The 5 Step Checklist System

- A proven method for
Avalanche Forecasting, Loss Prevention
and Safety


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Helicopter Skiing

Our mandate:

Risk Management Plan for Loss Prevention

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Reduction of human factors:

- Using the **5 step checklist** for avalanche forecasting and for safe travel in the mountains

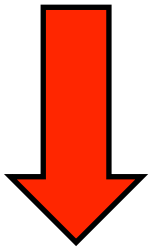
  - It is a systematic method for stability rating
  - Reduces the human factors in making errors
  - Prevents missing any items that have an effect on the snowpack stability

- 45 years experience, over 30,000 snow profiles, ~ 1000 annually

The 5 Step Checklist

Forecasting snow stability rating

- ❑ 1. Daily weather data
- ❑ 2. Graphs
- ❑ 3. Snow Profile observations
- ❑ 4. Field observations
- ❑ 5. Ski test and stability ratings



Ski terrain choice & use of guiding procedures

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Nature's Complexity & Chaos

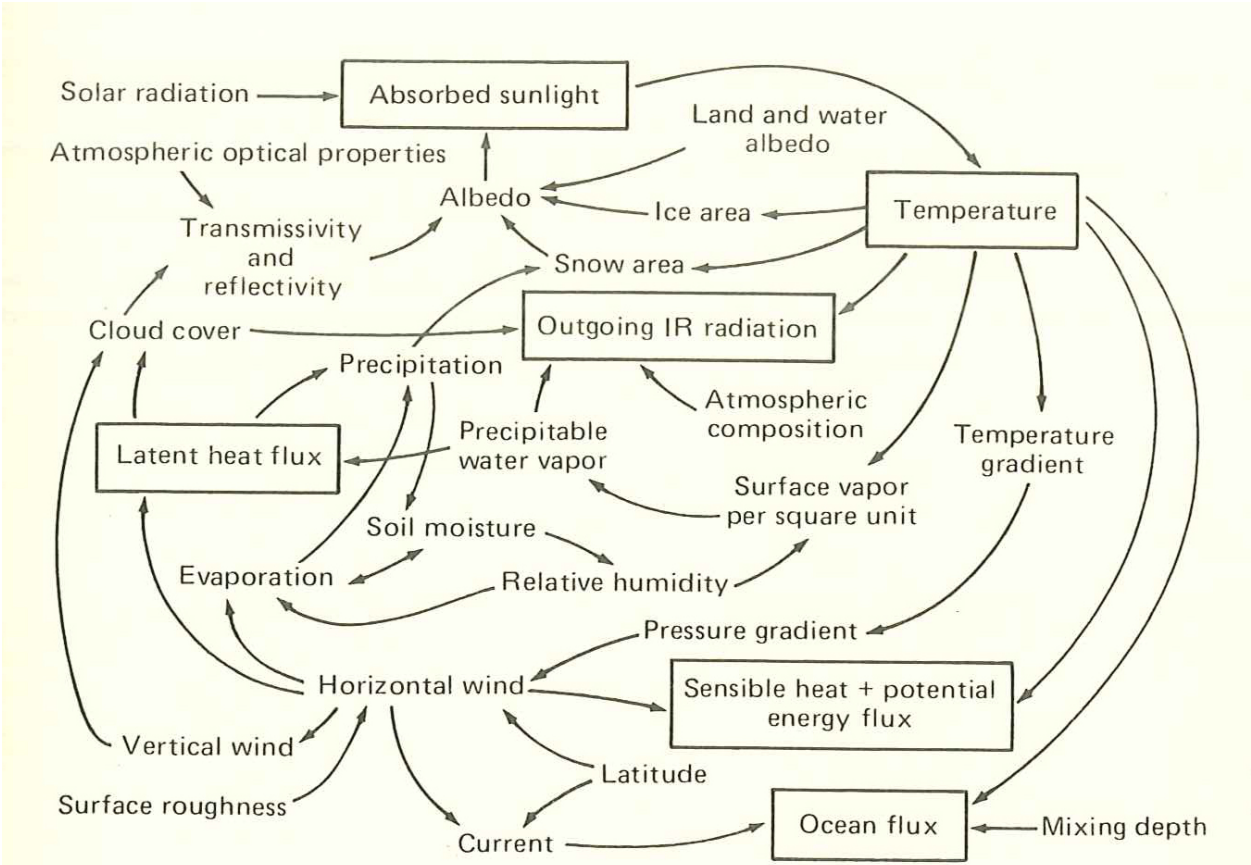

Figure 1.1. A model of the weather and climate machine illustrating its complex and intricate feedback mechanisms. The influence of several of the feedback processes are comparable in magnitude but opposite in direction. It is clear that variations in the energy input parameter at the top left may affect several of the meteorological parameters within the machine. From Kellogg and Schneider (1974).

Our Professional Ski Guides Organization

CSGA (Canadian Ski Guide Association) & CIMS (Canadian Institute for Mountain Safety)

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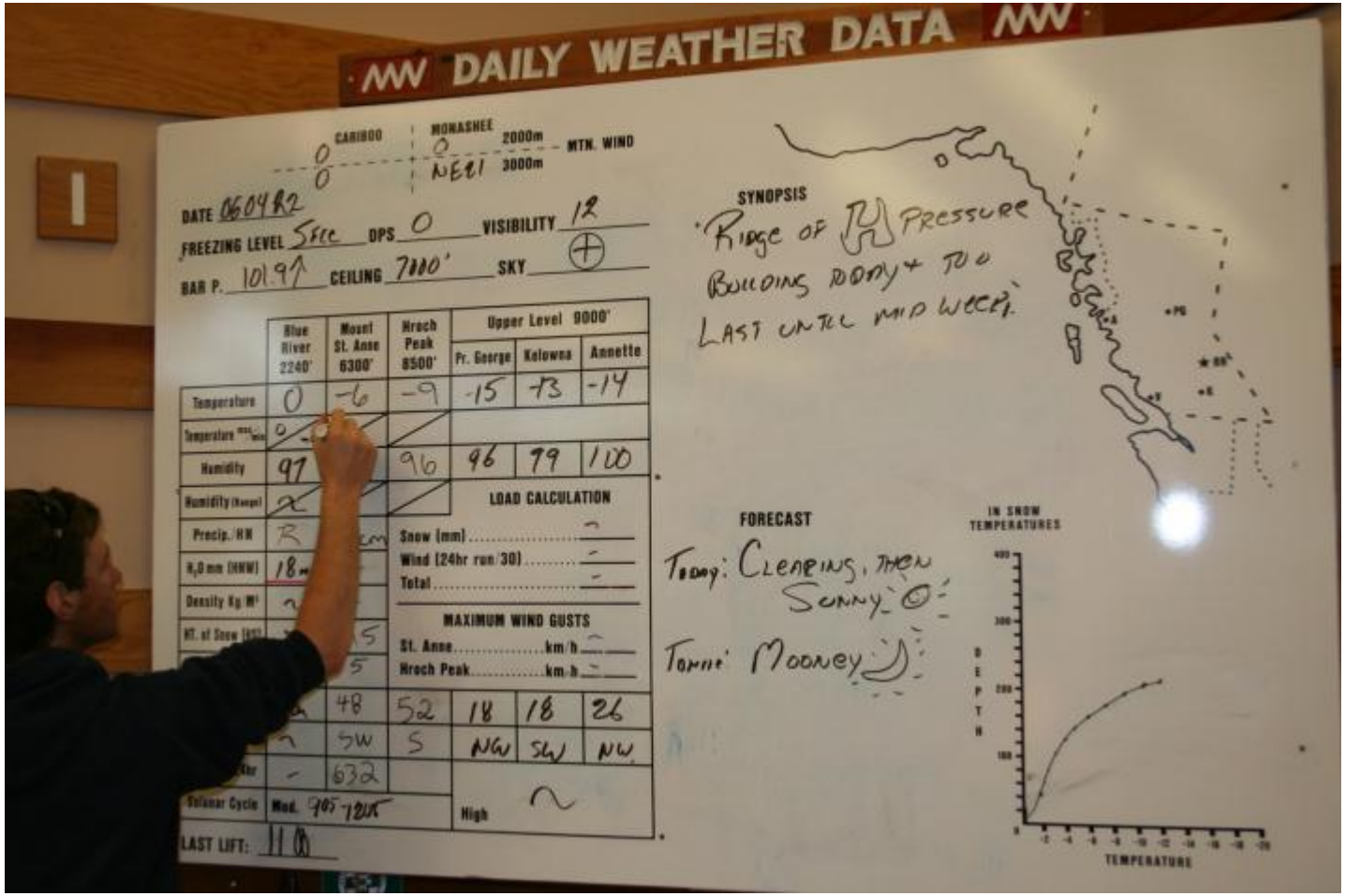
Step 1 Daily Weather Data



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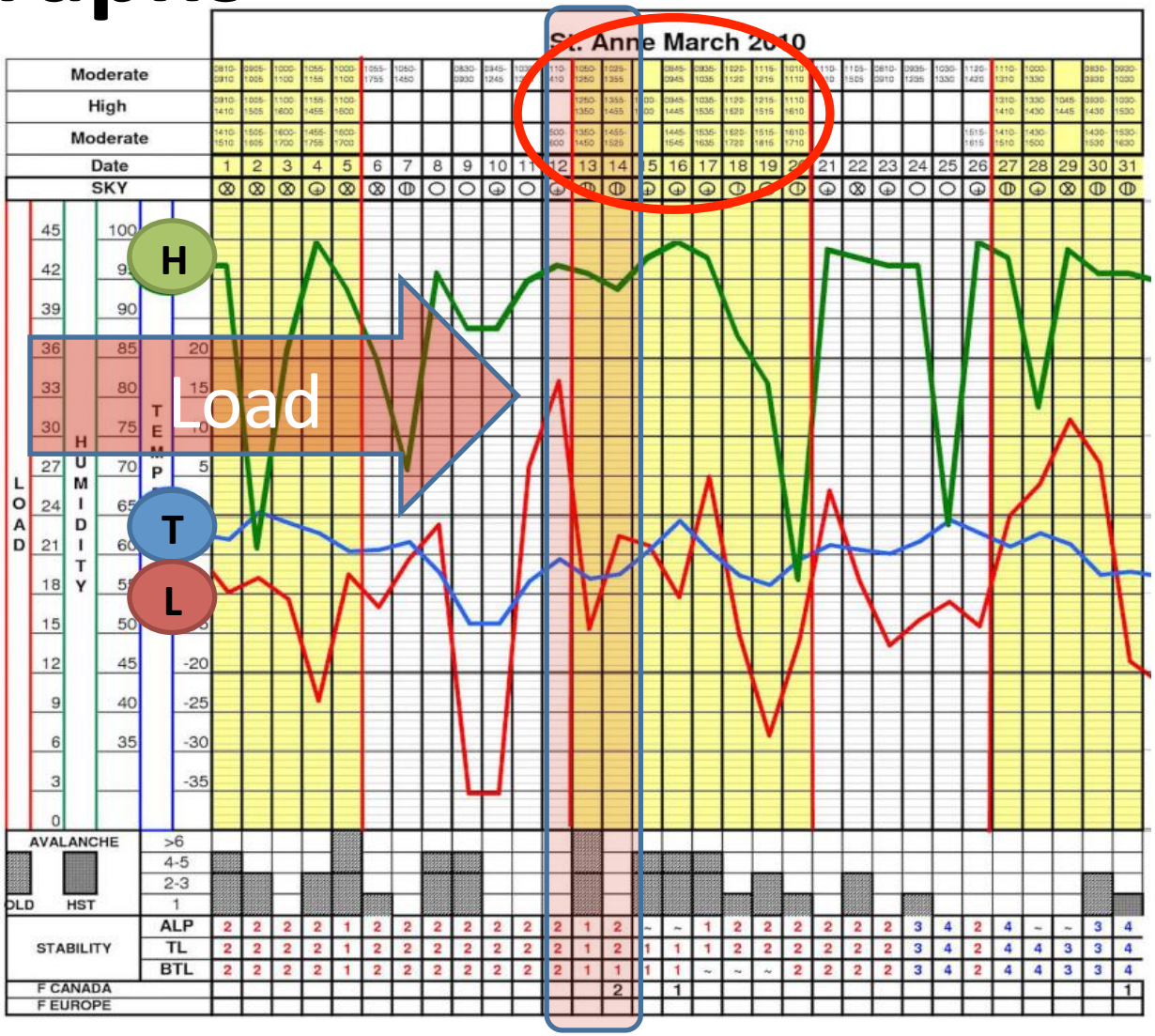
Step 2 Graphs

CSR (high cycle)

Humidity

Temperature

Load



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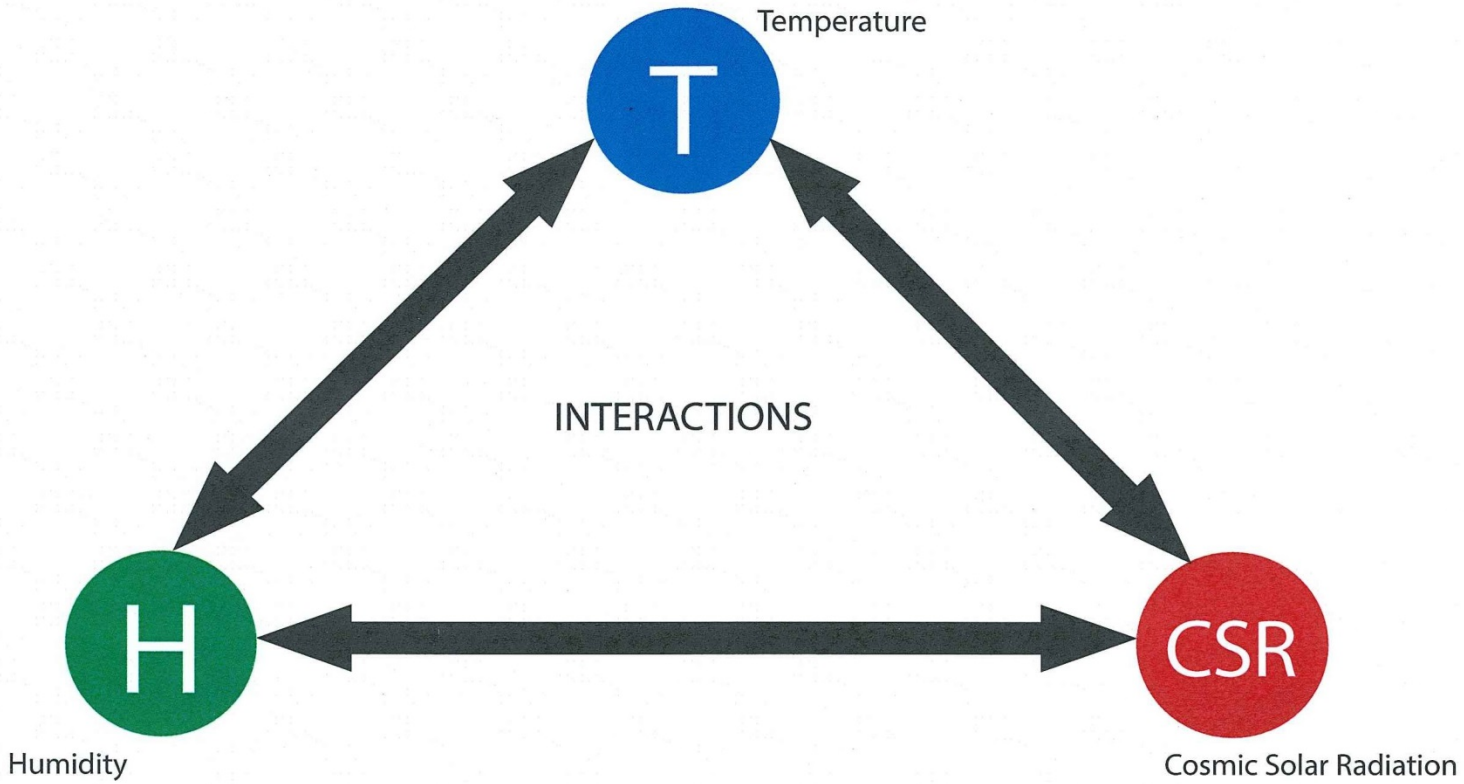
Step 2

The 3 Major Contributory Factors

for Stability Rating



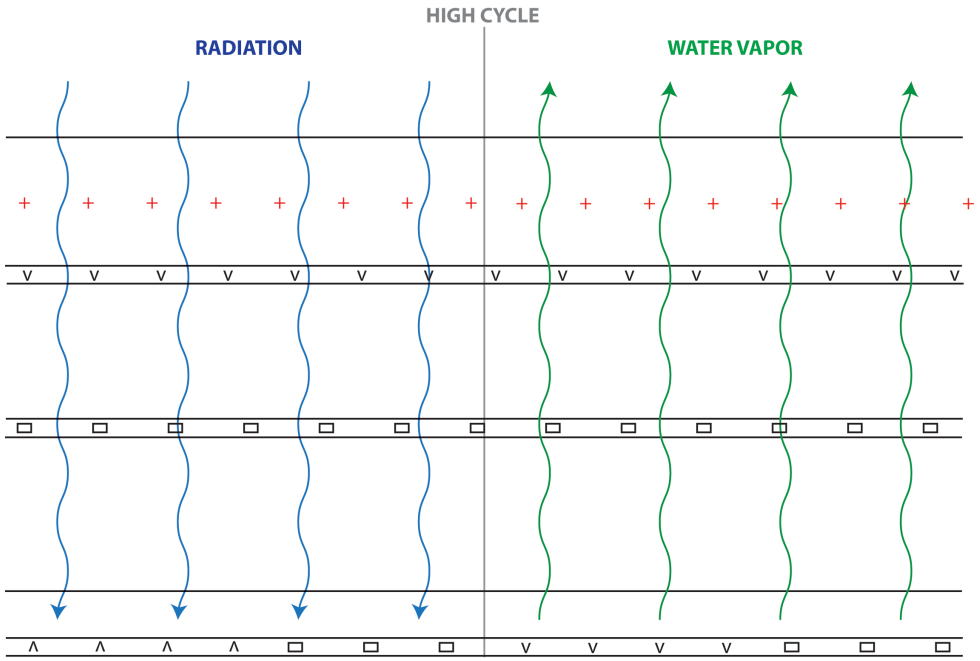
Step 2

Cosmic Solar Radiation (CSR)

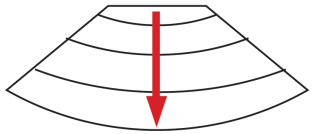
- Inflow of cosmic and solar radiation occurs in the high cycle related to the tidal chart/date/time.
- The universal system works in a well-organized and perfect manner.
- Cosmic rays are a stream of penetrating high speed atomic nuclei that enters the Earth's atmosphere.
- Energy is transmitted as electronic fields of waves of moving particles and is invisible.

Step 2

COSMIC SOLAR RADIATION



A snow layer may lift during atmospheric pressure during high cycle. Snowpack is now saturated with water vapor causing downward tension.

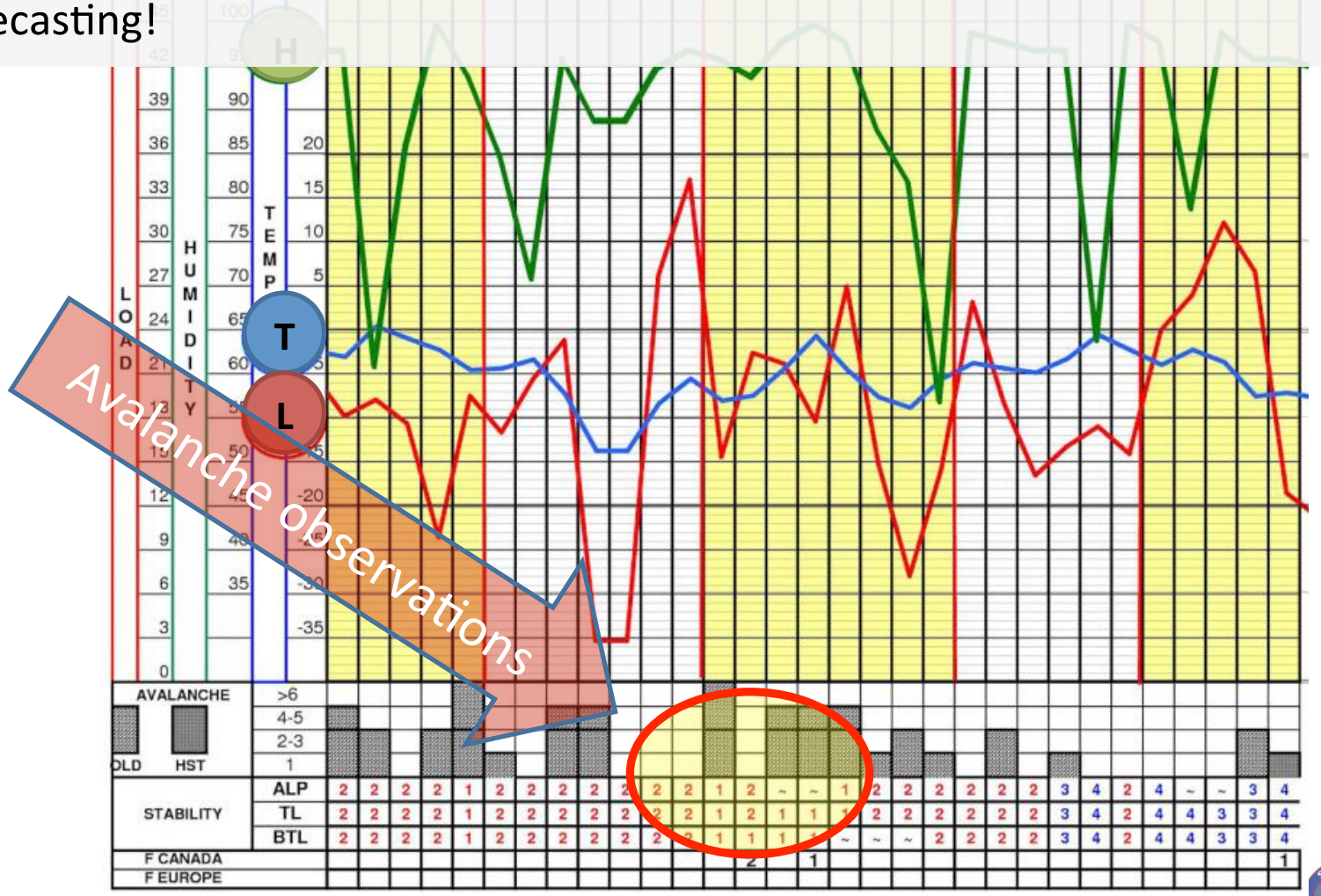


The water vapor then returns to the surface, deteriorating the strength of the snow layers and ice, causing tension and creeping of snowpack - more so in high cycles - increasing the probability of snow pack failure and for natural of skier interference avalanches

Step 2

Observations

We have observed worldwide that most **avalanches, ice falls and fatalities** occur during high cycle. Not using CSR cycle is a missing link for accurate forecasting!



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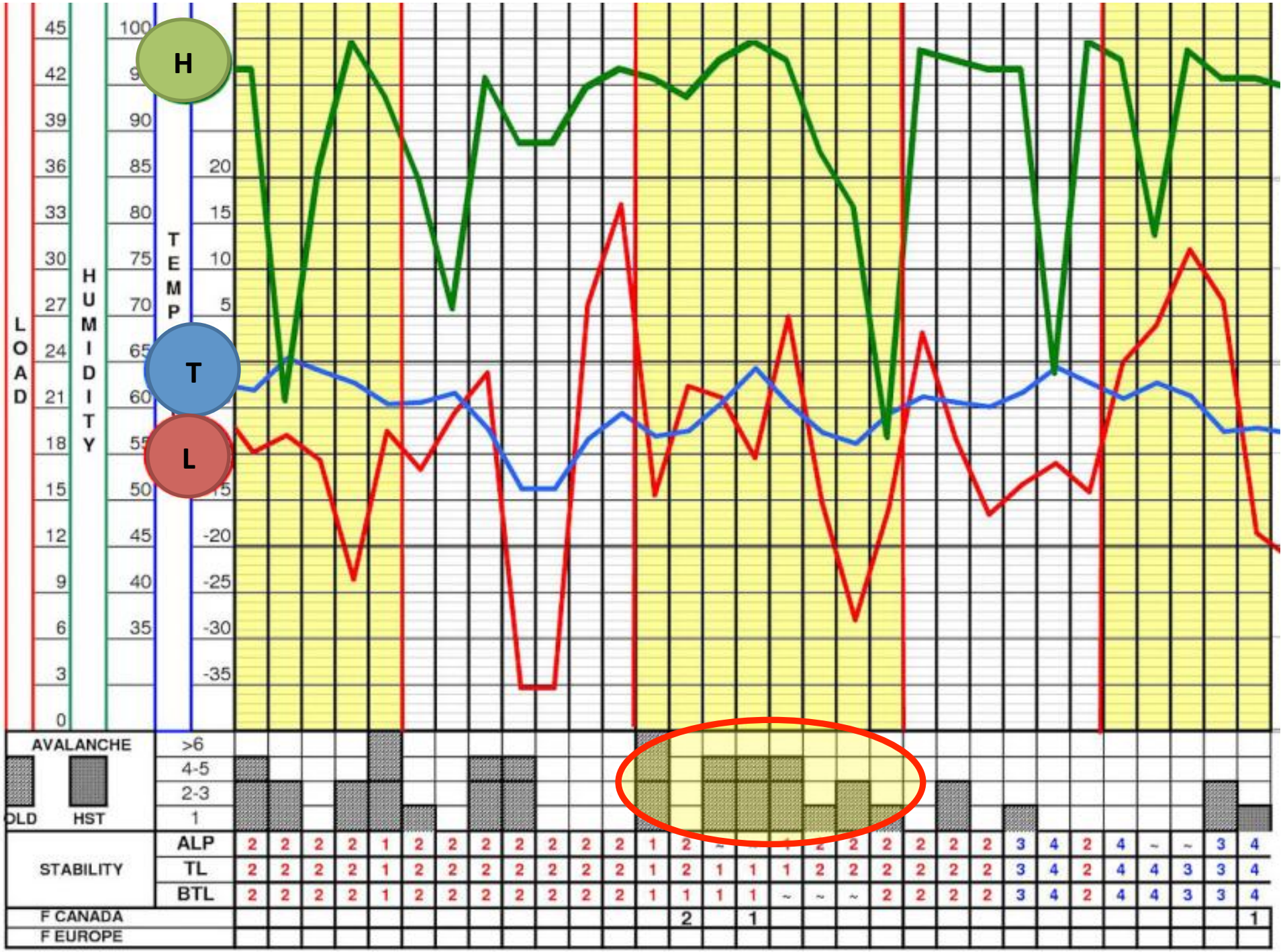
H
T
L
LOAD
HUMIDITY
TEMP
AVALANCHE
OLD
HST
>6
4-5
2-3
1
STABILITY
ALP
TL
BTL
F CANADA
F EUROPE

Step 3 Snow Pack Profiles

"If you don't dig, you don't know"

Shovel Shear Test

Most reliable and effective method for measuring stability and ratings

- Substantiate your findings with 3 to 5 tests

Looking for a gliding layer

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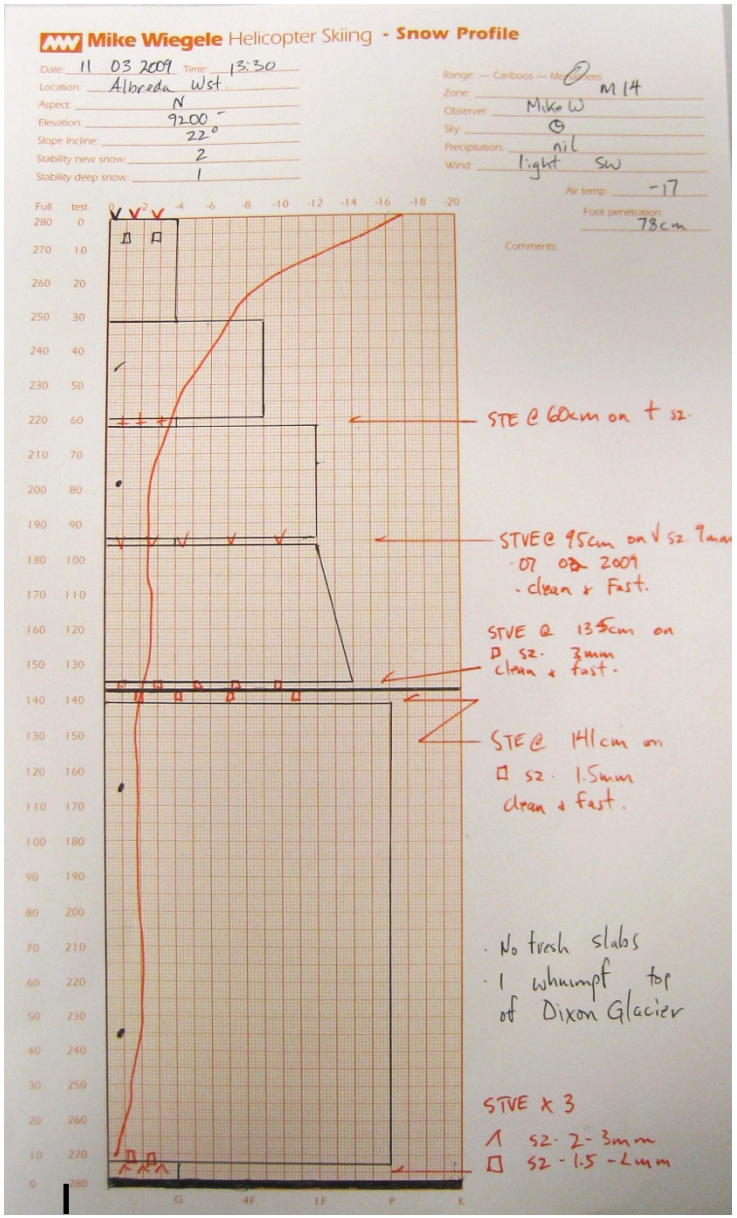
Step 3

Major Gliding Layers

- ☐ 1. Depth hoar (Λ)
- ☐ 2. Surface hoar (V)
- ☐ 3. Facets (☐)
- ☐ 4. Ice (-)
- ☐ 5. New snow crystals (+) (powder)



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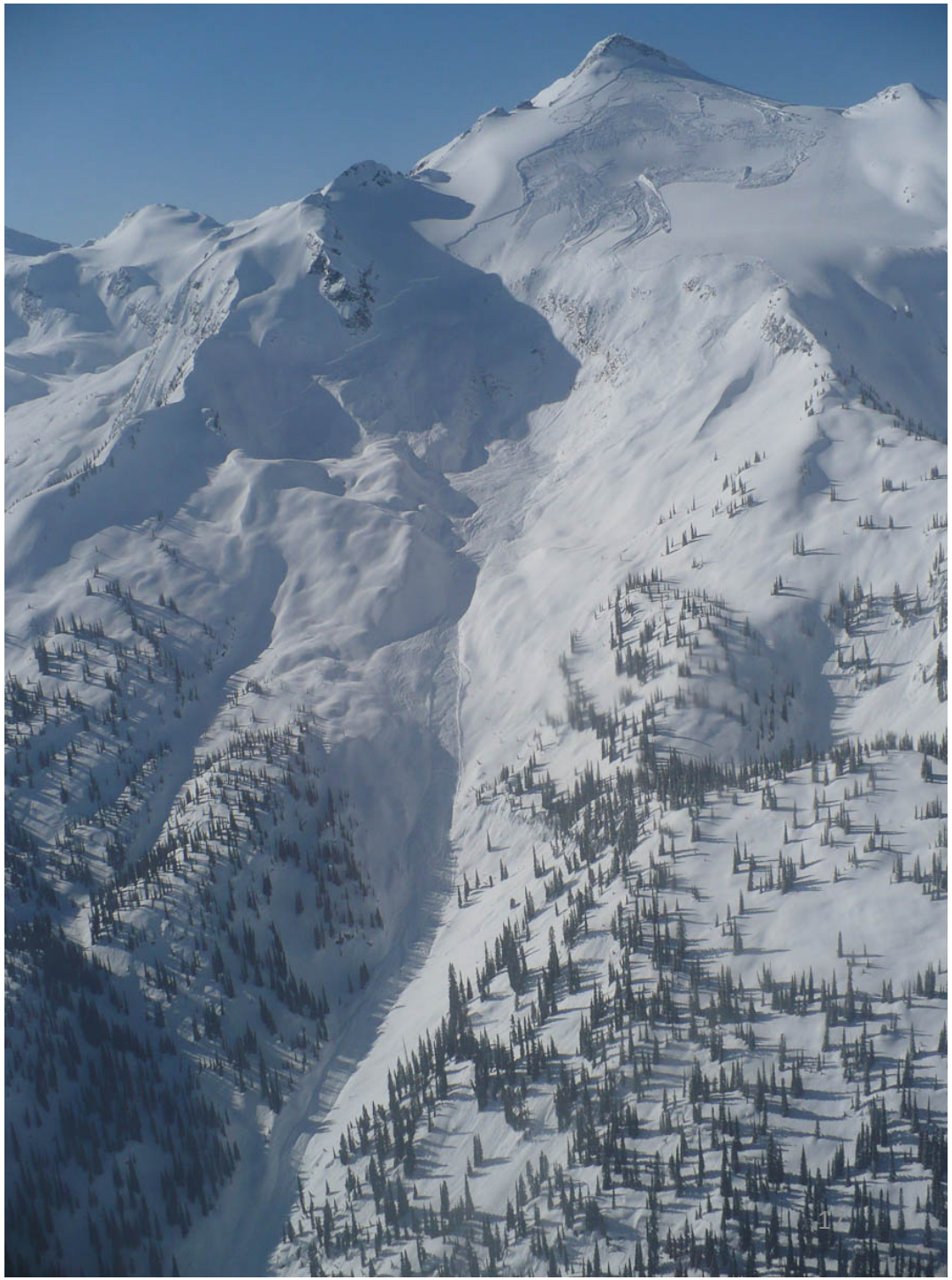
Step 4 Field Observations

Natural avalanche observations

override

snow profile tests



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Step 4

Field Observations

Natural avalanches alert us to changes taking place in the snowpack to very poor stability.

This avalanche occurred at the exact time of the CSR-cycle.

Ski tracks are from the day prior.

Step 5

Stability Rating and Ski Tests

Every turn is a ski test

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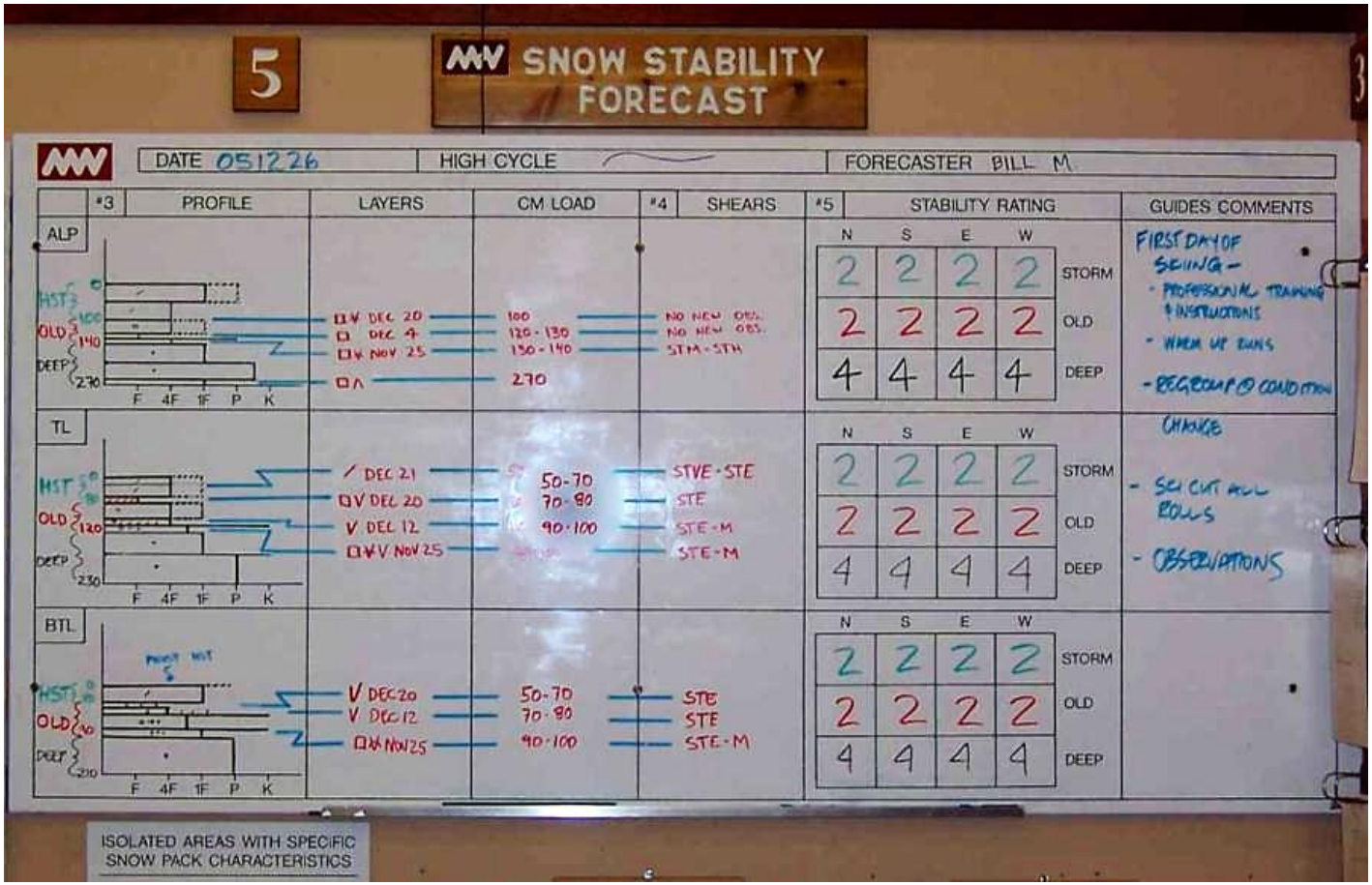
Step 5

Stability Rating

All elevations and exposures



Terrain choice and guiding procedures are applied accordingly.

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Step 5

Stability Rating Values

7 Stage Stability Rating Compared to 5 Stage

1	2	3	4	5	6	7
VP	Poor	Poor - Fair	Fair	Fair - good	Good	VG

VP	Poor	Fair	Good	VG
1	2	3	4	5

- **Fair ratings** are commonly used in the industry and are misleading and have created a false sense of security = tragic
- Too much room for human error
- Divide **Fair** into 3 sections
- Must be upgraded to 7 stage stability rating

- Better assists us in **terrain** selection and **guiding** procedure

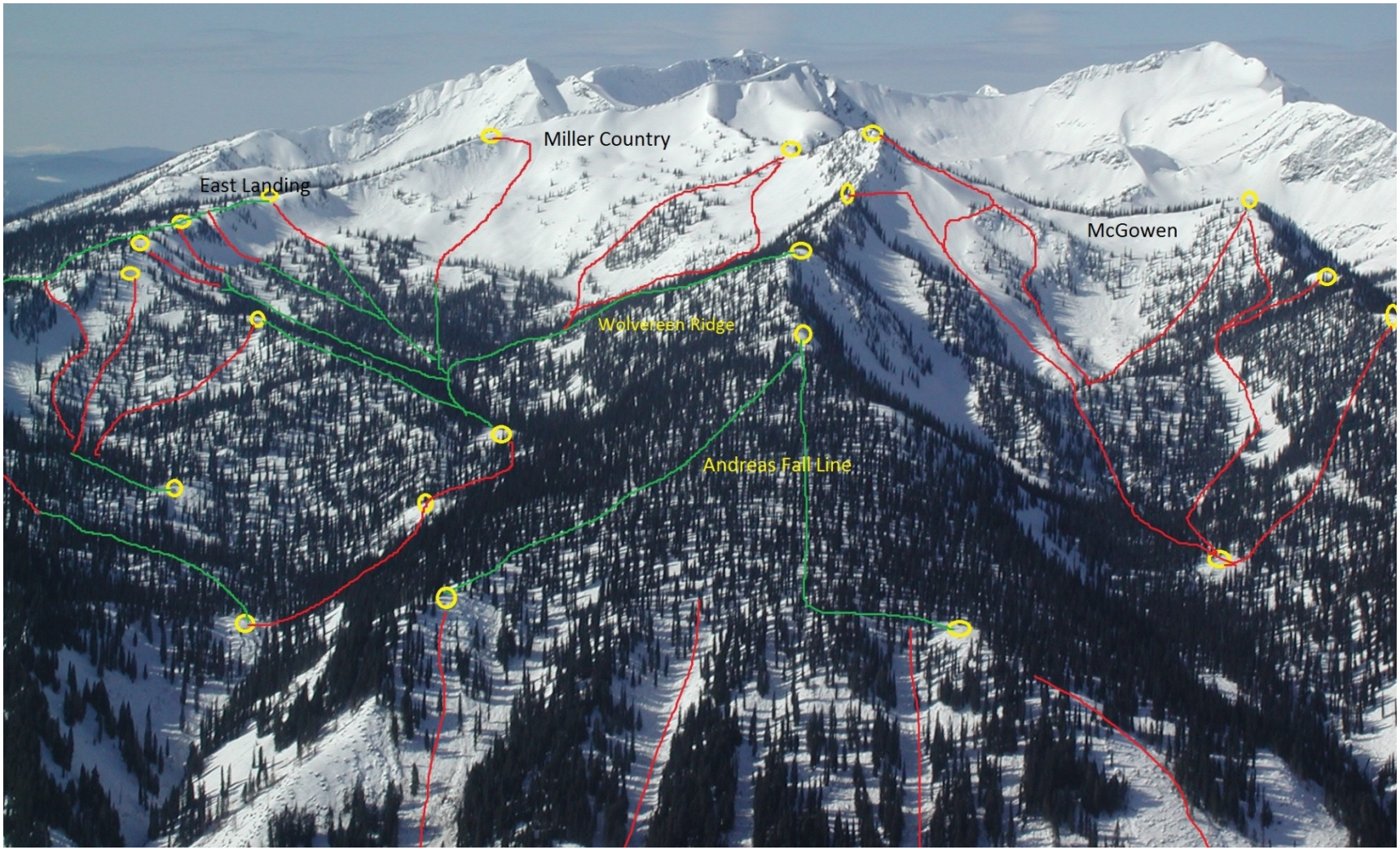
TERRAIN FEATURES

If snow stability is the problem terrain choice is the answer.

The most dangerous terrain features

- Glacier Icefalls & Crevasses
- Cliffs
- Trees
- Gullies
- Unsupported Slopes

Route Selection



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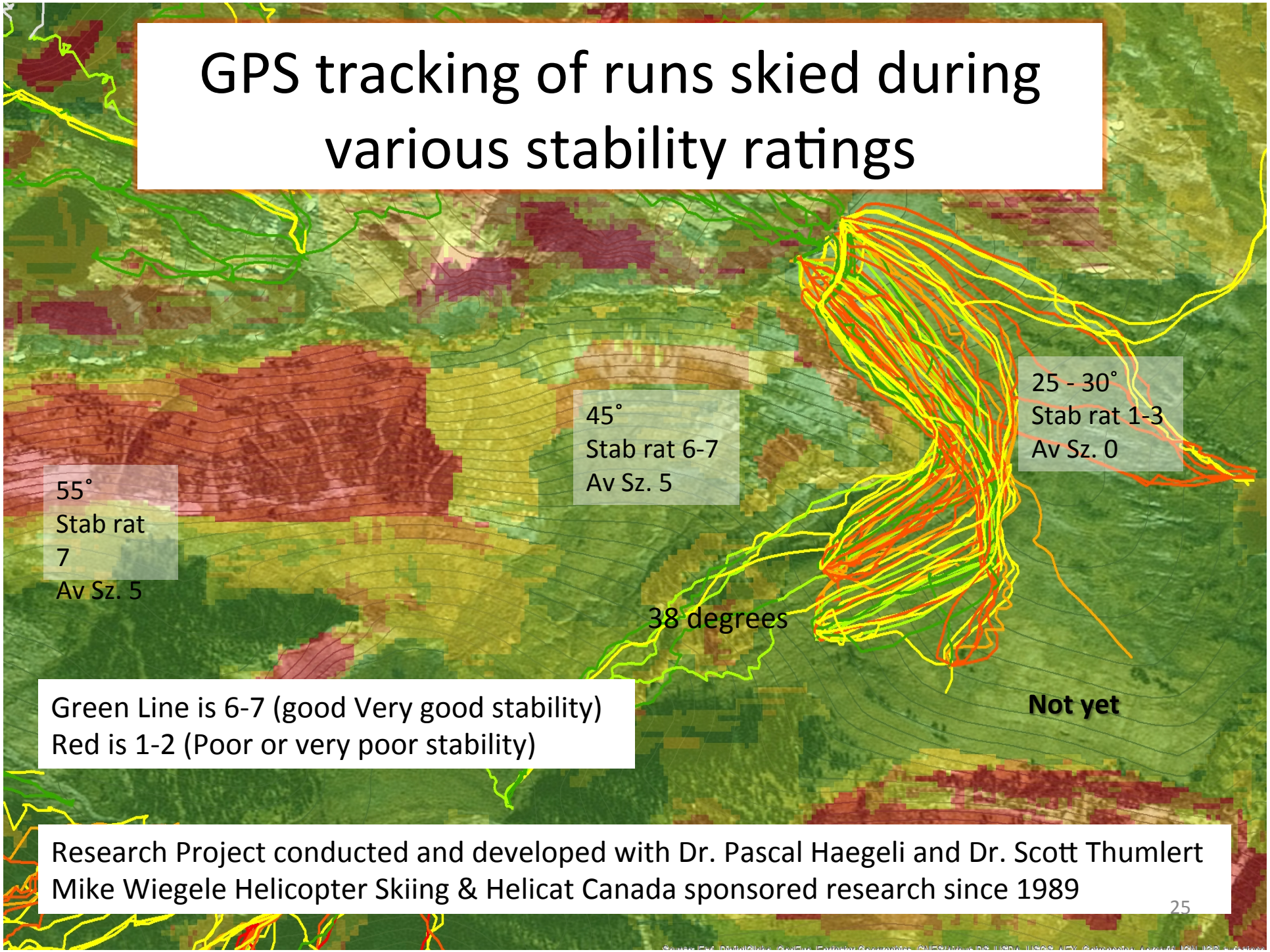
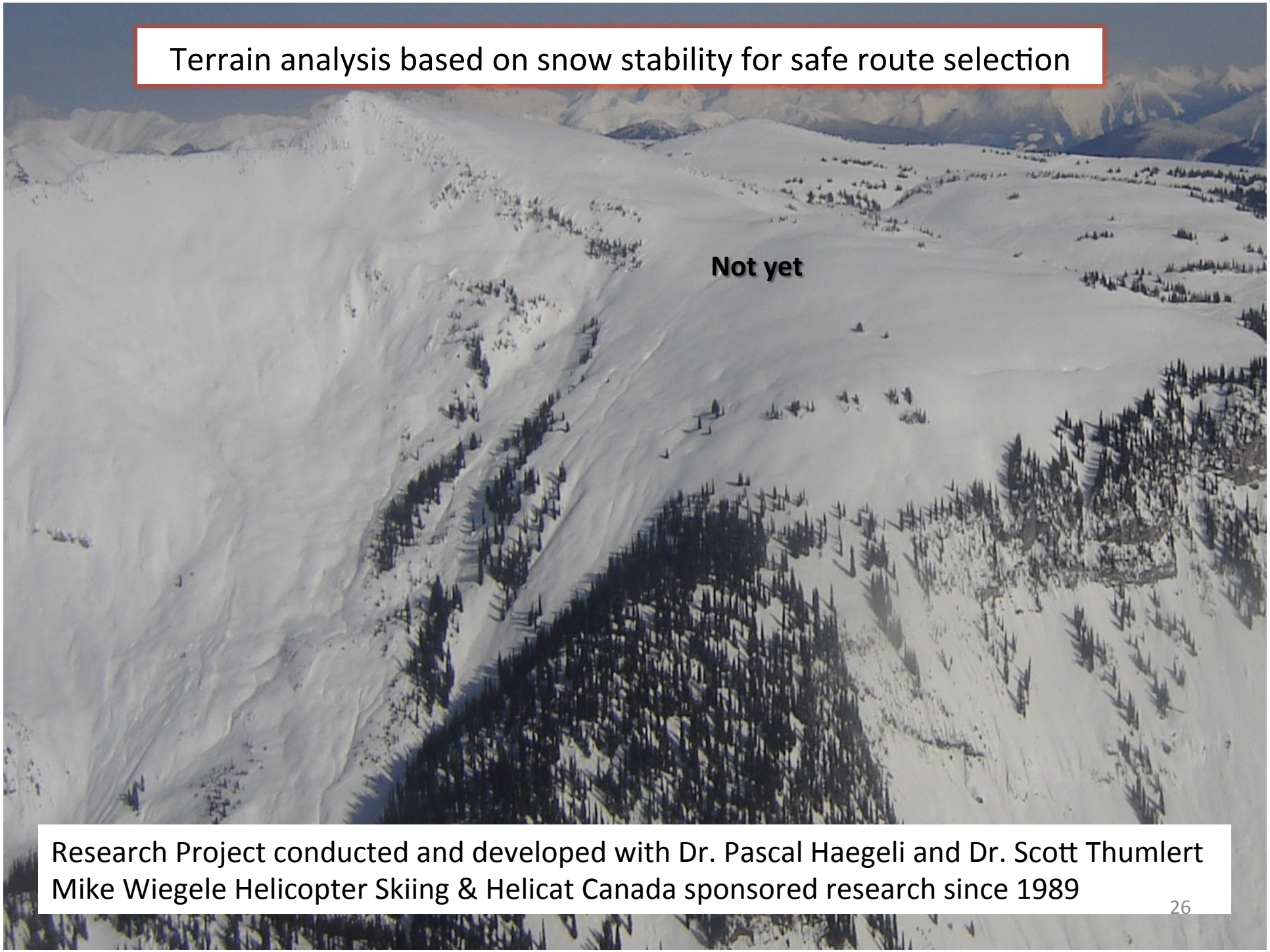
GPS tracking of runs skied during various stability ratings



Green Line is 6-7 (good Very good stability)
Red is 1-2 (Poor or very poor stability)

Research Project conducted and developed with Dr. Pascal Haegeli and Dr. Scott Thumlert
Mike Wiegele Helicopter Skiing & Helicat Canada sponsored research since 1989


Terrain analysis based on snow stability for safe route selection
Not yet
Research Project conducted and developed with Dr. Pascal Haegeli and Dr. Scott Thumlert
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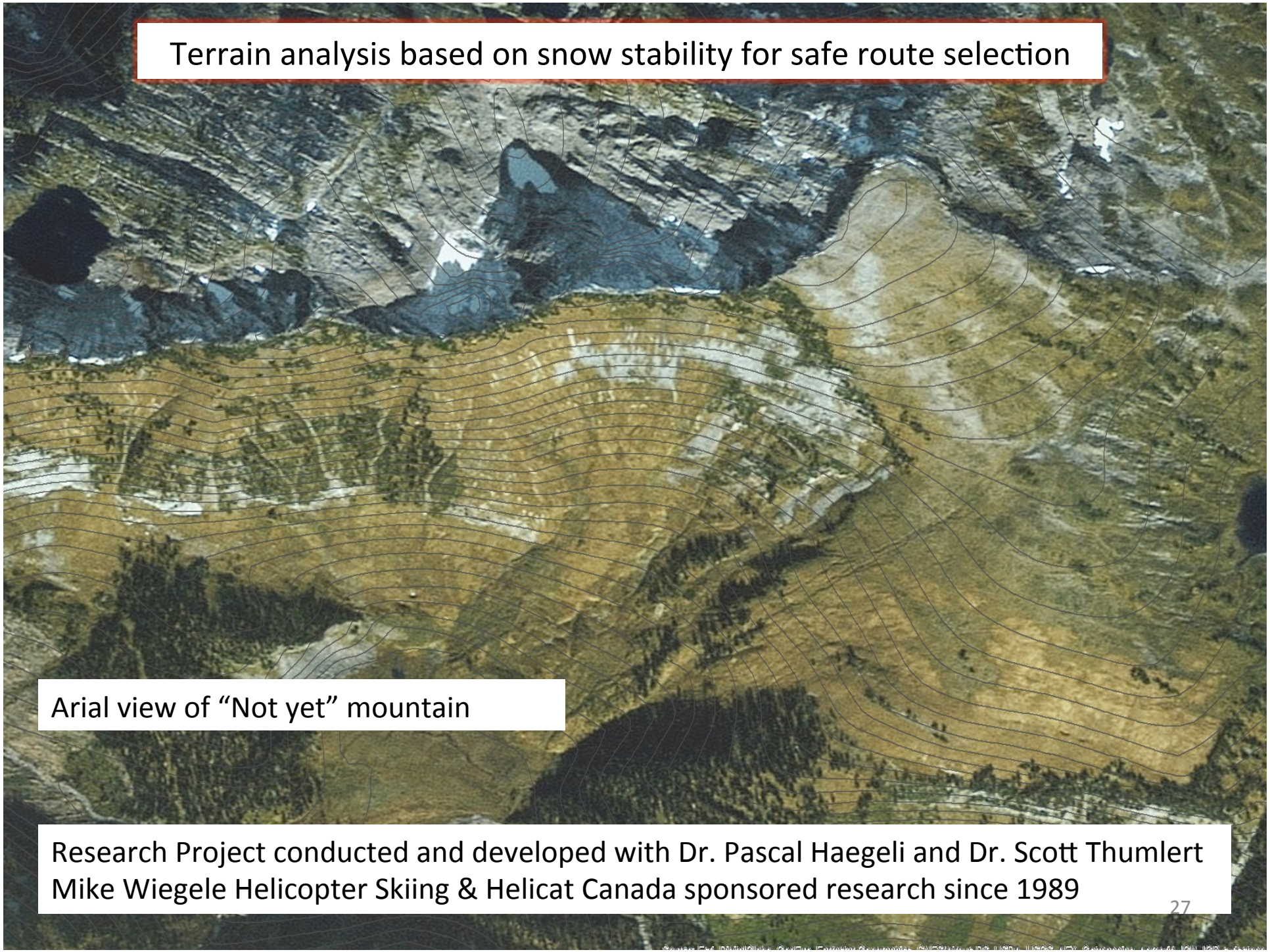
Terrain analysis based on snow stability for safe route selection
Arial view of “Not yet” mountain
Research Project conducted and developed with Dr. Pascal Haegeli and Dr. Scott Thumlert
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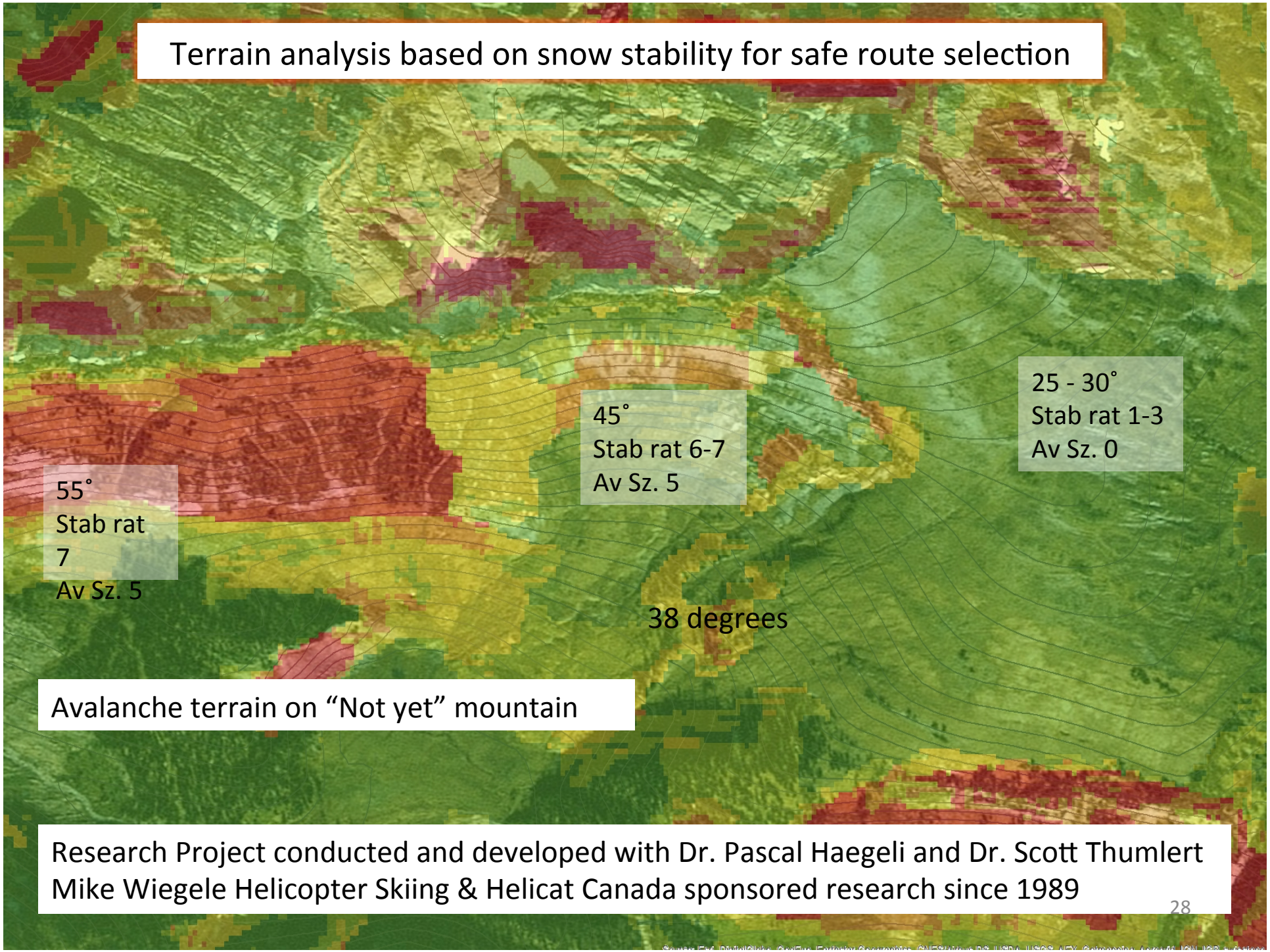
Terrain analysis based on snow stability for safe route selection
25 - 30˚
Stab rat 1-3
Av Sz. 0
45˚
Stab rat 6-7
Av Sz. 5
55˚
Stab rat
7
Av Sz. 5
38 degrees
Avalanche terrain on “Not yet” mountain
Research Project conducted and developed with Dr. Pascal Haegeli and Dr. Scott Thumlert
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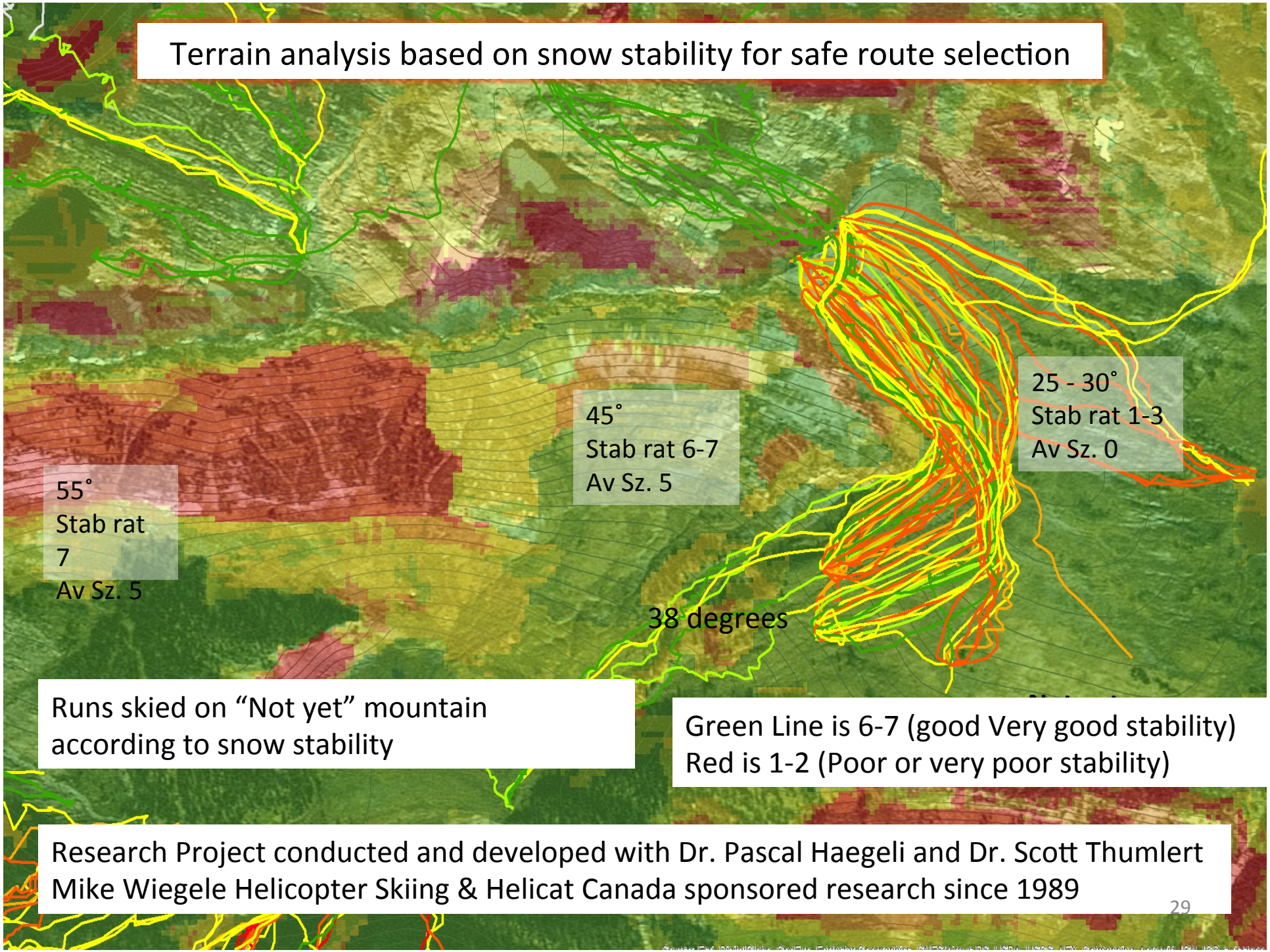
Terrain analysis based on snow stability for safe route selection
55˚
Stab rat
7
Av Sz. 5
45˚
Stab rat 6-7
Av Sz. 5
25 - 30˚
Stab rat 1-3
Av Sz. 0
38 degrees
Runs skied on “Not yet” mountain
according to snow stability
Green Line is 6-7 (good Very good stability)
Red is 1-2 (Poor or very poor stability)
Research Project conducted and developed with Dr. Pascal Haegeli and Dr. Scott Thumlert
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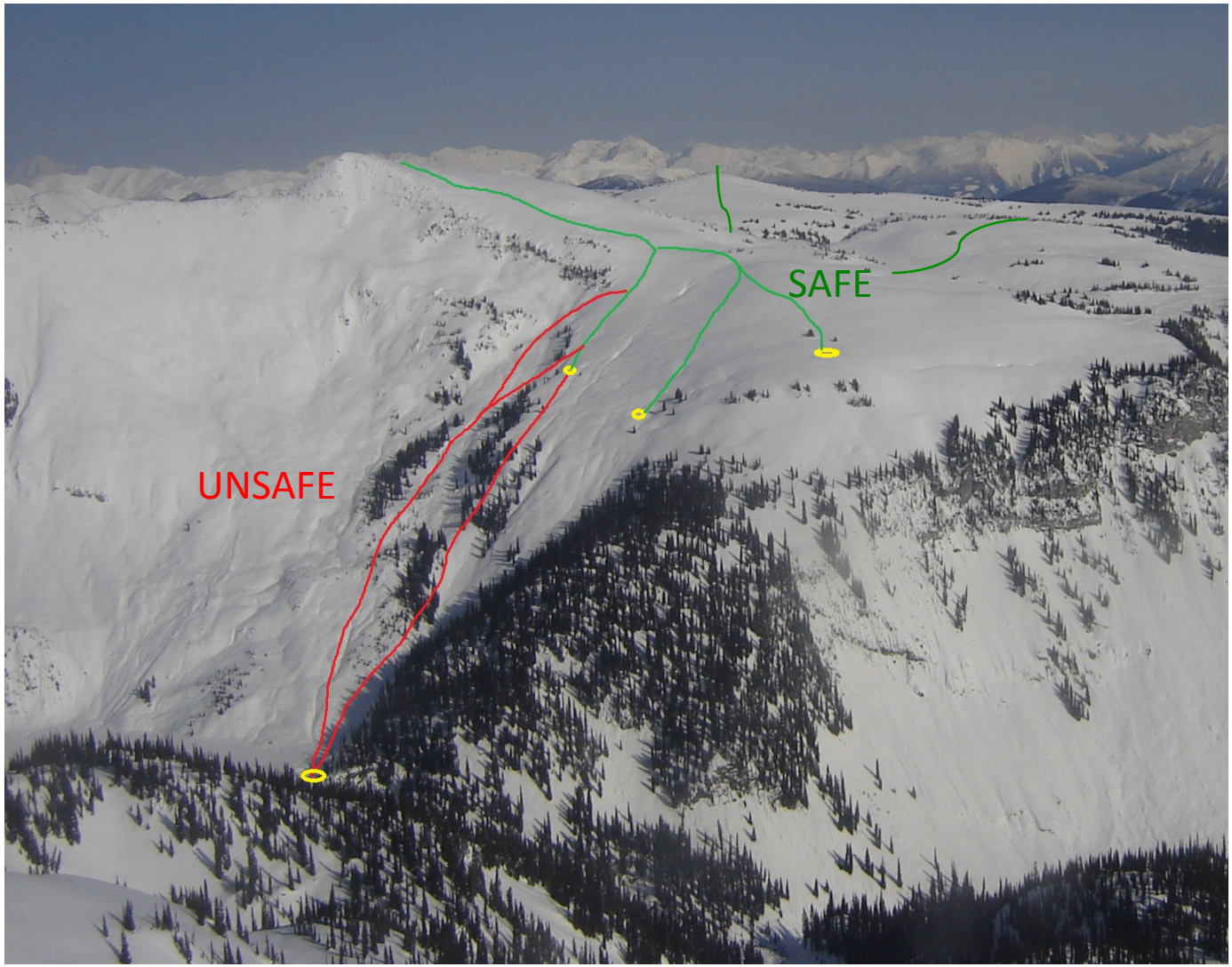
Safe Terrain



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Guiding Procedures – MUST DO

prior to entering potential avalanche slope

1. ☐ Field book – data
2. ☐ Snow profile and stability rating
3. ☐ Gliding layer – look for weaknesses and hot spots
4. ☐ Load – what is the load on top of gliding layer?
5. ☐ Shear – Rating 1-2-3-4-5-6-7 classification with shovel test only
6. ☐ Natural observations
7. ☐ Ski cut test results
8. ☐ Exposure - Elevation
9. ☐ Contributory factors
10. ☐ **Communicate and compare notes with other guides**

Terrain selection and **guiding** procedures

- Recognize mountain hazards on descending route
- Avoid and limit exposure to hazards
- Be alert and move swiftly
- Select safe areas for regrouping
- One skier exposed to hazard only
- Appropriate spacing between skiers – 5 turns
- Partner skiing in trees
- Guests follow directions from hazard prevention awareness folder

Precise ski guiding procedures for loss prevention & fun skiing

Recommendations for Avalanche Forecasting

Industry should adopt the following best practices:

A measured system reduces human error:

1. Use the 5 Step Checklist
2. Use Shovel Shear Test for stability rating only
3. Cosmic Solar Radiation – CSR-cycle
4. InfoEx report must exceed current safety standards

Recommendations continued

5. Worldwide standards are not meeting the requirements for backcountry skiing safety.
6. Research, education, training and certification curriculum must adopt professional industry standards

This will sustain and grow hospitality and tourism economy.

A Measured system overrides intuition and human factors

Thank you

Have fun, be safe, do diligent work

Mike Wiegele Helicopter Skiing & Helicat Canada sponsored research since 1989.
Research Projects conducted and developed with
Dr. Bruce Jamieson, University of Calgary,
Dr. Pascal Haegeli and Dr. Scott Thumlert, Simon Fraser University,
Onno Werringer from Alta ski area

Mike Wiegele
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