

Kwantlen Polytechnic University

Beautiful British Columbia



Opportunities for KPU



The Metro Vancouver area had a population of 2.6 million in 2021, making it the third-largest metropolitan area in Canada

Collectively, the Fraser Valley Regional District and Metro Vancouver generate over 62% of provincial gross farm receipts for a total \$1.6 billion.



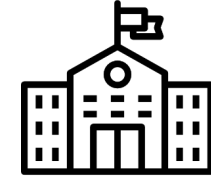
KPU at a Glance



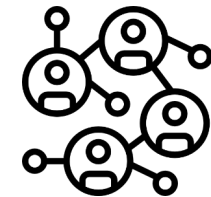
Operating budget:
\$300 million



Serving over
1 million citizens
in our region: growing
and diverse



BC's **4th largest**
university



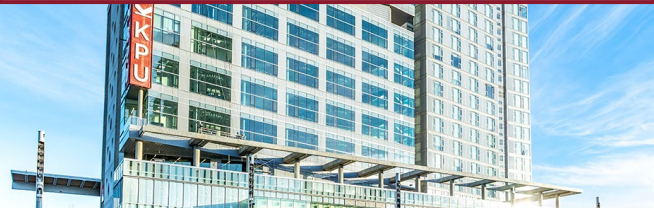
20,726 students
12,154 FTEs
5,198 International students
1,500 employees
900 faculty

5 Campuses

KPU Richmond



KPU Civic Plaza



KPU Langley



KPU Surrey



KPU Tech



Research Enterprise Overview

>140 Programs	100% Exp. Learning	3 Research Centres and Institutes
30-55% Faculty engaged with Research	9 Research Chairs	3 Farmer Training Programs

Farmer Training Programs



Research & Innovation Areas



Healthy Community



Social Inclusion



Technological Transformation



Design Solutions



Work and Learning



Sustainable Development

Research Support at KPU

Komplement Grant

- Teaching release for externally funded researchers

Knowledge Mobilization Grant

- Support open access scholarly publishing, research outreach, and knowledge mobilization

Student Research & Innovation Grant (SRIG)

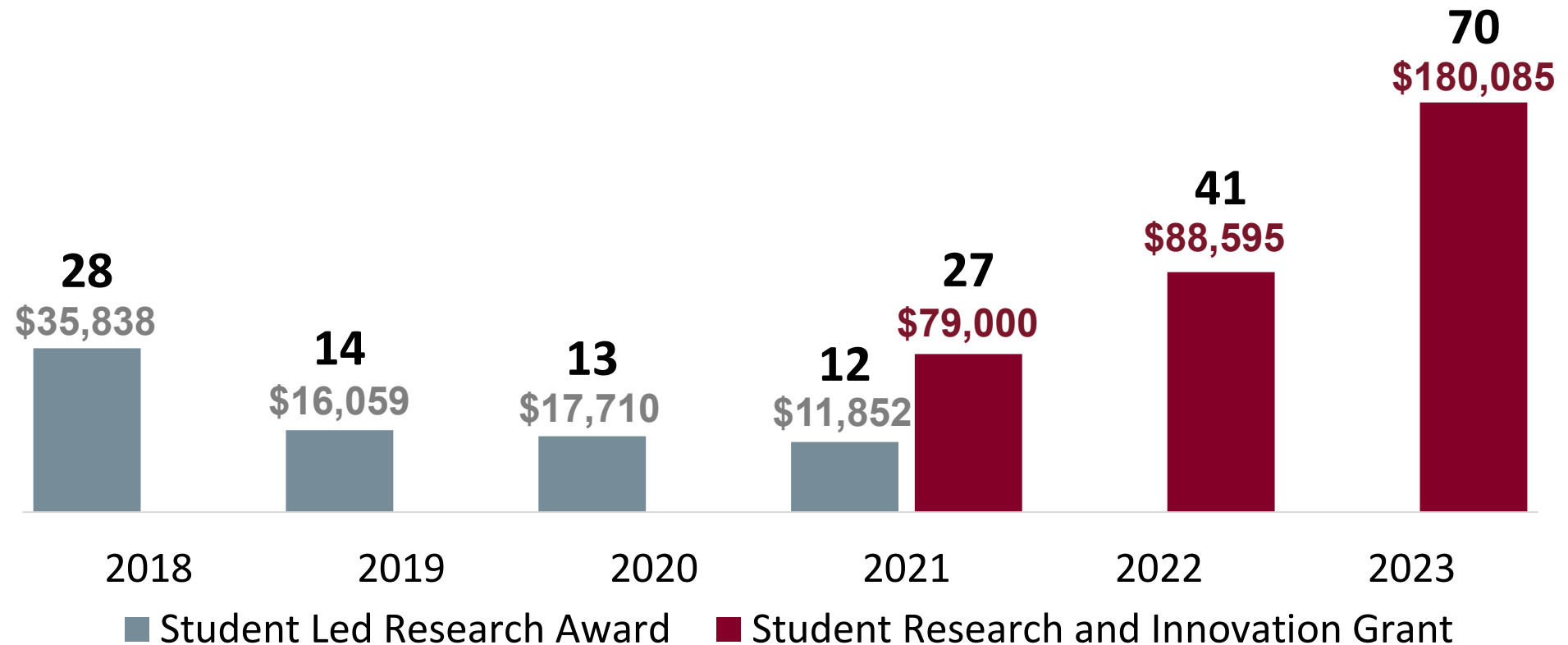
- Support student research and innovation projects

Every project is related to at least one of the 17 UN Sustainable Development Goals

**SUSTAINABLE
DEVELOPMENT
GOALS**

KPU Grants for Student Research & Innovation

Number of approved applications by entry year



Student Research & Innovation Grants (SRIG)



What Effects do Variety, Shading Method, and Planting Date Have on Bok Choi Bolting and Yield?

Amanda Tam,
Applied Science in Sustainable Agriculture



Sustainable Development as a Wicked Problem: The Case of the Brazilian Amazon Region

Natalie Tartarotti & Aline Rocha,
Entrepreneurial Leadership





Female Adequate Personal Protective Clothing (PPC) for Structural Firefighters

Berenice Beau,
Wilson School of Design



Research & Innovation Areas



Healthy Community



Design Solutions



Social Inclusion



Work and Learning



Technological Transformation



Sustainable Development

2015-2020

Beginning of a Journey in Research & Design



2015-2018 Projects

- Medical Drill Cover
- Arborist Protection
- Polar Burrito



2020

- Sherman Jen Chair Proposal
- WSD Governance Structure



2019

- Technical Apparel Capstone Development
- Extreme Weather Glove Project

2021-2022

Achieving New Heights in Design Research



2021

- CFI and NSERC grant applications
- Core 77 and Red Dot Awards



2022

NSERC Mobilization Grant awarded to Wilson School of Design



2021

- Internal collaboration platform established
- Hemiplegia Support Device



2022

Stephanie Phillips announced as the Sherman Jen Next-Gen Research Chair



Future Outlook

With the \$1 million NSERC Mobilize Grant awarded in October 2022, we are poised to further enhance our capabilities, focusing on integrating communication, culture, and a comprehensive framework for student involvement in research projects going forward.

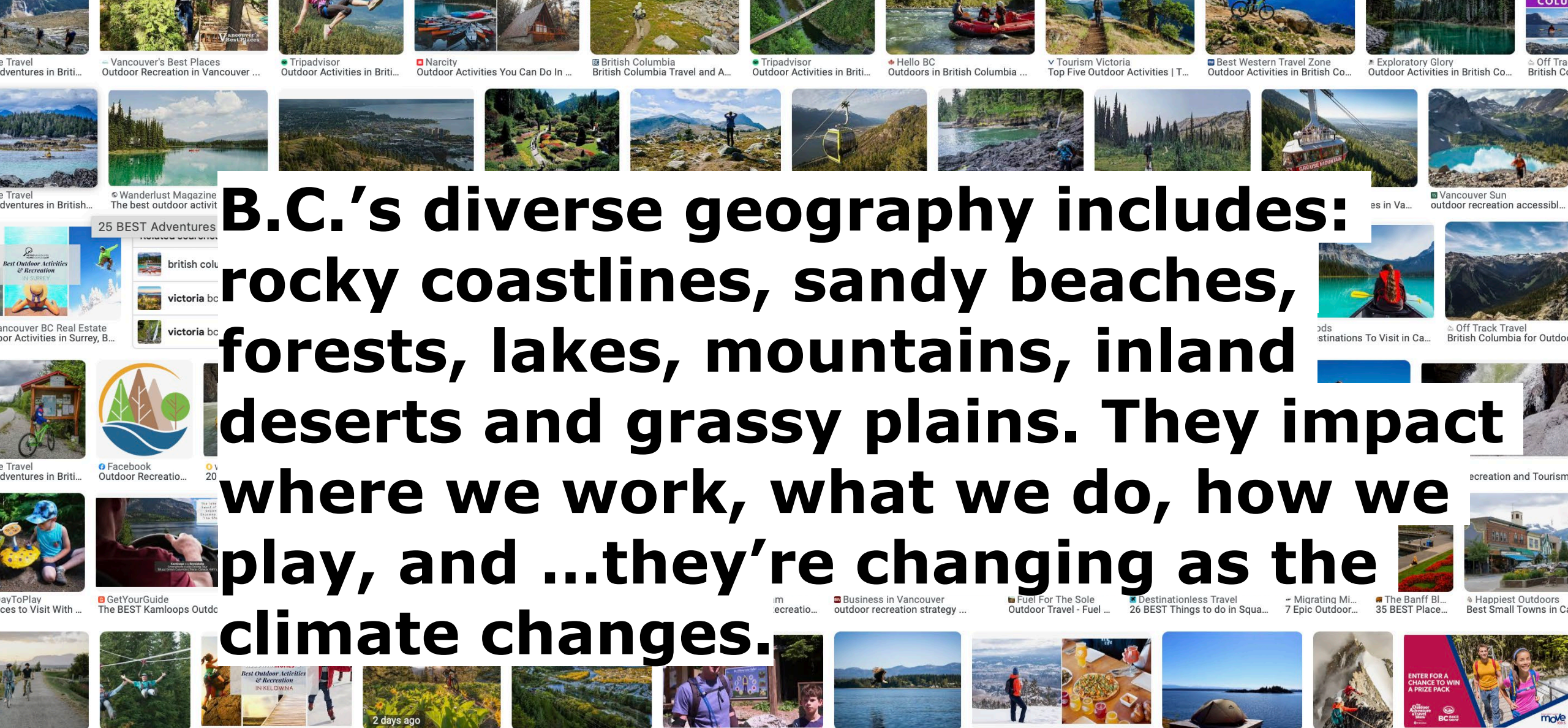


Learning Grounded in Design for **Extreme Environments**

Sue Fairburn, MSc MEdes, FRSA

sue.fairburn@kpu.ca

Polytechnics Canada Showcase 16 May 2024



**B.C.'s diverse geography includes:
rocky coastlines, sandy beaches,
forests, lakes, mountains, inland
deserts and grassy plains. They impact
where we work, what we do, how we
play, and ...they're changing as the
climate changes.**

What do we need to know about the Changing Climate? And why?

Climate literacy is expected to achieve in-depth comprehension about the essential principles of Earth's climate system, critical knowledge about assessing scientifically credible information about climate, wider dissemination of the information about climate and climate change in a meaningful way, and ability to make informed and responsible decisions with regard to personal actions that may affect climate....

<https://doi.org/10.1016/j.pdisas.2022.100222>

A common framework for MOOC curricular development in climate change education - Findings and adaptations under the BECK project for higher education institutions in Europe and Asia

research + design

01

OUR APPROACH

WE USE A HANDS-ON APPROACH TO IMPLEMENT TECHNOLOGICAL AND SOCIAL INNOVATIONS THAT SEEK TO MAKE PEOPLE'S LIVES BETTER, SAFER AND MORE COMFORTABLE.



01

Our research outcomes advance knowledge in challenging contexts.

02

Our research practices are developed with sustainable frameworks while addressing complexity through creativity.

03

We solve meaningful problems as defined by the UN Sustainable Development goals, with and for representative communities in our region.

01 - Designing Through Systems: Material sustainability cycles and local industry practices

02 - Designing for Extremes + Futures: Climate crises and regional biosystems.

03 - Designing with Inclusivity: User-centered fit, co-design methods, and performance analysis.

Learning + Design for Extremes

Knowledge Mobilization

INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
8-9 SEPTEMBER 2022, LONDON SOUTH BANK UNIVERSITY, LONDON, UK

EXPLORE, RESPOND, ADAPT: THE ROLE OF RISK AND EXPERTISE IN HYBRID (SOFT/HARD) PRODUCT EDUCATION.

Sue FAIRBURN and Stephanie PHILLIPS¹

¹ Wilson School of Design, Kwantlen Polytechnic University, CANADA

ABSTRACT

Design education is working with witness changing climate explore and settle further fit Why are risk and expertise in accessing extreme environments to survive and thrive. This paper where extremes (environments in high-risk environments. Experts who have mitigated to this expanded field. The demanding with a 7-week iterative prototyping happens teams self-organize and grow through design scenarios, and This paper reflects on project of ten perspectives and recon generation of risk-engage introducing the unfamiliar a

Keywords: Protective equipment partnerships, Climate crisis

1 INTRODUCTION

Over the coming decades, as environmental contexts due democratic exploration and shifts require additional design. The impact of climate change (temperature, humidity, etc) Al-Khalili writes: "Predicted science and technology are unforeseen" [2] Climate Change we rely, both in everyday life are the basis for "a new set of the future" and these aspects beyond plan and prepare to requires us to access regions While there are many places where humans go that require been in polar regions, ocean human body and protective range of non-ideal environments our interest and expand the

EPDE2022/21D99

24TH INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
08-09 SEPTEMBER 2022, LONDON SOUTH BANK UNIVERSITY, LONDON, UNITED KINGDOM

EXPLORING & DESIGNING IN THE CONTEXT OF SEARCH AND RESCUE

Susan CHRISTIANEN¹, Sue FAIRBURN²

¹ Auðna | Technology Transfer Office Iceland

² Wilson School of Design | Kwantlen Polytechnic University, Canada

ABSTRACT

In the face of extreme weather challenge of rapid changes demands to prevent accident Association for Search and With a community of 5000 sector and tourism company development of technical P beta-testing equipment in rescue and technical teams. real-time. Designing for co extensive knowledge, practice and equipment. This paper lessons learned from an in-the-field, in studio, and users" resulted in a vibrant these users, who are trained them to design inclusive, re are needed for adapting to

Keywords: Extreme Environment Equipment (PPE), Search and

1 INTRODUCTION

Living on a remote volcanic weather conditions, volcanic conditions and emergency optimised products, service variables. Extreme conditions and for the designers. Search conditions and those working the island's natural hazards challenges to prevent accident

As Design Educators, our role the users, who are familiar prepare them to design inclusive solutions for existing societies to a larger context and goal Sustainable Development (the Arctic Council. Working likelihood of developing up

EPDE2022/1200

25TH INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
7-8 SEPTEMBER 2023, ELISABETH UNIVERSITY SCHOOL OF DESIGN AND ENGINEERING, BARCELONA, SPAIN

DESIGN INTO EXTREMES: EXTENDED LEARNING

Sue FAIRBURN¹, Susan CHRISTIANEN² and Bailee VAN RIXKOORT¹

^{1,2} Wilson School of Design, Kwantlen Polytechnic University, Canada

² Extreme Design Lab, Iceland

ABSTRACT

Unprecedented climate emergencies are part of everyday conversations and experiences. As students seek how to design for these challenges, some design educators are providing learning grounded in what it means to live in extreme environments. As Space Architects, the authors design suitable living conditions and life support systems for unfamiliar, remote settings. The challenge is inaccessibility to end users, their latent needs, and real-time conditions. This case study describes a student team project to design/build a habitat (Canada) for a client (Europe) and a crew of analogue astronauts who would deploy and use the habitat during an "analogue mission in a lava tube (Iceland) (*situation created/selected for its similarities to space).

Design studios support students to work through a process to meet the learning objectives. Project outcomes for the curriculum presented, are functioning full-scale prototypes. However for this case study, the process was robust but not fully functional. Extreme contexts often lead to spectacular concepts, presented as 3D-modeled concepts that never reach a built state let alone usability testing and deployment in an extreme setting. The student team's technical concepts informed a final full-scale prototype that was deployed in a lava tube and inhabited by two crews of analogue astronauts. Post-mission reports conflicted on the habitability of the concept prototype. The co-author team of analogue astronaut, student/project lead, and design educator apply an Experience-Reflection-Action model to inform extended learning through end-user engagement, contextualized methods, and survivability versus habitability.

Keywords: Habitability, analogues, prototyping, extreme environments, user-centered, life support systems

1 INTRODUCTION

The term 'extreme' is becoming part of everyday conversations and experiences and design educators are increasingly integrating extreme contexts into studio projects to introduce students to methodologies and skills for critical survival responses to unprecedented weather events. To learn how to design practical solutions for locations affected by climate change is to provide support for communities and empower design students with agency for coping with climate change and the associated anxiety of uncertainty. Hickman and colleagues documented the global prevalence of climate anxiety in young adults and its impact on their daily function [1]. They identified 'constructive or practical' anxiety as an important rational form of anxiety and response to danger that can lead us to seek more information and work toward solutions, and concluded that the practice of 'solutions' is a strategy to manage anxiety arising from uncertain situations. [ibid]

Extremes: Case studies (Context & Experts)

PERI
URBAN

POLAR

ENIX

ALTA

ECHO

Focus: Thermal Rewarming

Focus: Pneumatic building

Project	Context/ Environment	Experts	Methodologies	Concept Prototype
2017: PERI-URBAN BURRITO TEAM SIZE: 5	Peri-urban (mountains, forested, snow, freshwater and coastal)	USER: Alpine Search Rescue Leader, Ski Patrol BODY: Thermal Physiologist PRODUCT: Engineer, Research and Development Manager	SITE VISIT: North Shore Rescue Community Base and Mustang Survival	Hooded hypothermia bag with three-way zipper for accessing points for vital areas and roll up and gusset for adjustability.
2018: POLAR BURRITO TEAM SIZE: 6 (1 International Exchange student)	Remote, Polar, water, shore, and ice pack	USER: Sedna Epic Expedition Leader, Polar Snorkeler BODY: Environmental Physiologist PRODUCT: Engineer, Research and Development Manager	SITE VISIT: Horseshoe Bay Marina / Sea Dragon Charters , and Mustang Survival FIELD TESTING: Snorkel Safari	Fur-hooded multi-layered extreme hypothermia bag with inflatable pillow, three-way zipper for accessing vital areas, and specialised locator toggle.
2019: MARINE BURRITO TEAM SIZE: 6 (2 international Exchange students)	Marine, commercial, recreational watercraft users.	USER: Dive Leader, Crew, Canadian Coast Guard BODY: Environmental physiologist PRODUCT: Engineer, Research and Development Manager	SITE VISIT: Coast Guard (Sea Island), Mustang Survival, Simon Fraser University Climate Laboratory for Exercise and Environmental Physiology (LEEP)	Hooded hypothermia bag with self-inflating pad, contour zipper for accessing vital areas
2020: HIGH ALTITUDE (HYPERBARIC) TEAM SIZE: 10	High altitude, mountaineering, emergency descent.	USER: 2 Amateur Mountaineers (7 summit) BODY: Hyperbaric Physiologists, Wilderness and Expedition Medicine PRODUCT: Engineer, Research and Development Manager & Aerospace Design Engineer	SITE VISIT: Thin Red Line Aerospace, Richmond Dyke (rock formation).	Lightweight portable, roll-top hyperbaric chamber and pump system, with windows for communication /monitoring victims of high altitude illness
2021: ANALOG ASTRONAUT HABITAT (HYPERBARIC) TEAM SIZE: 10	Lava Tube, remote, temperate climate	USER: Analogous Astronauts BODY: PRODUCT: Engineer, Research and Development Manager	No site visits due to pandemic	Habitat for Analogous space mission in Iceland. Integrated simulated airlock, thermal floor and layered materials for thermoregulation



CORE77

CORE77

CORE77

Environmental **CONTEXT:**

DEPD 3610: Soft goods & protective equipment design & development
“*where thought meets action*” through experiential, place-based learning.



Core77

Location: Garry Point Park,
Richmond, BC
Victim Status: Conscious
and unconscious

56

Field Testing ALTA Personal Hyperbaric Chamber 2020
Core77 Student Winner: 2021

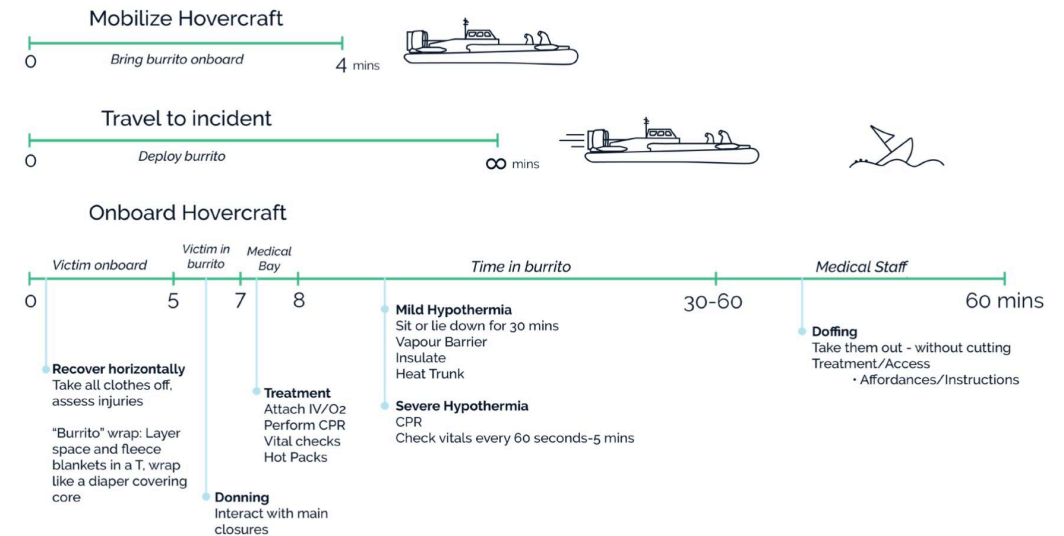
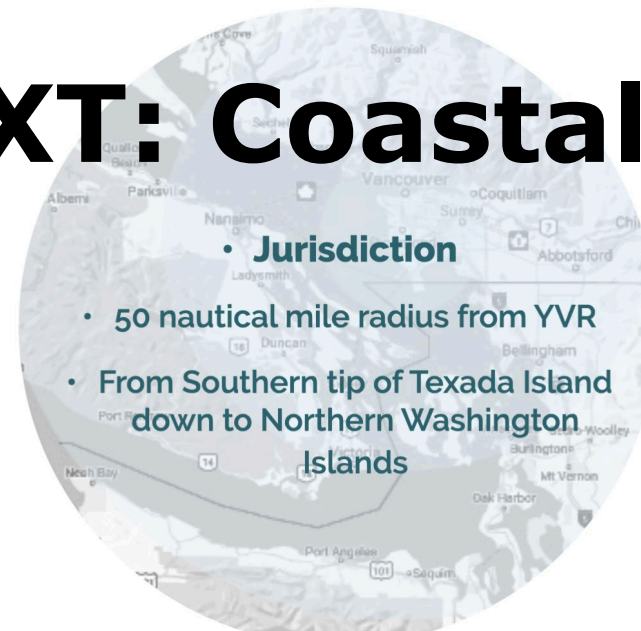


Field trip @ Canadian Coast Guard
Sea Island Vancouver 2023

Environmental CONTEXT: Coastal/Marine



Vancouver coast guard and other Agencies execute rescue scenarios.



CONTEXT: High Risk Environment Problems

“There were so many people on Everest, many more than expected...we also had very unhealthy competition between very experienced guides and guides with no experience at all.”

Dawa Yangzum Sherpa (2019)

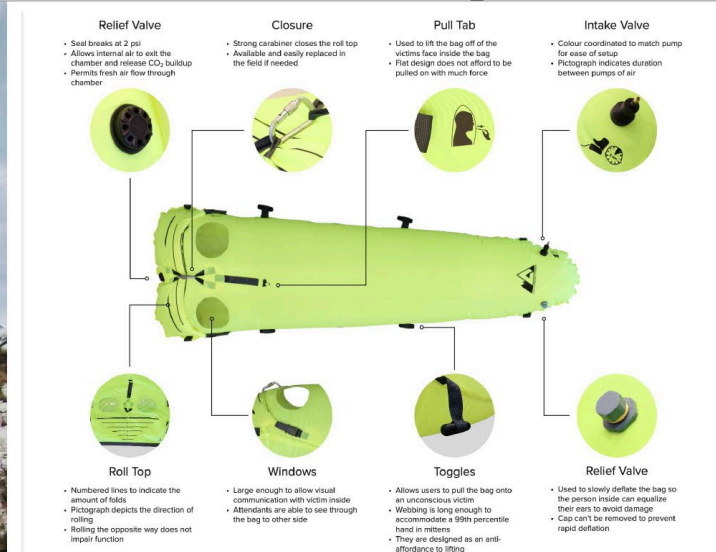
2020

Environmental CONTEXT: Altitude/Pressure

CORE77



Alta Hyperbaric Chamber 2020



Alta Carry Case

Alta carry case is a lightweight and convenient way to protect the chamber when not in use. The chamber rolls up to 1/8" and is secured with the compression straps to keep it rolled up. The carry case can be secured to its base to attach to other gear with the built-in handle.

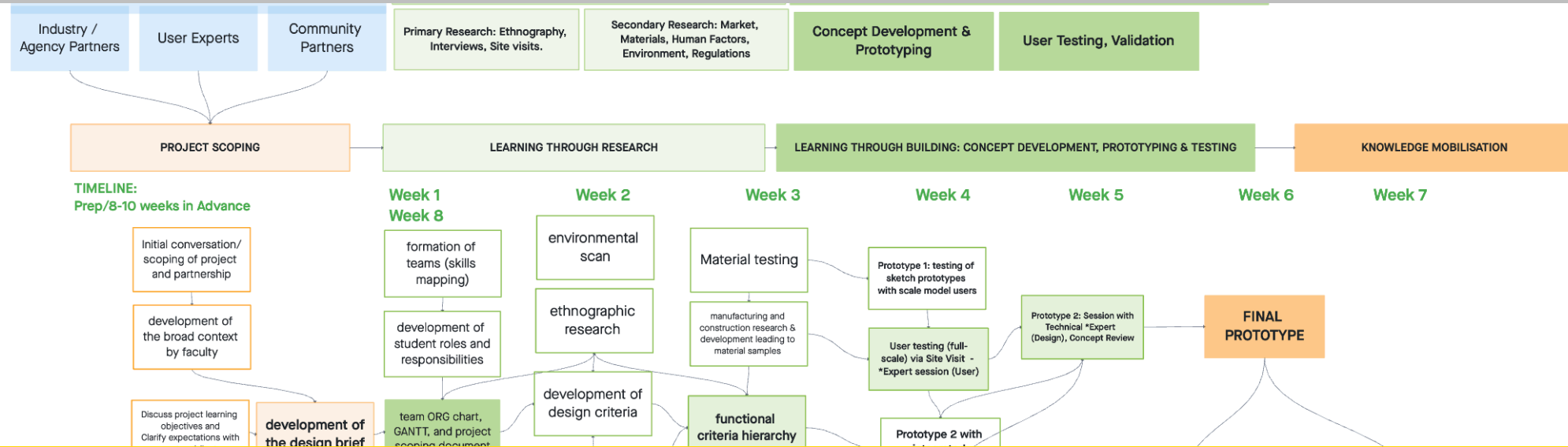


Alta Pump

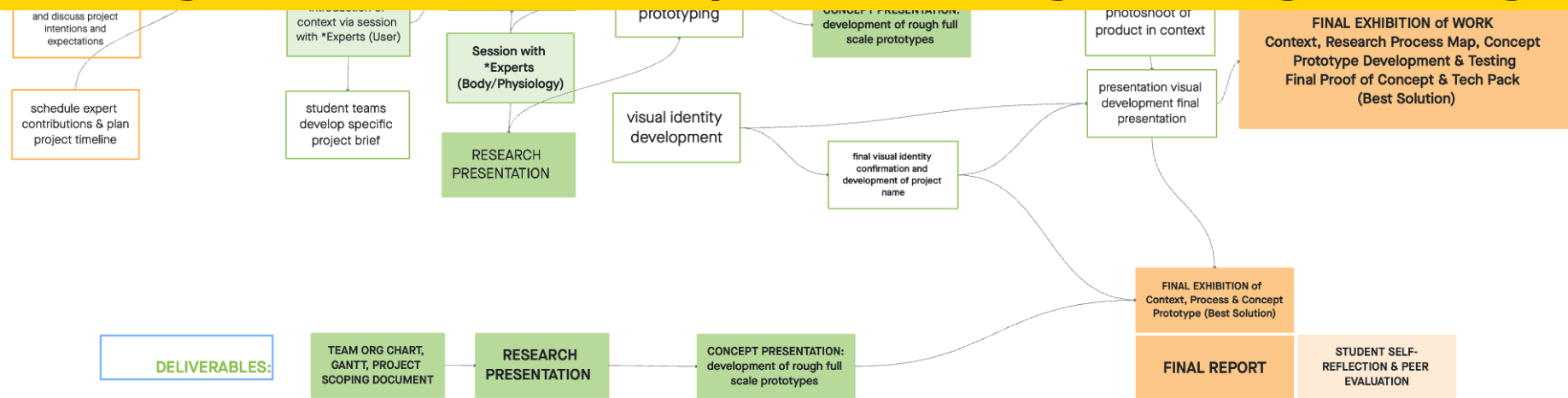
The pump fills the chamber to pressure with fresh air, while providing the user visual feedback for how fast to inflate. At only half a pound, it's much lighter than the competitor who increasing output per compression.



Program/Team Project Framework: DEPD 3610



Learning: through Research > with Experts > through building & testing



ESTABLISH COMMUNICATION Channels: Formal and informal communication between peers/faculty.

Partners: Industry/ Agency/ Academic

2017



**WILSON
SCHOOL
OF DESIGN**

2018



aisle
EST. 1993



2019



2020



SFU
SIMON FRASER
UNIVERSITY



2021



KPU

Expansive Methodology

Project Timeline ALTA 2020

Key Deliverables

Timeline of Tasks

Examples from ALTA

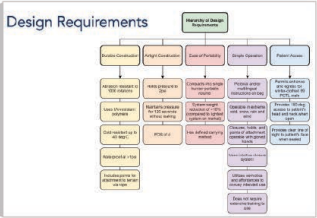
GANTT
Project scoping document

Initial conversation/scoping of project and partnership
Development of the broad context by faculty
Formation of teams (skills mapping)
Team charter



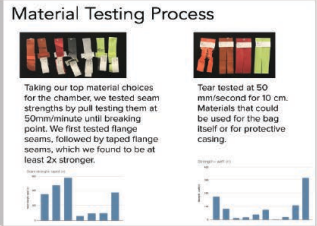
Research Presentation

Introduction of concept area to students with experts (User)
Student development of specific brief
Development of student roles and responsibilities
User and context research



Concept Presentation

Site visit
Development of design criteria
Ethnographic research
Session with experts (Physiology)
Functional criteria hierarchy
Initial sketch prototyping
Visual identity development
Material testing
Manufacturing technique exploration & development leading to material samples
Testing of sketch prototypes with scale model users



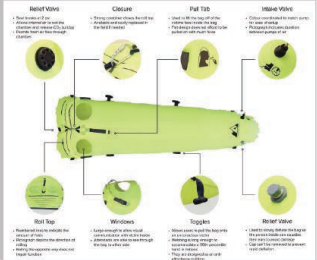
Final Presentation

Development of rough full scale prototypes
Site visit: for initial user testing (experts)
Concept Review
Initial user testing (full-scale) as a site visit - expert session (User)
Second iteration with function built in
Final prototype
Specification package development
Final visual identity confirmation and development of project name
Photoshoot of product in context > presentation visual development



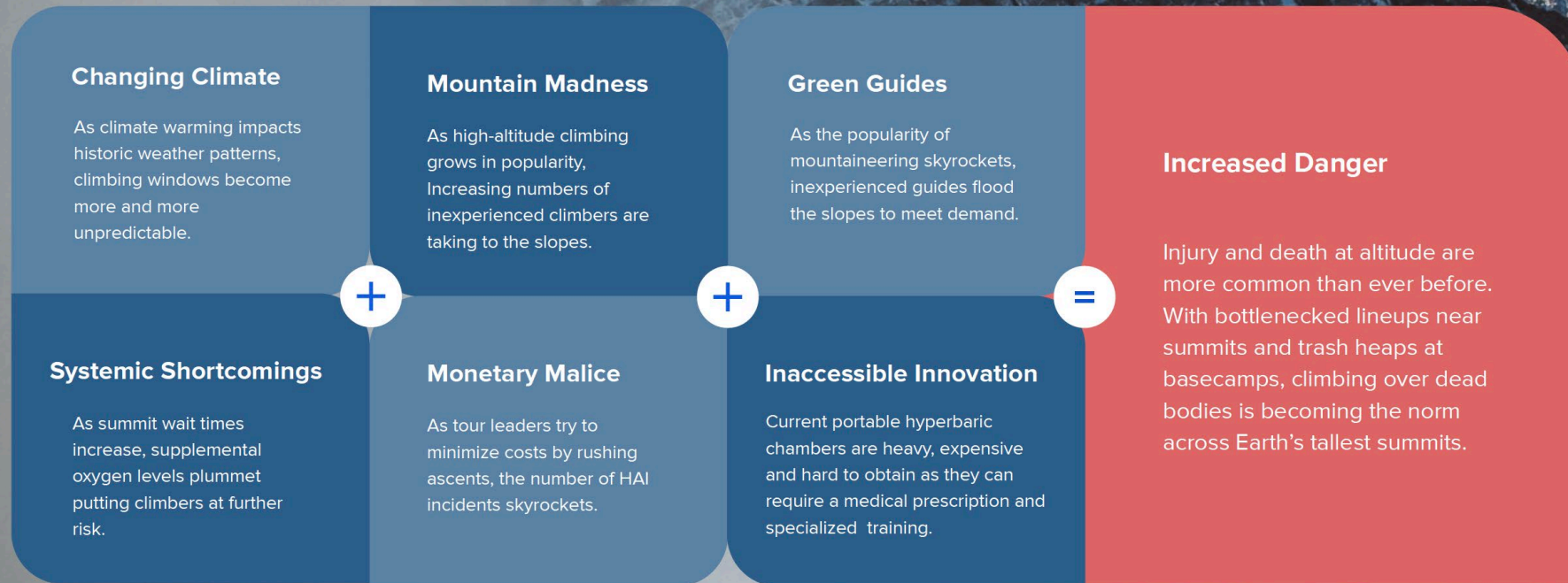
Final Evaluation

Report development
Student self-reflection
Peer evaluation

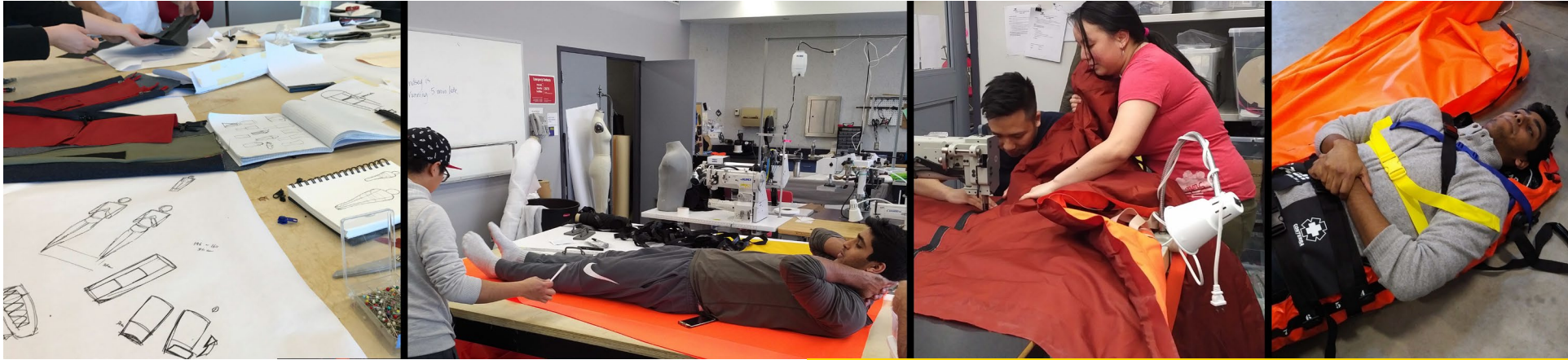


Expansive Methodology

Defining the Problem



Expansive Methodology



Design Development Project Burrito 2017

Projects are:

- Collaborative, explorative and technically demanding
 - Meaningful: Challenge-based
 - Set in high-risk environments / Unpredictable / Unfamiliar contexts
 - All Prototyping is on-site in speciality labs with Industry donated materials
- Learning with **EXPERTS in: BODY/ PRODUCT / USER**

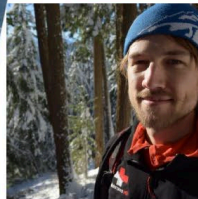
Expansive Methodology

EXPERTS
2020

Body : Physiology
Product : Technology
Users : Risk Mitigators



Wendell Uglene
Manager of Research and Technology,
Mustang Survival Corporation



Dr. Steven Roy
High Altitude Medicine Expert,
Remote Medical Trainer,
Wilderness MD



Elizabeth Rose
Author,
Canadian Mountaineer



Maxim de Jong
Founder and President,
Thin Red Line Aerospace



Dr. Sanja Savic
President and Safety Director,
BaroMedical



Dr. Anthony Chahal
President, Canadian Society of
Mountain Medicine
Emergency Medicine Expert



Capt. Chris Dare
CAF Officer,
Canadian Mountaineer

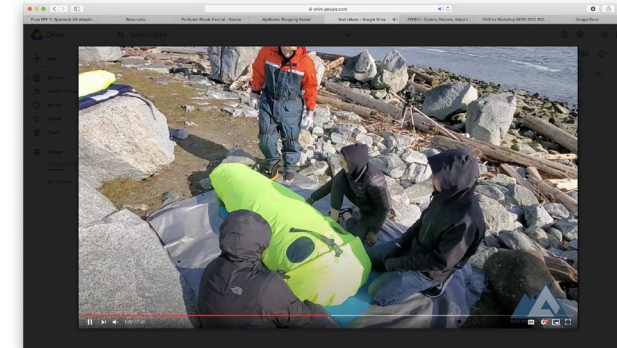
And also thanks to
Alex Biem, Klause
Kallesøe of
Baromedical,
Stephanie from the
physics department

Prototyping & Testing

		R	E	C	K	Donning	Access	Cleaning	Transport	Fit
X Zipper		-		-	-	+	+			
Zipper Guard		+					-			
Zipper T Pulls						+				
Six Way							+			
Inflatable		+		+	+	-				
Removable Inflatable								+		
Dual Valve Inflatable										+
Hood Cinching				+		-				+
Side Cinching				+		-				+
Length Adjustment				+		-				+
Handles									+	
Neck Baffle		+		+						

Design Evaluation Matrix: Project ENIX: Burrito 2019

- R Radiation
- E Evaporation
- C Convection
- K Conduction



<https://www.youtube.com/watch?v=UImJ1Q7NYJc> Field Testing ALTA 2020 (bottom)

New Extremes: 'Fire Weather'



2024 Project: Clean Air Shelters to mitigate the effects of smoke exposure for BC Wildland Firefighters

Timelapse O-tent deployment Mar 2024

Full project video: <https://www.youtube.com/watch?v=XvEBjN3IOHw>

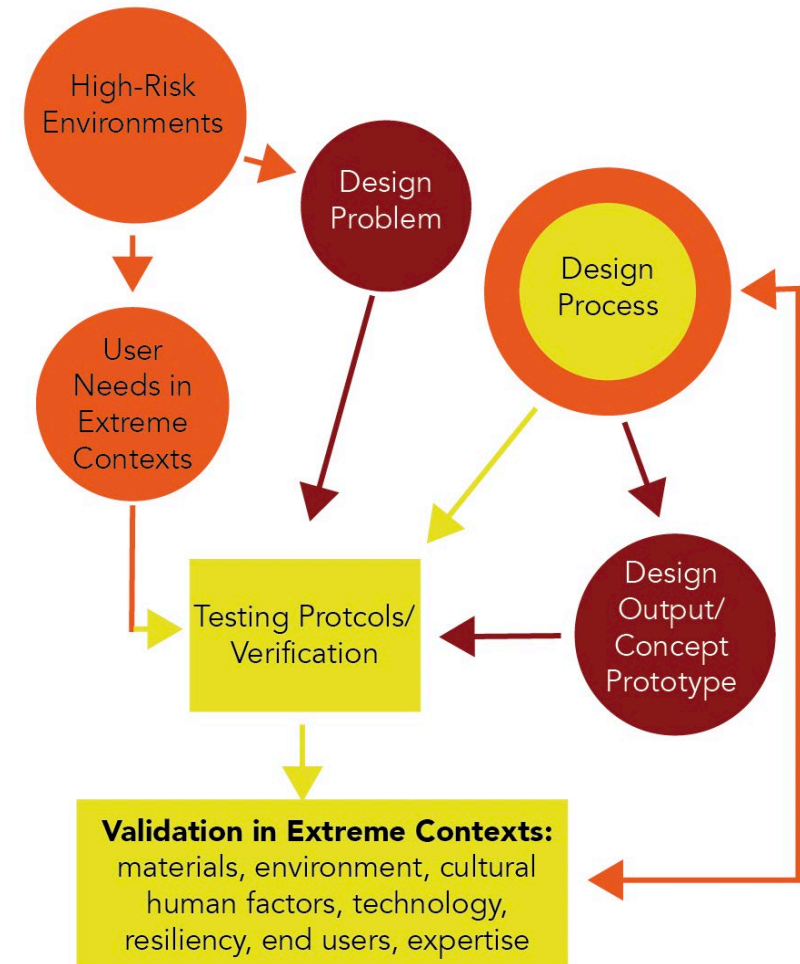
Design Validation:



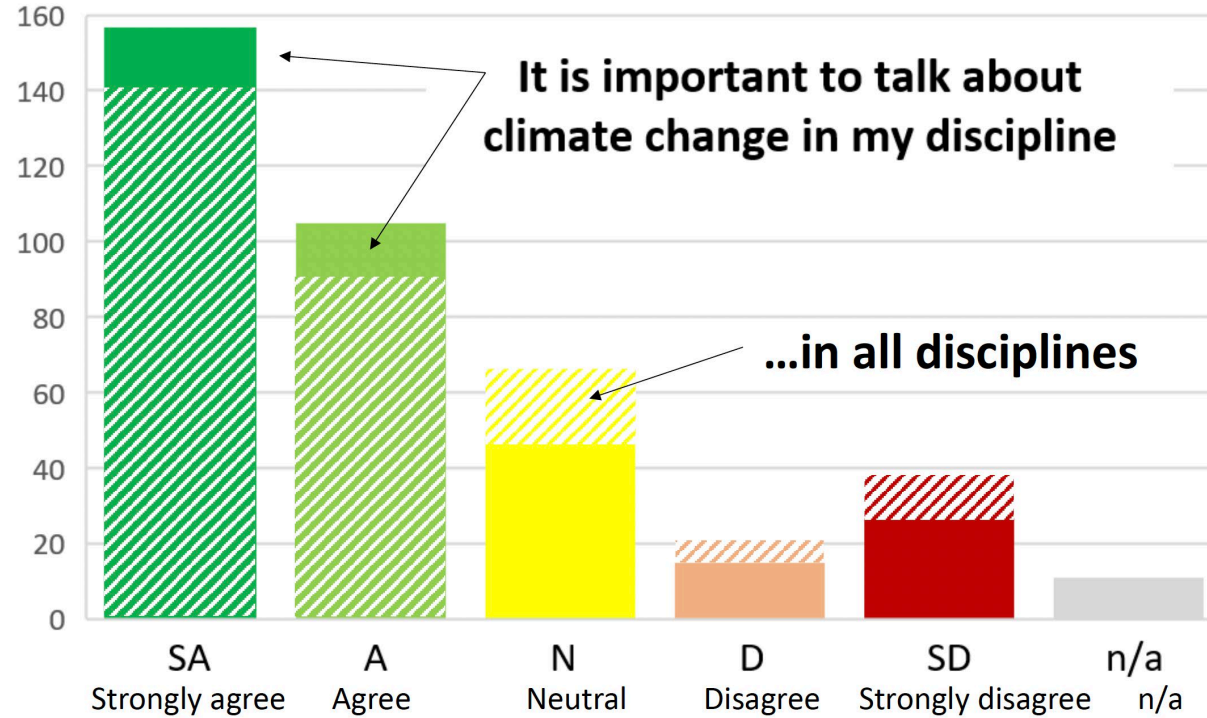
KPU team designs protective tents for wildfire crews

24 hours ago | News | 3:30

Design Validation O-Tent Summer 2024



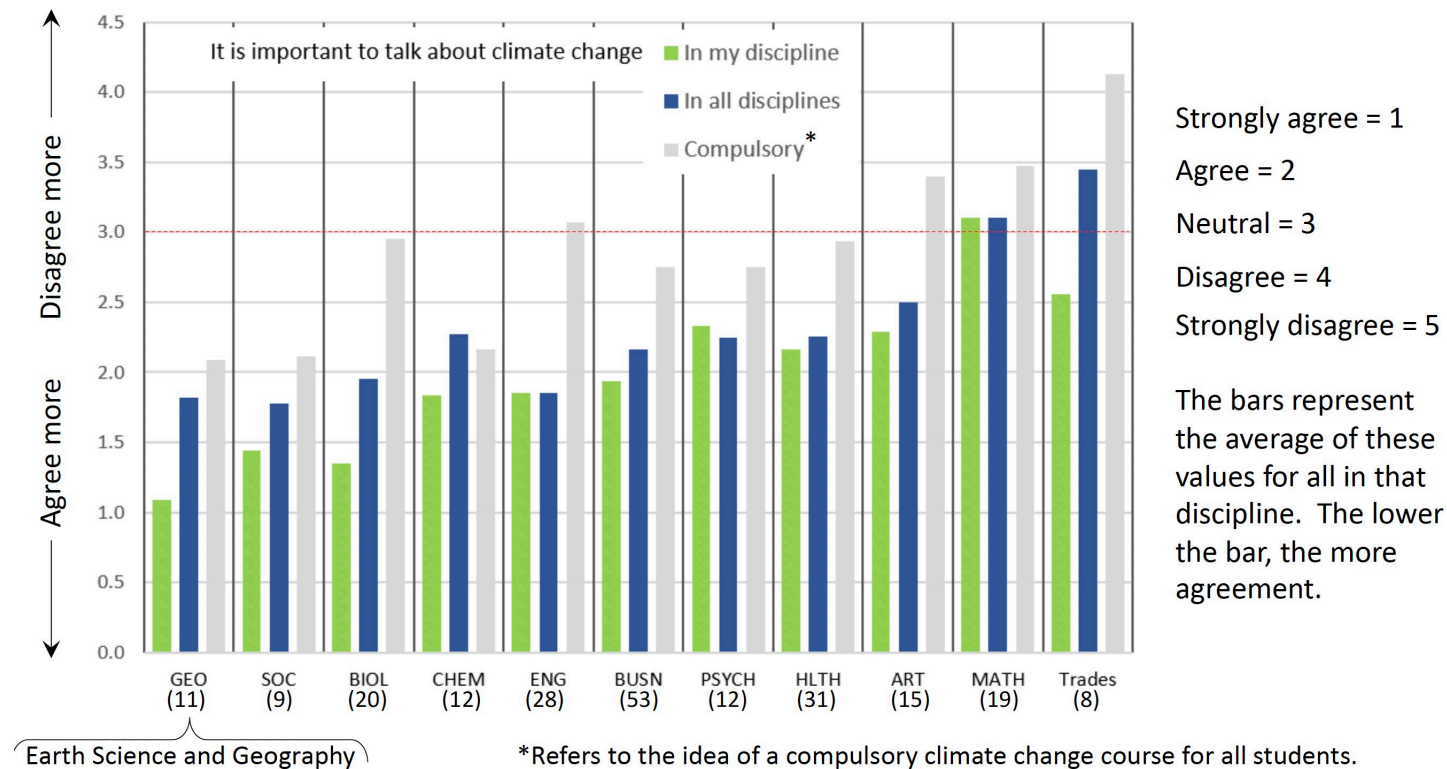
Federation of Post-Secondary Educators (BC) / Climate Action Standing Committee : **What we heard from Faculty across BC...**



Interdisciplinarity when teaching climate

Federation of Post-Secondary Educators (BC) / Climate Action Standing Committee : **What we heard from Faculty across BC...**

“It is important to talk about climate change” – by discipline



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