Skydiving Operations and Air Safety Investigation:
How an Extreme Sport Highlights Broader Issues for Air Safety Investigators

Avery Katz

Embry-Riddle Aeronautical University

April 12th, 2018

Introduction

It is no secret that in the United States, NTSB investigators often have their hands full. According to the FAA, there were 513 accidents between the years of 2013 and 2016 which were investigated by a National Transportation Safety Board that has about 400 employees. (Fact Sheet, 2014) Despite this work load, the NTSB still does a fantastic job. As a licensed skydiver with over 300 jumps, a former Cessna jump pilot, and President of the Aviation Safety Advisory Council at Embry-Riddle, I have always paid a great deal of attention to jump plane accidents and the subsequent NTSB reports. A website called, "Diver Driver" has done a fantastic job of chronicling all aviation accidents since 1982. Last year when reviewing these reports on their site, I noticed a trend. Since 2004, there have been approximately 21 fatal accidents directly related to jump plane operations. (Jump Plane, 2018) What is alarming? Nearly 20% of the accidents share a common cause which has resulted in 5 fatalities. This is the result of, as the NTSB states, "inadvertent deployment of the reserve parachute." (Rep. No. ERA09LA435) A review of the evidence will show that despite a trend in probable cause across four accidents, there has been no change in verbiage within the FAR-AIM, or additional flight training requirements to help prevent future incidents. Unfortunately, this means similar accidents will likely occur in the future, thus increasing the workload of investigators who have already presented the evidence needed to decrease accident figures. The following evidence will show a major disconnect between those who investigate accidents, and those who make regulations based upon the findings. Thus, a significant challenge to Air Safety Investigators is a lack of useful regulation originating from accident investigations.

Accident Review (In chronological order)

The first accident of the four, beginning in the 2004-2016 period studied, occurred on October 24th, 2004. The aircraft involved was a Cessna 206, Tail number N8619Z. (Rep. No. CHI05LA014) Generally, skydiving aircraft will climb to various altitudes depending upon aircraft type. For instance, PAC 750's generally climbs to 13,500, Cessna's normally climb to 10,500, etc. In this case, the 206 climbed to the normal altitude of 10,500 feet. The NTSB stated that "Aircraft control [was] not possible by the pilot following a premature deployment of a parachute as a parachutist exited the jump airplane during cruise flight. The inverted spin encountered by the pilot was an additional cause." (Rep. No. CHI05LA014) In this case, we see a simple inadvertent deployment by the jumper. With no further information listed, the likely cause was that the reserve handle was jumped on exit either by the jumper himself, or by contact with the airframe.

The second accident occurred on April 19th, 2008. The Aircraft was again, a Cessna 206, Tail number N2537X. (Rep. No. DEN08FA078) This was an interesting case in that it had multiple problems which ultimately led to the fatal accident. While at altitude, the pilot entered a stall and spin when trying to position themselves for jump run. This led to a rapid, uncontrolled descent where multiple jumpers were able to bail out of the airplane. However, sometime during the descent, witnesses claimed it appeared the airplane leveled out at "1,000 to 5,000 feet", indicating that the pilot may have regained control. However, a passenger's reserve parachute could then be seen "wrapped around the tail," indicating an inadvertent deployment. At this point, the aircraft again became uncontrolled and "spun or dove to the ground." (Rep. No. DEN08FA078) The NTSB report stated that, "Contributing factors in this accident were the entanglement of the parachute in the elevator control system, reducing the pilot's ability to regain

control." (Rep. No. DEN08FA078) While the reserve deployment was not the first event in the sequence which led to this accident, it certainly didn't make recovery any easier for the pilot. In fact, witness testimony suggests the pilot may have recovered, then entered a secondary spin upon reserve deployment.

The third accident occurred on August 01, 2009. The aircraft type was a Beechcraft B90, Tail Number N1999G. (Rep. No. ERA09LA435) The NTSB stated that, "an instructor positioned himself at the door opening with his jump student nearby. The student inadvertently pulled the instructor's reserve parachute D-ring, deploying the chute and pulling the instructor out of the airplane. The instructor contacted the left horizontal stabilizer then descended toward the ground coming to rest suspended in a tree by his parachute." (Rep. No. ERA09LA435) While blame can certainly be placed on the competency of the student in this instance, it is also questionable that an instructor was using an easily catchable reserve D-handle when jumping with an inexperienced student.

The final accident occurred Friday, August 16, 2013. The Aircraft type was a Cessna 206, and the registration was N2070K. The NTSB stated that,

> "During the flight, [a] passenger moved forward in the cabin, which resulted in the passenger's reserve parachute inadvertently deploying and the passenger being pulled through the open jump door. The passenger hit the doorframe, and the parachute became entangled with the empennage… …A post-accident examination revealed that the passenger had inadvertently attached his seatbelt to the handle that released the reserve parachute. Therefore, the reserve parachute deployed when the passenger moved." (Rep. No. CEN13LA500)

The NTSB's probable cause went on to state that, "The improper routing of the seatbelt, which resulted in the inadvertent deployment of the reserve parachute, and the open jump door, which allowed the passenger to be pulled from the airplane." (Rep. No. CEN13LA500) This probable

cause is very telling. While it does not specifically list D-handles, the process of elimination can be used to figure out which type of handle was involved. Generally, there are D handles and spongy, soft fabric handles. However, D ring handles are the only type with a hold point, thus they are the only type which could have had a seat belt threaded through them.

The Trend

Between the years of 2004 and 2016, the NTSB positively identified inadvertent reserve deployments as the cause of 19% of fatal aircraft accidents in the skydiving community. Upon closer examination, nearly 10% were directly related to the use of a D-handle. Curiously, a further statistic is that 75% of the fatal accidents involving inadvertent deployments were Cessna 206 crashes. These are proven statistics gained from numerous NTSB reports. Thus, the question which must be answered is, "has the FAA made any changes to federal regulations which would affect reserve container/handle construction, ban the use of D-handles, or change training standards for jump aircraft with higher fatality rates?" The answer is no.

Federal Regulations

The Section of the FAR AIM which deals with reserve parachutes in 14CFR 105.43, "Use of single-harness, dual-parachute systems." The following excerpt is taken from that section:

> "The main parachute must have been packed within 180 days before the date of its use by a certificated parachute rigger, the person making the next jump with that parachute, or a non-certificated person under the direct supervision of a certificated parachute rigger.
>
> (b) The reserve parachute must have been packed by a certificated parachute rigger…" (CFR14, § 105.43 (2018).)

In part 105, this is the only mention of reserve parachutes in a sport container (excluding tandem rigs). The FAA certainly provides clear guidance on reserve parachutes and how often they need to be repacked. They even go into later detail to discuss varied materials, canopy conditions, etc. Yet, in the entirety of the FAR-AIM, there is no mention of specific requirements for the construction of a reserve deployment handle, even though there is clearly a trend of certain designs leading to fatalities on board aircraft.

Furthermore, given the high percentage of Cessna 206's in accidents such as examined, one must ask if the FAA has implemented any kind of special training for jump pilots in the aircraft? The answer is no. It is proven that SFAR's (Special Federal Regulations) have been effective in the past. For instance, it reduced MU-2 accidents from 40 fatalities between 1988 and 2008, to only 2 between 2008 and 2016 (New MU-2B, 2016). Despite this, the FAA has not implemented any such training for Cessna 206's converted for jump operations.

Conclusion and Recommendation

The findings in recent aircraft accidents show a trend; the FAA has failed to input new regulations in response to the trends which have been displayed over a 12-year period of jump aircraft operation. Probable cause findings in 4 accidents have identified the reserve parachute as a factor, and at least two of them were further tied to a specific D-ring design. Furthermore, 75% of these accidents involved the same kind of aircraft, a Cessna 206. Yet, this is where the work of an investigator stops, and another organization such as the FAA must take charge. They must review the information provided and create meaningful change in regulation to save lives. In the example of skydiving operations used throughout the paper, meaningful change would include an addition to the verbiage of part 105. Examples could include a ban of D ring designs which potentially serve as a snag hazard on exits, seat belts, or which can inadvertently be deployed by

inexperienced student jumpers. Furthermore, an SFAR could be implemented which would help future Cessna 206 jump pilots create a safer environment for skydivers. The most important fact to note is that this issue spans beyond skydiving. The system in the United States could benefit in many instances from seeing more changes based upon the NTSB's findings. In this case, skydiving is simply indicative of a much larger issue. If this problem can be solved in the jump plane operations, it would create a pattern of meaningful change throughout the aviation community.

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