since April 1998, and as a seasonal employee with BLM and the U.S. Forest Service since May 1993. Liston completed 64 successful jumps with the BLM ram-air parachute system, and in 1998, successfully managed and deployed his reserve parachute on jump 28, following a parachute malfunction.

Liston was the third smokejumper of the last four-person group to jump Saturday afternoon, April 29, 2000. The fourth and last smokejumper, Thomas O. Roach, 28, had a main parachute system malfunction, a drogue-in-tow, but successfully deployed his reserve parachute and landed safely without injury. There were no problems reported with the 22 jumps completed earlier in the day.

Liston and Roach began their latest appointments on April 23, 2000, and completed four previous refresher jumps that week; they were in the process of completing their fifth refresher jump when the accident occurred. On that day, Liston and Roach successfully completed a refresher jump early in the afternoon, and were the only two smokejumpers to participate in a second jump.

The evidence shows that Liston's drogue parachute deployed but the main parachute did not. The reserve pilot-chute bridle and suspension lines entangled with the main drogue bridle preventing either parachute from deploying. Liston pulled all three handles. The exact sequence is unknown.

The evidence shows that Roach's drogue parachute deployed but the main parachute did not deploy when he pulled the drogue release handle. Roach recognized the malfunction as a drogue-in-tow (failure of the main parachute to deploy). He then initiated his emergency procedures, pulled his main release handle and his reserve parachute handle. The reserve parachute deployed. As it did, the drogue released and the main detached from the harness. He landed without further incident.

There is no evidence to indicate that the parachute packing (rigging) influenced the outcomes of these incidents. All parachutes, their rigging, and all equipment, including the harness assemblies, were in good repair, packed properly, and undamaged.



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### BACKGROUND OF THE ACCIDENT

Liston was hired on a 180-day temporary appointment as a forestry technician (smokejumper, GS-0462-06) on April 23, 2000, and was completing refresher training for his third year with the Alaska Smokejumpers. He had been on duty for six days, including the day of the accident. He first came to work with the AFS in 1995 as a member of the Midnight Sun hotshot crew. He worked with the Midnight Suns in 1995 and 1996, and was a squad boss with the North State fire crew (Type II) in 1997. He successfully completed rookie training with the Alaska Smokejumpers in 1998.

Liston completed 64 successful jumps with the BLM ram-air parachute system. All witnesses reported that he was in good spirits. On the jump critique video of the previous jump that day, he was asked about the jump. He indicated his eagerness to jump again, and wanted to get on the list and jump a fire on Monday.

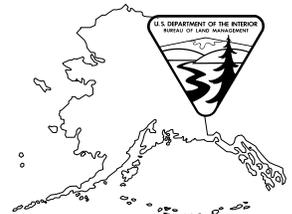
Roach was hired on a 180-day temporary appointment as a forestry technician (smokejumper, GS-0462-06) on April 23, 2000, and was completing refresher training for his third year with the Alaska Smokejumpers. He had been on duty for six days, including the day of the accident. He first came to the AFS in 1998. Previously, he had worked with the Minnesota Department of Natural Resources as a Smokechaser from 1993 to 1995, and as a member of the Helena hotshot crew in Montana from 1995 to 1997.

Roach successfully completed rookie training in 1998, and completed 63 successful jumps with the BLM ram-air parachute system. Roach also completed four previous jumps that week, including one earlier that afternoon.

### Supervision

Liston's and Roach's supervisor is Dalan T. Romero, Chief, Branch of Smokejumper Management, BLM, AFS.

William Cramer is the training supervisor for the Alaska Smokejumpers. He is responsible for the format, scheduling, and operation of the refresher training that Liston and Roach participated in from April 24 through April 29. Cramer was the spotter-in-charge aboard the J-17 (Casa 212) when Liston and Roach experienced malfunctions.



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# Parachute Riggers

Lance Clouser packed the reserve parachutes for both Liston and Roach and the main parachute for Liston. He holds a Federal Aviation Administration (FAA) Master Parachute Rigger Certificate and is a civilian sport parachutist.

David Hade packed the main parachute for Roach. He holds an FAA Master Parachute Rigger Certificate and is employed by the BLM as a year-round loft specialist.

## Equipment Section

The BLM began researching an alternate parachute to the FS-10 round canopy for smokejumping in 1978. Equipment development and testing began in 1979 and continued through 1981. Smokejumper training and field-testing started in 1982. The first operational fire jumps began in 1982. Further refinements in the ram-air equipment took place from 1982 through 1990. By 1990, the current harness design was finalized resulting in the ram-air harness model 8801. Rookie BLM smokejumper classes trained exclusively on the ram-air system for the first time in 1991. BLM smokejumpers currently use the system finalized in 1990 (BLM ram-air parachute system series 200).

The main parachute used is the Trilobe, a 330-square foot, seven-cell ram-air parachute. The ram-air parachute is a semi-rigid, airfoil-shaped canopy designed for maneuverability and target accuracy. The ram-air main parachute follows this sequence when opening:

1. Static line deploys drogue.
2. Drogue gives smokejumper an upright stable body position.
3. Drogue release handle is pulled by smokejumper. Released drogue pulls main parachute deployment bag (D-bag) off smokejumper's back.
4. Lines pay out (rubber retainer bands keep deployment bag closed until line stretch is complete).
5. D-bag is pulled off canopy.
6. Canopy inflates.

The reserve parachute, MT-1S by Paraflite, is a 270-square foot, five-cell ram-air canopy. This model was originally used as a main parachute during the research and development of the ram-air system from 1981 through 1984. The attachment of the reserve to the ram-air harness using "droop risers" allows the parachute to ride in the same position as the main when deployed.

The drogue parachute has two primary functions. First, the drogue serves to stabilize the smokejumper in an upright position after exit. The upright position avoids suspension line entanglements with the smokejumper during



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deployment of the main parachute. Second, the drogue serves as a pilot-chute for the main canopy. After the smokejumper pulls the drogue release handle, the drogue parachute is designed to release from the harness and pull the main parachute out of its container.

The 3-ring *drogue* release system allows parachutists to release the drogue by pulling a single *handle*. The 3-ring main release system allows the parachutists to jettison a malfunctioning main canopy by pulling a single handle.

## Accident/Incident History

Four primary types of malfunctions include: Drogue-in-Tow, Streamer, Spinning, and Horseshoe. (See the BLM *Ram-air Parachute Training Manual - 2000* for a description of each malfunction.) The emergency procedure is the same for every malfunction that cannot be cleared:

1. Throw away drogue release handle, left hand on hip, feet together, head down.
2. Look at main release handle.
3. Pull main release handle and throw it away.
4. Look at reserve handle.
5. Pull reserve handle.

The BLM *Ram-air Training Manual - 2000* identifies the following causes of a drogue-in-tow malfunction (when the drogue deployed but did not release as designed):

- 3-rings not hooked up correctly;
- wrong cables used to hook drogue;
- swedge came loose on drogue release handle; and,
- drogue bridle breaks.

The Liston fatality is the second involving the BLM ram-air system. The first fatality with the BLM ram-air system occurred in 1991. It involved a U.S. Forest Service employee who was cross training on the system. That investigation concluded that the smokejumper did not pull the drogue release handle. At 150 feet above ground level (AGL), the smokejumper attempted emergency procedures and pulled his reserve too late for the canopy to fully inflate.

It is estimated that there have been more than 30,000 BLM ram-air parachute jumps between 1979 to 1999. From 1979 to 1999, there have been 29 BLM smokejumper reserve parachute deployments. Primarily, these have been caused by tension knots, under a variety of ram-air main canopies. Three drogue-in-tow malfunctions have been reported with the present system; each was investigated and specific problems were identified. Two malfunctions in 1983 and 1984 were the result of manufacturing problems



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that have been corrected and one, in 1992, was the result of an incorrectly repaired bridle assembly. All timely reserve parachute deployments have been successful up to this incident.

**See Appendix C for a description of the parachute equipment used by Liston and Roach.**

## Materials Section

The system components designed and manufactured by BLM are the harness, main and reserve containers, main deployment bag, personal gear bag, static line and drogue deployment bag, separable reserve risers, and occasionally, the main risers. This equipment was designed and built in accordance with industry standards and practices. Parachutes are purchased from commercial sources and comply with FAA requirements and industry standards. Materials complied with applicable military specifications and industry standards at the time of construction.

## Smokejumper Operational Procedures

The BLM *Ram-air Parachute Training Manual - 2000*, Crew Handbook, FAA regulations and other current parachute reference manuals (i.e., Poynter's) provide the following information:

- Smokejumper policies, procedures, standard operating procedures;
- Specific operating practices;
- Exact procedures and operating instructions;
- Safety precautions, malfunctions and emergency procedures and hazard identification; and,
- Management involvement and control.

## Training Procedures

Rookie training includes four weeks of classroom, unit and jump training. Classroom training covers jump equipment orientation, ram-air flight theory, malfunction procedures, and jump spot factors. Unit training includes aircraft procedures, buddy checks, tower training, letdown training, and parachute landing falls. Jump training covers parachute simulator, and 12 actual training jumps. The students are intensively evaluated during each phase and performance is recorded and critiqued.



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The 2000 refresher training season was extended from the customary five-day duration to six days. This was done to minimize time pressure on both the instructors and employees undergoing refresher training, and airspace conflicts with the military.

The *Ram-air Parachute Training Manual - 2000* is up-to-date, current and accurate. Twenty-two pages of the manual cover recognition of malfunctions, malfunction procedures, emergency procedures, corrective actions and nine special situations that may occur during a jump. The manual section on malfunctions is extensive, and includes a number of malfunctions that have been experienced in the sport parachuting world, but not experienced by BLM smokejumpers. The malfunction involving the entanglement of the reserve pilot-chute with the drogue bridle is not discussed.

## Work Environment

Weather conditions at the time of the accident were mostly clear and sunny, with few clouds at 5,500 feet, and scattered clouds at 20,000 feet. Ground winds were light and variable (1-3 mph). Winds at jump altitude were reported at 190 degrees (from the south/southwest) at eight knots. The temperature recorded at AFS Fairbanks Remote Area Weather Station (altitude 454 feet) was 57 degrees Fahrenheit (F), with 25 percent relative humidity. The temperature at 3,450 feet mean sea level (MSL) recorded by weather sounding 30 minutes before the accident was 29-31 degrees F.

Minimum flight conditions for ram-air smokejumper jump operations are 3,000 feet minimum AGL and visual flight rules (VFR) conditions (500 feet below, 1,000 feet above, and 2,000 feet horizontally from clouds). The conditions at the time of the incident were within minimum standards.

The River Road jump spot is on flat terrain, about 450 feet above MSL in elevation. The ground cover vegetation is tussocks tundra with scattered mixed spruce and hardwoods. The ground is generally swampy with standing water 3-12 inches deep, between the individual tussocks.

Liston's fatality site was wooded with patches of snow, located approximately 3,000 feet northwest of the River Road jump spot.

Both sites are located south of the ridge that includes the Birch Hill ski area on Ft. Wainwright Military Installation, Alaska.



## CHRONOLOGY OF EVENTS

April 23, 2000 - Liston and Roach began employment with the Alaska Smokejumpers.

April 24, 2000 - Liston and Roach began Smokejumper Refresher training. The jump schedule was posted for the jump on April 29, 2000.

April 25, 2000 - Liston and Roach completed tower evaluations.

April 27, 2000 - Liston and Roach completed two practice jumps.

April 28, 2000 - Liston and Roach completed one practice jump.

### The Day of the Accident April 29, 2000.

(All times are in local time. Times are approximate.)

9:00 a.m. - Second refresher group, trainers, spotters, operations, etc. started work. Roll call was taken, morning briefing was given, and the workday was started in the loft, rigging, inspecting gear/parachutes until 10:00 a.m.

10:30 a.m. - Group met in the smokejumper lounge to critique previous days' jumps and watch jump video.

11:30 a.m. - 1:00 p.m. - Reviewed Bowl Mountain, Montana incident.

1:00 p.m. - 2:00 p.m. - Lunch.

2:00 p.m. - 2:30 p.m. - Group briefed on the afternoon jump criteria. Ground crew personnel were assigned to videotape and critique the jumps.

2:30 p.m. - First smokejumper load, consisting of eight employees suited up.

2:43 p.m. - Aircraft pilot-in-charge (PIC) Chris Eisele, and aircraft pilot (second PIC) Stoney Bauer started the jump ship, a Casa 212, Call Sign J- 17. **(Investigator's Note: the same jump ship and pilots were used for every jump that day.)**

2:49 p.m. - Wheels-up for first load. Jumps occurred at River Road jump spot, with two four-person sticks, a group of smokejumpers exiting the plane as it passes over the jump site.

3:10 p.m. - 3:13 p.m. - Jump ship landed and returned to standby shack for second smokejumper load.

3:15 p.m. - 3:16 p.m. - The Jump ship took off and went wheels up for second smokejumper load to River Road jump spot, with two four-person sticks.



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3:30 p.m. - Smokejumper Action Report indicated Request #25 Practice Jump, including Liston as the third person and Roach as the eighth person on the list. BLM spotters were Mitch Decoteau and Melvin Tenneson. Comments indicated cross wind pattern. It was evaluated as a good job by all.

Videotape footage showed Liston's landing and roll. He was seen packing his equipment bag.

Liston and Roach, with the ground crew (William Cramer, David Bloemker and Mike Lambright), were transported to the standby shack for the next scheduled jump.

3:41 p.m. - 3:42 p.m. - The jump ship landed and returned to standby shack and waited for smokejumpers to get their gear ready.

At the standby shack, Cramer observed the pre-jump procedures as being routine. David Hade observed that each smokejumper received a buddy check, or a major check of all smokejumper equipment by another smokejumper. The buddy check does not routinely include the personal gear bag. Cramer performed both Liston's and Roach's buddy checks. Liston's belly-bands were not routed through the d-rings of his harness. Cramer routed them correctly, then went back to the previous step **as required by procedures**, and found everything to be in order. Roach's equipment was checked by Cramer and found to be in order.

Prior to boarding the aircraft all smokejumpers received a final 3-ring and main container pin check performed by the spotter, Cramer, and the assistant spotter, Hade, by having the smokejumpers walk between them. On this final check, Cramer inspected the left riser 3-ring and the main container pin, and Hade inspected the right riser 3-ring and the drogue 3-ring. No problems were noted with the 3-rings (main riser 3-rings and drogue 3-rings) or the main container pin. After all of the smokejumpers were checked and approved for their jump, they all proceeded immediately to the aircraft.

4:15 p.m. - Before boarding the jump ship, Liston and Roach changed the jump order due to weight differences and the advantage of gaining vertical separation following exit.

4:17 p.m. - All of the smokejumpers were on board the jump ship.

4:26 p.m. - 4:27 p.m. - Jump ship was wheels-up with third smokejumper load.

4:30 p.m. - 4:40 p.m. - The Jump ship proceeded to the drop zone, where at 1,500 feet AGL the jump spot size-up was completed and found routine. Then the initial streamers were dropped to establish wind conditions. The initial set of streamers showed a fair amount of "up" air and approximately 100 yards of drift to the east/southeast. The check set of streamers made it into the spot with a normal descent rate. The spotter, Cramer, communicated with ground crew member, Paul Lenmark to inquire about wind conditions on



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the ground. The spotter was informed that the winds were light and variable, but generally in line with the streamers. Then the aircraft climbed to jump altitude 3,000 feet AGL. The spotter then briefed the first stick on wind speed and direction.

The smokejumpers of the first stick performed their four-point checks (drogue release handle, main release handle, reserve handle, and lower reserve static line snap shackle). The spotter confirmed with the jump stick that they were on final at 3,000 feet AGL. The spotter ensured that each static line was clear before giving the smokejumper in the door a slap to exit the aircraft. The exits appeared normal, no problems were noted inside the aircraft or with canopy openings.

4:40 p.m. - The pilot stated that all operations throughout the practice jump were normal. The four smokejumpers of the second stick were briefed.

4:41 p.m. - On final, the airplane was at 3,000 feet AGL, traveling at 103 knots, and the wind line as indicated by drift streamers was a northwesterly heading. The heading of the aircraft was north by northwest.

The smokejumpers hooked up their static lines and completed the four-point checks. The spotter notified the smokejumpers of the second stick that they were, "On final, 3,000 feet, static lines clear."

4:42 p.m. - 4:43 p.m. - None of the smokejumpers experienced any difficulties getting in the door and the exits appeared normal. The spotter had positive sight of each static line before he gave the smokejumpers a slap to exit the aircraft.

Several witnesses saw these smokejumpers exit the aircraft.

Gary (Ty) Humphrey exited the aircraft, went through his main parachute procedure, then turned to see Oded Shalom exit the aircraft and watched his parachute open properly. Humphrey then saw Liston exit the aircraft and only his drogue parachute deployed. Humphrey watched Liston fall all the way to the ground, but could not see any movement or hear any sound from Liston.

Shalom watched Liston jump under drogue. Shalom could not see any movement and did not hear anything from Liston. Shalom yelled at Liston to pull the handle, and then lost sight of him below his feet.

Roach watched Liston exit the aircraft, and noticed no problems as Liston exited the aircraft. About two or three seconds after Liston exited the aircraft, Roach exited the aircraft.

The spotter notified the pilot, "Jumpers Away." When the last smokejumper left the aircraft, the spotter looked toward the ground to check the exit point and then turned his attention to the smokejumpers. The spotter had a clear view of the last smokejumper, Roach, and saw the other canopies in his



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peripheral field of vision. Roach was stable under a fully inflated drogue and appeared normal. His back was to the spotter, with a normal feet-to-earth position. About three or four seconds after Roach exited the aircraft, the spotter saw him moving his right arm in a manner consistent with pulling his drogue release handle.

After a five count (about four or five seconds), Roach pulled his drogue release handle. His main parachute did not deploy, and during the next few seconds, he fell past Shalom. Roach then reached up behind him to check for lines and did not feel any. Then he pulled his main release handle. Roach pulled his reserve handle and the reserve opened successfully. Roach then looked around and saw the first two smokejumpers 300 feet above him and 300 feet away from him horizontally. Roach did not see Liston fall.

About eight to 10 seconds after Roach exited the aircraft, the spotter saw his reserve parachute begin to deploy over the inflated drogue. Ten seconds elapsed between the time the spotter notified the pilot “jumpers away,” and the spotter notified the pilot “had a drogue-in-tow malfunction on the last out.” The spotter radioed Lenmark at the jump spot that the last smokejumper had a drogue-in-tow malfunction on the last stick, and asked the ground crew to secure the equipment on the malfunction. The spotter did not know that Liston also experienced a malfunction. He notified the pilot that a smokejumper had a malfunction but had successfully pulled his reserve.

When Shalom turned back to look for Liston, he saw a reserve parachute deployed (**Investigator’s Note: Roach’s reserve parachute**). When he looked up for Roach, he could not find him.

Several persons observed the fall from various vantage points. The following is a synopsis of their accounts.

At the jump spot, James Veitch watched Liston, turned away, then looked back and saw a smokejumper with a drogue-in-tow. Veitch waited the normal cadence (about five seconds) for a smokejumper to go through emergency procedures and deploy his reserve parachute. Veitch saw that the drogue appeared normal, but could not see any arm or leg movement. He noticed the smokejumper in an upright position and not spinning. Veitch saw something flapping or floating above the head of the smokejumper.

From the jump spot, BLM smokejumper personnel, Kenneth Perry, Mathew Lyons, Ivan Smith, Bruce Ford and Mark Musitano observed the fall, and saw the smokejumper under drogue about 1,500 feet AGL, and 3,000 feet away falling feet first headed straight down. No observers heard any sounds. Ford watched Roach coming down on his reserve parachute, trailing a fully inflated drogue and another unidentifiable object. Bradley saw a portion of Liston’s fall and tried to capture it on video. He had difficulty viewing the fall through the video camera lens. Charlie Brown also filmed Liston’s fall and



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captured footage; the camera was set on a wide angle. **(Investigator's Note: Video footage does not show sufficient detail to determine the cause of the accident and has been sent to the FBI forensics laboratory for enhancement.)**

From the northwest corner of the Ft. Wainwright football field across the street from the AFS, Bryan P. Combs, BLM employee, saw that one of the smokejumpers' parachutes did not open, and the smokejumper was falling at a high rate of speed. Near the tree level, he saw an opened yellow and white parachute. Standing next to Combs, Justin Houston, BLM employee, observed the fall and stated that as the smokejumper reached the tree line something yellow had deployed and then disappeared.

Sergeant First Class Fredrick Kregel and Captain Deborah Crawford were standing in the Birchwood Subdivision, later determined to be 2,000 meters west of the accident site. Several adults and children were watching the smokejumpers exit the aircraft. Kregel watched as the first three jumpers exited the aircraft flying between 2,500 and 3,000 feet. He watched as the fourth jumper was falling out of the airplane and observed that it did not look right. He watched as three of the four parachutes deployed between 250 and 500 feet below the plane. At about 100 feet below the aircraft, it appeared the pilot-chute (light in color) on the fourth jumper opened and that pulled something dark in color, which was suspended five to 10 feet above the jumper. It appeared to Kregel that this jumper fell in a standard fall, feet first, without any apparent attempt to fight open the parachute or the reserve. As the smokejumper fell, he appeared to be spinning, and from Kregel's perspective, that he was going to land on the third jumper's parachute. Kregel stated that the third jumper's parachute, which was light in color, probably white, appeared to be released, and a new (reserve) parachute was deployed in two to three seconds. Kregel then watched as the unopened chute **(Investigator's Note: Roach's reserve deployment bag)** continued to fall to the ground. The witnesses from the Birchwood Subdivision watched until they lost sight of the individuals about 750-1000 feet off the ground when they went behind the tree line.

David Fischer, private citizen, observed Liston fall. Fischer was the closest witness, standing approximately 200 meters (650 feet) west of the intersection of Birch Hill Road, and the ski lodge entrance, and was closing up the skeet range. He heard a flapping sound, and saw a parachute that looked like a streamer. Sergeant Major Bert Thomas was inside his vehicle with the engine running talking to Fischer. Fischer turned to Thomas and stated that one of the smokejumpers just hit the ground. Thomas heard the flapping noise, and then they heard the impact. Thomas then drove his truck over to the intersection of Birch Hill Road and the ski lodge entrance.

Gregory Lavryk, private citizen, was driving on the dirt road (Birch Hill Road) and observed that Liston had a red parachute open as he went behind the tree line.

Thomas and Fischer began the search for Liston, who landed about 75 yards



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east of the intersection of Birch Hill Road and the ski lodge entrance.

Several smokejumpers at the jump site who watched Liston's fall (Perry, Veitch, Musitano, Bradley, Smith, and Lyons), ran to vehicles and drove west down River Road, and then north to the intersection of Birch Hill Road and the ski lodge entrance.

There was confusion on the jump spot with other personnel who were focused on Roach as to whether there were one or two malfunctions. People who watched Roach under the reserve parachute began to count the seven visible parachutes and then realized a smokejumper was missing.

4:46 p.m. - 4:47 p.m. - Thomas found Liston and yelled that he had found him. Fischer approached the scene as several smokejumpers entered the woods. Perry ran over to Liston's location, and checked for a pulse. Fischer returned to the Ski Lodge to call 911.

Bradley, an Emergency Medical Technician (EMT), took over the medical response, as EMTs Perry, Smith, and Lyons, and Musitano, assisted with CPR/emergency procedures. No pulse was obtained. Veitch took command of the scene.

4:56 p.m. - Ft. Wainwright Fire and Emergency Services were contacted by the Birch Hill Operator and Engine E6. Emergency C2 and Ambulance M212 were dispatched.

The jump ship searched for a deployed canopy. The jump ship turned around and followed the same line of flight to the exit point.

4:58 p.m. - Humphrey arrived where Liston was lying, and asked for the trauma kit from the Jump ship.

5:01 p.m. - Ft. Wainwright Fire and Emergency Services Ambulance arrived on the scene. Emergency medical services (EMS) personnel from Ft. Wainwright Fire and Emergency Services arrived on scene and Erik Jones, EMT, assumed control of the medical response.

5:04 p.m. - The jump ship confirmed that EMS reached Liston and returned to Ft. Wainwright.

5:05 p.m. - Medical personnel began to move Liston on a stretcher to the ambulance.

5:09 p.m. - The jump ship returned to the standby shack.

5:20 p.m. - Ft. Wainwright Fire and Emergency Services Ambulance M212 with Liston and Bradley aboard, Emergency C2 and Engine E6 departed the scene en route to Basset Army Community Hospital.

5:27 p.m. - Veitch videotaped the scene. Lenmark photographed the scene.



## Factual Report

5:28 p.m. - Ft. Wainwright Fire Department Ambulance arrived at Bassett Army Community Hospital, Urgent Care Center (BACH-UCC), 1060 Gaffney Road, Building #7420, Ft. Wainwright, with CPR in progress. Liston had no vital signs. Advanced life support and medical procedures were initiated, with no results.

BLM EMTs departed the accident scene. Other BLM personnel arrived and taped off the accident site.

5:36 p.m. - Liston had no vital signs, and was pronounced dead by Dr. Peter G. Deveaux, Captain, M.D., General Surgery.

5:45 p.m. - Specialist (SPC) George A. Dominguez and Sgt. Dalton, Ft. Wainwright Military Police arrived at the accident site.

6:14 p.m. - Special Agent Clarence Joubert III, U.S. Army Criminal Investigation Division (CID), arrived at the accident site and was briefed.

6:16 p.m. - Special Agent Sonny Siebert (CID), arrived at the accident site and was briefed by Dominguez. Siebert requested that Dominguez and another patrol remain on site and help secure the scene. Ft. Wainwright Military Police Investigators (MPI) Eastwood and Yeatts arrived at the accident site.

6:20 p.m. - Joubert, Siebert and Veitch entered the scene and took photos and video documentation of the scene.

6:22 p.m. - 6:40 p.m. - Military police took names of all persons on the scene and secured the scene.

7:00 p.m. - Bert Mitman, BLM smokejumper, was informed by Dash that Military CID (U.S. Army Criminal Investigation Division) wanted to interview the smokejumpers on the load and at the jump spot.

9:15 p.m. - The members of the Department of the Interior Serious Accident Investigation Team were notified, and the Team was activated.



## Factual Report

# CAUSAL FACTORS

### Direct Cause for Liston's death:

- Massive blunt force injuries due to a fall from height (failure of parachute to open).

### Indirect Causes for Liston's accident:

- Liston experienced a parachute malfunction when his reserve parachute's pilot-chute and suspension lines entangled with the main parachute's drogue (pilot-chute). This entanglement prevented either parachute from deploying. The entanglement overcame the ability of the employee to manage the event.

### Basic Causes for Liston's Accident:

- Liston's main parachute did not properly deploy because the main drogue did not release at the correct time in the deployment sequence.
- Liston's reserve parachute did not properly deploy because the reserve pilot-chute bridle was entangled with the drogue bridle. Physical evidence indicates that once the reserve pilot-chute was deployed by Liston initiating emergency procedures, it encircled (twisted with) the main parachute drogue bridle thus preventing full elongation of the reserve suspension lines. The twists caused the reserve deployment bag to stop against the drogue bridle where the bag and lines formed a knot with the drogue bridle. At some point thereafter, the main parachute drogue *released*. At this point, the load (tension) was transmitted between the main parachute drogue bridle and the reserve droop risers precluding full deployment of either parachute.
- Neither the main parachute canopy nor the reserve parachute canopy came out of their deployment bags due to the entanglement between the reserve suspension lines and main drogue bridle.



## Factual Report

### Direct cause for Roach's incident:

- Equipment Malfunction. The main parachute failed to open.

### Indirect Causes for Roach's incident:

- Roach's main parachute did not properly deploy because the main drogue did not release at the correct time in the deployment sequence.

### Basic Causes for Roach's incident:

- Undetermined.

### Significant facts that did not contribute to the accident

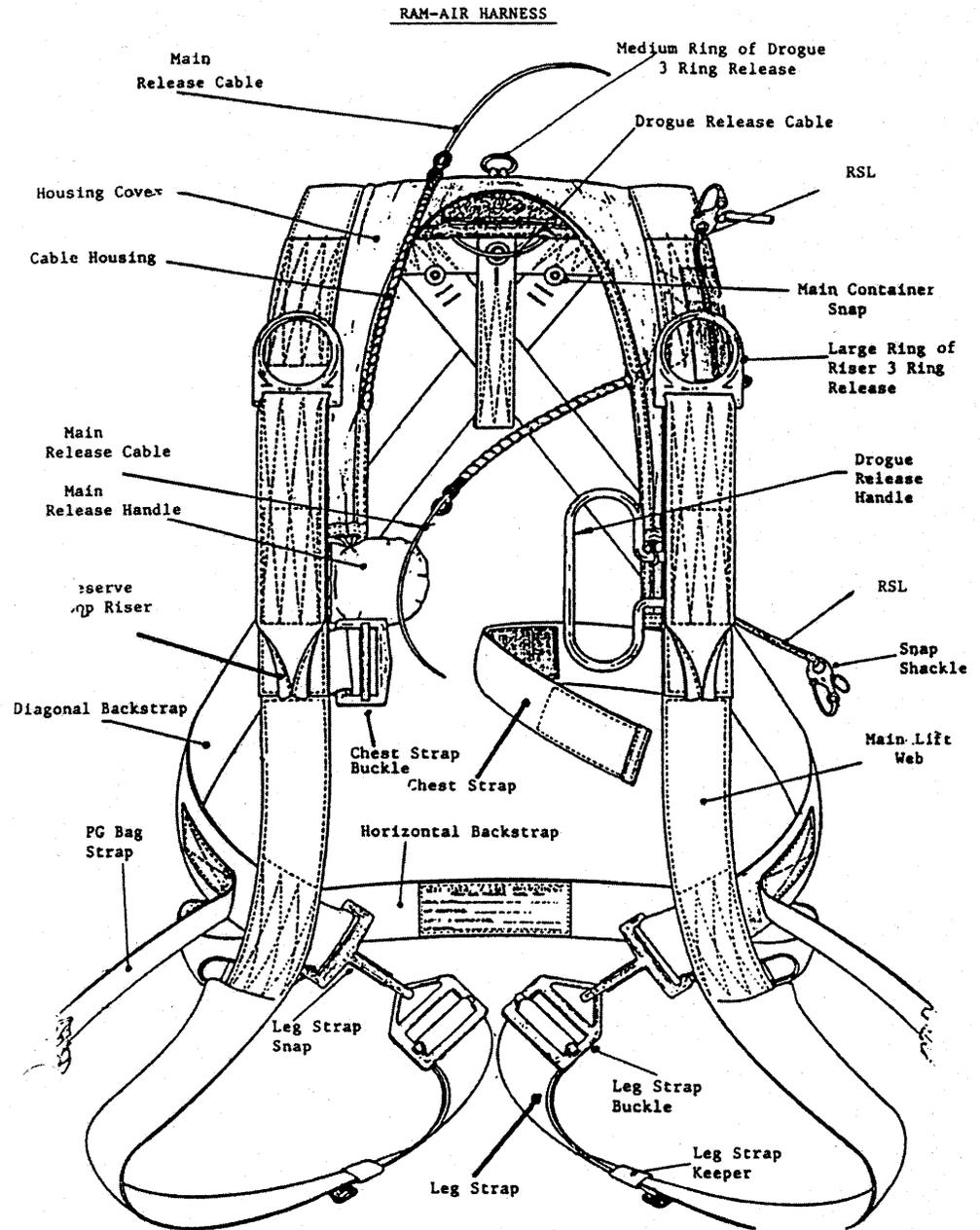
The Federal Aviation Administration has identified a record keeping error for the packing data card, a violation of FAA rules contained in Title 14, Code of Federal Regulations, Subpart C and Subpart F (14 CFR 65 and 14 CFR 105). During the investigation, Liston's reserve parachute packing slip was inspected. The packing slip was for reserve parachute number A103-R. However, Liston was carrying reserve parachute A224-R. This discrepancy is explained by the fact that reserve parachute A103-R was condemned months earlier, but its reserve container was still in good condition and remained in service with the incorrect card inadvertently left enclosed. Reserve Parachute A224-R was later packed into that reserve container, and the incorrect card was filled out without the packer checking the reverse side to verify the correct number of the parachute.



**APPENDIX**



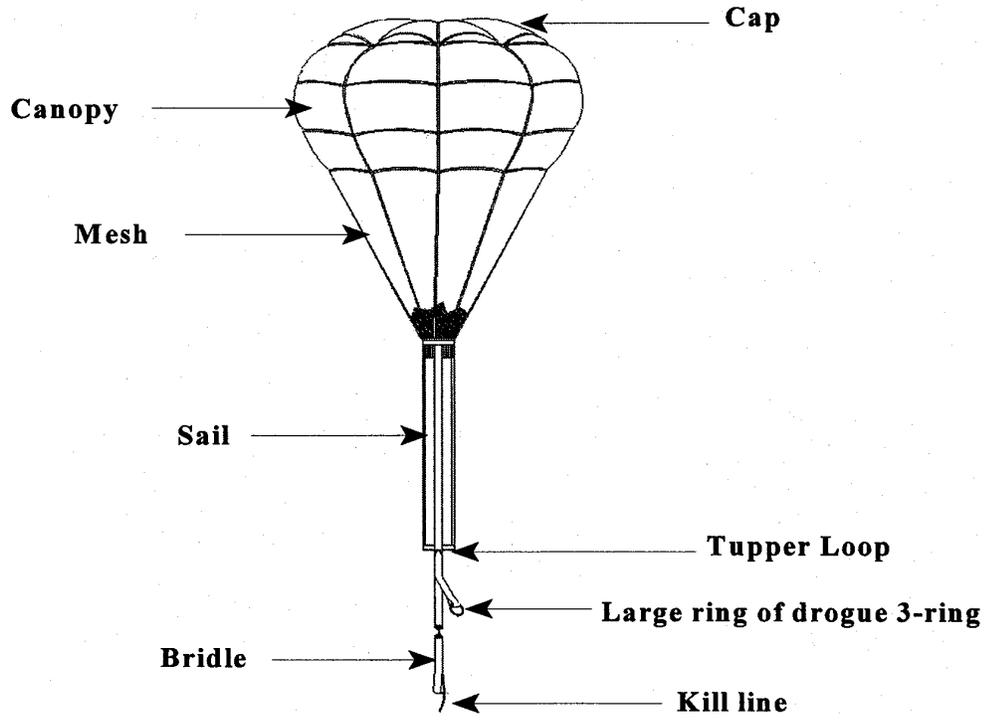
Model 8801 Ram-air HARNESS



Model 8801 Ram-Air Harness



*DROGUE*



## EQUIPMENT INVOLVED

**Parachute Equipment Involved** (Investigator's Note: "Z" after the number denotes the Top Skin of the canopy is zero porosity) :

### David J. Liston's Parachute Equipment

Parachute System Series - 200  
Ram-air Harness Number - 9012  
Ram-air Harness Model- 8801  
Ram-air Harness - Manufactured 1990

Drogue Riser or Container Number - A324Z  
Drogue Serial Number - 34984  
Drogue Model - B2002  
Drogue Type - ZP  
Drogue manufactured by - Paramedics Technology June 1998  
Placed in Service - July 5, 1998  
Drogue packed by - Doug Carrol  
Drogue pack date - March 15, 2000

Main Canopy Riser or Container Number - A277  
Main Canopy Serial Number - BLM-7-0611  
Main Canopy Model Number - 8910  
Main Canopy Type - Trilobe  
Main Canopy manufactured by - Quantum Parachutes on June 7, 1991  
Place in Service - June 13, 1991  
Main Canopy packed by - Lance Clouser  
Main Canopy packed date - March 22, 2000

Reserve Canopy Riser or Container Number - A224R  
Reserve Canopy Serial Number - MRS 9234  
Reserve Canopy Model - MT-1S  
Reserve Canopy manufactured by - Paraflite February 1998  
Placed in Service - June 25, 1998  
Reserve Canopy packed by - Lance Clouser  
Reserve Canopy packed date - March 28, 2000



## Factual Report

### Thomas O. Roach Parachute Equipment

Parachute System Series - 200  
Ram-air Harness Number - 9604  
Ram-air Harness Model - 8801  
Ram-air Harness - Manufactured 1994

Drogue Riser or Container Number - A222  
Drogue Serial Number - 3117  
Drogue Type - F-111  
Drogue manufactured by - Butler P.S. October 1992  
Placed in Service - March 31, 1993  
Drogue packed by - Fred Hernandez  
Drogue pack date - March 9, 2000

Main Canopy Riser or Container Number - A209  
Main Canopy Serial No: BLM7-0494  
Main Canopy Type - Trilobe  
Main Canopy Model - 8910 (Quantum)  
Main Canopy manufactured by - Quantum Parachute Inc. on April 13, 1990  
Place in Service: May 8, 1990  
Main packed by - Dave Hade  
Main packed date - March 13, 2000

Reserve Canopy Riser or Container Number - A169R  
Reserve Canopy Serial Number - MR 8158 S  
Reserve Canopy Model - MT-1S  
Reserve Canopy manufactured by - Paraflite October 1993  
Placed in Service - November 9, 1993  
Reserve packed by - Lance Clouser  
Reserve packed date - April 3, 2000



# Malfunction Time/Distance Fallen/Above Ground Level

Page 1 - Drogue Not Deployed

Page 2 - Drogue-in-Tow

Page 3 - Spinning

Page 4 - Streamer



# Factual Report

## Drogue Not Deployed

<b>Drogue Not Deployed or Bag Lock</b>			
<b>Seconds</b>	<b>Ft/Sec</b>	<b>Distance Fallen</b>	<b>AGL</b>
1	16	16	2984
2	48	64	2936
3	80	144	2856
4	112	256	2744
5	144	400	2600
6	168	568	2432
7	176	744	2256
8	176	920	2080
9	176	1096	1904
10	176	1272	1728
11	176	1448	1552
12	176	1624	1376
13	176	1800	1200
14	176	1976	1024
15	176	2152	848
16	176	2328	672
17	176	2504	496
18	176	2680	320
19	176	2856	144
20	176	3032	-32
21	176	3208	-208

These figures are based on a freefall speed of 120mph, approximately what a jumper would obtain without a drogue or canopy above him.

"Jump Thousand"  
 "Look Thousand"  
 "Reach Thousand"  
 "Wait Thousand"  
 "Pull Thousand"  
 "Check your canopy"  
 -Drogue in Tow identified  
 "Look, Reach, Pull" Main Release Handle  
 "Look, Reach, Pull" Reserve Handle

400' AGL is the lowest altitude that one could expect to deploy their MTIS reserve and land under a full canopy.



# Factual Report

## Drogue in Tow

DROGUE IN TOW			
Seconds	Ft/Sec	Distance Fallen	AGL
1	16	16	2984
2	48	64	2936
3	80	144	2856
4	112	256	2744
5	138	394	2606
6	147	537	2483
7	147	684	2316
8	147	831	2169
9	147	978	2022
10	147	1125	1875
11	147	1272	1728
12	147	1419	1581
13	147	1566	1434
14	147	1713	1287
15	147	1860	1140
16	147	2007	993
17	147	2154	846
18	147	2301	699
19	147	2448	552
20	147	2595	405
21	147	2742	258
22	147	2889	111
23	147	3036	-36
24	147	3183	-183
25	147	3330	-330

"Jump Thousand"  
 "Look Thousand"  
 "Reach Thousand"  
 "Wait Thousand"  
 "Pull Thousand"  
 "Check your canopy"  
 -Drogue in Tow identified  
 "Look, Reach, Pull" Main Release Handle  
 "Look, Reach, Pull" Reserve Handle

Fully opened reserve

400' AGL is the lowest altitude that one could expect to deploy their MTIS reserve and land under a full canopy.

This is based on an average jumper's exit weight of 250 lbs using an average age F-111 drogue. Figures correspond to a terminal fall speed of 100mph.



# Factual Report

## Spinning

Seconds	Ft/Sec	Distance Fallen	AGL	
1	16	16	2984	"Jump Thousand"
2	48	64	2936	"Look Thousand"
3	80	144	2888	"Reach Thousand"
4	112	256	2744	"Wait Thousand"
5	138	394	2606	"Pull Thousand"
6	100	494	2506	"Check your canopy"
7	50	544	2456	← Spinning malfunction identified
8	20	564	2436	← Hands on toggles
9	45	609	2391	-1st Pump
10	45	654	2346	-2nd Pump
11	45	699	2301	-3rd Pump
12	45	744	2256	← "Look, Reach, Pull" Main Release Handle
13	45	789	2211	← "Look, Reach, Pull" Reserve Handle
14	45	834	2166	
15	45	879	2121	
16	45	924	2076	
17	45	969	2031	
18	45	1014	1986	
19	45	1059	1941	
20	45	1104	1896	
21	45	1149	1851	
22	45	1194	1806	← Fully opened reserve
23	45	1239	1761	
24	45	1284	1716	
25	45	1329	1671	
26	45	1374	1626	
27	45	1419	1581	
28	45	1464	1536	
29	45	1509	1491	
30	45	1554	1446	
31	45	1599	1401	
32	45	1644	1356	
33	45	1689	1311	
34	45	1734	1266	
35	45	1779	1221	
36	45	1824	1176	
37	45	1869	1131	
38	45	1914	1086	
39	45	1959	1041	
40	45	2004	996	
41	45	2049	951	
42	45	2094	906	
43	45	2139	861	
44	45	2184	816	
45	45	2229	771	
46	45	2274	726	
47	45	2319	681	
48	45	2364	636	
49	45	2409	591	
50	45	2454	546	
51	45	2499	501	

52	45	2544	456	
53	45	2589	411	← 400' AGL is the lowest altitude that one could expect to deploy their MTIS reserve and land under a full canopy.
54	45	2634	366	
55	45	2679	321	
56	45	2724	276	
57	45	2769	231	
58	45	2814	186	
59	45	2859	141	
60	45	2904	96	
61	45	2949	51	
62	45	2994	6	
63	45	3039	-39	

This is based on an average jumper's exit weight of 250 lbs using an average age F-111 drogue. Figures correspond to a spinning malfunction fall speed of 45 feet per second, approx speed of a moderate to severe spinning malfunction.



# Factual Report

## Streamer

STREAMER							
Seconds	Ft/Sec	Distance Fallen	AGL				
1	18	16	2984				"Jump Thousand"
2	48	64	2936				"Look Thousand"
3	80	144	2856				"Reach Thousand"
4	112	256	2744				"Wait Thousand"
5	138	394	2606	←			"Pull Thousand"
6	147	537	2463				"Check your canopy"
7	147	684	2316				-Streamer identified
8	147	831	2169				-Hands on toggles
9	147	978	2022				-1st Pump
10	147	1125	1875				-2nd Pump
11	147	1272	1728				-3rd Pump
12	147	1419	1581				-"Look, Reach, Pull" Main Release Handle
13	147	1566	1434	←			-"Look, Reach, Pull" Reserve Handle
14	147	1713	1287				
15	147	1860	1140				
16	147	2007	993	←			Fully opened reserve
17	147	2154	846				
18	147	2301	699				
19	147	2448	552				
20	147	2595	405				
21	147	2742	258	←			
22	147	2889	111				400' AGL is the lowest altitude that one could expect to deploy their MTIS reserve and land under a full canopy.
23	147	3036	-36				
24	147	3183	-183				
25	147	3330	-330				

This is based on an average jumper's exit weight of 250 lbs using an average age F-111 drogue.  
 Figures correspond to a terminal fall speed of 100 mph, approx speed of a "streamer" malfunction.



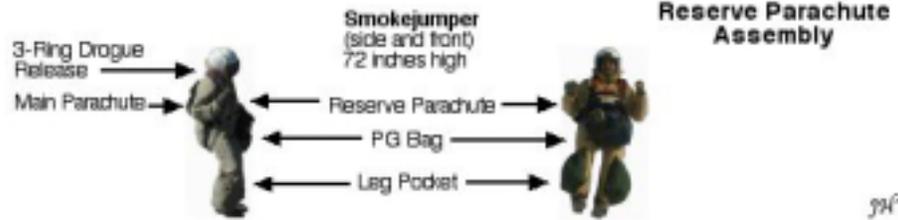
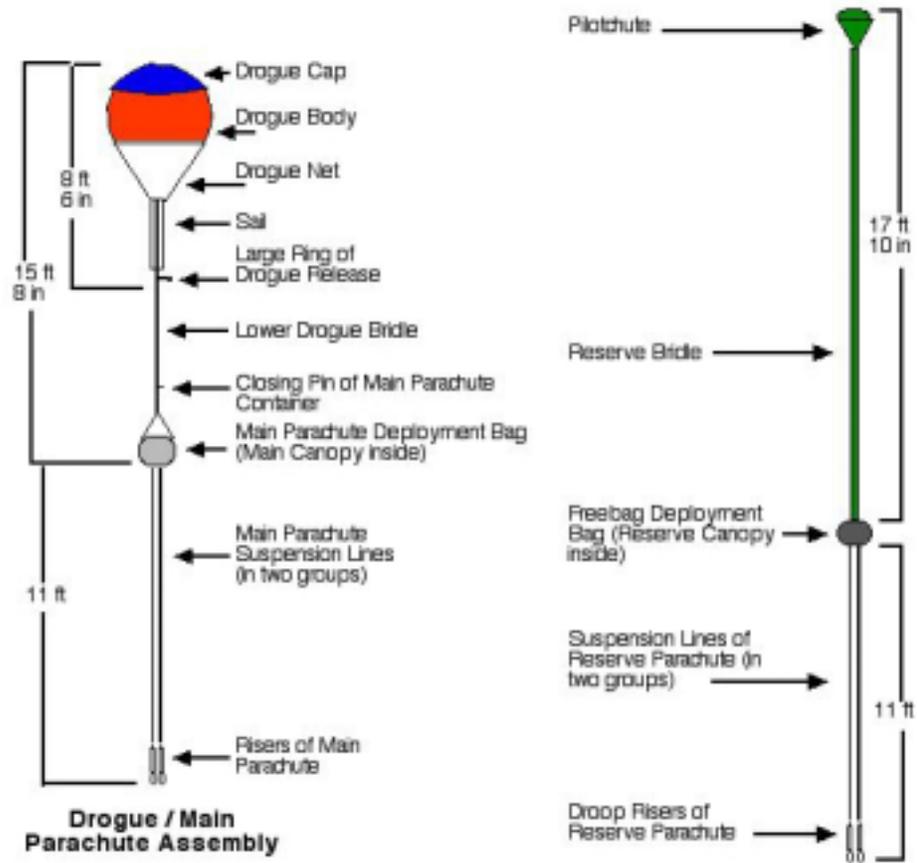
## Deployment Sequence

- Page 1 - Parachute Nomenclature
- Page 2 - Normal Parachute Deployment
- Page 3 - Normal Reserve Deployment with  
Drogue-in-Tow Malfunction



# Factual Report

## Parachute Nomenclature

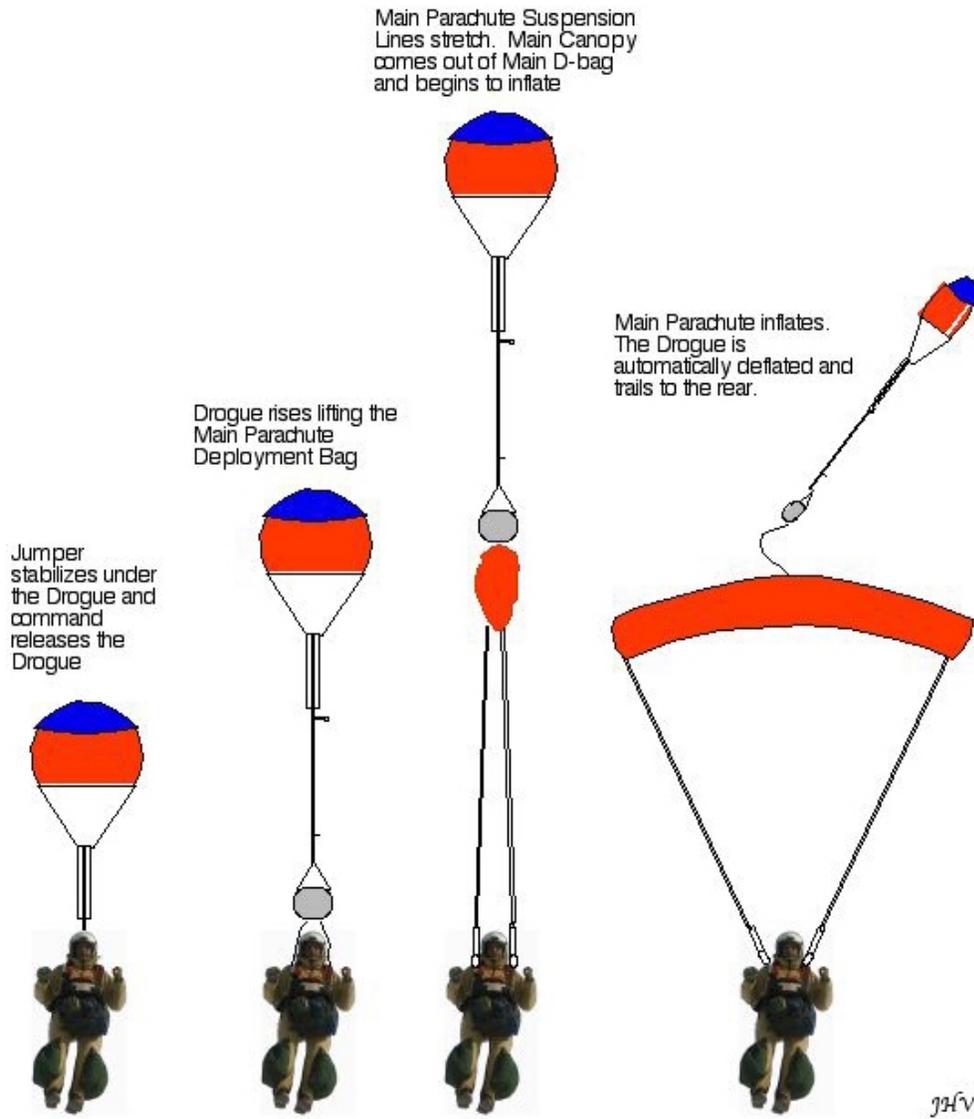


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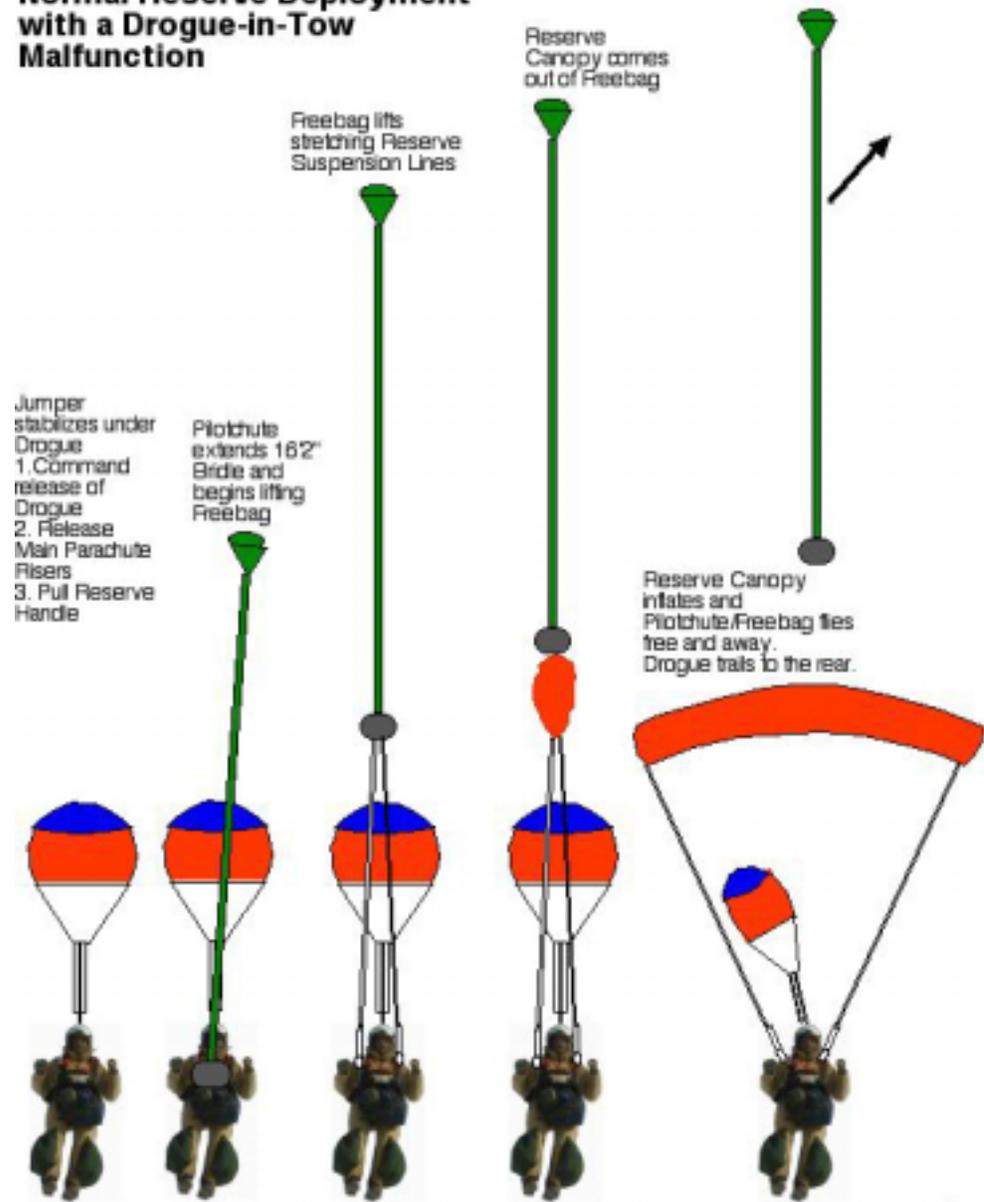
# Factual Report

## Normal Parachute Deployment



Normal Reserve Deployment with Drogue-in-Tow Malfunction

**Normal Reserve Deployment with a Drogue-in-Tow Malfunction**



JH/V

