Bio:

Kevin Koprek is an Instructor with Rigging for Rescue based in Ouray, Colorado. He serves as volunteer with Ouray Mountain Rescue Team, Ouray Volunteer Fire Department, and Ouray County EMS. In addition to teaching seminars with Rigging for Rescue, Kevin facilitates in-house testing and instructor development.

Abstract:

High quality and effective rigging solutions required to suspend or move live loads have long been evaluated primarily upon principles associated with mechanical engineering. Equipment has been developed and tested against intended tasks and associated industry Standards/Certifications, such as the British Columbia Council on Technical Rescue - Belay Competence Drop Test Method; NFPA 1983 - Rescue Belay Standard; and ASTM F-2436. Sound mechanical engineering is the threshold any device or system should meet if it is to offer a favorable contribution to the overall risk management process. But there is more to the story. A review of accident reports involving human-machine systems will commonly include key contributing factors associated with human error. For over a decade, Rigging for Rescue has conducted test series with the inclusion of human operators on devices/systems. Our intent is to gain insight and better understand the specific relationships between equipment, environment, and operators performing tasks while suspending or moving live loads in high consequence terrain (i.e. Mission Profile). Do the techniques being utilized mitigate risk to acceptable levels? And what are the limitations of various techniques?

This paper and presentation is inspired by literature review in the areas of human machine systems design and evaluation, psycho-motor skill development, bi-manual coordination, and dual task performance. Key concepts from the literature review are offered for comparison against human factor testing in 2017 and 2019 conducted with participating fire departments from the Front Range of Colorado. A total of 305 Human Factor tests were conducted with 133 unique operators. Rope systems included in this test series were Single Main/Separate Belay as well as Two Tensioned Rope Systems. A variety of devices and associated techniques were included (Scarab, ATC Guide, MPD, Purcell Prusik, VT Prusik (configured as a Schwabisch 6 over 1 hitch), and the legacy 8mm triple-wrapped Nylon Prusik. Both quantitative and qualitative analysis were performed through measurement of forces, stopping distance, rope in service, elongation, and video review of operator technique.

Initial findings of this work suggest a more structured and systemic method for training and evaluating the human aspect of the rope rescue system could produce higher degrees of reliability of the overall system. Additionally, all of the devices and systems considered throughout these test series have revealed a number of limitations.

Regardless of the device or system being considered, it is apparent that high validity training/practice coupled with timely and appropriate (quantity & quality) feedback will increase the reliability of most human-machine systems.