GL0285

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108—1295
TELEPHONE 801-524-3422

MEMORANDUM

May 1, 1985

TO: P. M. Wright and D. L. Nielson

FROM: Sue F. and Duncan F.

SUBJECT: Avalanche Research

SNOW AND AVALANCHE RESEARCH IDEAS

This is not a comprehensive list, but gives you a few ideas about our thoughts. The U.S. Forest Service has cut out their own avalanche research effort, so the need is great for a center (and where better than UURI?).

1. Develop a system for building composite snow profiles from remote areas within the forecast region (Provo to Logan in the Wasatch at this time). Design software for accessing weather data and snowpack structure information, and reconstructing snowpack structure with updated weather observations. Also design a filing and easy access system for operational use by the avalanche forecaster. This will help improve backcountry avalanche forecasts for remote areas that have weather stations but are not always accessible for snowpack investigations. It will also be a way to operationally test current models for snowpack development and avalanche formation.

2. Obtain photos of snow crystals falling during a storm. Correlate these observations with upper air readings from weather stations and avalanche occurrence records to better understand the role of precipitation in avalanche formation and to devise more accurate avalanche forecasts from weather observations and forecasts.

3. Observe and record light changes within the snow stratigraphy as a method of remote sensing snowpack structure.

4. Investigate trigger mechanisms for avalanches. Extensive work has been done on explosive initiation of avalanches. However, avalanche control workers find that explosives are effective only if placed correctly within the starting zone. This placement depends on terrain and snowpack features in addition to the character of the charge. A theoretical investigation on the proper placement of a trigger mechanism is needed. In addition, the effectiveness of other trigger mechanisms, like cornice falls, skiers, and other avalanches, need to be investigated. These mechanisms apply different stress patterns that also depend upon snow stratigraphy and terrain. The mechanical properties of snowpacks, particularly those that develop long fracture lines (like the 1-1/2 miles of the one that got the church in Alta a few years ago) are not well known.

5. A large variety of stresses influence a large variety of snow types within the natural snowcover. The response of medium to high density (> 250 kg/m^3) snow with well-rounded grains has been studied under compressive stresses. However, little work has been done on lower density snow (most commonly found in seasonal snowpacks), snow of varying granular structure, or under varying tensile or shear stress (the predominate stresses under which avalanching snow fractures).

6. Understanding the social aspects of backcountry users who travel within hazardous terrain would help to improve avalanche education and increase the effectiveness of public statements about avalanche hazard.
7. An accurate wind flow and precipitation model needs to be developed for the Northern Wasatch Mountains. This would improve mountain weather and avalanche forecasts. Mountain weather forecasts are presently very poor, which causes ski areas to lose much money each season in both unrequired closures of the road and unnecessary calling out of mountain crews. Accurate forecasts will require much computer modeling, as well as new weather data from remote sites.
8. Little Cottonwood Canyon is one of the most hazardous avalanche areas in North America because of the size and extent of avalanches that reach the road, public buildings, and private dwellings. For years they have controlled the size and timing of avalanches with surplus artillery. Their ammunitionis running out. A cost-effective investigation needs to be done to look at the alternatives for avalanche safety within the canyon. Alternatives may include making more rounds, developing a rocket system, or implementing a passive system of defense structures.
9. Instrumentation development is required to more accurately measure stresses and strains within the snowcover, non-destructive measurement of snow stratigraphy, remotely record avalanche occurrence, improve remote telemetry of weather stations where power is unavailable, record and analyze the areal extent of avalanching, etc.
10. In areas beyond the Cottonwood Canyons, an atlas of avalanche paths would help forecasting and highway department personnel. We will be talking in mid-month to UDOT about this, but it might be the sort of thing FEMA would be interested in.