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The Effect Of Skydiver Experience On High-Performance Landing Fatalities

Gregory Bodensteiner

THE EFFECT OF SKYDIVER EXPERIENCE ON HIGH-PERFORMANCE LANDING FATALITIES

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Gregory F. Bodensteiner
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This thesis, submitted by Gregory F. Bodensteiner in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

Joseph Vacek, J.D.

Paul Lindseth, Ph.D.

Eric Basile, M.S.

This thesis is being submitted by the appointed advisory committee as having met all of the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

Wayne Swisher, Ph.D.
Dean of the School of Graduate Studies

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ABSTRACT

Skydiving fatalities upon landing, especially during high-performance landings, have overwhelmed the sport as one of the largest categories of fatalities. The purpose of this study was to explore the effect of an experienced skydiver on high-performance landing fatalities since the introduction of high-performance canopies. In addition, the study determined if experts in the field see factors of experience as contributors to fatalities. The United States Parachute Association fatality database published online was used to analyze the effect between skydiver experience and high-performance landing fatalities. Five interviews were conducted with industry experts. No statistically significant result was found relating experience to high-performance landing fatalities. Interviews were inconclusive in perceptions of experience related to high-performance landing fatalities, however time in the sport and education was discussed by a majority of the experts. Lack of significance and inconclusive interview results indicates no effect was found between high-performance landing fatalities and skydiver experience.

CHAPTER I

INTRODUCTION

Skydiving fatalities upon landing have overwhelmed the sport as one of the largest categories of fatalities almost every year since 1993 with the introduction of performance canopies, especially during high-performance landings. Over the decades skydiving has become a popular recreational sport and as a result, safety advancements have radically changed gear and training has evolved and improved (Hart & Griffith, 2003b). From skydiving's introduction as a sport, the implementation of new technology in gear, and the introduction of new flying techniques, both during free fall and under canopy, the sport continually changes. In the instance of canopy and landing techniques, an unfortunate rise in fatalities has occurred from an increase in the risk with the introduction of higher performance parachute technology (Hart & Griffith, 2003b). These canopies are harder to fly skillfully and a parachutist can quickly overstep their ability.

One of the advances was the creation of high-performance canopies that allowed for greater maneuverability, higher speeds, greater descents, and an associated increase in the level of risk skydivers accepted while flying them (Sitter, 2014). Before the introduction of high-performance canopies a landing fatality occurred approximately once every other year, generally occurring when skydivers did not see and avoid obstacles (Sitter, 2014). With performance canopies, landing fatalities in the U.S. have increased (Sitter, 2014). For the last 20 years,

landing accidents have been the largest fatality category, about one-third of the fatalities annually (Sitter, 2014).

Statement of the Problem

In the U.S. during 2013, according to the United States Parachute Association (USPA), there were 24 total fatalities from a member pool of 35,616 members and 3.2 million estimated skydives (United States Parachute Association [USPA], 2014c). Landing problems accounted for seven of those fatalities and three of those were skydivers under high-performance canopies. The landing problem category is defined as an occurrence where the skydiver died while attempting to land a fully inflated (fully functioning) main or reserve canopy (USPA, 2014c). Due to the high speeds and high descent rates of a high-performance landing under these canopies and the turn onto final approach too near the ground to complete the landing, the skydivers could not survive the landing (Sitter, 2014). Only one year prior in 2012, landing problems made up 36.8% of fatalities and five out of the seven accidents were intentional low turns used to execute an advanced landing maneuver (Sitter, 2013).

In an accident review written by Burke (2011), a Safety and Training Advisor during this time at Skydive Arizona in Eloy, AZ, Skydive Arizona's accidents generally trend parallel to the nationally reported accidents. Low turns for a high speed landing are the highest of accidents consisting of 24% of the fatalities, while the landing problems not involving low turns only consist of 7% of the fatalities at Skydive Arizona (Burke, 2011).

The intentional low turn to the ground, or hook turn, is an abrupt turn initiated by the skydiver that induces a dive in order to gain a higher speed. The longer the turn is maintained, such as a 180° turn progressing to a 360° turn, the more speed is gained. To complete the landing, the parachutist needs to convert the vertical speed into forward speed by beginning a flare. With

the remaining high speed during the flare, the skydiver is able to fly parallel near the ground up to a few hundred feet without losing altitude, commonly known as a swoop. During this time a skydiver may skim across the ground to fly for distance, speed, drag their feet over land or water, or perform accuracy landings. This high-performance landing, the hook turn followed by the flare or swoop, is often referred to as swooping. Many skydivers report this maneuver as fun and challenging. Certain maneuvers, such as those listed above, have become competitive disciplines in the sport (Vidovic & Rugai, 2007). The increase in risk with a hook turn followed by a swoop is the skydiver's close proximity to the ground at speeds in excess of a normal approach and up to 75 mph (USPA, 2014c). If the turn is initiated too close to the ground, the parachutist does not recover to level flight before contact with the ground, or at high speeds, even minor deviations in the landing could be deadly.

Since the introduction of high-performance canopies, there have been deaths related to landing accidents due to intentional low turns (USPA, 2014a). Within the skydiving community, there are notions as to what may be causing the rise in landing fatalities and whether or not it is related to

- the experience level of the parachutist; and
- skydivers, no matter what, are susceptible to human error (Hart & Griffith, 2003a).

There are inherent risks associated with skydiving no matter the experience or level of discipline as in the case of high-performance landings. These areas will be discussed as possible contributions to the rise in high-performance landing fatalities.

Purpose of the Study

The purpose of this study was to explore the effect of an experienced skydiver on high-performance landing maneuver fatalities since the introduction of high-performance canopies and determine if experts in the field see factors of experience as contributors to fatalities.

Research Questions

Most studies on civilian skydiving or parachuting have focused on specific categories of accidents and accidents related to landings over time (Hart & Griffith, 2003b). To the best of the author's knowledge a study has not been done to compare an individual characteristic (experience in number of skydives) of the skydiver to the fatalities related to intentional low turn landing accidents or ascertain a consensus among experts in the community on what an experienced skydiver is in relation to intentional low turn landing accidents. The hypothesis was that the skydivers' individual characteristic (experience) has an impact on the relation to high-performance landing fatalities. The following research questions were proposed:

1. Does skydiver experience have an effect on high-performance landing fatalities?
2. What do industry professionals perceive as an experienced skydiver with relation to high-performance landing fatalities?

Literature Review

This review will include a brief history of the sport, an explanation of the high-performance landing maneuver, a review of the categories of fatalities and factors involved that influence a skydiver during freefall and landing, including experience, currency, perception, and skill.

Background.

High-performance landing accidents have become a consistent leading area of skydiving fatalities. Canopy selection recommendations are based on skydiver experience, size, and style of flying and have been developed by professionals in the sport. Basic guidelines given in the USPA Skydiver's Information Manual (SIM) describe what constitutes an advanced canopy, based on wing loading or size of canopy, and how one should choose a more advanced canopy. However, there are no written regulations that prevent an inexperienced skydiver, or any skydiver who may not be proficient and current, from choosing to buy or use a high-performance canopy. Therefore, canopy size selection is not mandated in the Basic Safety Requirements (BSR) written in the SIM (USPA, 2013). Germain (2004), through his experience with his time in the sport, testing and design of his own parachutes, practice, and training in either normal or high-performance landings, is trying to provide guidelines for skydivers to follow for safe parachuting at any level of experience.

Much of the progress in flight is attributed to the introduction of the ram-air canopy. Currently this is the only option of canopy, leaving the old round canopies of military surplus an item of novelty. The United States Parachute Association's (USPA) *Parachutist* magazine first published a 12-part series on how to fly the ram-air canopy in 1998-1999 and about the same time when the first high-speed landing competitions began to show up (Gibson, 2002a). This magazine series led to a change in the USPA's Integrated Student Program (ISP) in which canopy flight training was included in earning the A license (Gibson, 2002a). The issue with the 12-part series and some of the educational programs available at the time was the teaching addressed straight-in, normal approaches and did not expand on high-speed landings (Gibson, 2002a). Gibson's (2002) six-part *Parachutist* series, "The Fine Art of Swoop Survival,"

discusses advancing from basic approaches to swooping, or high-performance landings. Higher speed landings present more opportunities for a skydiver to make mistakes versus a straight-in, normal approach and the results of the mistakes are more serious (Gibson, 2002a). USPA's Integrated Student Program A license progression provides a series of exercises to help students understand canopy flight from the seat of their pants, through trial and error, to discover individual canopy characteristics in response to various control inputs (Gibson, 2002a). Through this process, students learn basic characteristics and responses of a canopy to help them recognize personal readiness for a variety of equipment (Gibson, 2002a). In 2011, the USPA created new canopy training recommendations in an effort to reduce canopy-related fatalities and injuries. The result was a change in the requirements to earn a B license, specifically, canopy control training designed to build on the A license training, testing, coach and instructor rating courses, and methods for drop zones to separate high-performance landings from other established landing pattern traffic (USPA Board of Directors Meeting, Denver, Colorado, 2011).

High-performance landing.

A high-performance landing is generalized as a landing other than a standard, normal glide, straight in final approach. The landings discussed throughout this report will focus on landings that are established by inducing a higher amount of speed through, what is referred to in the skydiving community as a hook turn. The danger does not necessarily reside in the initiation of the maneuver, but the recovery from the turn before contact with the ground and the extra speed that a skydiver must carry throughout the landing flare in close proximity to the ground. The turn may also be referred to as an intentional low turn. The Skydiver's Information Manual (SIM) does not recommend turning low to the ground as this is one of the biggest causes of injury and death (USPA, 2013). Therefore, the intentional low turn to gain speed is considered

risky and requires good judgment, quick decision-making, training, and experience to execute properly. For an in depth look at a high-performance landing, refer to Gibson's (2002b, 2002c) *Parachutist* articles titled "The Fine Art of Swoop Survival."

Definition of terms.

- Canopy: The major component of the parachute system comprised of fabric membranes that connect to the parachute harness by suspension lines and provide the means for the jumper to descend safely (USPA, 2014b).
- Coach: The entry-level USPA instructional rating whose holder may teach the general (non-method-specific sections of the first-jump course) and conduct group freefall skills training and jumps with students, all under the supervision of a USPA Instructor (USPA, 2014b).
- Currency: Defined in this study as the number of participant skydives conducted in the previous 12 months.
- Drop Zone: Skydiving establishment or intended parachute landing area (USPA, 2014b).
- Exit weight: The combined weight of the jumper and all his or her equipment for that jump (USPA, 2014b).
- Experience: Defined in this study as the total number of participant skydives conducted in a lifetime.
- Final approach: The final portion of flight before a skydiver lands (USPA, 2014b).
- Full Flight: The stabilized state of hands-off canopy flight under an open and fully functioning parachute (USPA, 2014b).

- High-performance landing: Defined in this study as a speed-induced landing, initiated by a hook turn and terminating in a swoop.
- Hook Turn: A canopy maneuver that results in a steep dive (USPA, 2014b).
- Instructor: The holder of a USPA Instructor rating qualified in one or more of four methods of instruction: USPA Accelerated Freefall, instructor-assisted deployment, static line, or tandem. The mid level of the USPA instructional rating hierarchy. A USPA Instructor may train and certify a student for the USPA A License, supervise USPA Coaches, and is eligible for appointment as USPA Safety & Training Advisor (USPA, 2014b).
- Intentional low turn: Defined in this study as a turn, usually a hook turn or swoop, that is initiated close to the ground to gain speed for a high-performance landing.
- Landing Pattern: The deliberate flight path, usually rectangular, that a jumper uses in the final phase of descent under canopy (USPA, 2013, p. 217)
- License: Certificate of proficiency recognizing that a skydiver has met a specified level of experience, skill, and knowledge. There are four classes of USPA licenses: A, B, C and D. USPA licenses are recognized internationally through the Federation Aeronautique Internationale (FAI) (USPA, 2014b).
    - A License: The first level license which signifies that a skydiver has advanced beyond the student phase. Persons holding a USPA A License are able to jumpmaster themselves, perform basic group freefall jumps and water jumps, participate in certain USPA collegiate competition events, and pack their own main parachute (USPA, 2014b).

- B License: The second level USPA license. Persons holding a USPA B License are authorized to participate in the USPA collegiate 4-way formation skydiving event, perform night jumps, and when qualified, apply for a USPA Coach rating (USPA, 2014b).
- C License: The third level license issued by USPA. USPA C-license holders may apply when qualified for the USPA AFF, IAD, and Static-Line Instructor ratings, ride as passenger on USPA Tandem Instructor training and rating renewal jumps, and participate in intermediate-altitude jumps and open field and level 1 exhibition jumps (USPA, 2014b).
- D License: The fourth and highest level or license issued by USPA. USPA D-license holders may participate in all competitions at the national level, apply when qualified for all USPA instructional and proficiency ratings, and participate in high-altitude jumps (USPA, 2014b).

- Main Parachute: A parachute worn as the primary parachute used or intended to be used in conjunction with a reserve parachute. (FAR 105 definition) (USPA, 2014b)
- Malfunction: The complete or partial failure of a parachute canopy to accomplish proper opening, descent or flight characteristics (USPA, 2014b).
- Night Jump: A skydive made from one hour after official sunset to one hour before official sunrise. The FAA considers any jump made after sunset and before sunrise a night jump requiring equipment specified in FAR 105 (USPA, 2014b).
- Parachute: A fabric device that slows the descent of a falling object (USPA, 2014b). Also defined in this study as the device used for navigating and

conducting parachutist controlled maneuvers. See also canopy and ram-air parachute.

- Parachutist: A person who intends to exit an aircraft while in flight using a single-harness, dual parachute system to descend to the surface (USPA, 2014b). See also skydiver.
- Ram-air parachute: A parachute with a canopy consisting of an upper and lower surface that is inflated by ram air entering through specially designed openings in the front of the canopy to form a gliding airfoil. (FAR 105 definition) (USPA, 2013, p. 220). See also canopy and parachute.
- Reserve parachute: An approved parachute worn for emergency use to be activated only upon failure of the main parachute or in any other emergency where use of the main parachute is impractical or use of the main parachute would increase risk (USPA, 2014b).
- Safety and Training Advisor (S&TA): A local person appointed by the USPA Regional Director as his or her representative and who is available to provide advice and administrative assistance as the USPA representative at an individual drop zone or specified area (USPA, 2014b).
- Skydive:
    - The descent of a person to the surface from an aircraft in flight when he or she uses or intends to use a parachute during all or part of that descent (USPA, 2014b).
    - To jump from an aircraft with a parachute (USPA, 2014b).

- Skydiver: A person who engages in skydiving (USPA, 2014b). See also parachutist.
- Swoop:
    - *verb*: To rapidly dive toward and then make a controlled approach relative to a target (USPA, 2014b).
    - *noun*: The controlled flight from above one body to meet or fly close to another body, a stationary object, or the ground (USPA, 2014b).
- Wing loading: The skydiver's exit weight divided by the area of the parachute canopy, expressed in the United States in pounds per square foot (USPA, 2014b).

Fatality category definitions.

The following fatality definitions are taken from Sitter (2014).

- No Pull/Low Pull: Skydiver did not initiate opening of the main or reserve parachute in time.
- Malfunction: Skydiver did not respond successfully to a main parachute malfunction in time.
- Reserve Problem: Within its normal operating envelope, the reserve system did not save the skydiver.
- Collision: They skydiver hit someone or something (including aircraft) in freefall or under canopy prior to landing.
- Landing Problem: They skydiver died while attempting to land a fully inflated main or reserve parachute.
- Other: Deaths that do not fit into any of the other five categories.

Human Elements.

Sports are voluntary activities and individuals are attracted by the needs specific to each individual sport. Anxiety, sensation seeking, stress, experience, and skill might be necessary components in predicting participation in sports involving high levels of personal risk (Zuckerman, 1983). Zuckerman (1979a) defined sensation seeking as "the need for varied, novel and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experience" (p. 10).

Involvement in skydiving is tailored to this idea of sensation seeking, but further risk taking in the acceptance of conducting intentional low turns may support that experience may not be enough to overcome most of the risks. However, Zuckerman (1983) points out that sensation seekers do not take risks just to experience risk, but there has to be a reward. In the instance of skydiving, and furthermore high-performance landings, a unique experience justifies the risk. If it is considered that skydivers who perform advanced maneuvers are higher sensation seekers, it is worth noting Zuckerman's (1979b) finding that high sensation seekers tend to underestimate risk compared to low sensation seekers.

An ability to cope with the effects of stress, particularly on mental performance, is important to persons in high-risk environments (McClernon, McCauley, O'Connor, & Warm, 2011), such as skydiving. A definition of stress as it pertains to aviation, provided by Salas, Driskell, and Hughes (1996), addresses stress as the process by which certain environmental demands evoke an evaluation process in which an individual's perceived demand exceeds available resources and the result is undesirable psychological, physiological, or behavioral outcomes, such as improper decisions. In other words, stress acts by restricting attention and distracting from the primary task (McClernon et al., 2011). As demonstrated in multiple

experiments conducted within the skydiving environment (Allison et al., 2012; Breivik, Roth, & Jørgensen, 1998; Hare, Wetherell, & Smith, 2013; Price & Bundesen, 2005; Roth, Breivik, Jørgensen, & Hoffman, 1996), the perception of stress can change over time, with perceived stress reducing over time though measured responses indicate increases in actual stress. Stress is also a personal reaction, explained by the ability to process the demands based on an individual's capacity to deal with the specific situation (Thunholm, 2008). Skydiving induces high stress and anxiety responses even after repeated skydives and shows that both experienced and inexperienced skydivers have higher stress and anxiety during a skydive compared with their baseline control samples (Deinzer, Kirschbaum, Gresele, & Hellhammer, 1997; Hare, Wetherell, & Smith, 2013; Price & Bundesen, 2005). Heart rate information obtained from skydivers also expresses this relation (Allison et al., 2012; Breivik, Roth, & Jørgensen, 1998). Noticing the relation between elevated stress and heart rate, an increasing number of studies suggest that stress can positively influence risky decision-making and attentiveness to threat-related cues, resulting in fewer errors in decision-making tasks (Akinola & Mendes, 2012; Putman, Antypa, Crysovergi, & van der Does, 2010; van den Bos, Harteveld, & Stoop, 2009). It could be postulated that as a skydiver gains experience over a number of skydives, the initial stress felt by the individual will perceivably fade over time, though studies confirm that actual stress levels remain high during the skydive.

In skydiving, threat-related cues are the freefall, execution of the high-risk, high-performance low turns, hazardous attitudes, unfamiliar locations, or handling the parachute in unfamiliar conditions, such as different weather or density altitudes than normally experienced. In contrast to observed and gathered data from skydivers, the self-reported levels of stress and anxiety indicate that as a skydiver has more experience, they perceive less stress and anxiety,

though actual measured values compared to novices are higher during activity than at baseline controls (Hare, Wetherell, & Smith, 2013; Roth, Breivik, Jørgensen, & Hoffman, 1996).

A theory of the effects of pressure on motor performance, based on psychologists Michael Eysenck and Manuel Calvo's work, which describes the effects of anxiety, states that anxiety consumes our awareness through worry and that when it has been consumed to the point where no additional resources remain focused to on-task awareness, performance degrades, and our effort increases (Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011). Competitive pressure affects psychological, physiological, and kinematic variables through the observation of expert golfers in a putting experiment (Cooke et al., 2011). Increased effort can enhance performance by devoting additional resources that increase the amount of awareness given to a task; however, awareness given to a task that has been learned to the level of automaticity can cause a disruption of performance in experts (Cooke et al., 2011). The addition of competitive pressure has also been shown to have an effect on motor performance, through increased muscle tension, changes in movement such as increased jerkiness and decreased smoothness, and increases in heart rate which can reflect increases in anxiety (Cooke et al., 2011). The reports that are provided through the USPA concerning high-performance landing fatalities do not indicate the environment the parachutist was flying in, such as a practice attempt, a routine landing, or one conducted at a competition. Though the fatalities may not have occurred during competition, the increased demand of a high-performance landing performed at a personal, competitive level as the individual trains for competition or personal development, induces an increase of pressure on the individual since timing, judgment and decision-making are quick and critical.

Under the natural environment of skydiving, quick decision-making is a matter of life, serious injury, or death (USPA, 2013). Wiggins and Bollwerk (2006) define decision making as an information processing strategy. The process is acquiring, examining, and acting upon information and it is based on the demands of the task and is dependent upon the knowledge and experience of the decision maker. Decision-making models in aviation are credited to Drucker (1954), a famed business management scholar and author and the models are considered classic decision making models. Many decision-making models are prescriptive, or prompt a response after something has already happened. Decision-making models are impractical where decisions are made under time pressure (Bertrand, 2005). Like Ordóñez and Benson (1997), Bertrand (2005) explains the classic model allows sufficient time to generate options, consequences are not immediate, input is gathered from others and the workload is manageable. Bertrand (2005) suggests a naturalistic decision making model for those working in time sensitive environments, or a model for the way people will actually make decisions in a natural setting. It is a model where "good enough," considering time constraints, won't allow for the best or perfect option (Bertrand, 2005).

Skydivers have to make decisions under critical time pressure and under increased levels of stress all while depending on themselves to land safely. The high workload and demanding tasks quickly add up and place strain on the ability to make clear and quick decisions (Ordóñez & Benson, 1997; Starcke & Brand, 2012). Though the level of risk taken can change depending on the style of skydiving, size of the canopy, and level of performance during landing, decision-making at any point can affect the remainder of the landing sequence. Working in the skydiving environment requires fast decisions.

Decision-making situations induce stress on an individual (Starcke & Brand, 2012). Other important factors in decision-making are the influences of stress on cognitive and emotional functioning (Starcke, Polzer, Wolf, & Brand, 2011). Starcke and Brand (2012) quickly point out strategic decisions are not always well calculated by humans, for example, decisions may be made based on biases, previous heuristics, or other intuitive tendencies.

Many decisions made under stress may provoke stress responses themselves (Starcke & Brand, 2012). In skydiving, the event itself induces stress and has a compounding affect by not only altering decision-making but increasing the stress of making the decision to skydive or complete a high-performance landing. In skydiving, stress and decision-making are intimately connected. The consequences for proper decision-making are high in skydiving as the environment is considered high-risk and the potential for injury or death is significant. Participating in voluntary higher-risk maneuvers compounds the issue. Akinola and Mendes (2012) discuss that stress can enhance selective attention to threat-related cues (shoot/don't shoot scenarios for police officers) and making decisions that help avoid danger could be facilitated in high-stress states. In relation to all areas of skydiving, not only higher risk, high-performance landings, the threat could be associated to hazardous attitudes, unfamiliar locations such as off airport landings, or handling the parachute in unfamiliar conditions such as turbulence or weather not normally experienced.

A high-performance landing in skydiving is a product of years of practice, thousands of attempts, and executing this maneuver is seen as an impressive accomplishment among those in the skydiving community. Though these high-risk maneuvers are voluntary and intentional, at the moment of execution, stress and anxiety could play a part in the decision-making throughout the entirety of the landing sequence. Section 6: Advanced Progression of the USPA Skydiver's

Information Manual (SIM) (USPA, 2013) addresses advanced canopy piloting topics but does not include the high demand on decision making in this environment. However, under Section 6-11, subpart G, Item 3:

> USPA warns all jumpers that some of the maneuvers described to develop an understanding of canopy flight involve a greater risk of injury, even serious injury or death, than a routine parachute landing using a straight-in approach flown at the canopy's natural speed until flaring. (USPA, 2013, p. 153)

This new or additional stress, anxiety, and risk experienced during high-performance landings can increase risk in decision making and can lead to an increased potential for injury or death (Putman, Antypa, Crysovergi, & van der Does, 2010; van den Bos, Harteveld, & Stoop, 2009).

Similar to aviation, human error aspects related to accidents and incidents are applied to the parachutist as well. Hart and Griffith (2003a) reviewed 308 skydiving fatalities that were reported between 1993-2001 and found that 264, or 86% were categorized as human error. Hart, Griffith and Randell (2006) found an 82% human error fault out of the 125 fatalities from 2000-2004. Human error does not have a universally agreed upon definition but Reason (2008) defines error as a deviation. Deviations may include physical deviations, mental slips or mental lapses, or deviation from a predetermined plan. Human error contained any accident where the principal causes were errors, inappropriate actions, inattention, or omission of important actions (Hart & Griffith, 2003a; Hart, Griffith, & Randell, 2006). Skydiving takes place in an environment likely contributing to the influence of human error accidents, such as working under extreme time pressure, under high anxiety, and under arousal states (Hart & Griffith, 2003a).

Experience, skill, and perception.

How a parachutist trains, practices, or plays may be influenced by the individual's experience, which in turn has an influence on how the individual learns, and the complexity of the task (Panchuk, Spittle, Johnston, & Spittle, 2013). Cooke, Kavussanu, McIntyre, Boardley, and Ring (2011), while studying the performance of expert golfers completing a putting experiment, presented that pressure affects the behavior of an expert by having a positive effect on performance. Egan, Verheul, and Savelsbergh (2007) observed soccer players kicking a moving ball and noticed that the integration of the control of timing of the ball movement with the speed of the individual's movement was a skill more developed in experienced soccer players, or those with competitive experience. The skilled performers display flexibility of movement each time they are presented with a new task, modifying their movements any time they perceive the situation is changing (Egan, Verheul, & Savelsbergh, 2007). Czyz et al. (2013) explores especial skill, or a developed skill that produces an advantage in performance based on practice from large amounts of repeating a specific action. "The amount of practice, not necessarily the years of practice maybe a better determinant of the especial skill effect," (Czyz et al., 2013, p. 149). Learning from practice at a single drop zone, choosing to fly during similar weather conditions, time of day, etc., develops into repetitive actions and a level of comfort within a particular environment and this occurs variably depending on the skydiver. The decision to skydive as often or as seldom as one chooses is an individual choice, will affect the currency, and overall experience.

The lack of information within the USPA descriptive reports may not include location of most accidents, description of landing by the parachutist, or whether or not that individual was flying in familiar territory. Information is often unreported. However, Burke (2011) cites,

"visiting jumpers are 5.1 times more likely to die on any given jump at Skydive Arizona than local jumpers" (The Local Knowledge Factor section, para. 2). Burke (2011) continues that visitors to the drop zone incur fatal accidents 20% higher compared to the national average. Czyz et al. (2013) reported, a learned, selectively specific skill creates an environment of optimal parameters for a set basketball shot. With a change in parameters of the set basketball shot, experienced players' movements changed by using a heavier ball and the automaticity that underlies the especial skill may have been the disrupted component of the action (Breslin, Hodges, Kennedy, Hanlon, & Williams, 2010). Compare to skydivers in a normal landing pattern and approach at a familiar drop zone. Out of a familiar environment, the performance of a landing done correctly based on that familiar environment may results in the incorrect application in new situations, causing an accident. Burke (2011) associates poor training to the increased risk to visiting skydivers at Skydive Arizona, especially poor landing pattern planning. Resilience to the effects of fatigue, distraction, competitive pressure, or performance anxiety on the automaticity of the especial skill and its application was unclear (Czyz et al., 2013). Unfortunately, these effects are major contributing factors to human error within the aviation environment (Reason, 2008) and correspondingly so in skydiving flight.

Researching perceived abilities, Kruger and Dunning (1999) proposed that incompetence skewed ability to recognize one's poor performance. Kruger and Dunning (1999) found a dual effect of experience: unskilled participants perform poorly and fail to realize it; and extremely skilled participants who perform well fail to realize that the success was not shared by the other participants. Dunning, Johnson, Ehrlinger, and Kruger (2003) question whether or not one can be in a position to self-assess skills and experience accurately or even have the ability to do so. "For success to occur, many things must go right: The person must be skilled, apply effort, and

perhaps be a bit lucky. For failure to occur, the lack of any one of these components is sufficient" (Kruger & Dunning, 1999, p. 1131).

Decision-making (Bertrand, 2005; Starcke, Polzer, Wolf, & Brand, 2011), anxiety and perception of stress versus actual stress (Hare, Wetherell, & Smith, 2013; Price & Bundesen, 2005) play a role in developing experience. Skydivers too are prone to human errors (Hart & Griffith, 2003a) and whether or not learning takes place from the errors will determine contributions to experience and to landing problems (Burke, 2011). The combination of these effects will pose a problem in clearly defining experience and the relation to high-performance landing fatalities. Experience also has to be weighed carefully as there are positive and negative effects to falling into this title (Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011; Egan, Verheul, & Savelsbergh, 2007).

CHAPTER II

METHOD

Limitations in the current literature support further analysis of skydiving fatalities and the intentional low turn landing fatalities. In addition to the limited number of studies conducted within skydiving, there are even fewer studies that look into relationships of skydiver characteristics, such as experience, and high-performance landing fatalities. Although the current literature has explored skydiving fatalities, it does not provide an in depth look at the details of high-performance landing fatalities and the experience of a skydiver.

At this point, no studies have statistically analyzed the effect between skydiver experience on intentional low turn landing fatalities or made an attempt at finding a consensus on what an experienced skydiver is in regards to high-performance landings. The following method will examine skydivers in the U.S. on these two areas.

Population

The United States Parachuting Association (USPA) group membership pool was the objective population for the statistical analysis. From the membership pool, the USPA creates a database from those skydivers that have suffered a fatality in the U.S. and categorizes them according to the accident type. The USPA fatality database was the target population for the current study. The annual report and definitions used by Sitter (2014) were used to classify the fatalities into six categories. The categories include (a) no pull/low pull, (b) malfunction, (c) reserve problem, (d) collision, (e) landing problem, and (f) other.

In order to answer the second research question, six experts within the industry were contacted for interviews to obtain subjective views on the topic and determine a consensus on skydiver experience and potential causes of high-performance landing fatalities.

Sample

From the USPA fatality database, the fatalities that were further described as intentional low turn landing accidents, hook turn accidents, high-speed induced accidents, or swoop accidents were categorized as high-performance landings, analyzed, and compared to skydiver experience.

The experts were chosen based on criteria such as their leadership within the industry, positions they have held or are holding within the industry, the knowledge and technology they provide to the industry, and the time they have spent as participants or working professionals within the skydiving industry.

Procedure

Information regarding U.S. related skydiving fatalities was gathered from the USPA Accident Reports (USPA, 2014a). Data categorized as "Landing Problems" were further broken down into high-performance landing fatalities if they met the criteria of being described in the fatality report as an intentional low turn, hook turn, high speed induced, or swoop accident, and other fatalities for all other landing related fatalities. The University of North Dakota's Institutional Review Board was consulted and board approval was not deemed necessary due to the public accessibility of the data, which has already been de-identified by the USPA. The USPA reports are compiled from various reporting sources and often may include missing data in one or any of the fields of the skydivers' characteristics (age, experience, etc.). For instance, in the case of experience, the numbers may have been gathered from the skydiver's logbook – self-

reported data – or obtained as a best guess from what was last known, estimating how long that skydiver has been in the sport. Some of the information reported was also an estimate. For example, the report might have indicated that the skydiver was involved in the sport for 13-plus years or had 2,800-plus skydives. This author, without having any further way to obtain more specific data, used those numbers on the assumption that the skydiver had at least the minimum reported value, so 13-plus years in the sport was rounded to 13 years or 2,800-plus skydives was rounded to 2,800 skydives. This represents an error in the accuracy of the reporting procedures and translates into error in the accuracy of the statistical test results.

The University of North Dakota's Institutional Review Board approval was required for the expert interviews and approved the research and interview protocol prior to conducting the interviews. Experts were contacted via email for interview requests and asked to submit an electronic informed consent form (Appendix A) before beginning the study. All participants completed the informed consent form before the interviews were conducted. The interview was conducted via telephone and recorded using TapeACall software.

Analysis of Data

USPA fatality data reviewed as defined in the procedures process was analyzed using IBM SPSS version 23 software. An independent t-test analysis was used to test the significance between the independent variable (high-performance landing fatalities) and the dependent variable (experience). The t-test compared the experience of the skydivers in the high-performance landing fatality group to the experience of skydivers in the other landing fatality group. A determination of significance was made between experience and fatalities after analyzing the fatality data. Interview recordings were reviewed to determine if there were

commonalities among industry professionals' perceptions on what an experienced skydiver is and how that relates to high-performance landing fatalities.

CHAPTER III

RESULTS

Statistical Analysis of Fatality Data

From the United States Parachute Association's (USPA) fatality database, 60 total fatalities created the data set with high-performance landing fatalities consisting of half of all reported landing fatalities (N = 30). Landing accidents were analyzed and Tables 1 and 2 show the characteristics of the skydivers. Table 1 indicates the average age of a skydiver involved in a landing fatality was 39.25 years (N = 59) with the youngest skydiver being 21 and the oldest being 72. The average time the skydiver was in the sport in number of years was 9.93 years (N = 54), with the minimum time of 0 years and the maximum time of 35 years. Experience measured through the number of skydives was a mean of 1730.72 skydives (N = 60) with a minimum number of skydives of 1 and a maximum number of 11000.

Table 1. Skydiver Characteristics.

	N	Min	Max	Mean	Range
Age	59	21	72	39.25	51
Time in Sport in Years	54	0	35	9.93	35
Experience by Number of Skydives	60	1	11,000	1,730.72	10,999

Table 2 details the distribution of the gender of skydivers and also includes the distribution of high-performance and other landing fatalities. Gender distribution in percent indicates a small female population of 10% (N = 6). The landing fatality categories however, are split with each group consisting of 50% of the fatalities (N = 30).

An independent samples t-test using a 95% confidence interval was run to determine

Table 2. Distributions.

		Frequency	Percent	Valid Percent
Gender of Skydiver	Male	53	88.3	89.8
	Female	6	10.0	10.2
	Total	59	98.3	100.0
Type of Landing Fatality	High-Performance Landing Fatality	30	50.0	50
	Other Landing Fatality	30	50.0	50
	Total	60	100.0	100.0

what effect exists between skydiver experience, using the number of skydives, and landing fatalities. Tables 3 and 4 provide the results of the test. Levene's test for equality of variance is not significant ($p > .05$) and the variances between groups are not significantly different. Equal variances assumed was then used in which there was not a statistically significant difference ($p = .23$) between experience and high-performance landing fatalities or other landing fatalities and an effect cannot be determined.

Table 3. Group Statistics.

	Type of Landing	N	Mean	Std. Deviation	Std. Error Mean
Experience by Number of Skydives	High-Performance Landing Fatality	30	2,070.57	2,267.59	414.00
	Other Landing Fatality	30	1,390.87	2,048.79	374.06

Table 4. Independent Samples t-test: Experience Effect on Fatality Type.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Experience by Number of Skydives	Equal variances assumed	.04	.85	1.22	58	.23	679.70	557.96	-437.17	1,796.57
	Equal variances not assumed			1.22	57.41	.23	679.70	557.96	-437.42	1,796.82

On average, skydiver experience did not have a significant effect on high-performance landing fatalities (M = 2070.57, SE = 414.00) compared to other landing fatalities (M = 1390.87, SE = 374.06), $t(58) = 1.22$, $p > .05$, and represents a small-sized effect, $r = .16$. The small effect size indicates a non-substantial effect and can partly be attributed to the small sample size.

Findings from the Skydiving Experts Interviews

The results from the expert interviews are presented from the information gathered in the interview protocol (Appendix B). Not all questions or statements from the interview protocol are presented. The descriptions below include data most pertinent to answering the research question or support the research question. For example, the first question regarding personal information was used to help the interviewee relax by answering simple questions related to their skydiving experience. This introductory question confirmed information about the roles participants have held or currently hold within the community to establish them as knowledgeable experts within the field.

Six potential participants were contacted, five male and one female. One of the participants declined the interview. The results reflect the five remaining participants' answers.

Responses to interview questions.

With regard to the community perception of landing fatalities rising over the years, all five experts were in agreement with the numbers reported in the annual fatality report and personal involvement in the sport. Within the interviews, additional information was provided by the participants on what may be overall contributing factors. Participants 2, 3 and 4 contributed with statements that reflect the change in gear, as indicated by Sitter (2014), has lead to issues. For example, the gear is more radical and requires a much higher level of skill to control and fly safely. At the same time, the gear provides a much easier landing leading to use of smaller, faster

canopies, which could still be perceivably landed safely (Participant 4). Participant 4 discussed in the interview that the landings on newer canopies were softer and easier than ever before and there was a simultaneous shift in realizing that the soft, easier landings were possible under faster canopies. The consequence of faster, easier to fly parachutes is a decrease in time to respond to changes with gaining a comfort in the parachute capabilities but being unaware of one's own ability to handle the more advanced gear (Participant 4). Participant 3 sees that skydivers are being driven to fly faster parachutes and this too comes with the consequence of not understanding what is involved.

Experience involves multiple factors, which could include time in the sport, how many total skydives members have, how many skydives completed recently, what discipline (tandem flying, accuracy canopy flying, etc.), and maybe most challenging, how well do they make decisions. Participants were asked to define experience in the interview without reference to skydiving numbers. Given the complex factors involved in forming a personal opinion on defining experience, the participant answers varied considerably, but simultaneously centered on the defining idea of "it depends." Participant 4 had to preclude the answer with "to make a definition of what is an experienced skydiver is a futile and a meaningless exercise unless you put it in context." The participants included in the definitions that an experienced skydiver should have skydived in a variety of conditions, have a great deal of understanding, be current – which is another topic to consider on its own – consider a specific discipline or consider an overall view, attaining enough time in the sport, and even considerations such as courtesy and maturity. While a consensus was not reached when asked to define experience, two themes emerged. A majority of interviewees (3 out of 5) mentioned putting in a lot of time and

continuing with education. Participant 5 described gaining experience is about "attaining enough time in the sport… to learn from our mistakes."

The question pertinent to experience required for undertaking advanced landing maneuvers also revolves around experience and the complexities of subjectively defining it; the participants responded with a variety of answers. As Participant 5 responded, the stage when one could begin advanced maneuvers has to be taken in context and "it's about education and it's about empowering people… to attain the necessary experience…" Participant 2 recognized the skydiver should add additional canopy maneuvers, be task oriented, start advancing after the basics have been learned for the reason that you have to know how the parachute works and flies. Participant 1 mentioned, "sooner or later you are going to be surprised… are you going to overreact, underreact, or react just the right amount." Proper handling of the parachute will result in a desirable outcome. Education is a key point in lowering the accident and fatality rate in the landing portion, or more importantly the time spent flying the parachute (Participant 1, 5). Only Participant 3 put a requirement in terms of numbers, that "the average skydiver is not ready to generate any extra airspeed before 200 jumps." In regards to discussion with Participant 3, this statement indicates using any maneuver to create that extra airspeed in close proximity to the ground for landing but not the exclusion during maneuvering at a safe altitude in order to gain canopy handling proficiency. No central themes carried through all of the participants' answers on what level of experience should be required to start advanced landing maneuvers and a consensus was not reached.

CHAPTER IV

DISCUSSION

Implication of Results

Statistical reflection.

The statistical analysis did not show significance between the effect of experience and type of landing fatality. Another outcome of the statistical analysis was skydivers who suffered from high-performance landing fatalities had a higher mean number of skydives than those who suffered from other landing fatalities. While not statistically significant, an explanation for these results is that it takes a reasonable amount of learning, skill acquisition, and practice, which amounts to higher experience as measured by number of skydives, in order to perform an advanced landing maneuver. This explanation is similar to an observation Czyz et al. (2013) found in review of massive practice developing an especial skill. There are no limitations on performing advanced landing maneuvers from the very first skydive, however, the typical progression of skill and understanding lead to the relationship of more experience before beginning advanced maneuver training.

Interview reflection.

Though the question about community perception was directed at gathering opinions about what they have seen personally, the strong bias of having that information published as a constant reminder of where fatalities occur may have clouded over the desired response.

The culture of skydiving, in the opinion of the experts, has changed. Participant 1 stated that older, smaller drop zones had a lot more control over what was taking place. A much greater family atmosphere and more experienced skydivers, safety officers, or even close friends took a bigger initiative in looking after a skydiver. This could include a thorough gear check for a visitor to the drop zone, requiring a demonstration of emergency procedures, or limiting what the skydiver can do until abilities have been demonstrated. Education is available to help learning to fly more advanced maneuvers, but not all skydivers seek it out or the training might not be readily available largely due to financial cost of the course or travel to get to a location that offers training (Participant 3). Kruger and Dunning (1999) suggest teaching participants the skills to recognize incompetence and recognize previous errors to avoid repeating the errors.

Table 5 depicts the experience criteria used within current literature in the left column and participants with shared criteria in the remaining columns. Experience was not clearly defined in the literature and further reflected in the interviewee's answers. Consider Breslin, Hodges, Kennedy, Hanlon, and Williams (2010) used 10 years of experience within the sport and did not discuss how they chose years in lieu of age or how they chose 10 years as qualifying as an expert. Defining experience presented a challenge for most of the participants as it was geared toward personal definitions.

It was important that experience be described without the use of numbers to expand on the complexity of what is involved in gaining experience and how numbers of skydives cannot completely quantify experience. One of the two themes focused on putting in a lot of time, but no participants described what a lot of time is and how that defines an experienced skydiver. The other theme revolving around education was also not clearly defined resulting in a concept of experience but without a clear path to attain experience. Experience not being clearly defined

Table 5. Experience Overview: Literature Compared to Participant Response

	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5
Time	X		X		X
Compete	X				
Continue Learning	X	X	X	X	X
Leader/Teacher	X			X	X
Current		X	X		X
Variety	X			X	
Decision-making					X

Note. Literature experience criteria obtained from (Breslin, Hodges, Kennedy, Hanlon, & Williams, 2010; Cooke, Kavussanu, McIntyre, Boardley, & Ring, 2011; Czyz et al., 2013; Demirhan, 2005; Egan, Verheul, & Savelsbergh, 2007; Gautier, Thouvarecq, & Larue, 2008; Keetch, Schmidt, Lee, & Young, 2005; Panchuk, Spittle, Johnston, & Spittle, 2013).

reflects what was found in current literature. Without significance in the t-test, an indicator that did not create a result pointing toward an experience level based on numbers of skydives, it could be expected there might be some ambiguity in personally defining experience and how to apply that to advanced landing maneuvers. Through multiple interview questions, not only when asked to specifically define what experience is, education was cited within each participant's response in relation to experience and it appears education is an important factor of experience. Table 5 also includes remarks that were given with regard to any interview response describing experience, or experience required for advanced maneuvers. Though all participants mentioned education and it could be viewed, based on Table 5, that a consensus was reached, education was not cited as the one component used to define experience nor was an explanation provided on what or how much education makes experience. Expanding on the first question asked of experience, participants also had difficulties describing the experience required for advanced maneuvers. The responses varied between all individuals, leaving the question of experience and the effect on high-performance landings open for further research.

Limitations of the Study

Limitations of the current study include self-reported data and author bias. Information furnished to the USPA was self-reported, which adds to the possibility of error in the data that was given, recorded, and published. Errors in reporting will add to the error in the analysis. Some of the information was not reported accurately and the author made singular interpretations with the information to most accurately analyze the data. Only the author and one expert within the industry reviewed the fatality data from the United States Parachute Association's (USPA) database. There was not a third party review of the fatality data to determine final consensus of the categorization of the landing fatalities. This task was somewhat complicated by the sensitivity of the topic and the ability of those with the most accurate information being able to ethically share that information. The interviews were conducted and interpreted solely by the author.

Continuation of Research

A test to further explore the possibility of significance of being involved with a high-performance landing fatality would involve defining a level of experience, based on number of skydives, at which a skydiver would be considered an expert. The characteristic of experience by number of skydives could be broken into low experience and high experience. A 2 x 2 factorial ANOVA could then be run using the level of experience categories against the landing fatality categories. A consideration that was not involved in this study was to define at what level of experience, as determined by number of skydives, could be used to determine skydiver experience. It may take a larger panel of experts or a survey instrument sent to the skydiving community for an appropriate sampling to determine at what skydive number, or range, a skydiver could be considered an expert. Development of an especial skill may not define at what

skydive number experience is achieved, but a study conducted in a manner similar to Czyz et al. (2013) may help demonstrate how much practice is involved in reaching an advantage in performance or what type of practice is required to get that advantage (Panchuk, Spittle, Johnston, & Spittle, 2013).

Further research using a larger panel of reviewers in determining the causes of fatalities and a larger panel of interviewees to assist in interpreting participant answers may provide a broader and more accurate view of the skydiving industry. A better or more clear-cut understanding of what defines a parachutist as an expert would also provide transparency to the industry and may assist in creating guidelines or training procedures geared for individuals trying to figure out where they stand as a beginner, intermediate or advanced parachutist in a categorical world. With a consensus among skydiving professionals and the skydiving community, defining a level of experience with a number may allow for a point where a skydiver can determine if the risks could be undertaken safely and where the United States Parachute Association, coaches, manufacturers, etc., can develop training or rules to enhance safety. If future researchers could identify during the landing when, or what, may have caused an error leading to a fatality, further studies on how those errors disrupt automaticity and lead to outcome changes that end in an accident or fatality could be analyzed. For example, other data collected that may help identify these errors are: entry and exit velocity from the high-performance landing maneuver, variability of velocity throughout, changes in the flight pattern structured off of a standard landing pattern, and other variables associated with a high-performance landing. A better understanding of the effects of experience on a parachutist may open a new door to understanding better training techniques required to overcome the more complex risks of higher performance maneuvers, both physically and mentally.

Conclusions

Limited research is available in the sport of skydiving and that which does exist does not explore the topic of experience with a relation to high-performance landing fatalities. Current literature does not provide a conclusive definition of experience, which can be seen in the results of this study through both the non-significance in the statistical analysis and the indefiniteness in the Participants' interview answers. Within the context of the research parameters, statistical significance was not found; thus, no significant effect exists between high-performance landing fatalities and skydiver experience. Other factors not included in the analysis contain elements of the human contribution to performing a skydiving landing. These elements include decision-making, stress, anxiety, community culture, time pressure, and perceptions of any of the areas by the individual skydiver. Determining contributing factors of high-performance landing fatalities, continued efforts in defining experience, and obtaining real-time data for error mapping may be a way to educate skydivers and reduce the possibility of committing a fatal error.

APPENDICES

Appendix A
Consent Form

The University of North Dakota
Consent to Participate in Research

TITLE:	Skydiver Experience and the Relation to High-Performance Landing Fatalities
PROJECT DIRECTOR:	Gregory Bodensteiner
PHONE #	701.899.4023
DEPARTMENT:	Aviation

STATEMENT OF RESEARCH

A person who is to participate in the research must give his or her informed consent to such participation. This consent must be based on an understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

WHAT IS THE PURPOSE OF THIS STUDY?

You are invited to be in a research study about skydiver experience and the relation to fatalities because you have been identified as an expert within the industry with valued opinions and statements regarding this area of research.

The purpose of this research study is to explore the relationship between an experienced skydiver and high-performance landing maneuver fatalities involved since the introduction of high-performance canopies. The hypothesis is skydiver experience has an impact on landing fatalities. Information being sought through personal interviews pertains to personal opinions on the theoretical definition of what skydiver experience is and that relationship to the landing fatalities.

HOW MANY PEOPLE WILL PARTICIPATE?

Approximately six people will take part in this study through phone interviews.

HOW LONG WILL I BE IN THIS STUDY?

Your participation in the study will last approximately 45-90 minutes. You will participate in an interview by phone at your convenience.

WHAT WILL HAPPEN DURING THIS STUDY?

You will be contacted at a convenient time that has been arranged by you and the principal investigator. During the interview you will be asked a series of questions regarding your personal experience and knowledge with relation to what is skydiver experience and the relation to high-performance landing fatalities. You are free to skip any question throughout the interview if you prefer not to answer and may end the interview at any time.

WHAT ARE THE RISKS OF THE STUDY?

There may be some risk from being in this study. Some questions may be of a sensitive nature and you may therefore become upset as a result. However, such risk is minimal. If, however, you become upset by questions, you may stop at any time or choose not to answer a question. If you would like to talk to someone about your feelings about this study, you are encouraged to seek help. For those participants who may have an adverse emotional reaction due to the nature of the subject content, The University of North Dakota Counseling center is available at 701.777. 2127. Participants may also call 2-1-1 any time of day to be connected with local resources, such as FirstLink (myfirstlink.org) in the North Dakota area, which provides assistance to identify, access, and make effective use of community and volunteer resources 24 hours a day.

WHAT ARE THE BENEFITS OF THIS STUDY?

You may not benefit personally from being in this study. However, we hope that in the future other people might benefit from this study because it provides a scientific assessment of landing fatalities in skydiving and expert insights into the potential to enhance the understanding of landing issues in the skydiving community.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

Costs associated with the study are personal time and costs associated with time spent on the phone.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for being in this research study.

WHO IS FUNDING THE STUDY?

The University of North Dakota and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research study.

CONFIDENTIALITY

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. The data and consents will be kept a minimum of three years from the end of the study. Your study record may be reviewed by Government agencies, the UND Research Development and Compliance office, and the University of North Dakota Institutional Review Board.

Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of anonymity within the written report and subsequent published reports. Answers given to interview questions, and when reported within study, will be coded in a manor that eliminates individuality. The data gathered from the interview process will be digitized, moved to a data storage device, and stored in a lockable safe by the principal investigator who will have sole access along with the University of North Dakota Institutional Review Board auditors, and paper copies destroyed.

If we write a report or article about this study, we will describe the study results in a summarized manner so that you cannot be identified.

After interviews have been conducted, you have the right to review the recordings and change or revise your answers. The principal investigator has sole access, the information will be using for educational purposes only and the recordings will be destroyed at the appropriate time.

IS THIS STUDY VOLUNTARY?

Your participation is voluntary. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota

CONTACTS AND QUESTIONS?

The researcher conducting this study is Gregory Bodensteiner. You may ask any

questions you have now. If you later have questions, concerns, or complaints about the research please contact Gregory Bodensteiner at 701.899.4023 or the research faculty advisor, Joseph Vacek J.D., at 701.732.0736.

If you have questions regarding your rights as a research subject, you may contact The University of North Dakota Institutional Review Board at (701) 777-4279.

- You may also call this number about any problems, complaints, or concerns you have about this research study.
- You may also call this number if you cannot reach research staff, or you wish to talk with someone who is independent of the research team.
- General information about being a research subject can be found by clicking "Information for Research Participants" on the web site: http://und.edu/research/resources/human-subjects/research-participants.cfm

I give consent to be audiotaped during this study.

Yes
No

I give consent for my quotes to be used in the research: however I will not be identified.

Yes
No

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.
Participants Name:
Date:

Appendix B
Interview Protocol

Protocol

- At the onset of the interview, which is being conducted over the phone at the participants convenience and comfort, participants will be notified that the conversation will be recorded for further coding and analysis and all information exchanged unless specifically stated will be used for data.
- Participant answers will not be directly quoted without permission given in the consent form and if quoted will remain anonymous within the research with no identifying information associated with responses.
- Do you agree to have the interview recorded for educational purposes?
- Are you in a place that is reasonably quiet and comfortable?
- As stated in the consent form, do you agree to have answers quoted?
- This interview and your participation is voluntary, and you can therefore choose not to answer any or all of the questions and leave the interview at any time.
- This interview may take approximately 90 minutes to complete.

Interview Questions

1) Explanation of study and Warm up Questions:
   a) How long have you been in the sport?
   b) What roles have you held? What jobs have you held in the community or industry?
   c) How many skydives do you have?
   d) Do you participate in the high-performance landing discipline?
      i) Have you sustained any injuries related to it?
      ii) Do you personally know others that have been injured or have passed?

2) The community perception, from what I've gathered by word of mouth or from Parachutist, is that landing fatalities have risen, (why do you think this belief exists)/(what do you feel is going on)?
   a) Do you agree with community perception? Why/why not?
   b) What do you see as possible contributing factors, skydiver characteristics, or environmental factors to landing fatalities?
   c) In your experience, what have you perceived that leads you to believe that such a factor or factors are important?
      i) Would you please describe a particular event or experience?

3) What have you observed that explains high-performance landing fatalities and incidents?
   a) Would you please describe your experience in detail?
   b) What do you feel supports your notion?

4) How would you define experience, an experienced skydiver, or a skydiver with good versus bad experience?
   a) How would you define advanced equipment or maneuvers?

b) In your own words, how would you describe a high-performance landing?
c) At what point would you consider a landing high-performance or high risk?

5) What are your opinions on the amount of experience, or experience level a skydiver should have before undertaking advanced canopy maneuvers?
   a) How do you feel this affects the community or the participants?
   b) What are your thoughts on the level of experience being accepted by the community?
   c) Unlike rules and recommendations for camera and wingsuit use, there are no specific rules, recommendations, or licenses for a skydiver to pursue advanced canopy piloting. Based on your thoughts before regarding experience and acceptance, is this sufficient?

6) Beginning 2012, new rules were added to for the B license. What are your thoughts on the new rules and the impact on the high-performance landing discipline?
   a) What do you feel could be done about these accidents at the advanced level?

7) How do you see the high-performance landing discipline fitting into the advancement of the sport?

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