SP-755 Proposal for Testing the Dynamic Effects of Screamers
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Introduction:

A screamer is a commercially available device designed to limit the force applied to a climbing anchor by a falling climber. It is constructed by sewing a folded loop of nylon webbing with stitching that will fail when a specified force is applied. The ends of the loop are clipped into carabiners on the anchor and the rope as a climber ascends. When the climber falls and weights the anchor to 500lbs, the screamer's stitching begins to rip, presumably exchanging the climber's kinetic energy for the work required to rip the webbing loop open and limiting the force on the anchor to the 500lb breaking strength of the stitching.

However, a closer look at energy considerations suggests that the such a device may not be as useful as it appears at first glance. The inobvious factor is the unfolding of the loop, which drops the climber a distance of twice the length of the open loop. If a screamer is a .5 meter loop folded in half, and the force to break the stitching is 2000Newtons, the most energy it can absorb is 1000Joules, the amount of energy released by a 100kg climber falling about one meter. To absorb this meter's worth of energy, the climber must fall an additional meter; all of the energy absorbed by the device is immediately returned to the climber. According this scenario, the screamer is useless; the falling climber should fall, rip the screamer apart, and once again have the same kinetic energy that must still be absorbed, presumably by applying a greater force to the anchor and stretching the rope proportionally.

An additional consequence of the opening screamer is that the ripping stitches produces a harmonic driving oscillation that is transfered to the anchor. On carabiners, the effect is presumed to open carabiner gates, effectively weakening the link when its strength is most needed, but the effects of the oscillations on the anchors themselves has not been studied.

While testing camming devices, it has been noted that they shoot upwards in the crack when the load is suddenly removed (when carabiners break,

on a time scale of about a 1000th of a second). If the screamer produces similar high frequency unloading, we predict that camming devices may move drastically

In this experiment, we hope to observe the oscillations produced by screamers and their effects on carabiners and camming anchors. We want to determine whether screamers really reduce peak forces and what limitations one might expect when using a screamer in conjunction with a camming device.

Methods:

Before testing can begin, two tasks must be accomplished: callibration of the load cell and addition of a floor anchor.

For an initial test, I propose four drops:

- an initial drop without a screamer to determine baseline force/time curve
- a drop with a screamer connected via harware links to the ceiling beam to determine the oscillation forces
- a drop with a screamer connected via carabiners to the ceiling beam to determine carabiner opening and oscillation forces
- a drop with a screamer connected by harware links to a camming device to observe effects on camming devices

For each drop we will measure the force on the anchor and take high-speed photographs of the event to determine the kinematics. The drop height and rope length must be recorded. Should the results indicate that screamers may produce violent movement in camming devices or fail to reduce forces, then further study will be conducted. Materials and Resources:

To perform this test, we will need the following:

- Screamers

- Ropes sections
- Drop test facility
- Assorted carabiners and harware links
- High speed camera stuff: to watch what happens during loading and determine the velocity and acceleration of the falling mass.
- Load cell: to measure the force on the anchor during loading.
- Floor anchor: to keep the belayer from being pulled upwards, thus lowering peak forces.
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Schedule:

We hope to have performed these tests by the end of October, 1995.