Exhibit Number: 10

The following exhibit is several assorted documents that exceeds the 10-page limit therefore it cannot be scanned. A small portion has been scanned to aid in your research for information. The exhibit is on file at the Montana Historical Society and can be viewed there.

EXHIBIT 10
DATE 2-17-05
HB 588

February 15, 2005

Chairman Jim Keane
Vice-Chair Kathleen Galvin-Halcro
Vice-Chair Joe McKenney
Montana House Business and Labor Committee
P.O. Box 200400
Helena, MT 59620-0500

Dear Chairman Keane and Vice-Chairs Galvin-Halcro and McKenney,

My name is Jeff Ballard, Chairman of the Billings American Legion Program, and I have great concerns about HB 588 and HJ Res. 19. I, as well as the entire baseball community, was deeply saddened by the tragic death of Brandon Patch. This tragic accident is something that should never occur in sports, but unfortunately all sports have a component of danger to them.

Baseball is ranked one of the safest sports nationally. Baseball has actually seen a decline in injuries over the last 10 years. Aluminum bats have been around for 30+ years and over that time there has been no indication that aluminum bats have made baseball less safe. The fact is that being a pitcher, regardless of what bat is used, can be a dangerous position. Often times you are out of position once you have released the ball and this makes reacting to a ball hit back at you a difficult thing. I have pitched at all levels of baseball, pitched against both wood and aluminum bats, and I can tell you from personal experience that when a ball is hit solidly back at you it is incredibly fast and scary. I have been hit numerous times in the body and head area with balls batted off both wood and aluminum bats and I didn't have enough time to react and catch the ball with my glove. I recently read a report, which you will be furnished with, done on Pitcher Response Time and their conclusions concur with what I have just written, regardless of the bat, pitchers do not have enough time to react.

In the late 80's and 90's, bat companies competed strongly for the best bats. I believe if you look at the offensive data, you will see a dramatic increase in offensive production during that time period. In 1998 following the College World Series and a final score of 21-14, the NCAA decided that the bats were to lively and causing an unwanted amount of offense. They decided to regulate the bats and there charge was to make aluminum bats perform more like wood bats. The exit velocity of the best Major League White Ash wood bat was 97 mph and so they made bat companies restrict the exit velocity of aluminum bats to 97 mph. This is known as BESR certification. They have also required the aluminum bats to be weighted similar to wood bats by imposing the –3 rule, which simply means that a bat cannot weigh more than 3 oz. less than the length, i.e. a 34 inch bat cannot weigh less than 31 oz. All bats used in high school, college, and legion must have the BESR stamp of approval on it or it is an illegal bat. The interesting part about the bat certifications is that this was done for offensive reasons and had nothing to do

with safety, because at the time the certifications went into effect there was no evidence of a safety issue and there still isn't. Baseball is a very safe sport.

Based on my experiences and research, I do not believe the bat should be held accountable for this tragic accident and therefore I do not believe we need to pass a law or resolution banning non-wood bats. A NCAA Research Committee has already put regulations in place and every level of amateur baseball follows these rules. Passing this legislation will have far reaching negative affects on youth baseball in this state. I strongly urge this committee to vote down HB 588 and HJ Res. 19.

Sincerely,

Jeff Ballard
Billings American Legion Baseball
Chairman

03702

COPY

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Research Project
College Baseball Pitcher Response Time
ESI/BA Project No. 10304F
January 13, 2003

Report Submitted by:

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Research Report
College Baseball Pitcher Response Time
January 13, 2003

Background

Breen & Associates/Engineering Systems Inc (ESI) was requested to conduct research from a human factors standpoint to evaluate the potential response time of college level baseball pitchers to balls batted in their direction. Included in this research is an analysis to determine the extent to which slower batted ball speeds, allegedly due to bat construction would affect the pitcher's opportunity to deflect balls rather than being struck.

ESI is an independent, multi-disciplined firm that provides professional consulting and engineering services involving investigation, research, testing, and related technologies. This project was conducted under the direction of Kevin C. Breen (PE-WI), Principal and Director of Marine & Automotive Research. Mr. Breen's formal education includes a Master's of Industrial Engineering focused in the area of Human Factors. His experience includes more than 25 year in research, testing, and investigation with significant involvement in human factors aspects of recreational activities, including field study of participants. Other senior technical staff involved in this project included Neil Cichy (PE-FL) and Erick Knox (PhD), details of qualification are attached.

A batted ball with an average speed of 100 mph (~147 feet/sec) will travel from home plate to the pitcher's area (nominally 54 feet from the plate) in 367 milliseconds (ms.). The average speed of a batted ball is a function of several variables; these variables include the speed of the pitch, the speed of the bat, and the nature of the bat/ball impact momentum/energy transfer.

It has been alleged that non-wood bats can create a more efficient energy/momentum transfer and as a result there is a potential for greater average batted ball speeds, thus less available time for the pitcher in order to react to field or deflect the ball. If it is assumed, as alleged, that a ball is traveling an average of 5 to 9 mph faster this corresponds to a difference of nominally 15 to 30 ms.

Current NCAA (2001) regulations as stated in section 11, permits either wood or non-wood bats to be used provided the bat is certified in accordance with the NCAA certification program. In addition, ASTM F1881-98 "Standard Test Method for

Measuring Baseball Bat Performance Factor" provides a test method to measure the Coefficient of Restitution (COR) of the bat-ball collision.

Prior to this date the items listed in *Attachment A* have been provided for review and background reference. An initial review of the background references indicate that there are no analyses of pitcher response time that have been conducted in game or game-like situations.

The scope of this project was focused on a scientifically based evaluation of the response time of college level pitchers in game or game-like situations and to evaluate the potential effect of minor differences in available time that may, as has been claimed in some situations, be attributable to differences in the energy/momentum transfer associated with the "hit". This claim has not been scientifically evaluated or confirmed, but used only as an assumption for the purposes of this research.

The following tasks have been conducted as a part of this project.

- A literature search and review of reasonably available, relevant research and studies was conducted. A list of the literature located is provided in *Attachment B.*

- A field study was conducted to measure and quantify pitcher response to batted balls in game-like conditions. This study was conducted in a manner that enhanced the analytical precision beyond what would be reasonable to obtain from actual competitive games by selective targeting and measurement/documentation devices. The documentation associated with this field study is shown in *Attachment C.*

- A series of videotapes from actual college level games were obtained and analyzed to evaluate and quantify pitcher response to batted balls. In addition, video tapes in situations where pitchers were struck were analyzed to determine available response time, pitcher reactions, and the potential effects of slower batted ball speeds. A listing of the game tapes reviewed is shown in *Attachment D.*

Research

Literature Review

A significant area that has benefited from reaction time study is the automotive area. This has been a topic of research and study for many decades. Though there are obviously

significant differences in the reaction/response time models for automobile drivers compared to baseball pitchers some useful concepts are of value.

Typical real-world automotive responses involve the driver transitioning from a relaxed, possibly inattentive state to deal with a hazard. The driver may be involved in conversation with other occupants, looking at the roadside scenery, or simply "day-dreaming" for an extended time period preceding the need to react/respond. By contrast, a baseball pitcher and other athletes are typically constantly focused on the position and motion of the ball or other game related activity.

The automotive literature indicates that driver emergency response times are typically in the 1500 ms. (1.5 seconds) to 3500 ms. (3.5 seconds) range. Response includes the time to become aware from the potentially non-attentive state, identify the hazard/emergency, make a decision as to the initial course of action, and execute necessary body movements; typically to actuate a control such as the brake or steering wheel. The range in time published shows a significant variation, largely due to the variation in pre-event attentive state; i.e. vigilant versus non-attentive and complex verse simple reaction. This difference, 3500 ms compared to 1500 ms is more than 200%.

Early automotive research demonstrated the effect of "surprise" versus "prepared" "responses". In one study, the mean brake application time for surprised test subjects was nominally 750 ms. compared to nominally 500 ms. for prepared subjects; a difference of 50%. Clearly, there is a significant effect on human response time affected by the level of preparedness.

Another aspect of the automotive literature that may be of interest in this project is the response times of more "active" automotive drivers such as motorcyclist and riders of active type off-road vehicle operators. For example, in one research study, Thom (1981/1985) indicates that motorcycle operation using proper anticipation techniques showed brake application times less than 230-330 ms. less than half of earlier passenger car brake application response times in the 500 ms. ranges. Similarly, Fowler (1994) indicates the response of rider active off-road vehicles/operators to be nominally one-half that of passenger cars and their operators. These studies indicate that driver response time in situations involving more active/athletic individuals are significantly less than response times where the operators are not physically active; this (active) would be the situation for sports such as baseball.

Beyond the automotive literature, the literature review in this project was separated into three categories.

- Baseball focused- hitting or catching
- General human factors/physiological based

- Other sport/activity response times

The published literature reviewed regarding baseball response times did not reveal any studies that included real or near game simulations.

Cassidy/Burton (1997) reviewed the reaction literature and report that accurate responses may begin 125 ms. after ball contact and complete motion of the arm to the ball in at least 200 ms.; for a total response time of 325 ms. This response time does not consider the benefits that would be gained by anticipation, proper technique, and being prepared to field/deflect the ball prior to ball motion being detected.

They report that the actual swing of the bat for the hitter begins 250 ms after the pitcher releases the ball; there are cues that allow batters to coordinate their action based on the motions of the pitchers. They summarize that reaction times (RT) may decrease with increased ball velocity. An explanation of the faster RT is attributed to the role of auditory anticipation. This review indicates that fielding a baseball is not a standard RT situation, rather there are a number of cues available to fielders prior to the ball being hit; they recommend a minimum safe fielding time of ~325 ms. and speculate that pitchers may need longer. None of their findings are based on scientific studies involving actual game situations and do not address the benefits of anticipation or proper technique in reaction times.

Using a ball throwing machine a study was conducted of reaction time and movement speed by Williams/MacFarlane (1975). This study reports that RT for a simple situation is in the 150 ms. range, but can increase when the situation becomes more complicated. They conclude that there is no dependent correlation between RT and motion time (MT). It is discussed that both RT and MT can be reduced both through practice and anticipation. The test data shows RT of 148 ms. and MT 99 ms. (totaling 247 ms.) for ball speeds of 123 mph. A ball traveling an average speed 123 mph (180 feet/sec) will travel from the plate to the pitchers area in 300 ms.

Brandt (1998) conducted an experiment where fielders were stationed behind a net screen and balls shot at the players from varying distances measuring the available time based on ball speed/distance and the per cent of time the "shots" would have hit the test subject. His data for college baseball indicates that at 363 ms. subjects were successful more than 90% of the time, and for available time of 376 ms. the subjects were successful 100% of the time. This study acknowledges that it does not account for real game situations where the fielder has other cues, such as the batter's swing, that would tend improve performance. The study suggests that this is cancelled out by the fact that in the testing the fielders were always concentrating, which may not be the situation in an actual game.

However, no data was presented to support this determination. Though there *may* be some pitches/hits during game situations where a fielder may be distracted, this is not the

case for pitchers, who are by the nature of that position critically involved in every pitch. Pitchers are taught/coached to include a motion to a ready position a part of the follow-thru for every pitch. In addition, the effect of moving the pitching cannon closer than 50 to 60 feet from the test subject as a part of the test methodology can affect reaction time due to the depth perception effects that are critical in judging spatial issues.

A program for NCAA compliance under the direction of Crisco (1997) indicates that literature on the topic is limited and existing standards are based on practical experience with little scientific basis. In an evaluation to determine what time is necessary to avoid being impacted by a batted ball, the Cassidy-Burton review is cited with the total response time estimated to be 325 ms. It is acknowledged that the review is based on limited scientific studies and that valid experiments are needed. This estimate leads to a chart (Figure 3) which indicates that batted ball velocities less than 115 mph would be judged as "Safe Batted Balls".

Studies that address the mechanics and science of hitting generally indicate that the entire hitting process occurs in a short time period. Watts (1990) suggests that without some form of preparation/anticipation or tracking strategies hitting a baseball would be nearly impossible. J. Breen (1967) analyzed the importance of technique in improving a hitter's ability to view and track the ball in anticipation of the ball reaching the plate area. Using a biomechanical approach to the stages of the hitting tasks, Welch (1995) described discrete body motion, responses, and adjustments in the batter's swing that occur in less than 100 ms. The start of the swing sequence begins ~570 ms. prior to ball contact. This would indicate that successful contact could only be achieved at pitched ball average speed of less than 65 mph, significantly slower than many pitches, unless the hitter initiates the sequence in anticipation of the pitch. Movement time of the bat from the initial motion of the swing to ball contact is in the 120 to 160 ms time frame.

It has been noted that batting involves a more complicated series of decisions than a pitcher avoiding being struck by a hit ball. A similar example, though more unpredictable is a batter avoiding being hit by an errant pitch. The batters focus is first on hitting not avoiding, while a pitcher at the release of the ball immediately is a fielder and there is an expectation that the pitch would be hit in his direction. In addition, the action by a pitcher to avoid being struck by a batted ball is a simple, reflex type, action that is shorter than more involved decision processes.

Many authors have addressed the concept of anticipation as related to affecting reaction time. Schmidt (1968) considers the effect of fore-periods in anticipation's reduction of reaction times; among the factor affecting beneficial anticipation is learning and the complexity of the tasks involved. Poulton (1950) shows mean reaction times of 150 to 200 ms. for simple and complex graded reactions respectively; with the effect of anticipation reducing the reaction to the 25 ms. range. Further Schmidt's (1977) research indicates that error correct reaction time may be 60 to 100 ms or longer; and may be

affected by incorrect anticipation. Included in the anticipation literature are references that proper anticipation could reduce reaction time to zero.

The more fundamental oriented human factors based literature addresses some aspects of body motion, viewing/vision, and body motion. DeGoede/Ashton-Miller (2001) show hand motion times for young males that range from 226 to 283 ms; this study acknowledges that the MT could be less in higher threat conditions and the limitations due to experiment design in measuring the maximum capacity in lower threat situations. Crago (1976) shows that humans are capable of tracking fairly precisely force and displacements in the 100 ms. time range; latency times in the 60 ms. range were common. In similar research Johansson (1988) showed linear tracking between applied force and grip force in the 100 ms. time frame; concluding that motor responses are largely automatic.

The human factors and baseball related literature clearly documents response times in the 200-300 ms. range; it does appear that complete response time less than 200 ms. for baseball type tasks are not common. Response times in the 325 to 367 ms. time frame have also been published from baseball; these are based on test methods that are limited in scope and do not address many issues related to game situations. In addition, these response times do not take into account in any systematic way the benefits from anticipation times that would be associated with game situations especially as related to pitchers.

A review of literature and data from other sports serves to confirm that athletes routinely respond in similar time frames. For example, tennis ball speeds frequently approach 120 mph, a hockey puck can achieve speeds in excess of 118 mph, free kicks in soccer can approach 70 mph and likewise volleyball spikes can exceed 70 mph, each of these sport events result in response times less than 300-400 ms.

In a Master's thesis Silva (NIU-1989) studied the reaction times of female volleyball players in various movement actions, the mean reaction time was less than 300 ms. for all conditions researched.

It should be noted that though this literature review was not intended to be comprehensive, it does span more than 50 years of study. Further, most of the literature reviewed also reviewed and cited other research in the area. These citations in the referenced literature include review of more than 400 papers/studies, though some duplication was noted.

In summary, the literature clearly indicates that human response time including reasonable anticipation time for athletic tasks including pitching and fielding are very short. However, no literature was located that addressed the application of basic human

characteristics or applications to baseball in game type situations from a testing or scientific standpoint.

Field Study

As a second phase in this project a study was conducted to measure on a scientific basis the response times of college level pitchers in game type situations. To accomplish this, active members of the baseball teams at Rollins College (Winter Park, Florida) and Stetson University (DeLand, Florida) were recruited. Included were pitchers, catchers, and hitters/fielders.

During December 2001, a series of "game" events were organized. The games consisted of a number of "innings". In each inning each pitcher threw 12 balls to 1-2 batters; the pitches were made both from a wind up and from a stretch. The game consisted of 9 innings; pitchers threw for 3 innings. The pitchers were instructed to "throw" balls as they would pitch in a regular game, but to generally throw strikes; as this was done in the off-season no curve balls were thrown. The batters, using aluminum bats, were instructed to try to hit the ball "hard up the middle" to the extent possible.

Each pitcher was given a dark jersey that was targeted with reflective targets denoting various body landmarks; in addition, a kayaking helmet was also used to provide a secure/fixed reference target on the pitcher's head. The game events were documented with various video cameras; a separate high speed, motion analysis based video camera system was framed on both the pitcher and batter; the system has a resolution time of 60 to 240 frames per second. Also in those framed views were synchronization lights that allowed precise visual tracking of the events in each field of view. Various control targets, field dimensions, and radar equipment to monitor pitch speed were also utilized for data control and verification. Pitches were charted recording batter/bat, and other aspects shown in *Attachment C* to monitor the number of pitches and hits.

In total, 7 "games" were conducted that involved 21 different pitchers. Games were played both during the daylight and at night, using stadium lights. Following the field study, the game films were reviewed. In total more than 700 pitches were recorded, from these ~70 hits were identified in which the pitcher either reacted to be an active fielder or moved to respond to a ball hit in his vicinity. Those events were selected for further motion and timing analysis. In those events a timeline was recorded from the game films.

The timeline included the following sequence:

- Flash of the timing light to sequence the pitcher and batter reference frames