

AVATECH¹

Brint Markle shoved an extra pair of ski goggles into his rucksack as he ran out the door to meet his Uber. As he headed towards Logan Airport, Brint reflected on a whirlwind two years. Brint had just finished up his MBA at the MIT Sloan School of Management where he had been incubating his startup in between classes and assignments. By carefully selecting coursework and engaging with Professors, Brint had shaped the initial stages of the idea for his startup throughout business school. He was however, very excited to be able to dedicate his full, undivided attention to his company Avatech.

He entered Logan Airport and headed straight to the counter, “checking in for Alaska please.”

Let’s Go For It

The seed for the idea of Avatech started in 2010 when Brint and his close friend were backcountry skiing in Switzerland. The pair, both experienced backcountry skiers, were on a ski trip to Mont Fort. On a beautiful, clear sunny morning, the pair debated if they should hit the regular slopes early or check out a new backcountry trail on the other side of the mountain. They were wondering if the weather and snow conditions would be optimal for them to venture in the backcountry. As they looked out at the serene view from the window, the glistening snow seemed to give them the right answer and they decided to just “go for it.”

The fresh snowfall from the night before made for a perfect powder day, as Brint and his friend carved through the snow. It was shaping up to be a great ski morning, and a perfect way to reign in the last few days of their trip before heading back to work, when all of sudden, they heard an unmistakable rumble.

¹ This case was developed by Scott Stern and Jane Wu solely for the purposes of classroom discussion. It is not intended to illustrate either effective or ineffective handling of an administrative situation, nor as a source of data. Some case details have been adapted to facilitate the learning objectives of the case. It should not be quoted, reproduced, distributed, or shared in hard copy, electronic or any other form without express permission from the authors. Feedback is welcome to sstern@mit.edu.

As experienced skiers, they both knew exactly what that sound meant – they needed to get out, and get out fast. Despite their efforts to ski quickly out of the path of the avalanche, his friend was carried out several hundred yards by the sliding snow and was nearly pushed over a set of cliffs. Though luckily he managed to ski out just in time, they were both visibly shaken by the close call.

Over the next few weeks, Brint kept replaying the experience in his mind. He and his friend were trained, advanced backcountry skiers and mountaineers, but they had been totally susceptible to that avalanche. What bothered him the most was that he knew many other skiing and mountaineering friends that had experienced similar situations, some narrowly escaping the avalanche like him, and others that ended up trapped for hours. All the sporting equipment available served reactive purposes, including ropes and compactible shovels for digging to beacons for signaling. It just seemed to Brint that the industry was focused on ensuring survival after running into an avalanche, rather than providing preventative methods. To Brint this seemed like a gaping void, there needed to be a better way for outdoor enthusiasts to understand the snow below their feet.

Starting up as a Student

The idea of solving the dangerous risk of avalanches stuck in the back of Brint's mind, as he headed off to Cambridge, Massachusetts to start his first year of business school. He entered with a loosely defined mission - with the two-year stretch of intellectual freedom that business school afforded him, he wanted to at least try to find a solution to this problem.

Shortly after the first few weeks of orientation ended, Brint set to work searching for the right resources for his planned endeavor. Having seen the benefits of small work teams as a management consultant at Bain & Co., Brint knew this could not be a one-man job, especially because the solution he envisioned was beyond the scope of his own skills. He started attending numerous meet-ups oriented around engineering, entrepreneurship, and idea generation in the MIT, Harvard and the broader Boston-Cambridge ecosystems. At each event, he actively pitched this pain point he had uncovered, trying to not only refine his thinking about the space, but also to find the right co-founders that shared a passion for the problem. Brint was also researching avalanche forecasting, and toying around with using radar to analyze snow for avalanche risk. He also attended a brainstorming session with the engineering team at Draper Laboratory, where interacting with the design and process oriented thinkers made Brint refine his co-founder search to include not only a shared passion but

also ideally, an engineering background. Brint also carefully selected his MBA course electives to complement his entrepreneurial ambitions, enrolling primarily in courses focused on creating new ventures, entrepreneurial strategy and product design.

During his Product Design and Development course, Brint found himself immersed in a classroom composed primarily of computer and mechanical engineering students. The course, taught by Prof. Steve Eppinger, required students to form small teams to work through the phases of understanding a problem, designing a potential solution and working through the development of its initial prototype. Knowing that this could be an opportunity for him to find the right team, he was enthusiastic to pitch his idea of building a snow quality detector of sorts. The goal of improving backcountry safety resonated with skiers Sam Whittemore and Jim Christian. Sam was studying for a Bachelors of Science with a focus on engineering, while Jim was completing his masters of science with a design background. They both shared Brint's love for the outdoors and wanted to build something that could be immediately applied to solving a real problem. With their class project stipend of \$1000 USD, the three new team members set to work researching sensors and thinking about how to develop a device for better assessment of snowpack conditions and avalanche risk. As they worked through the semester, they realized that their strong team dynamic and quick progress on their idea made extending the project beyond the classroom a very real option. Over a beer at the Charles Muddy pub, the three discussed forming a start-up to bring technological innovation to avalanche safety, aptly named Avatech.

Snowfall Options

Avalanches

Avalanches refer to when a large volume of snow slides down a slope at a fast pace. They are typically triggered when the snow load on a slope is so great that it can no longer stay on the mountain side, meaning the highest risk times are when the snow load has shifted such as right after fresh snowfall or gusting winds. Avalanches are generally grouped into three categories:^{2,3} 1) Sluffs, which are the lowest risk, and a result of small surface slides of powdered snow, 2) Wet

² <http://www.fsavalanche.org/Default.aspx?ContentId=4>

³ <http://www.meted.ucar.edu/afwa/avalanche/navmenu.php?tab=1&page=2.3.0>

avalanches, which are a result of snow melt, and 3) Slab avalanches, which are the most dangerous type, and a result of dislodged ice slopes.

Often the basic formation of an avalanche is a result of heavy snow settling down on weak layers of snow, which loosens the entire top layer enough to slide downhill. In recent years however, human related factors including construction, deforestation, soil erosion, sporting overuse or vibrations from All Terrain Vehicles and snowmobiles have been increasingly responsible for disturbances to the snowpack.⁴ In fact, since the mid-1990s the number of avalanche accidents and fatalities have seen a significant spike due to the growth in backcountry sports and shifting climate conditions, moving from an average of under 10 deaths per year to as many as 35 deaths in a single winter.⁵

Backcountry Skiing and Equipment

Backcountry skiing has seen a huge crossover from being a sport performed by a minor population to becoming a trend amongst advanced recreational skiers. More brands have been developing gear for the sport including safety, resulting in a growth in the industry to sales of over \$13 million USD per year.⁶ Most products currently available for recreational consumers serve reactive purposes after an individual has already been trapped in an avalanche. They can be broadly categorized⁷ into: 1) devices aimed to reduce the degree of burial such as floatation vests like the Avagear life vest and the ABS Avalanche Balloon System; 2) devices that reduce the burial time such as beacons, transceivers, shovels and ropes; 3) and devices that aim to prolong survival time after being buried such as the AvaLung which creates an air pocket. Current industry research however, indicates that despite the availability of these types of reactive devices, 52% of avalanche victims that are buried fall victim to the cold.⁸

A primary method⁹ for proactive avalanche detection involves digging a deep hole of roughly six feet into the snow pack to feel the density of the snow manually and search for any layers of weaker snow. The entire process takes about 20-30 minutes to collect a single data point from the snow, however given the rapidly changing conditions on a mountain, this method requires repeatedly

⁴ <http://www.conserve-energy-future.com/types-causes-effects-of-avalanches.php>

⁵ <http://avalanche.state.co.us/accidents/us/>

⁶ <http://www.snowsports.org/Retailers/Research/SnowSportsFactSheet>

⁷ http://thewary.com/files/brugger_falk_report_2002.pdf

⁸ http://thewary.com/files/brugger_falk_report_2002.pdf

⁹ <http://www.fsavalanche.org/Default.aspx?ContentId=60&LinkId=65&ParentLinkId=74>

digging holes to evaluate the landscape of the snow across time and space. As this process of collecting multiple data points can be cumbersome, skiers and mountaineers often make assumptions or quick decisions, especially when daylight is running out. In addition, if skiers do not repeatedly dig holes, this method can be ineffective the spatial variability of snow pack conditions can be dramatic even on a single slope. Some quick “hacks” developed in the ski community include using ski poles to feel the layers of the snow; using an inexpensive slope meter to measure a mountain’s slope angle and avoiding high slope areas; picking slopes with lots of trees; or kicking the cornices of a wind slab - a pile of snow formed by wind - to test the surface stability.¹⁰ These methods, though more efficient are not particularly accurate methods of detecting the conditions of the snow.

More precise tools designed for research purposes have been developed such as the SnowMicroPen and the ramsonde. A ramsonde or ram penetrometer, retailed by specialty scientific equipment retailers, is a cone-tipped metal rod that is designed for measuring the hardness of snow. Researchers drive the rod downwards in multiple locations on a snowpack to collect readings on the overall hardness. While it is easier to collect a ramsonde reading than digging a hole in the snow, the product price point is over \$1,000 USD¹¹ and is not available for retail purchases. The SnowMicroPen¹² is a Swiss constant-speed probe that drives through the snow and provides an extremely precise and detailed profile of the snow hardness, snow grain types and structure information. They are primarily used for university-grade research as they carry a high cost of over \$50,000 USD and have very limited production runs. Overall, it is uncommon for skiers and mountaineers to use the ramsonde or SnowMicroPen due to cost, difficulty of access and their optimization for research.

MIT Global Founders’ Skills Accelerator (MIT GFSA)

Launched out of a partnership between all of MIT’s schools and colleges, the MIT Global Founders’ Skills Accelerator (MIT GFSA) ¹³ is an international entrepreneurship program that provides student entrepreneurs with the skills

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<http://www.avalanche.org/moonstone/TAR/avi%20review%20articles/Simple%20Snow%20Stability%20Tests.htm>

¹¹ <http://www.snowmetrics.com/store/standard-ramsonde-set-p-202.html>

¹² <http://www.fsavalanche.org/Default.aspx?ContentId=32&LinkId=44&ParentLinkId=37>

¹³ For more information about the Martin Trust Center and its accelerator programs (now renamed Delta V) please visit: <http://entrepreneurship.mit.edu/accelerator/program/>

and resources needed to launch successful startups. The program, developed by Martin Trust Managing Director Bill Aulet, typically brings students in from June until September, with all the startups housed at the Martin Trust Center for MIT Entrepreneurship in Cambridge, Massachusetts. Participating student teams are granted up to \$20,000 equity-free for meeting customized milestones, as well as individual stipends and workspace. In addition, an advisory board (a simulated board of directors made of industry experts, experienced entrepreneurs and academics) for each team meets monthly to help teams set the best milestones for validating their business given their limited resources.

After a professor recommended they apply to the GFSA, Brint, Sam and Jim put together an application outlining their interdisciplinary skills, their conviction about the importance of their startup, and their working prototype they developed in class. The trio was accepted to participate in the first official class along with seven other Boston-based startup teams and six international startup teams from Canada, China, Germany, Russia, Scotland and Turkey.

Brint and his co-founders decided to make careful use of the resources available to them. They agreed that the injection of financial capital would be largely allocated towards building an actual minimally viable product. Their \$1,000 project they developed for their class was a good start, but it was far from a cohesive, functional working product. In addition the access to they realized GFSA afforded them access to expert judgment and the ability to tap into a large network of MIT alumni and supporters. Brint, Sam and Jim knew they were sorely missing expert advice in some key areas and made it a priority to leverage the GFSA network to build up a strong advisory committee. With the advisory board and MVP as key priorities, they got to work full-time on their fledgling startup.

Brint set to work searching for the best experts to bring together, as he knew the Avatech team was missing expertise in hardware manufacturing, building startups and avalanche safety. He also sought to gain the support of well-respected backcountry professionals such as professional skier Hilaree O'Neill, world champion skier Chris Davenport and professional telemark skier Max Mancini. Concurrent to his efforts of building out a diverse advisory board, Brint was also thinking about the missing gaps on his operational team. As he discussed his need for software development talent to the GFSA community, someone excitedly told Brint he had a close friend who would be the perfect fit.

Meanwhile Sam and Jim were making strong progress on the product development side, investing a large portion of their GFSA funding into building out five working prototypes. The Avatech product was starting to take form, consisting of a proprietary snowpack sensor connected to a durable data display screen. They had been testing the product, named AvatechSP, using low-cost substitutions for snow such as oatmeal and shaved ice. They were however, starting to realize that while these common household items were budget-friendly, they needed to work with real, untampered snow on the slopes to understand the performance of their technology in this incredibly complex medium. As they discussed the ambiguity of their lab results for AvatechSP, the trio made plans to head into the mountains.

This is for work!

As it was summer in the northern hemisphere, Brint, Jim and Sam turned their attentions down south to find a suitable testing site. Brint had spent a few years living in Santiago right after undergraduate so the team had ample local connections to help make the logistics of their trip smoother so they could focus on testing their product as opposed to navigating through a foreign city. As such the trio booked last-minute flights to Santiago and started packing their bags for the Andes.

Over a period of ten days, the trio visited multiple ski resorts, trekking up their slopes to put their five AvatechSP prototypes to the test. Seeing the data points register on their displays, Sam and Jim were ecstatic to see that their prototypes were functional and being built in the right direction. Their AvatechSP prototypes collapsed well enough to be easily tucked into skiing daypacks and more importantly, the probes were quick to make readings on the snow hardness. They still had some work to do with improving the accuracy of the readings, but seeing their prototypes working in real snow was a big milestone for the team. In addition, it was the first time the company felt like it was solving a very, very real problem as the backcountry guides that accompanied them were already eager to buy AvatechSP for themselves.

The conversations with the backcountry guides also helped Brint, Jim and Sam identify an opportunity to expand AvatechSP's utility. As the guides described how they communicated with one another using low-tech walkie-talkies when guiding tours through the backcountry, the Avatech co-founders realized they could build a communication platform on top of AvatechSP. By allowing people using AvatechSP at various locations on a mountain, they could provide a more

comprehensive understanding of the conditions of the snow pile. While the idea was still rough, they could also imagine using the data collected by all of Avatech's future users to predict the likelihood of avalanches, among potential other applications.

The trip made them also realize just how important it was for them to get Sam and Jim spending time on real mountains to test and refine their product. It gave them the chance to truly iterate their designs and specs, in a way that working with imitation substances in a lab could never provide. They had made significant progress but it also came with a high price tag, even if they were to stay in the United States. The only way they could continue their product design process effectively was to raise capital but as first time founders, what was the best way to do so?

Finding Financing

The co-founders debated the use of popular crowdfunding platforms such as Kickstarter to raise money for on-site testing and a first production run. On one hand, Brint felt like raising equity-free money from customers through pre-orders could be more allow them to hold greater control of their company. In addition, being able to prove out customer demand could de-risk the company and lower the cost of venture financing. On the other hand, intellectual property was very much on Sam and Jim's mind as they knew that with like most technological innovations, there was a good probability that once AvatechSP hit the market, competitors would be interested in taking it apart and reverse engineering it. As such they encouraged Brint to delay crowdfunding as an option until they had filed for intellectual property, even if it was only to dissuade or slow down their potential competitors a little. They felt that they could at the very least file for protection of key elements of the AvatechSP design such as their algorithms for analyzing snow pile data, the design of the individual sensors on their probe, and their method of integrating hardware to collect data. Also, Sam and Jim worried about the additional pressure of delivering to customers by a promised date could compromise the quality control of their initial batch. Ultimately the three co-founders decided to raise a small seed round to start building a few products for experts and professionals to use and revisit crowdfunding in the future.

They decided to target angel investors much like they did with their advisors, seeking diversity in experience and network. The GFSA provided a good starting network for the three co-founders as they started combing through the list of

mentors and affiliates to find the right fit. They made it a goal to secure a small angel round - just enough to get them through further testing and initial prototypes - before fall.

Wrapping up the summer

Back in Cambridge, the three co-founders started working on their investor pitch. They knew they needed enough capital to refine their prototypes and create a small batch of working prototypes for testing. Reflecting on how key outdoor gear brands such as Patagonia and the North Face had gained traction, the Avatech co-founders decided that they needed to gain the buy-in of the experts if they wanted this product to be successful for the broader backcountry skiing and mountaineering market. Brint suggested raising enough money to get AvatechSP in the hands of top professionals including avalanche educators, avalanche forecasters, guides, and ski patrol first. Sam and Jim worked through the estimates of their testing and material costs, arriving at roughly \$500K to cover this milestone.

While working on the slide deck for their pitch, they realized that while they had a pretty detailed vision for the production plan of AvatechSP, the story of Avatech's future they needed to sell investors on, was much more unclear. The problem was the multitude of choices the co-founders faced: they could for example focus mostly on research and development, filing for patent protection and then licensing the technology to existing ski equipment manufacturers; they could focus on building AvatechSP to be a data collection and sharing platform with the aggregate data used to predict avalanches, water content, or even future water flows for agriculture and dams; they could focus on getting the product to market quickly ; or perhaps they could collaborate with outdoor retailers like REI and Patagonia, providing them with digital ski technology to complement their outdoor gear portfolio. While the co-founders could imagine eventually building a company that encompassed more than one of these options, for example retailing AvatechSP in REI while also building a digital ski data platform, they knew that they were resource-constrained. In the short term they needed to focus on one path to successfully execute on first and allocate their resources accordingly.

As the co-founders started shopping their pitch deck to some angel investors through the GFSA network, they started to realize that different people were interested in buying into different potential outcomes for the business. One angel for example, had expertise in oil and mining, and believed that the basic

functionality of AvatechSP could be applied to evaluating the conditions of potential excavation sites. Another angel had strong relations with the military, and believed that it could be an asset for their snow-based operations. Others with backgrounds in consumer technology believed that there was the potential to build the de facto social platform for outdoor athletes leveraging network effects on the mountains. Most however, shared Brint, Jim and Sam's passion for outdoor sports and saw potential in the three of them working together to improve the safety of venturing into nature. Thus, the Avatech founders were able to secure their initial seed round from local angel investors on the promise they showed with their individual track records and early prototypes.

Multiple Business Possibilities

Key Milestones

With their seed funding secured, the founders transitioned out of MIT into their own office. By July 2014 they had grown their team to just under ten people, hiring a lead electrical engineer, a lead mobile full-stack developer, and also Thomas Laakso, a former brand-marketing executive at leading ski gear manufacturer Black Diamond. They had built a strong advisory team composed of fifteen industry experts including professional guides, glaciology and snow researchers, champion skiers and avalanche safety experts.

The team had hit some key milestones over the past seven months including filing for three patents and sending working prototypes to experts in Canada, Norway, Iceland, Greenland and Switzerland for testing. They had also wrapped up shooting on their launch video set to debut at the end of September in Banff, Canada. Brint had secured participation from several notable skiers and mountaineers, and was hopeful this video would drive awareness of Avatech among their early adopter community.

Brint, Sam and Jim were proud of the progress they had accomplished over the past year and a half. They had grown Avatech from an idea to a beta product, moving from classroom to their own startup office, yet as they thought about the future, they still had key decisions they needed to make in terms of their future. With the basis of the product and company formed, they could see four potential alternatives for their business:

1. Avatech could build an industry reputation and intellectual property portfolio for being innovators in snow and/or backcountry safety. Vibram

followed this type of strategy initially, licensing their intellectual property and trademark to manufacturers of rubber outsoles for outdoor footwear. The next steps under this strategy would be for the founders to focus on securing their existing filings and filing for additional patent protection. Strategic additional hires would be engineers and researchers with expertise in snow that could work together to develop new breakthrough applications. Under this type of strategy, Avatech would build a portfolio of intellectual property, collect data to demonstrate the efficacy of their technological solution, and licensing both the hardware design and software algorithms to clients such as sporting equipment manufacturers.

2. Avatech could focus on building partnerships to integrate their product into existing sporting equipment producers. The avalanche airbag company ABS for example, partnered with athletic companies including Dakine, The North Face and Vaude¹⁴ to integrate avalanche bags, produced by ABS, into new models of their ski backpacks. They could refocus Thomas Laakso's responsibilities or hire an additional experienced business development person in the ski business to identify a potential extreme sports equipment partner. Under this strategy Avatech would be able to leverage the existing supplier and distribution channels of their partners, while their partners would be able to amplify their existing product offerings.
3. Avatech could focus on building a sporting equipment brand that produces technology-based gear. Unlike traditional providers of sporting gear that focus solely on performance, Avatech could develop a line of innovative gear with an additional layer of data-driven safety. Lululemon for example, developed women's yoga wear using novel fabrics that were activity-specific rather than the existing offerings of generic active wear. Strategic additional hires would be experienced with managing supply chain and retail distribution. In the short term, Avatech could focus on running a small batch of AvatechSP and selling it to influential early adopters, eventually developing additional technology-based outdoor products.
4. Avatech could focus on building a digital ski safety platform integrating the datastream from AvatechSP users, avalanche center history and forecasts, and data from personal locator beacons, radios or satellite

¹⁴ <https://www.abs-airbag.com/us/system-partners.html>

phones of skiers on the mountains. Avatech could become a leading source for data on snowpack conditions, creating network effects on the mountains. In the long term, this diversity and depth of data collected by Avatech could make them the most comprehensive forecaster of avalanches. Strategic additional hires would be software developers to build the platform and integrate the different data streams, and potentially a data scientist to help analyze the data and build predictive models.

While Brint, Sam and Jim knew these alternatives were not mutually exclusive over the long term, right now they were a lean team with limited runway meaning they needed to choose the next experiments to invest in carefully. Building relationships with sporting equipment retailers such as REI or Patagonia would be very different from hiring additional software engineers to build a data-driven, consumer-focused platform. With multiple possible directions, which strategy should Avatech follow? How should the co-founders allocate their remaining resources?

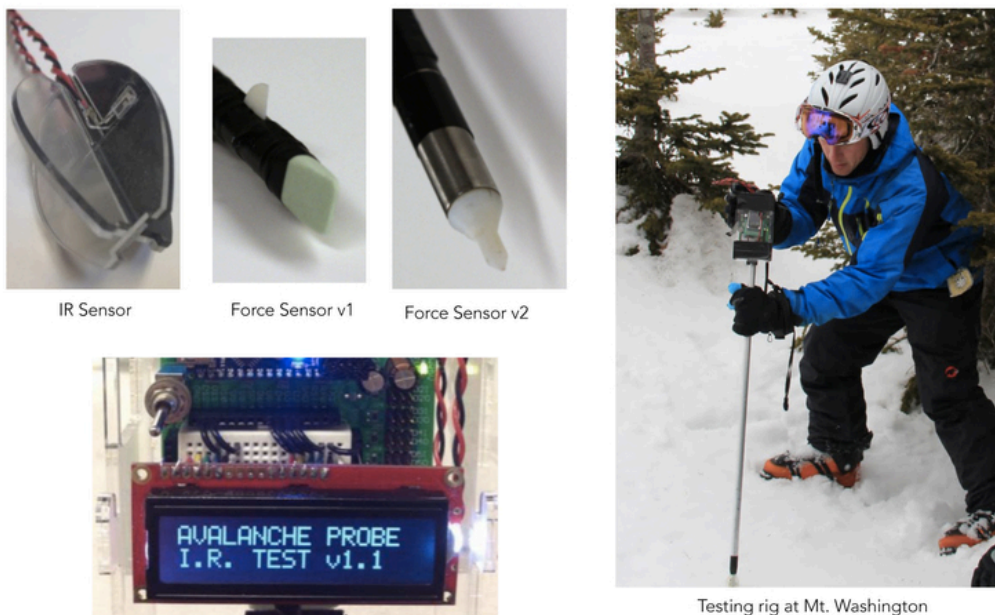
Appendix

Figure 1a. Current version of AvatechSP, a collapsible digital snow profiler.



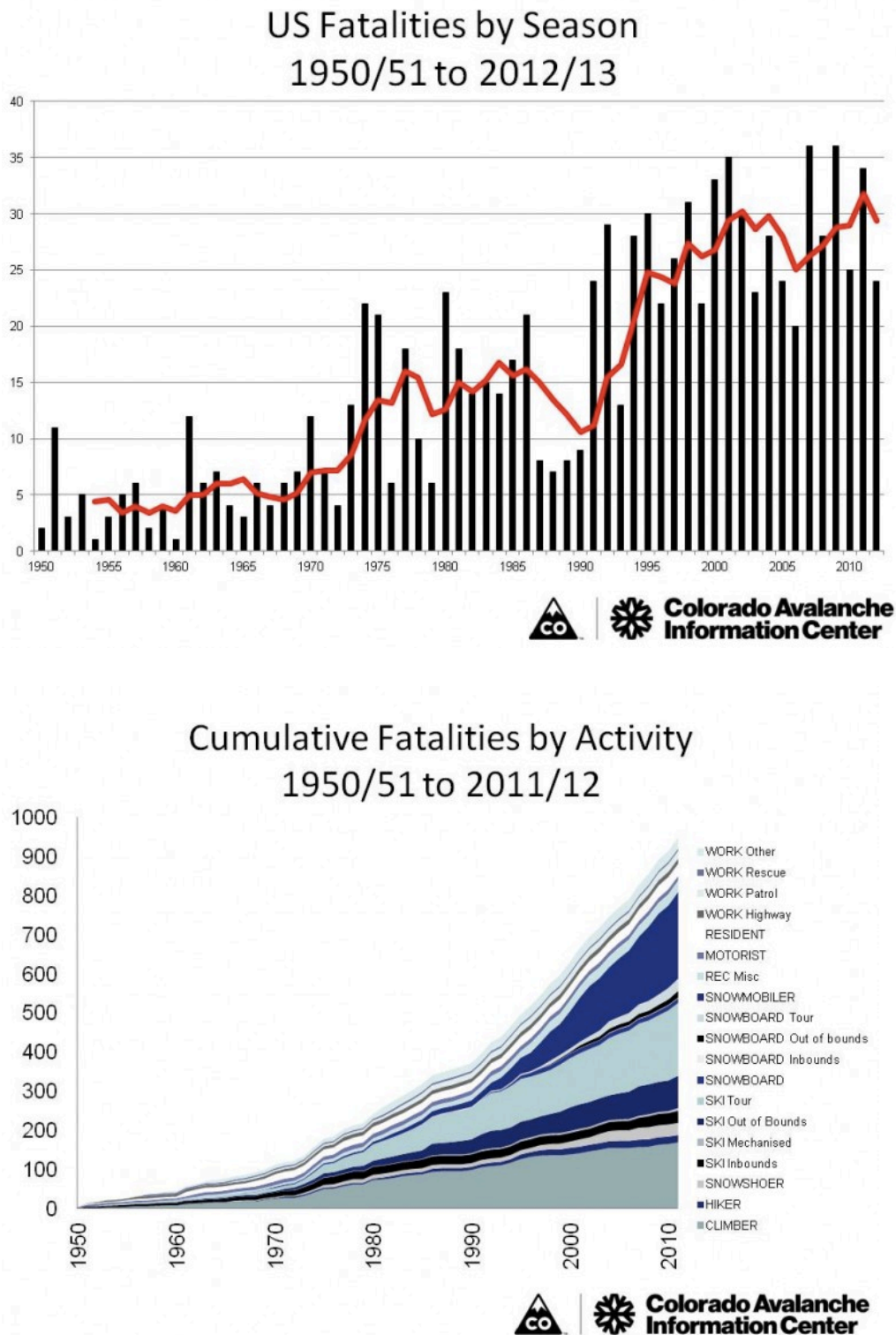
Source: *Avatech*

Figure 1b. Key sensors of the AvatechSP (L). On-site testing on the mountain (R).



Source: *Tais Mauk*. <http://www.taismauk.com/preventing-avalanche-fatalities/>

Figure 3. Overview of fatalities in the US & cumulative fatalities by activity.



Source: Colorado Avalanche Information Center.

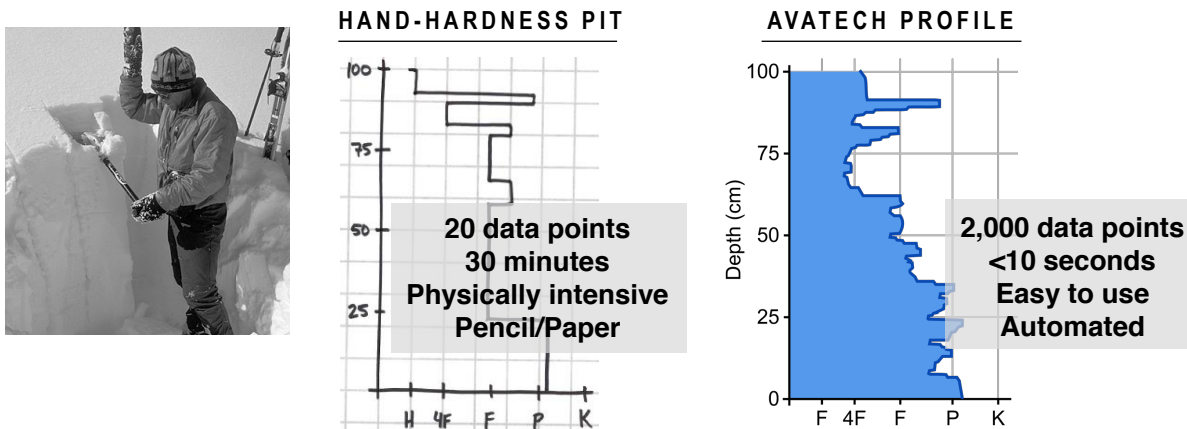
Figure 2. Process of using the AvatechSP.

Stab into snow, and it gives readouts of how stable the snow is



Source: *Company*

Figure 3. Existing method for avalanche detection (L) vs. AvatechSP (R).



Source: *Company*