



February 18, 2008

Dr. Patrick Leung
School of Engineering Science
Simon Fraser University
Burnaby, BC
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Re: ENSC 440 Functional Specifications for a Helmet-Embedded
Communications System

Dear Dr. Leung,

Our team is working diligently to design an innovative solution to the growing and diverse communication needs of snow-sports enthusiasts. By integrating a communication and location tracking system into a snow-sports helmet, our product will deliver a new level of safety and convenience to winter sport enthusiasts. We have outlined the functional specification of our product in the attached document, *Functional Specifications for a Helmet-Embedded Communications System*.

In the attached functional specifications, we outline the top-level functionalities that are required from both our proof-of-concept prototype and our market ready model. Our team members will use this document to guide us through the design and implementation phase of our project, and to assist us in evaluating our prototype in our post-mortem.

Ensuring the success of our proposal is a team of five enthusiastic and talented individuals from the School of Engineering Science: Mathew Bond, Daniel Hessels, Robert Hueber, Darren Jang, and Rob Tyson. Please feel welcome to contact us by phone at 604-783-9650 or email at ensc440-rush@sfu.ca if you have any questions regarding this proposal.

Sincerely,

A handwritten signature in blue ink that reads "Mathew Bond". The signature is written in a cursive, flowing style.

Mathew Bond, CEO RUSH

Enclosure: Functional Specifications for a Helmet-Embedded
Communications System

cc: Mr. Steve Whitmore, Mr. Brad Oldham, Mr. Jason Lee



Raven

Functional Specifications for a Helmet-Embedded Communications System

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Submitted to: Dr. Patrick Leung
Mr. Steve Whitmore
Mr. Brad Oldham
Mr. Jason Lee

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Executive Summary

The current adoption of personal communication technologies continues to deeply penetrate our social networks. As an indicator of this, we are expected to see in 2008, the *global* number of cellular telephone users surpass the number of those without cell phones [1]. Clearly our dependence on convenient wireless communications has pervaded our consciousness so thoroughly that we constantly rely upon them at home, at work, and on the go.

With the recent increase in the availability of portable media services, outdoor enthusiasts have readily adopted music players, GPS receivers, and FRS radios to enhance their recreational experience. While these technologies have so far existed independently, RUSH now innovatively integrates them together into our fully featured snow-sports helmet that offers users wireless control and uncompromised protection.

The development of our product will progress in two phases. The first phase will consist of developing a proof-of-concept prototype that has the ability to:

- Transmit and receive FRS radio signals
- Continuously log location and performance data
- Play audio from a portable music device
- Be activated by a wireless control
- Be controlled simply and intuitively

This phase of development is scheduled to be complete by April 14, 2008.

In the second phase of development, RUSH will build on the progress of stage one by integrating our prototype system into a helmet that meets accepted safety standards and is sleek, stylish and market competitive. The final product will be a modular system whose enhanced functionality offers a more competitive suite of features and upholds the highest standards in ergonomic design.

Table of Contents

Executive Summary	ii
List of Figures	iii
Glossary	iii
1. Introduction	1
1.1. Scope	1
1.2. Objectives	1
2. System Requirements	2
2.1. Product Overview	2
2.2. General Requirements	3
2.3. Physical Requirements	3
2.4. Electrical Requirements	4
2.5. Environmental Requirements	5
2.6. Performance Requirements	5
2.7. Safety Requirements	6
2.8. Usability Requirements	6
3. Conclusion	10
4. References	11

List of Figures

Figure 1 – Functional Overview []	2
Figure 2 – Possible wireless control placements	4
Figure 3 – Recoding and transferring data to a computer for analysis [] .	7
Figure 4 – Removing electronic modules []	8
Figure 5 – Wireless Control Activation	9

Glossary

FRS	Family Radio Service
GPS	Global Positioning System
Normal Use	A period of use in which the product is transmitting FRS radio signals 10% of the time

1. Introduction

The RUSH Raven is a helmet-embedded communications system that brings together the functionality of handheld GPS units and common two way radios in the form of an ergonomic and easy to use snow sports helmet.

1.1. Scope

This document defines the required functionality of a market ready version of the RUSH Raven. We take care to fully describe the requirements of our proof of concept prototype, while providing additional requirements outlining the enhanced functionality needed to gain acceptance and market share in a competitive market.

1.2. Objectives

This document is intended to guide the members of the RUSH team throughout the process of designing, implementing, testing, and evaluating the RUSH Raven.

Throughout this document, we will utilize the following convention to denote functional requirements:

[R#] – X A functional requirement.

In this convention, # represents the number of the functional requirement and X can be one of the following three values:

- P** The requirement applies to the proof-of-concept system only.
- PF** The requirement applies to both the proof-of-concept system and the market ready product.
- F** The requirement applies to only the market ready product.

2. System Requirements

2.1. Product Overview

While cruising the slopes of a ski resort, it is common to notice snow-sports enthusiasts wearing safety helmets and operating personal communication devices such as an FRS radio. The RUSH Raven combines these functions with position tracking and a wireless control to provide the user with an all-in-one Helmet Embedded Communication System. This unified solution simplifies the use of the former subsystems, while adding new functionality and capabilities. The easy-to-use wireless controller will enable the user to communicate to other FRS users without the frustration of fishing in a pocket for a separate device that can be clumsily dropped by gloved hands. Position tracking will enable the system to inform the user of various parameters like velocity, altitude and compass bearing, while the product's ability to transfer data to a personal computer will allow the user to review and analyze his/her daily performance. All the modules that comprise the system will be replaceable, enhancing the lifetime of our product and enabling the user to repair or upgrade the electronic modules or helmet as they wish.

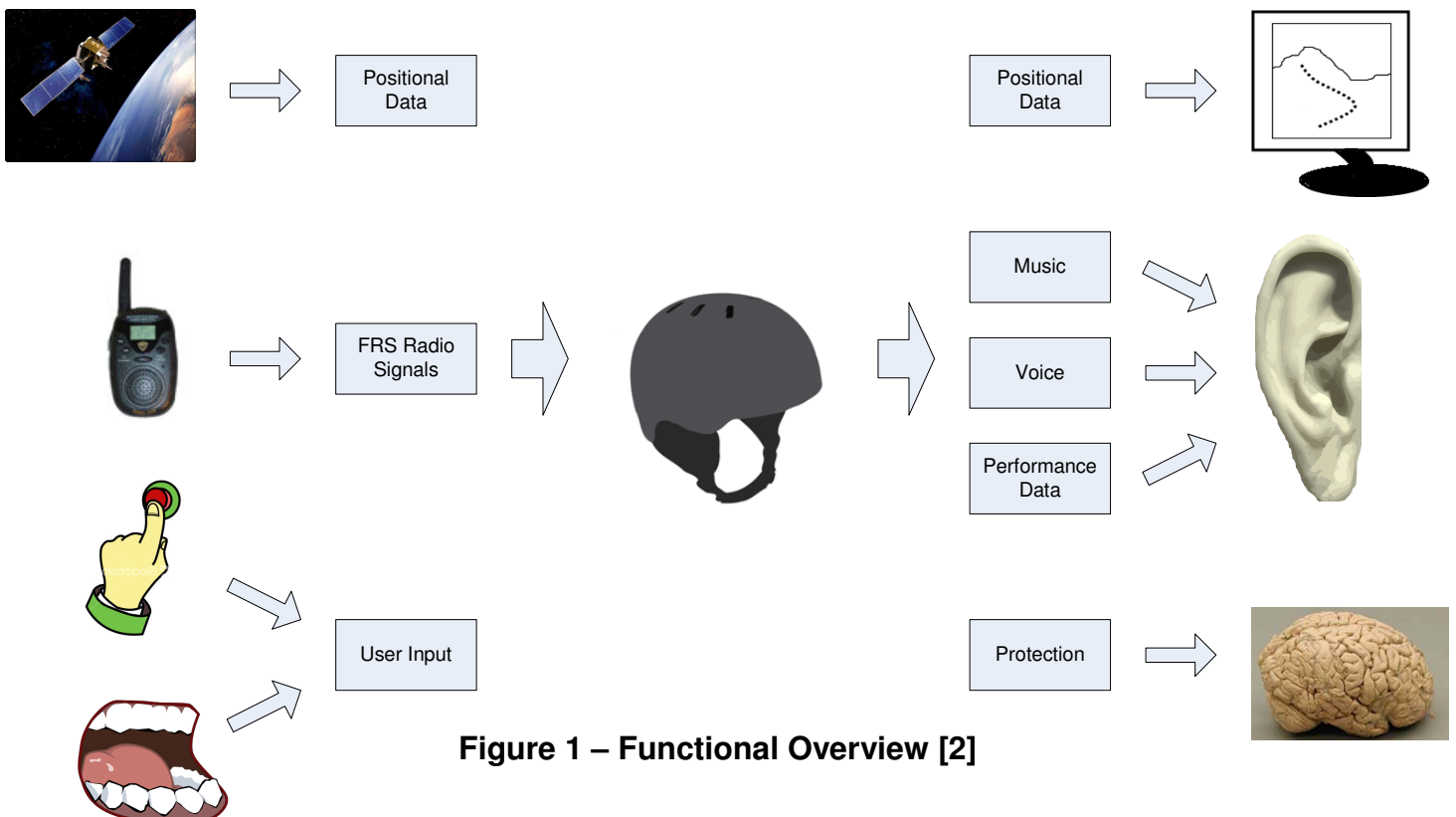


Figure 1 – Functional Overview [2]

2.2. General Requirements

- R[1] – F** The product must provide protection against head injuries.
- R[2] – PF** The product must provide voice communication between a number of users.
- R[3] – PF** The communications system will be compatible with the FRS radio standard.
- R[4] – PF** The communications system must transmit and receive FRS radio signals on all 14 FRS channels.
- R[5] – PF** The communications system can be activated by a wireless control.
- R[6] – PF** The product will be able to continuously track and log its location.
- R[7] – F** The product will provide real time feedback of performance data such as velocity and altitude.
- R[8] – PF** The product shall be able to play audio from a portable audio player.
- R[9] – F** The product will cost less then \$350 CDN.
- R[10] – F** The product will be sold in a package containing the assembled helmet, electronic modules, and wireless control.
- R[11] – F** Replacement helmets, electronic modules, and remote controls will be sold separately.

2.3. Physical Requirements

- R[12] – F** The helmet must be comfortable.
- R[13] – F** The helmet must be stylish and sexy.
- R[14] – F** The helmet must be of a size, shape, and weight comparable to existing high performance helmets.

- R[15] – F The helmet must be well ventilated.
- R[16] – F The helmet will be available in different sizes to fit a range of users.
- R[17] – F The helmet will be available in different colours.
- R[18] – F The helmet must have an adjustable chin strap.
- R[19] – F The helmet must provide a secure attachment for ski goggles.
- R[20] – PF The wireless control shall securely and comfortably attach to the user's person, clothing, or equipment.
- R[21] – F The wireless control will be available in a standard shape as well as novelty shapes.

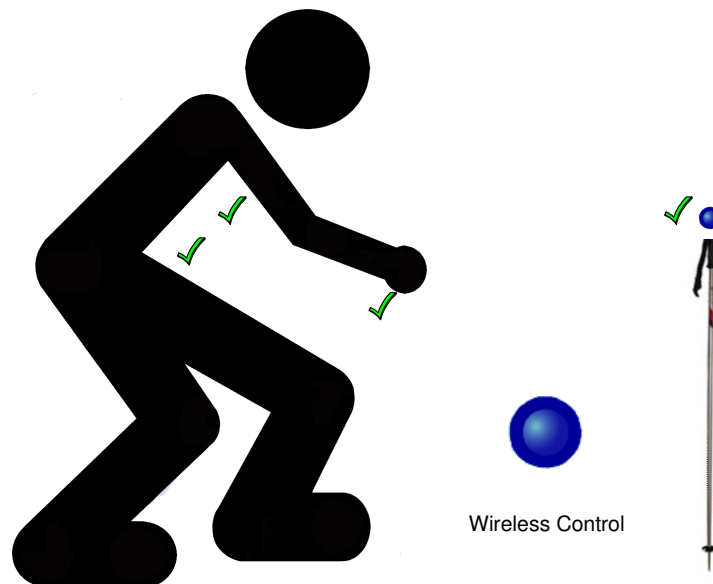


Figure 2 – Possible wireless control placements [3]

2.4. Electrical Requirements

- R[22] – PF The helmet will be powered by a portable power source.
- R[23] – PF The helmet's power source shall be rechargeable.

- R[24] – F A charger for the helmet’s power source shall be included with the product.
- R[25] – PF The wireless control will be powered by a portable power source.

2.5. Environmental Requirements

- R[26] - F The electronic modules shall be housed in waterproof enclosures according to the IP65 standard [4].
- R[27] - F The electronic modules shall be resistant to impact and kinetic shock.
- R[28] - F The product must operate at altitudes up to 4000 meters.
- R[29] - F The product must operate in temperatures from -30°C to +30°C.

2.6. Performance Requirements

- R[30] – PF The product must function in an oxygen and nitrogen atmosphere consistent with the atmospheric composition of Earth.
- R[31] – PF The communications system must operate with a range equivalent to existing FRS radios [5].
- R[32] – PF The product shall be able to operate for at least 10 hrs under normal use conditions.
- R[33] – F The velocity of the user shall not affect the performance of the product.
- R[34] – PF The wireless control must reliably activate the communications system from a distance of under 2 meters.

2.7. Safety Requirements

- R[35] – F** The helmet must meet ASTM F2040-06 and CEM 1077 safety standards [6].
- R[36] – F** The product must meet applicable electronic and wireless safety standards.
- R[37] – F** The helmet shall provide the ability to locate the user in case of emergency.
- R[38] – F** The electronic modules must be integrated into the helmet in a manner that is aesthetically pleasing and does not compromise the helmets primary function as safety equipment.
- R[39] – PF** The product’s audible output shall be volume limited to avoid causing permanent hearing damage.
- R[40] – PF** Listening to music from a portable audio player must not interfere with the operation of the communications system.

2.8. Usability Requirements

- R[41] – PF** While in use, the product must be able produce an clear audible output.
- R[42] – PF** While in use, the product must be able to clearly receive vocal input.
- R[43] – PF** The user shall be able to turn the communications module on or off.
- R[44] – PF** The user shall be able to adjust the volume of the unit.
- R[45] – PF** The user shall be able to turn the location tracking module on or off.
- R[46] – PF** The user shall be able to transfer the recorded location data to a home computer.

R[47] – PF The user shall be able to analyze performance data, such as velocity, with computer software.

R[48] – F The computer software shall be able to graphical display a location history of the product.

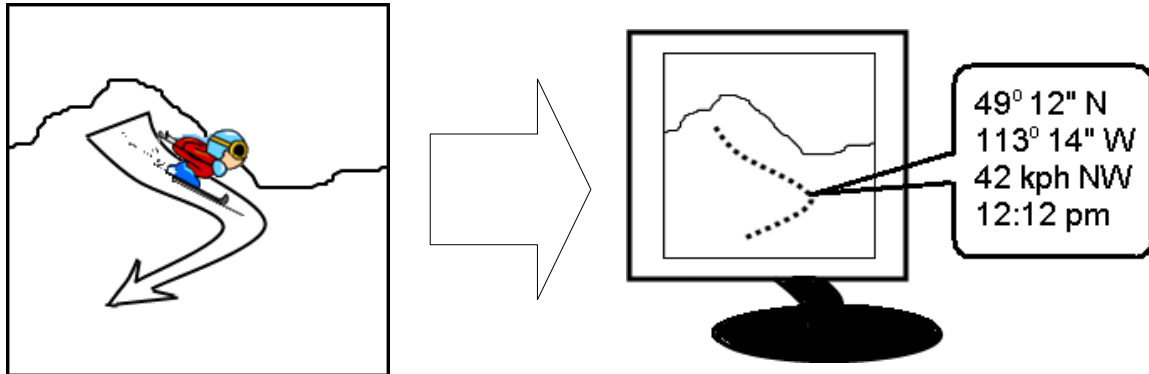


Figure 3 – Recoding and transferring data to a computer for analysis [7]

R[49] – PF Manual controls for the communications system must be included on the helmet.

R[50] – PF All manual controls must be simple and intuitive, as well as provide positive feedback to the user.

R[51] – PF Manual controls must be operable using gloved hands.

R[52] – PF The wireless control shall not interfere with the user's ability to ski or snowboard.

R[53] – PF The wireless control shall be difficult to accidentally activate.

R[54] – PF The product shall inform the user of errors.

R[55] – PF The product shall warn if it is running low on power.

R[56] – F All electronic modules shall be removable from the helmet.

R[57] – F All removable components shall remain securely attached to the helmet while in use.

R[58] – F All removable components shall be removable and replaceable by the user.



Figure 4 – Removing electronic modules [8]

- R[59] – F** The interface between the helmet and its electronic modules shall allow for future upgrades of the electronic modules.
- R[60] – PF** The communications system must respond to only one wireless control.
- R[61] – PF** The wireless control must activate only one communications system.

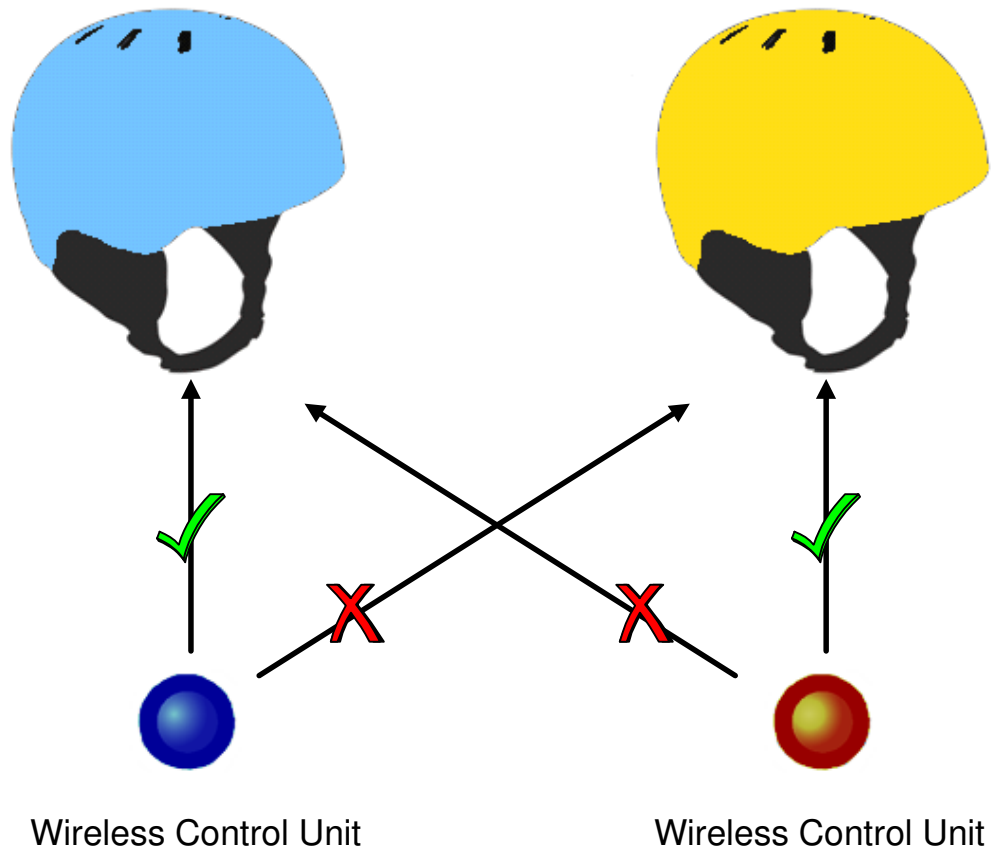


Figure 5 – Wireless Control Activation

- R[62] – PF** The helmet must be able to pair with a different wireless control.
- R[63] – F** The removal and replacement of the portable power sources shall be simple and fool-proof.

3. Conclusion

This document specifies the pertinent functional aspects of the RUSH Raven, providing a flexible guide for the engineers to design and implement a proof-of-concept prototype on-time and under budget. Furthermore, with a comprehensive approach to intelligent ergonomic design, we have laid the foundation for our products to revolutionize the way snow-sports enthusiasts communicate. By introducing a novel method of personal communication to snow-sports enthusiasts, the Raven is sure to enrich their experience and enjoyment through its simplicity and usefulness.

4. References

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