8888 University Drive, Burnaby BC Canada
jac-ensc440@sfu.ca

January 20, 2011

Dr. Andrew Rawicz
School Of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 440 Capstone Project Proposal: Auto Secure Binding - An Automated Snowboard Binding System, by JAC Innovations Ltd.

Dear Dr. Rawicz,

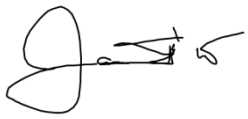
Please find the attached proposal for our product Auto Secure Binding (ASB). We are proud to introduce an innovative evolution in the snowboarding industry. Our product allows users hands-free operation of their bindings. Our objective is to enhance the user's snowboarding experience by providing convenience and style.

The proposal will provide a basic overview, estimated budget, preliminary scheduling, and team organization for the project. All the information and sections will justify that our product is feasible and marketable.

The company consists of five motivated and knowledgeable fifth-year engineering students: Clara Luo, Andrew Ng, Jackie Ng, Jeffrey Sun, and Jacky Wong. These five individuals bring their experience in software engineering, hardware fabrication, and telecommunications to the team.

If you have any inquiries or comments regarding our project, please feel free to contact our team via e-mail at jac-ensc440@sfu.ca. Alternatively, you may contact me directly by e-mail at chiw@sfu.ca or by telephone at 604-751-5556.

Sincerely,



Jacky Wong
Chief Executive Officer
JAC Innovation

Enclosed: *Proposal for Auto Secure Bindings - An Automated Snowboard Binding System*

JAC INNOVATIONS

Project Proposal

for an automated snowboard binding securing system

Project Team: Clara Luo
Andrew Ng
Jackie Ng
Jeffrey Sun
Jacky Wong

Team Contact: jac-ensc440@sfu.ca

Document Created: January 21st, 2010
Document Revised: January 25th, 2010

Submitted to: Dr. Andrew Rawicz
Michael Sjoerdsma
School of Engineering Science
Simon Fraser University

Executive Summary

Snowboarding is a seasonal sport in which many snowboarders around the world have a limited time to experience the snow. The slow binding process at the beginning and end of every run diminishes the quantity of snowboarding time. Intending to eliminate the issue, we are proud to introduce to you the new and revolutionary Auto-Secure Bindings (ASB).

Using Auto Secure Bindings, users will be able to have their boots secured the moment they step onto the base-pad of the bindings. If the user finds the fit inadequate the user is able to adjust the bindings with the press of a button. The button is located on a wireless wrist-watch controller. This will save the user valuable snowboarding time.

The cost of the prototype is estimated to be around $680. We recognise that the prototype costs are significantly higher than the costs of other bindings. However, medium to large scale product costs will be lower. Through our market research we have determined that the target market is financially well endowed. Thus, this will be marketed as a premium product which the target market can afford.

JAC Innovations is consisted of five inventive engineering students in the systems and electronics field who enjoy snowboarding. With their knowledge in the engineering field and their experience in snowboarding they can create an innovative product which complements the two. Also, some of the members have business experience. With their combined knowledge it is possible to find areas to reduce costs thus improving profit.

Our development schedule involves research, design, implementation, and testing. The majority of our time will be spent on design and implementation. However, we recognise that testing is of the utmost importance. Snowboarding involves a high speed environment where safety is a concern. Our purpose is to ensure the safety of our users and enhance their experience.

AUTO · SECURE · BINDINGS

Contents

Table of Figures

AUTO · SECURE · BINDINGS

Introduction

Snowboarding is a global winter sport and it is the exhilaration of conquering the snowy terrain with a delicate combination of balance, skill, and technique. In Canada and the United States there are approximately 7.7 million snowboarders [2, 3]. These amateur, enthusiast, and professional snowboarders seek the thrill of speeding down snow-covered slopes and the pursuit of the perfect powder runs. This means that snowboarders would wish to maximize their time riding down the mountain rather than bending over or sitting down fumbling with their snowboard bindings.

At present, there are several variations in design of snowboard bindings. However, with each variation lies compromises and trade-offs in performance, comfort, convenience, and style. JAC Innovations wants to combine to the best attributes of each design and automate the binding process to create the ultimate snowboard bindings. The Auto-Secure Bindings (ASB) will be the pinnacle of snowboard binding technology. The ASB is a system with two components. The first component is the pair of bindings which will be activated by both the user's foot and the wireless wrist watch controller, the second component.

Snowboarding is an expensive sport, to get started one would require a snowboard, bindings, snowboarding boots, proper apparel, and the admission fees for the mountain. But according to the Canadian Ski Council, 78% of snowboarders have a household income greater than $50,000 and out of that group, 69% have a household income greater than $75,000 [2]. This trend is also seen in the United States as 28.5% of snowboarders have a household income greater than $100,000 [2]. This suggests that the target market would be more inclined to spend their disposable income and with the ASB, we can effectively enter this potentially lucrative market.

In addition, the Canadian Ski Council states that 59% of snowboarders fall between 18 to 34 years of age [4]. Aesthetic appeal and the cool factor are of much importance to this age range. The concept of a pair of wireless automatic snowboard bindings with a stylish controller that looks good and performs well will surely satisfy the craving for the newest and most innovative products.

Not only does the ASB ameliorate the convenience and style of standard snowboard bindings, the ASB will also preserve the performance and comfort of them. The ASB will be designed to be user friendly with a low learning curve so that the transition from switching to the ASB will be smooth and effortless. So just hop on, let the ASB do the work, and enjoy the ride.

JAC INNOVATIONS

System Overview

The ASB is a revolutionary automated snowboarding binding system. The ASB consists of two units, an automated tightening and loosening mechanism integrated on snowboard bindings and a wireless wrist watch that controls the operation of the system. The conceptual overview in Figure 1 below illustrates the functionality of the device.

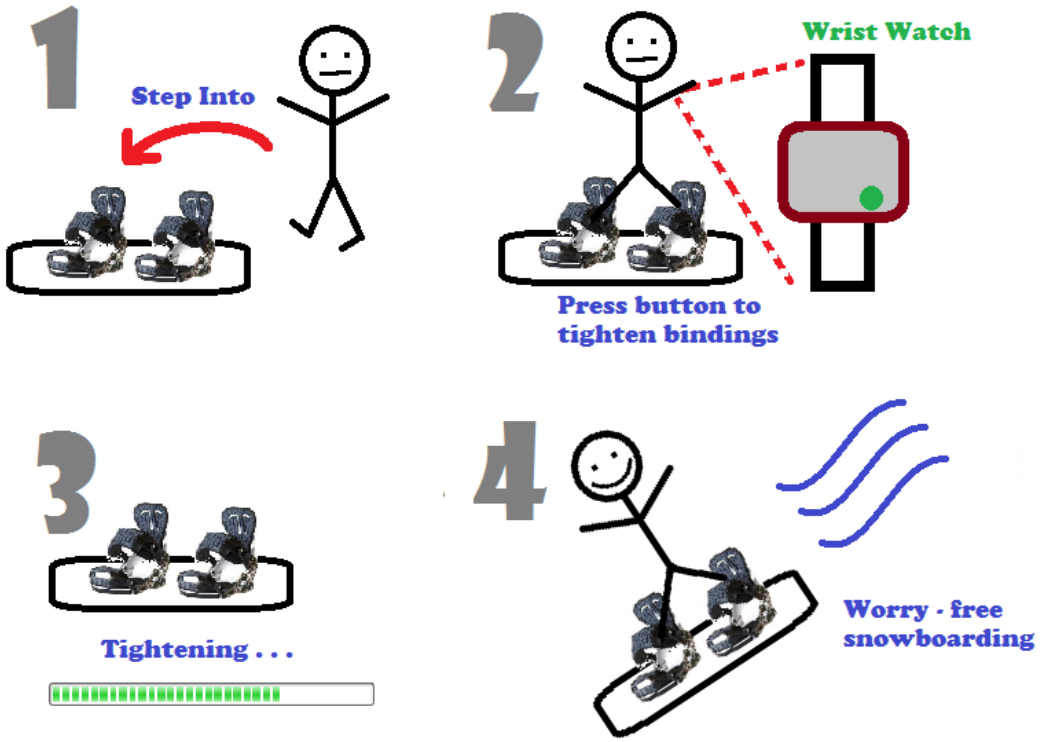


Figure 1 – Auto-Secure Bindings Application

The controller unit of the system acts as the base station to manipulate the bindings. Its primary function is to secure the boots of the user to the snowboard. The bindings are initially in the open position so that the user can easily step into the apparatus. A sensor is strategically placed on the each of the base plates of the bindings. Once the boot comes into contact with the sensor, it activates the securing process then enters stand-by mode upon completion. The device does not consume any battery power when the sensor is not in contact with the rider's boot, as the sensor will physically open the circuit.

To secure the boot, a sturdy metal frame closes and multiple straps running across the frame applies pressure to the boot while providing comfort. Motors mounted onto the joints of the binding will actuate the foot cover. By automating the binding system it is more convenient for the user with respect to binding set-up time.

The wrist watch unit has all the functionalities of an everyday watch. But more importantly, it is the controller for the bindings system. The user tightens or loosens the binding(s) by pressing the

corresponding button on the watch. The controller uses a radio frequency transceiver to communicate with the bindings. Having the control unit integrated on a small and light-weight wrist watch makes the device portable, non-intrusive, and user-friendly. The following flowchart illustrates the simplified control logic of the ASB opening and closing procedures.

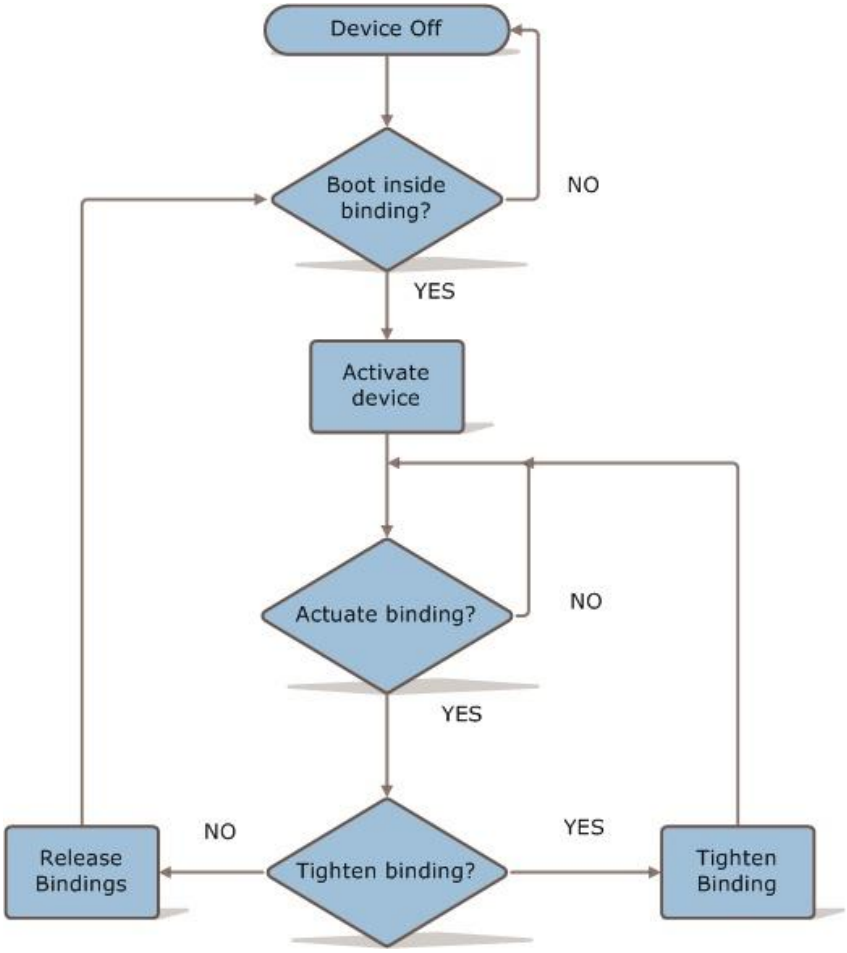


Figure 2 – ASB Mechanism Logic Flowchart

Existing Solutions

Competition

Currently, the majority of snowboarders use the standard, strap-in style bindings. These bindings require the users to sit down and set-up their bindings every time they go down the mountain for a run. The biggest issue with snowboarding right now is that there is no method to securely bind the boots to the board without sitting or bending over. Shown below are a few model types which have been attempted in solving the problem but each their own problematic issues.

Figure 3 – Strap-In Style Bindings [4]

Step-In Bindings

The step-in system requires a special type of boot which latches into the step-in bindings when the user steps correctly into the footpad. Although this allowed users to bind their feet into the snowboard without sitting down or bending over, there were multiple complaints due to the lack of heel support and the system being jammed by ice and snow. Also, the step-in boots required a stiff foot-arch section for the locking mechanism which reduced the flex and comfort compared to normal snowboarding boot.

Figure 3 – Step-In Style Bindings [5]

Flow-In Bindings

The flow-in system allowed the users to use any type of boot. The user would need to configure the front section of the binding to conform to their boot. The user would slip their foot into the front section of the binding then pull the heel support upwards allowing for bindings set-up without sitting. However they are still required to bend over. The locking technique used is not very secure and many users claim that they can feel the bindings becoming loose [7].

Figure 5 – Flow-In Bindings [7]

Proposed Solution

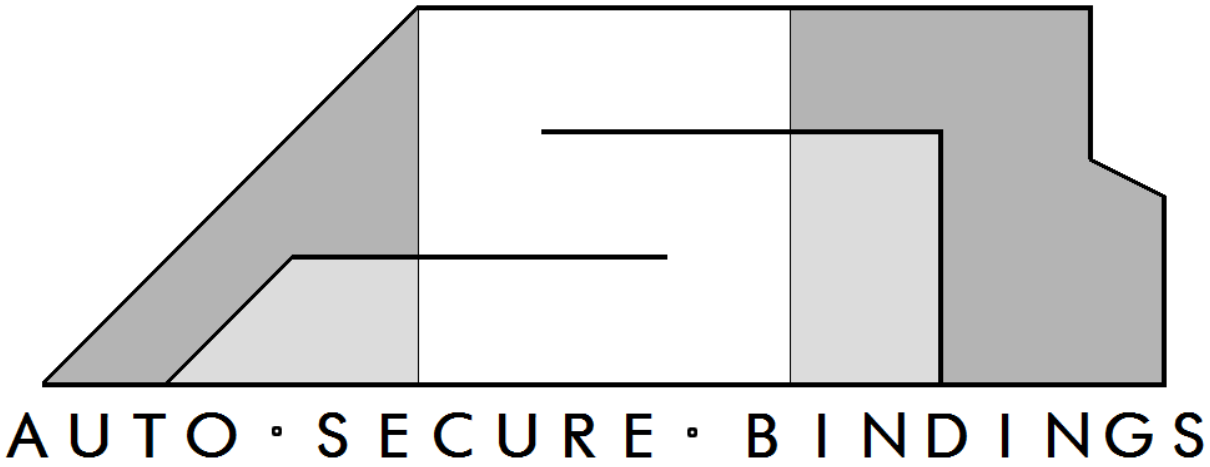
ASB

Our proposed solution is the Auto-Secure Bindings (ASB). This system will not require the user to bend over or sit down at all. The user can control the bindings via the wireless controller. This solution will improve the snowboarding experience by allowing the user to have more run time and reducing their effort required during set-up at the beginning of every run.

The system will use motors to actuate the binding motion. We will utilize ratchet joints to secure the bindings when the user is going down the mountain. The system's wireless controller will be in the form of a watch, it will communicate with the board via radio frequency signals. The user can manually control the tension of the bindings using the watch allowing for a more customised and comfortable fit.

The main constraints to completion of the project are time and resources. Since this is a shorter semester than usual we only have 15 weeks to complete the project. During this time, we must wait for project and funding approval. Within the limited time we must complete the full system which includes a wireless controller and a pair of automated bindings.

With more time and resources we could develop a smaller and lighter module that has greater durability. As well, we would be able to develop some extra features such as emergency beacons and more emergency and safety protocols.



Budgets

Bill of Materials

The cost breakdown required to design and implement the ASB is based on research done by JAC Innovations for the various essential components. Below are two charts showing tentative bills of materials for the two parts of the ASB.

Component	Cost
Automatic Snowboard Bindings:	
Binding Material	$20
Padding Material	$10
Ratchet Joints	$15 x 8 = $120
Motors	$25 x 4 = $100
Microcontroller	$30 x 2 = $60
RF Receiver	$15 x 2 = $30
Electroluminescent Wire	$10 x 2 = $20
Battery	$10 x 2 =$20
Wireless Wristband Controller:	
Microcontroller	$30
RF Transmitter	$20
LCD Display	$20
Battery	$10
Miscellaneous:	
Taxes (12%)	$50
Shipping	$20
Contingency	$50
Total	**$680**

Figure 6 – Cost Breakdown Table

The compiled cost charts shows that the ASB prototype will require $680 to build. However, we expect that the final market-ready product to cost considerably less due to the economies of scale and research into more efficient and economical materials and parts.

Sources of Funding

The executives of JAC Innovations will provide the initial start-up investment required to develop and implement the ASB. External funding has been sought from the Simon Fraser Engineering Science Student Endowment Fund (ESSEF). A requested amount of $680 for the ESSEF application has already been submitted and is pending reply.

Additional financial assistance can be also requested from the Wighton Engineering Development Fund. However, the Wighton Fund will be only pursued if extraneous costs results in debt for the executives of JAC Innovations.

Time Schedule

Gantt Chart

The Gantt chart shown below illustrates the estimated time for key development phases of the project.

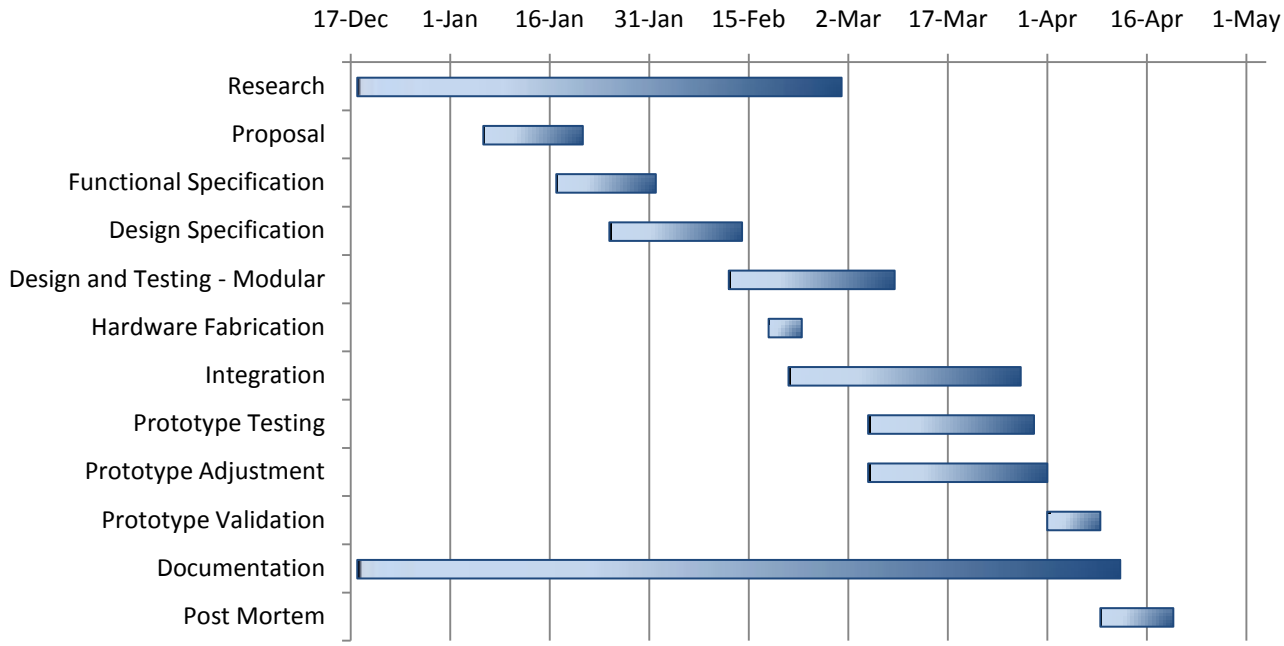


Figure 7 - Gantt Chart Schedule

The design stages are expected to follow the schedule and meet the specified deadlines. These development stages include:

Research: A continuous ongoing process to discover and investigate more suitable building materials and components. Research for better design development and optimization of the ASB.

Functional Specification: Propose behaviours and function requirements of ASB. Identify and specify the functions of the wrist watch and the bindings according to the design requirements.

Design Specification: The design of ASB must meet the design requirements. The binding and wrist watch materials, structures, properties and performance must be appropriate and satisfy the design requirements. The design of ASB must be suitable for its purpose.

Design and Testing of Modules: To ensure every component needed for the ASB system is working properly, each component will be tested on its functionalities and performances.

Hardware Fabrication: Build and assemble ASB using appropriate building materials. Build the binding using key components such as motors, ratchet joints, rubber padding, and microcontrollers and RF transceivers. The binding frame is fabricated from metal copper. For wireless wrist watch, essential parts include microcontroller, RF transmitter and LCD display.

Integration: Implement software component into ASB. Integrate the ASB system by combining the wrist watch component and the binding components. Ensuring all units function properly and interacts with each other flawlessly.

Prototype Testing: In this continuous process, the ASB will be tested repeatedly for software and hardware functionalities.

Prototype Adjustment: A concurrent process with prototype testing. Update and adjust software component, and adjust hardware components accordingly to meet design specifications and requirements.

Milestone Chart

The following figure is the milestone chart which outlines the various achievements we will have accomplished over the 4 month period.

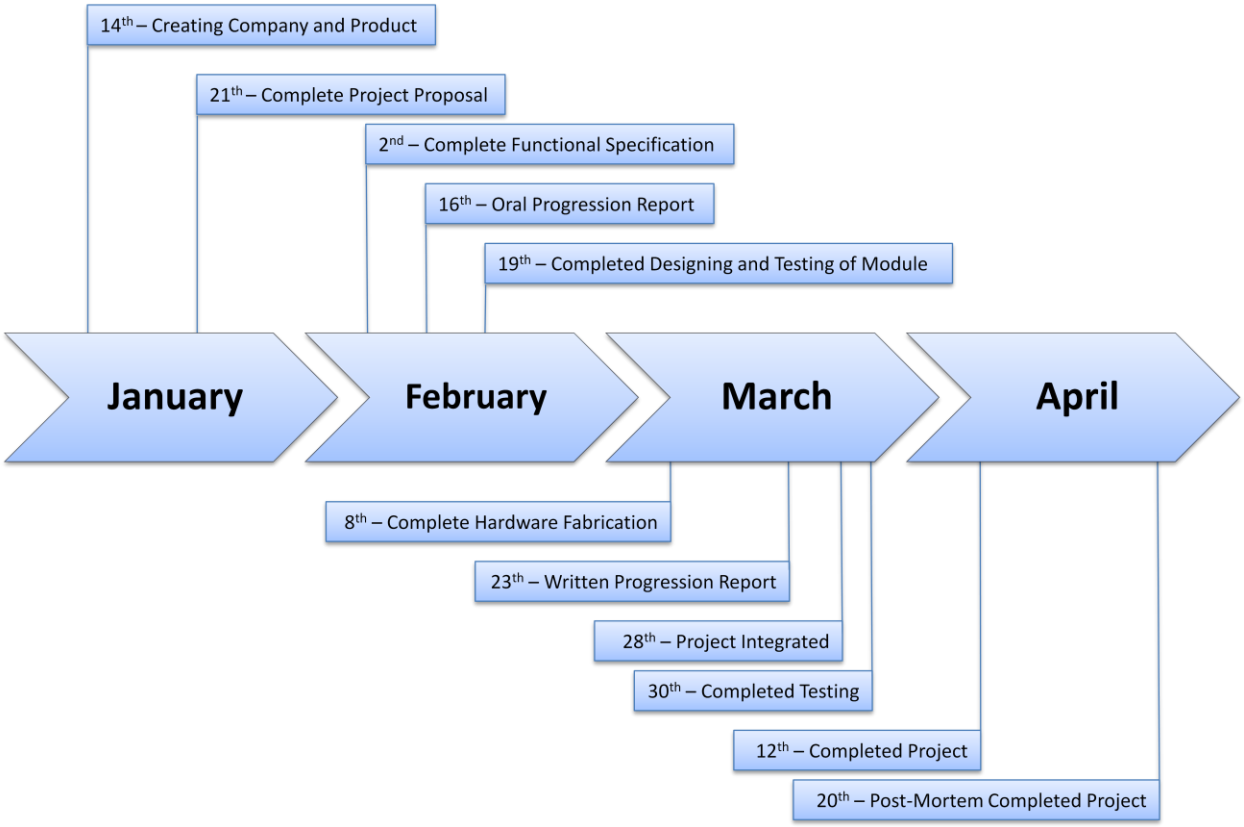
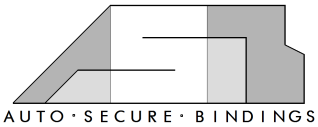


Figure 8 - Milestone Chart



Company Profile

Team Dynamics

JAC Innovations consists of five talented and determined fifth year engineers: Clara Luo, Andrew Ng, Jackie Ng, Jeffrey Sun, and Jacky Wong. Our team is comprised of two systems and three electronics engineers. The diversity in our concentrations allows us to complement each other as well as providing each other advice in our strengths.

The corporate structure of JAC Innovations has five executive positions. Jacky Wong, the chief executive officer (CEO), oversees all operations within the group along with decision making. Jeffrey Sun, the chief financial officer (CFO), is in charge of maintaining the financial books. Clara Luo, the chief operation officer (COO), is in charge of organizing meetings and ensuring that the project is on schedule. Andrew Ng, the chief technical officer (CTO), is responsible for all technical design and operations. Jackie Ng, the chief marketing officer (CMO), manages all marketing goals and ensures that the products all meet the marketing demands.

To ensure proper group dynamics and to stay on task, the team has decided to meet up at least once every week to discuss the progress of each task. Our team members have allocated extra time slots every week so if we require additional meetings then the group will be readily available. A meeting agenda is made and distributed before each meeting to ensure that the group meetings will remain organized and focused. Additionally, minutes will be made and distributed after each meeting providing each member a summary of the discussions.

As all our members are aware of the difficulty of the project on hand, group dynamics and teamwork will be crucial to the project's outcome. JAC Innovations strives to produce products with the utmost quality on schedule.

Company Organization

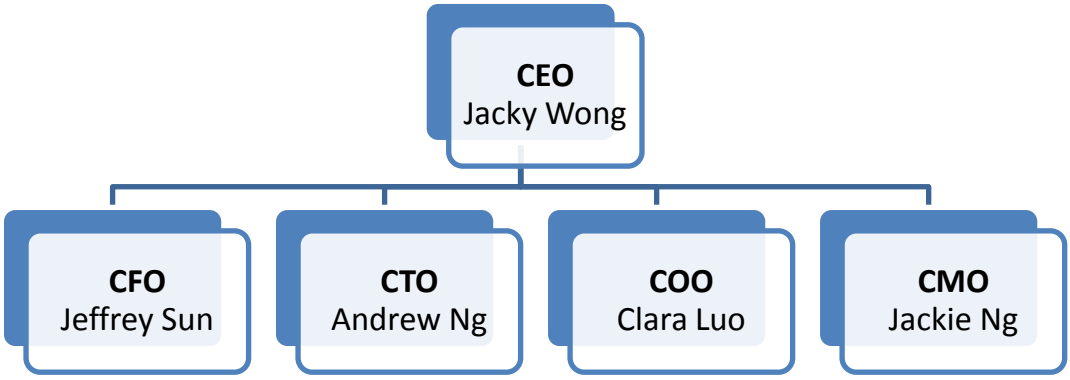


Figure 9 – Organizational Structure

Jacky Wong – Chief Executive Officer (CEO)

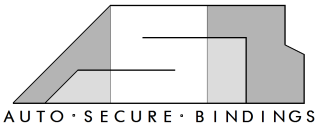
Jacky Wong is a fifth year Electronics Engineering student at Simon Fraser University. During his studies, he has developed very strong hardware and software skills. He has also shown excellent leadership skills throughout the history of his academic career. His work experience at Ericsson Canada and CCSI Getronics has helped him develop his skills in working in a team to meet tight deadlines. His calm and collected character along with his leadership properties helps him make critical decisions along with solving any disputes between members of the team.

Clara Luo – Chief Operating Officer (COO)

Clara Luo is a fifth year Electronics Engineering student at Simon Fraser University. During her co-op, she has developed different software programming skills including but not limiting to C, C++, Java, and Assembly. Her attention to details will be a crucial in searching for details that other members might have overlooked. Her focus and drive will make her ideal for the tough task of organizing and supervising all aspects of the project.

Jeffrey Sun – Chief Financial Officer (CFO)

Jeffery Sun is a fifth year Systems Engineering student at Simon Fraser University. He is responsible of keeping track of the financial accounts, mediating financial decisions, and discovering potential funding. He has spent a year at Ericsson Canada performing high-quality software testing and development for large scale networking. During his studies, Mr. Sun has completed several projects relating to hardware and software design in robotics and FPGAs. He brings mechanical aptitude along with a business mindset to JAC Innovations. His excellent communication and interpersonal skills allows him to meet suppliers and clients without technical assistance as he possesses a strong engineering foundation.



Andrew Ng – Chief Technical Officer (CTO)

Andrew Ng is a fifth year Systems Engineering student at Simon Fraser University. He has various different experiences in working with different programming languages including C, C++, and MATLAB. Along with knowledge in the engineering field as a lead designer he has successfully developed a working prototype in SFU I-3 competition and was awarded the 3rd place. He is an individual that is capable in overcoming technical difficulties, and improving designs. These qualities make him the best associate for this position.

Jackie Ng – Chief Marketing Officer (CMO)

Jackie Ng is a fifth year student in Electronics Engineering at Simon Fraser University. During his time at SFU, he has developed the skills to manage market research. He is proficient in data analysis and creating statistical reports using MATLAB and the Microsoft Office Suite. He has numerous unique and creative ideas allowing him to be innovative and a good out-of-the-box thinker.

Conclusion

Snowboarders have been plagued by inconvenience for too long. To make the experience more enjoyable our product will provide them with a quicker and more comfortable ride down the slopes. We will revolutionize the snowboarding market by integrating electronic and mechanical components into the product. We know there is a demand for a product to make the snowboarding experience better. Our company will strive to develop a product which will fulfill that demand.

Our product will be very work intensive but if we follow our timeline we know completion on schedule can be done. With the varying backgrounds and the solid work ethic of the team we have a strong foundation for the project.

JAC Innovations has future plans to improve this product by adding more safety features such as emergency beacons. We also plan to develop more innovative products which will improve people's lifestyle.

Reference

[1] Flickr® from Yahoo! Inc. (2010). Retrieved Jan 25, 2011 from Yahoo! Inc.: http://farm4.static.flickr.com/3075/2683207106_fb79db8bee_o.jpg

[2] National Ski Areas Association. (2009). *National Ski Areas Association*. Retrieved Jan 22, 2011 from Snowboarding Participation: http://www.nsaa.org/nsaa/press/nsga-snbd-09.pdf

[3] N. Laplante, J. Lee. (2009). 2008 – 2009 Canadian Skier and Snowboarder Facts and Stats. *Canadian Ski Council*. pg. 7 – 22.

[4] Burton. (2011). *Burton*. Retrieved Jan 22, 2011 from C60 EST Bindings: http://s7d2.scene7.com/is/image/Burton/232214001_5?$2011Brtn_PDP_Binding_FS500$&hei=450

[5] M. Pyhajarvi. (2008). *HomeboySki*. Retrieved Jan 22, 2011 from Step Binding – What is Snowboarding Step Binding?: http://homeboyski.com/wp-content/uploads/2008/10/step-binding-system.jpg

[6] Snowboard Addicts. (2006). *Snowboard Addicts*. Retrieved Jan 22, 2011 from Flow vs. Traditional Bindings: http://snowboardaddicts.com/archive/index.php/t-1323.html

[7] K2 Snowboading. (2011). *K2 Snowboarding*. Retrieved Jan 22, 2011 from Cinch CTC Bindings: http://k2snowboarding.com/bindings/cinch-ctc