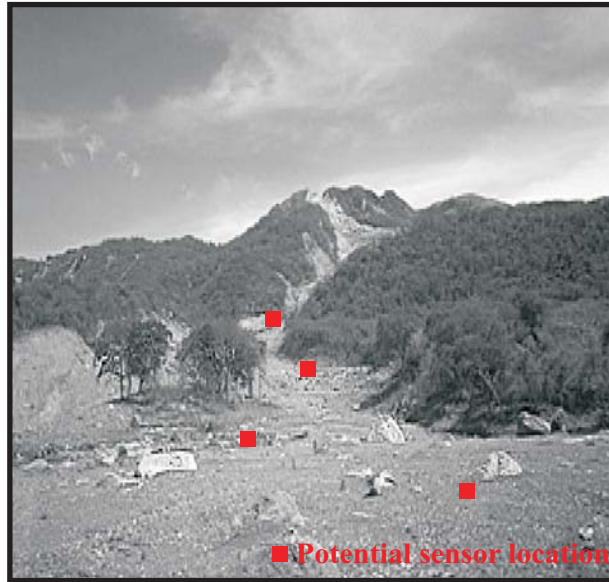


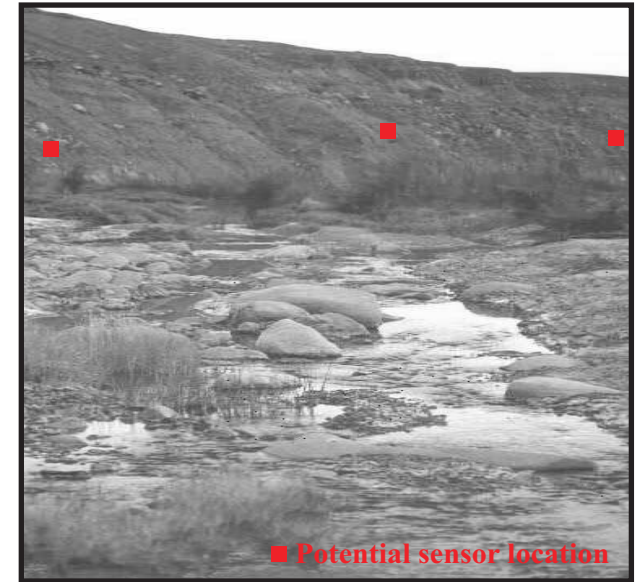
FLASH FLOOD/DEBRIS FLOW WARNING SYSTEM



Debris Flow



Lahar



Flash Flood

Flash floods, debris flows, and lahars contribute to a significant number of deaths worldwide every year. While systems exist for providing warnings of such events, they are high cost and complex. They are also generally deemed impractical for residences as the alarm time is too short for a realistic response.

There are exceptions to the above:

- Many of the deaths and injuries associated with flash and debris flows are highway related. In this case, a very short warning time would allow travelers on the highways to be alerted, or the highway closed, by automatic means.
- Lahars, in some situations, will allow a much greater warning time due to their greater travel distance. As such, warnings may allow for residential evacuation.
- Even if the warning time is short, if people are trained in the proper evacuation path to a safe location, then a short warning is adequate. It is certainly better than no warning at all.

A warning system for flash floods/debris flows is currently under development. This system utilizes low cost, disposable, intelligent sensors that are placed in the potential flow channel, but above the level of normal stream flow. When displaced, these sensors register the displacement with a local processing device placed at the alarm point. If cascading events are detected, an alarm is tripped. Similarly, proper placement of the sensors allow for monitoring of flow elevation conditions within the channel. A failsafe device insures that a warning is displayed when unrecognized conditions are encountered within the system.

The major benefit of this system is that it is an intelligent, low cost, network placed in the flow channel. It only reports on events that cause multiple sensor displacement. Cascading events are required to trigger the system. As these can only be generated by some form of mass flow, the system is very robust. The primary sensors, being low cost, can be readily, and cheaply, maintained and replaced. The sensors can also be camouflaged in a variety of ways that makes them essentially invisible to the public.

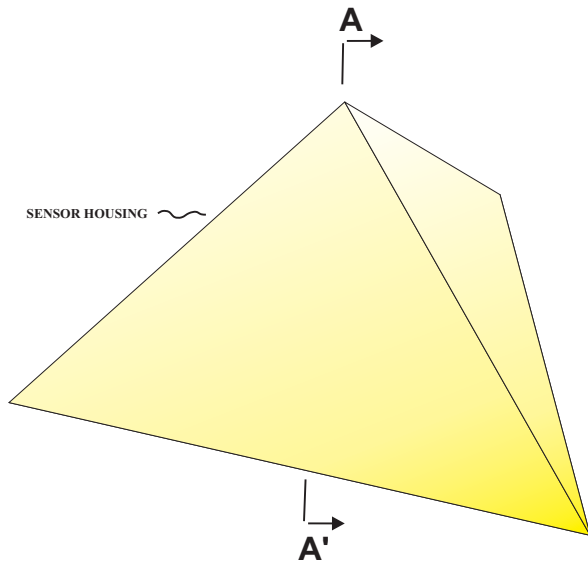


ZOSTRICH GEOTECHNICAL

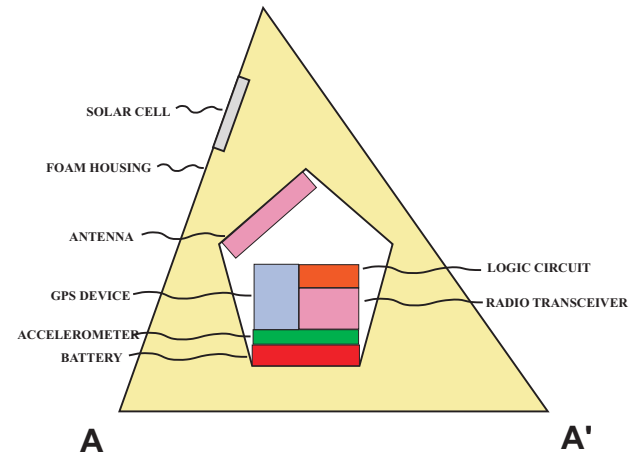
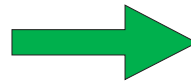
110 W. 6th Ave. # 241, Ellensburg, WA 98926 USA
Telephone: (888) 412-5901 Fax: (509) 968-4
e-mail: zostrich@zostrich.com

GEOTECHNICAL MASS FLOW SENSOR

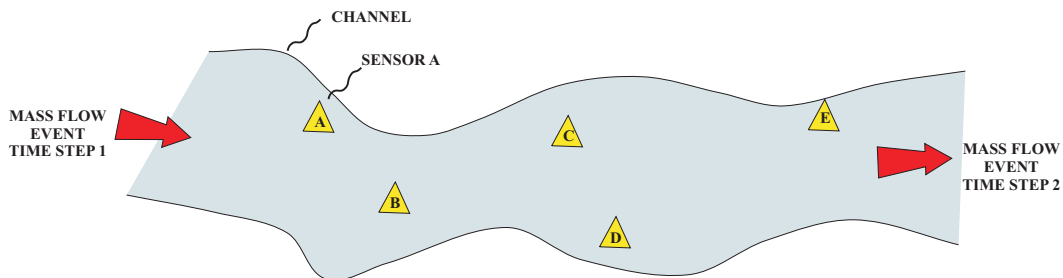
(Patent applied for)



TYPICAL FLOW SENSOR



BLOCK DIAGRAM, SECTIONAL VIEW



The sensor housing is composed of a tough foam plastic. The preferred geometric shape is tetragonal, but any shape can be used.

Within the housing is a battery driven sensor capsule. This capsule is composed of an accelerometer (to measure local tilt/displacement), a GPS unit (for global location, if desired), a radio transceiver, a logic unit, and a battery to power the unit.

The units can form an intelligent network or be arranged in a master/slave configuration, reporting to a central processing/alarm unit.

When mass flow disturbs the units, as in the diagram to the left, the sensors would report that sensor A was moved (and/or stopped reporting), followed by B, C, D, and E. This report, as filtered and interpreted by the central processor, would issue an alarm for whatever section reported as being in motion.

Adaptations can be made for snow cover, camouflage, etc. based upon local needs.



ZOSTRICH GEOTECHNICAL

110 W. 6th Ave. PMB# 241, Ellensburg, WA 98926 USA
Telephone: (888) 412-5901 Fax: (509) 968-4312
e-mail: zostrich@zostrich.com