Adaptive Windbreaker Jacket for Men with Lower Body Mobility Differences

Josh Penrod and Kristen Morris, Colorado State University, USA

Keywords: Adaptive apparel, functional clothing design, outerwear, disability

Mentor Statement: This adaptive windbreaker jacket was developed as part of the student's senior-level capstone course and an independent study. The student focused on adaptive outerwear for their capstone collection, which is not well designed into. The student conducted extensive user needs and market research, ideated the collection based on his chosen target market's needs, patterned, prototyped, and developed the final garment over two semesters. This ensemble is one of six garments in a larger project. The student was mentored on this project throughout all design and development stages, specifically ideation, 3D renderings, patternmaking, technical development, fitting, and developing the technical package using Backbone PLM (product lifecycle management) software. The mentor provided summative design critiques throughout the capstone course, including additional learning on advanced garment manufacturing techniques and how to apply technology in garment design to meet consumer needs in the final garment creation process. This garment was selected for submission based on the elevated level of innovation highlighting the use of Bemis SewFree technology and the student's experimentation with patternmaking and constructing SewFree garments with trend-forward style for consumers with disabilities. The resulting design exceeds the features and functionality of adaptive outerwear available.

Statement of Purpose: This project aimed to address weather protection and mobility of men with lower body mobility differences who use wheelchairs for mobility assistance. The adaptive windbreaker was designed with features that make it easier for people to move in while wearing

Image 1: Fashion-forward colorway options for the target market.

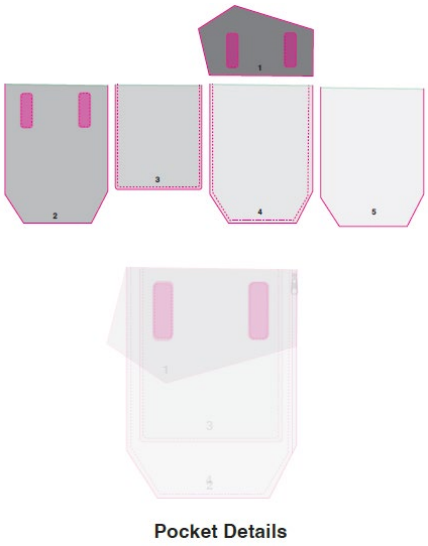

Image 2: Pocket details for front pockets.

© 2023 The author(s). Published under a Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

it and adjust to different weather conditions. By developing this product, I hope to promote inclusivity and diversity in the outdoor industry.

Market and User Research: After analyzing products from the mass-market outdoor and the adaptive apparel market, it was clear there was a disconnect between apparel for consumers with lower body mobility differences and those who do not have these needs. Traditional mass-market outdoor products have a youthful edge with sleek designs. Adaptive outerwear lacks comparable modern designs despite more recent innovations in adaptive closures and construction technologies, like Bemis SewFree and tapes, that could be applied to develop inclusive products. Therefore, to understand the needs of my target market, I read online articles and research papers. I read transcripts of interviews of men with lower body mobility differences, and I participated in a focus group where this market was represented. From these experiences, I found that my target market desired modern and trend-forward outerwear jackets, but they could not find designs specifically with their needs in mind. From there I started researching Bemis technologies and found that Bemis SewFree tapes could be used to construct low-profile seams while also creating a waterproof barrier, all of which is implemented in this adaptive windbreaker design.

Aesthetic Properties and Functional Design Features: From the interviews and focus group, I developed a list of functional and aesthetic features to include in the design. The functional features addressed mobility, comfort, easy on/off, adaptive to weather conditions, and chafe-free seams. The aesthetic qualities included bold colors and subtle textures to make the windbreaker more fashionable. I addressed the need for an increased range of motion and repeated forward arm motions through wider armholes and sourcing stretch woven fabric. The length of the jacket is shorter in the front and longer in the back with a shirttail hem. The longer back is needed to shed rain away and keep the wearer's lower back covered in poor weather when reaching and bending. To address thermal comfort and water protection, I chose Polartec Neoshell, a lightweight, breathable, and waterproof fabric, to prevent overheating or discomfort. Polartec NeoShell is a revolutionary 'waterproof'/breathable fabric by creating a fabric that allows for the continuous release of heat and moisture vapor. The air exchange between the inside and outside of the garment keeps the wearer comfortable while being protected from the elements. Unlike other waterproof/breathable, NeoShell does not require a buildup of pressure inside the garment before the moisture vapor moves across the polyurethane membrane. Additionally, the jacket features two large cargo pockets. The pockets feature multiple interior pockets, and they close with a hidden magnet. The center front zipper is a magnetic one-handed zipper. The jacket construction used a combination of traditional sewing and Bemis SewFree tapes. I used traditional sewing in repetitive stress/strain areas to reinforce the seams and added Bemis tapes to maintain the waterproof barrier. The trend-forward features included a modern silhouette and trendy colors.

Process and Execution: The first step in the design process was to create the design for the adaptive windbreaker in CLO3D using an Alvanon Men's 38 virtual dress form, of which the department has a physical dress form. After I developed the initial CLO3D design and fit it in

© 2023 The author(s). Published under a Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

3D, I exported the pattern file from CLO3D into Adobe Illustrator. In Illustrator, I simplified the lines and removed extra lines and pattern labels to prepare for cutting using a laser cutter. I used a laser cutter to cut out the pattern pieces because it could precisely cut the patterns from the chosen fabric while also melting the edge of the synthetic material. This provided accurate and consistent cuts and easier seam tape application. After cutting the pieces, I used Bemis SewFree tape and an industrial lockstitch machine to construct the garment. Once the prototype of the windbreaker was assembled, I fit it on the physical Alvanon dress form. Changes to the fit, pocket placement, and other adjustments were noted, photographed, and documented in the tech pack developed simultaneously using Backbone PLM. Next, I adjusted the patterns in CLO3D based on the fitting notes and created a new prototype following the same process. I repeated this prototyping process until the final product met my desired standards.

Contributions: Overall, this design was a direct outcome of primary and secondary research with men with lower body differences. In reflecting on the design process, using CLO3D and industrial laser cutters helped streamline the prototyping process and ensure that the windbreaker was produced efficiently and accurately. This allowed for more time and resources to be dedicated to perfecting the design and functionality of the windbreaker for my target market.

© 2023 The author(s). Published under a Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

© 2023 The author(s). Published under a Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.