**Portable Fall Arrest System for Fall Prevention Research**

Falling is a leading cause of injury and death for individuals 65 years and older. Three million older adults are treated for falls by emergency departments a year resulting in $50 billion dollars in total medical costs in 2015. The considerable independence and mortality concerns resulting from falls represent a critical need to mitigate fall risks. Therefore, research is needed to find novel risk factors and interventions that can better identify and treat individuals at an increased risk for falling.

Many falls occur during upright stance or while walking. Consequently, research that attempts to characterize neuromuscular impairments focuses on standing balance and walking. This research often challenges individuals through conditions such as uneven ground, low visibility, obstacle crossing, a surface perturbation (inducing a slip), and/or cognitive distractions to test the robustness of their control strategies. While healthy individuals are able to traverse challenging environments with little concern for falling, the high fall-risk populations who are often at the center of these studies posses a realistic potential of falling. As researchers hold participants’ safety paramount in these studies, there is a need for a well-designed fall arrest system to prevent a potentially injurious fall during research participation. Developing such a system will enable cutting-edge research to be conducted at Montana State.

Fall prevention research is currently being conducted in the MSU Neuromuscular Biomechanics Laboratory. The lab is currently limited to testing conditions and populations that pose negligible fall risk due to the lack of an available fall arrest system. Your design of a safe and effective fall arrest system will enable greater advances in fall prevention research by enabling testing during conditions that challenge postural control to a greater extent. Specific research questions and laboratory constraints require that a fall arrest system be designed with the following criteria in mind.

1. Safe to use (participant safety is a paramount design requirement)
2. Will stop a person (up to 350 lbs) from contacting the ground in the event that they lose their balance
3. Can be used for stationary (for standing balance or treadmill gait) or moving (while walking oveground) tasks
4. Will not impede movement of participants during use (except in the event of a fall)
5. Can be set up and operated easily by one person
6. Is easily transportable and space efficient when stored/not in use
7. Accommodates the various potential uses and space constraints of the Neuromuscular Biomechanics Laboratory



**Figure 1.** Schematic of a participant secured to a fall arrest system from a previous human movement research study.

Richardson JK, Thies SB, DeMott TK, Ashton-Miller JA. Gait analysis in a challenging environment differentiates between fallers and nonfallers among older patients with peripheral neuropathy. *Arch Phys Med Rehabil*. 2005;86(8):1539-1544. doi:10.1016/j.apmr.2004.12.032.