TRAINING CANADIAN OLYMPIC SKIERS WITH STEALTH™

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PLAN GROUP

GEOMATICS ENGINEERING

ION ALBERTA SECTION, 12FEB10

Introduction

- Competitive alpine skiers win or lose races by fractions of a second
- Precise position and timing information during training is critical

Challenges

- Accuracy of 10 cm and 1 ms, 20 times per second
- Negligible influence on skiers up to 130 km h^{-1}
- Robust and easy to use device less than 500 g, power autonomy of 4 hours, -20˚ C
- Suitable data presentation & interpretation for skiers and coaches
- Training for downhill, super-giant slalom, giant slalom, and ski testing

Can GPS Do It?

- Yes in principle, but
  - Topography limits signal visibility
  - Weight and power are constraining

Program Launch

- Top-Secret program launched by Canada's **Own The Podium/A Nous le Podium 2010** in collaboration with PLAN Group, Schulich School of Engineering, University of Calgary in 2006…
- …To develop a GPS-based device that would meet pre-defined requirements
- Result, three years later: ***Sensor for the Training of Elite Athletes*** (**STEALTH™**)

Gérard Lachapelle, head of the PLAN Group and CRC/iCORE Chair in Wireless Location at U of C, and Alpine Canada Alpin's chief athletics officer Max Gartner, exchange hats to celebrate the new partnership. / Photo by Grady Semmens

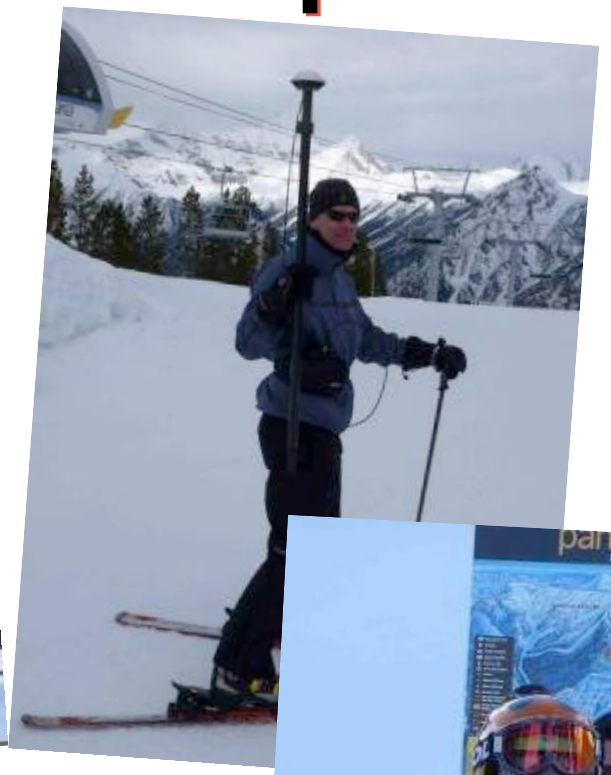
Early Testing (Oct 06)

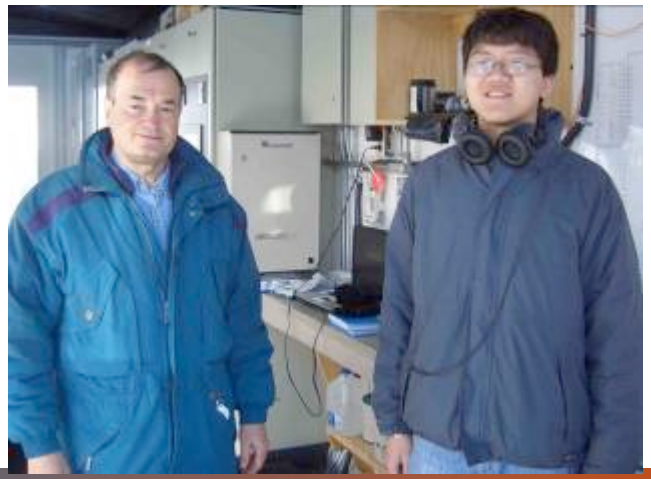
- To test viability of approach
- Use of standard equipment
- GPS performance exceeded accuracy requirement with topographic blockage up to 30˚

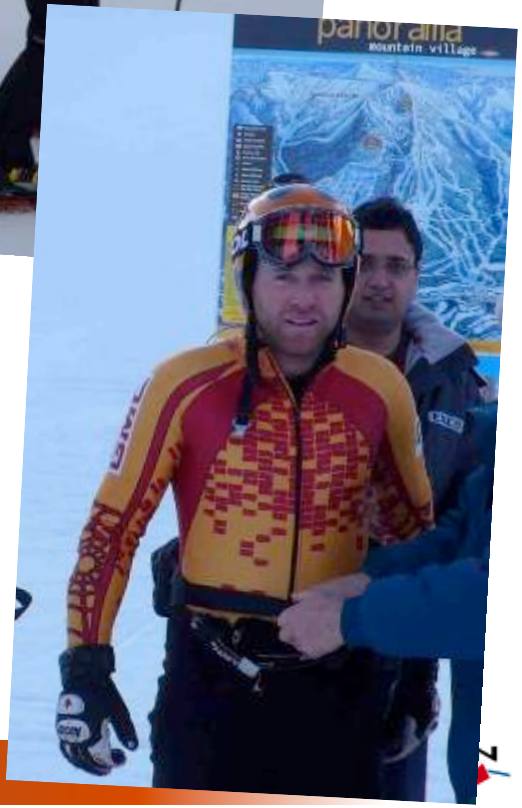
Field Prototype (Feb 07)

- Purpose: To produce an integrated prototype for tests with live skiers and coaches
- Development of hardware
- 370 g, 4-hour autonomy
- Testing on the slope

Testing at Panorama – Apr 07







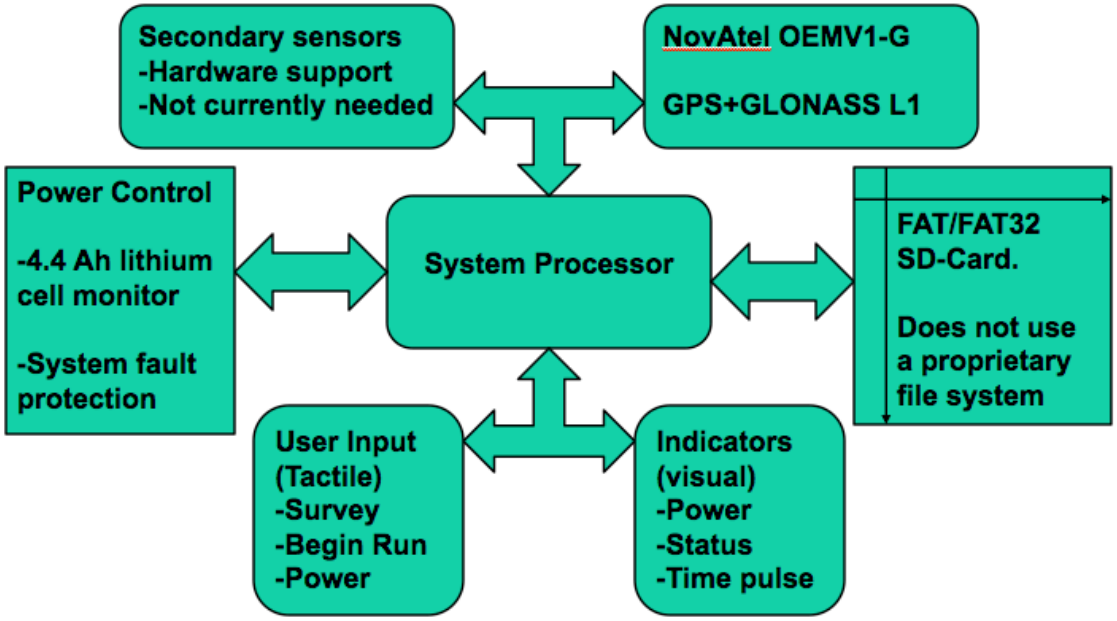
Not All Ideas Work Out Well…

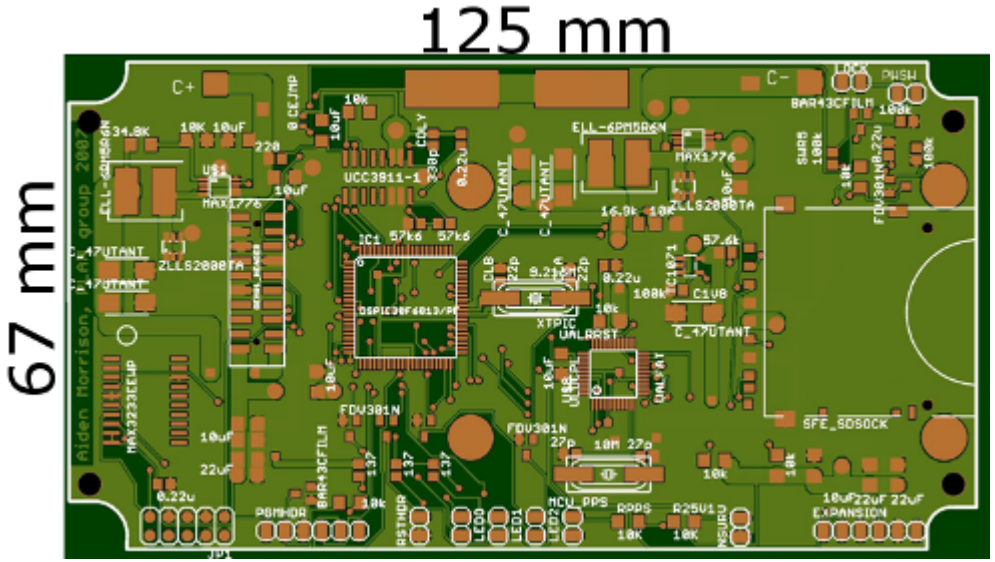
But very successful – Moved on to operational system development

Operational System – Aug07

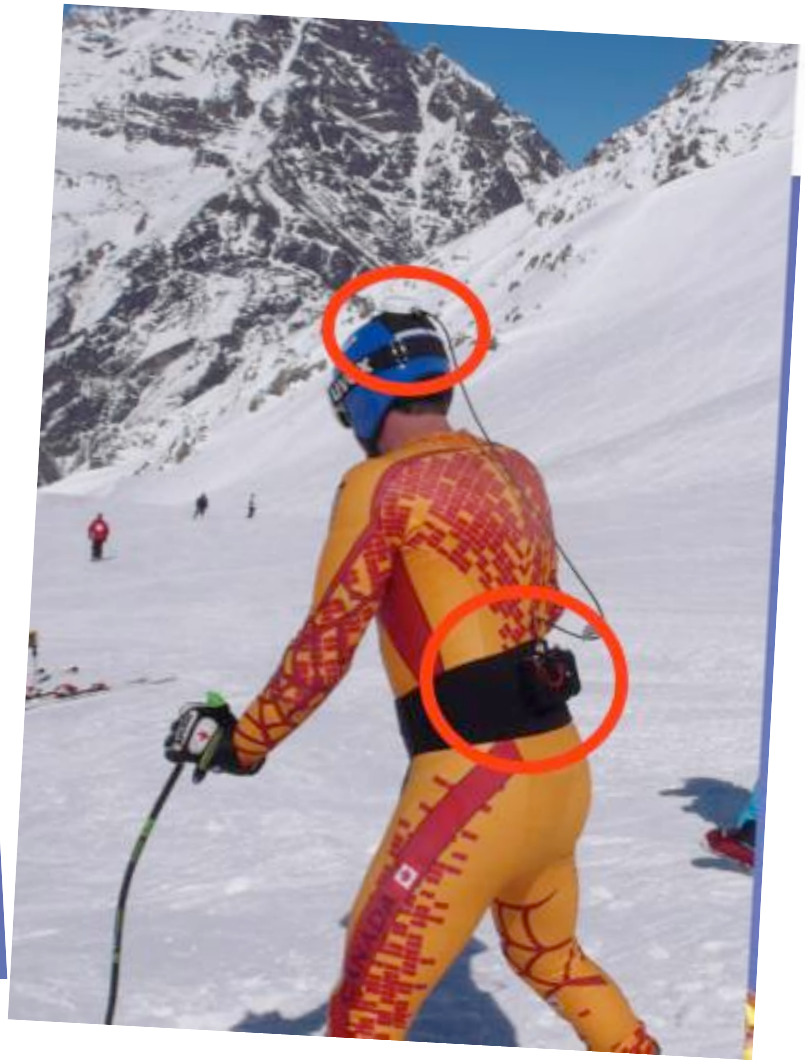
- **Minimized size** and weight
  - 25 kg → 370 g → 280 g
  - 37 x 77 x 131 mm
- **Ruggedized** platform
  - 3.2 mm thick delrin casing
- **Maximized** performance
  - NovAtel's GPS+GLONASS card
  - Up to 8 hour continuous use
- Added features
  - External sensor synch.

STEALTH Embedded Architecture





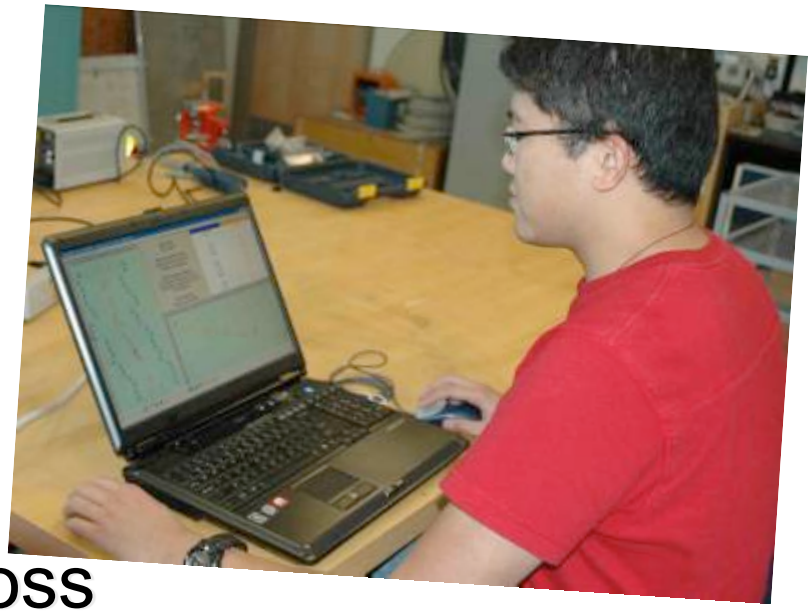
Mounted Field Hardware



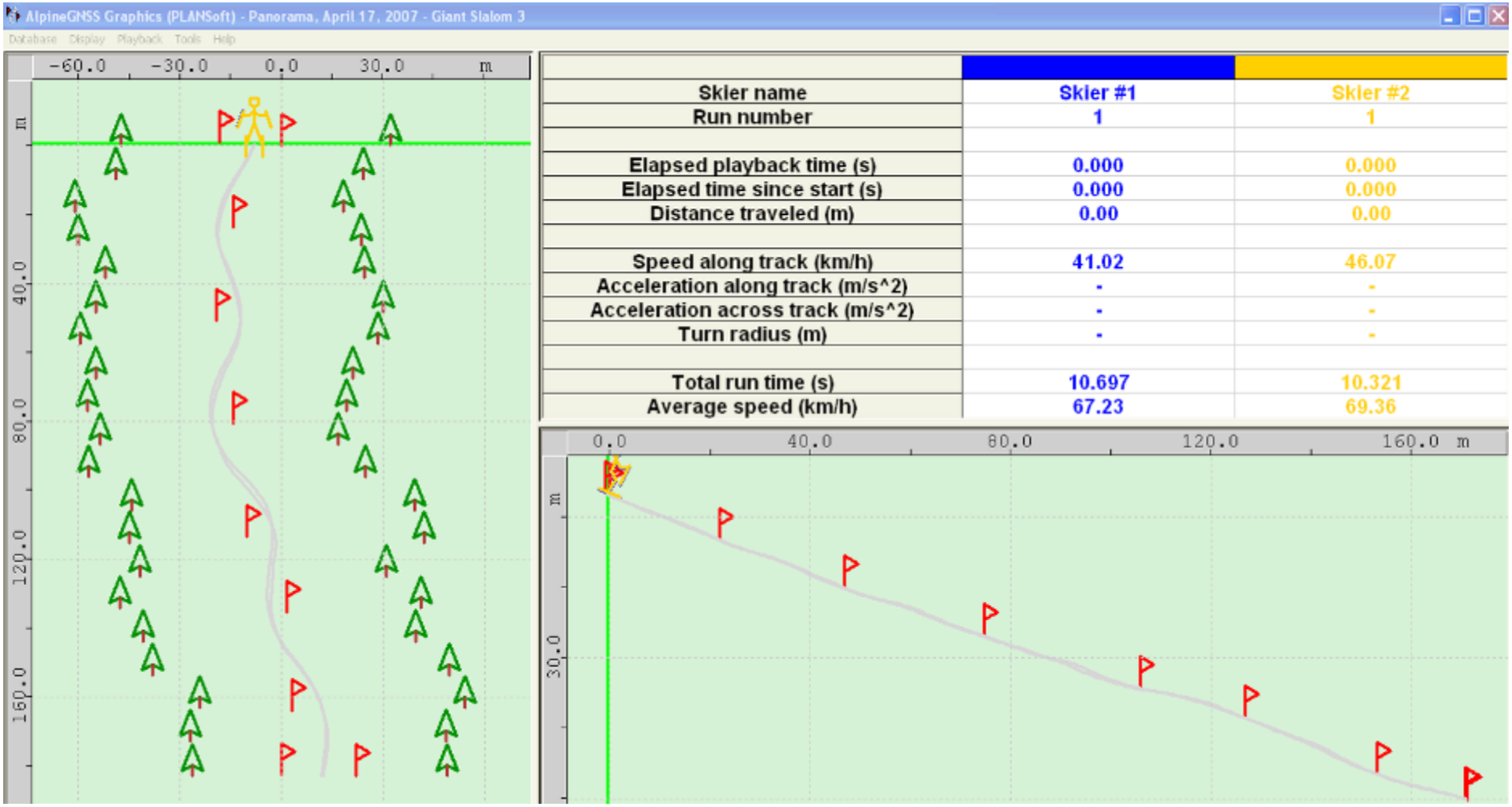
Training with STEALTH™ (Nakiska, 12Nov09)

AlpineGNSS Graphics™ (1/2)

- Interactive display software
- Skier trajectory parallel to hill face & height profile
- Parameters of interest:
  - Elapsed time, speed
  - Acceleration along and across track
  - Turn radius
- Interactive cursor displays speed & other parameters



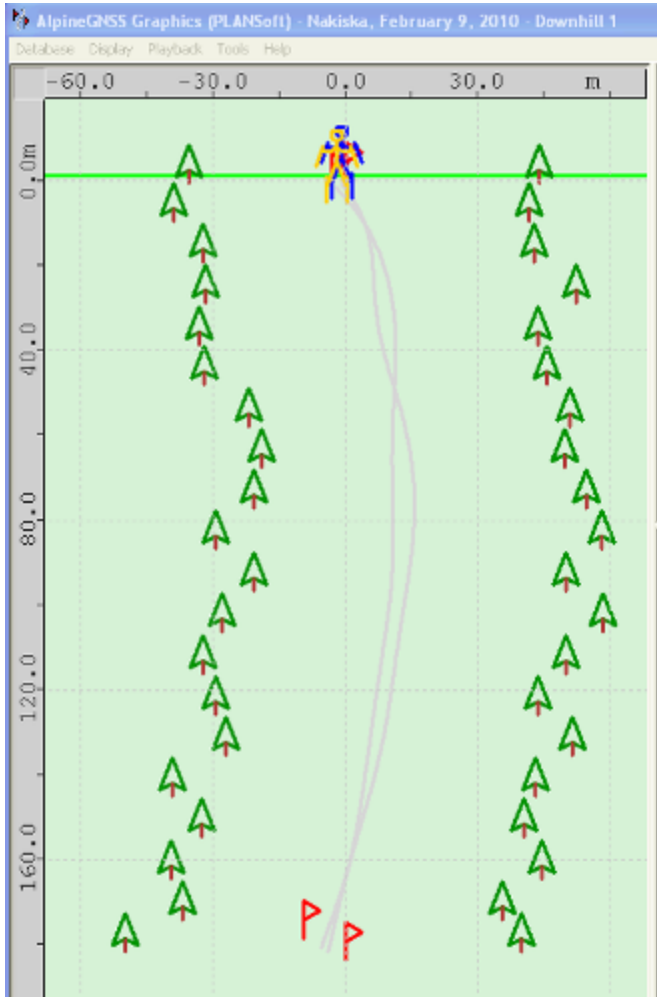
AlpineGNSS Graphics™ (2/2)



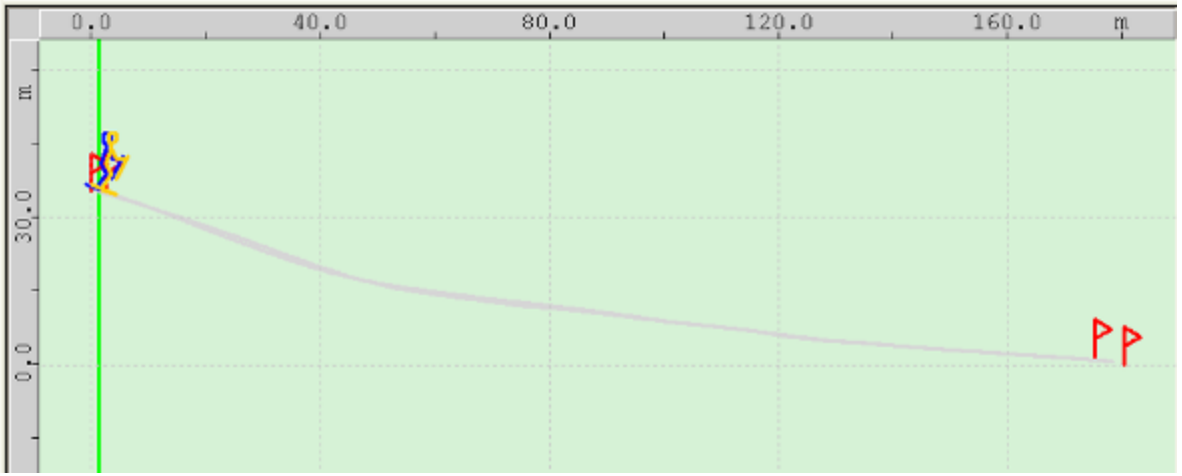
	Skier #1	Skier #2
Skier name	Skier #1	Skier #2
Run number	1	1
Elapsed playback time (s)	0.000	0.000
Elapsed time since start (s)	0.000	0.000
Distance traveled (m)	0.00	0.00
Speed along track (km/h)	41.02	46.07
Acceleration along track (m/s^2)	-	-
Acceleration across track (m/s^2)	-	-
Turn radius (m)	-	-
Total run time (s)	10.697	10.321
Average speed (km/h)	67.23	69.36

Amateur Vs Elite.

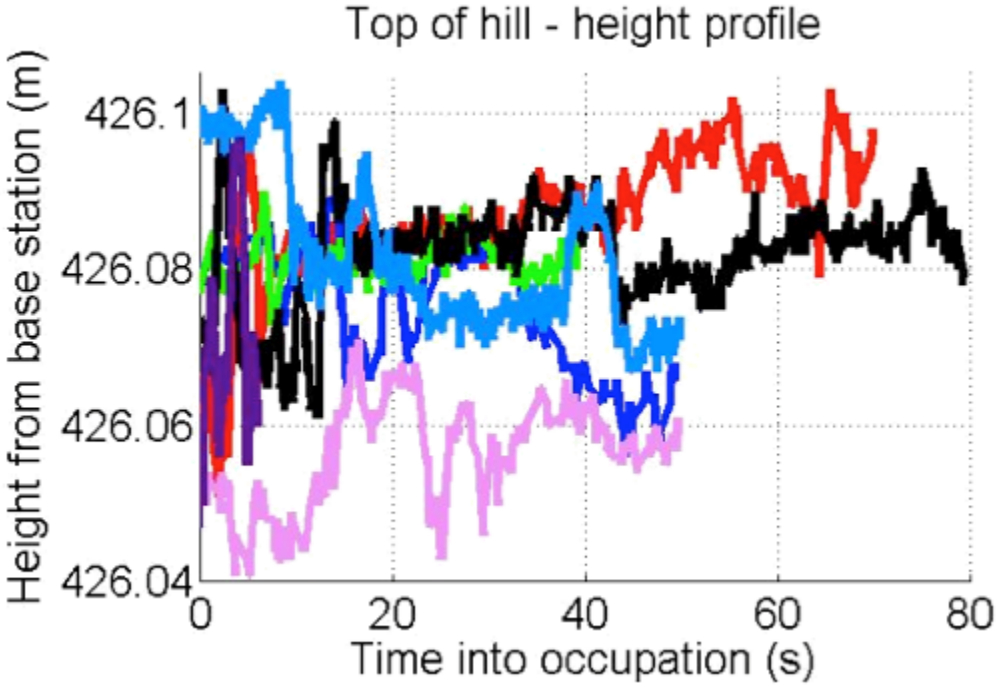
Nakiska – 9Feb10: STEALTH + NovAtel FlexPakV2 L1L2G

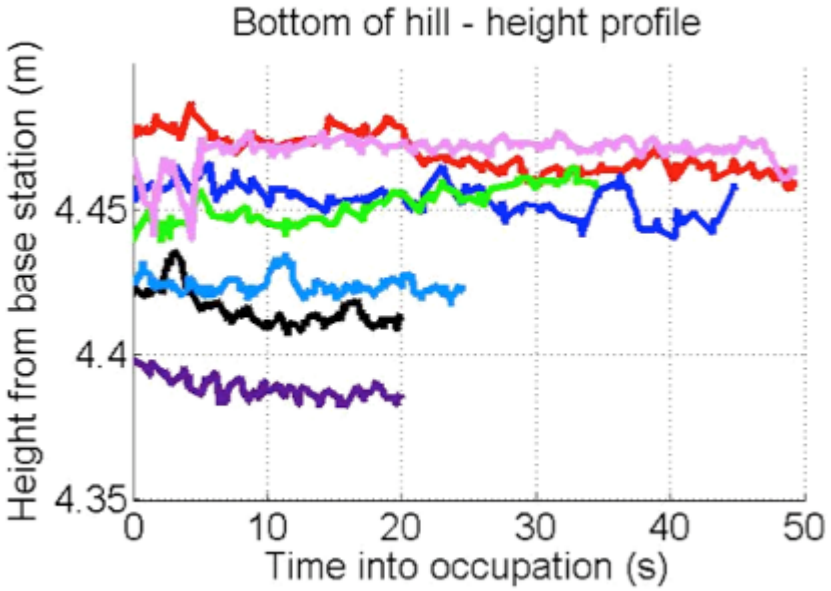


Skier name	Gerard Lachapelle	Gerard Lachapelle
Run number	4	7
Elapsed playback time (s)	0.000	0.000
Elapsed time since start (s)	0.000	0.000
Distance traveled (m)	0.00	0.00
Speed along track (km/h)	33.08	38.40
Acceleration along track (m/s^2)	-	-
Acceleration across track (m/s^2)	-	-
Turn radius (m)	-	-
Total run time (s)	14.406	13.260
Average speed (km/h)	46.64	50.28



Verifying Accuracy through Height Repeatability





Summary

- System used routinely by Canadian Team since 2007 for training purposes
- One of many technologies used by team to enhance performance
- Future: Further enhancements and other applications:
  - Relative trajectory
  - Probability of correct fix with GPS/GLONASS L1 and L1/L2

Sponsors, Collaborators & Donors

- Own The Podium/À Nous le Podium 2010
- Alpine Canada Alpin
- iCORE
- NovAtel Inc