PACT Travel Golf Equipment and Apparel

Travel Golf Apparel and Equipment

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Table of Contents

Project Overview

Golf, for those who don't play, is a very misunderstood game. Often perceived as high class or even pretentious, but golf is more than that. It's a game where athletes are consistently pushing for better shots, lower scores, and improved experiences on the course. The perfect or "pure" golf shot is something that every golfer hopes to experience and works towards on every shot. The pure shot moment is an instantaneous revelation that unfolds effortlessly, solid and serene, and unveils the perfect golf experience. It is a mental euphoria that ignites the obsession to repeat the moment, a desire that grows with each successful shot. Golf is a sport that requires dedication and precision dependent solely on the player, and the "pure" shot is the goal that drives the addiction to consistently play better.

Players often begin with their local courses when learning, but after time the desire grows to conquer new courses and thus destination golf begins. Players travel to scenic courses all over the world to experience new challenges, beautiful courses, and have a fun time with friends. Many famous courses are also a bucket-list item for golfers, with rich golf-histories that players want to experience and be a part of. Destination golf is much more than trying a new course, it's a new experience, a new challenge, and a great way to enjoy the outdoors.

Product Classification

This line is called the PACT product line. The line is classified under the apparel and equipment fields. The equipment is a golf bag that also serves as a long-distance air travel bag. Current traveling golf bags are an expensive secondary piece that a golfer must purchase to safely travel with their clubs. These bags typically act as a slipcover and do not provide any additional protection for clubheads. The PACT bag eliminates the need for an additional travel

bag while also conveniently storing anything a golfer might need on the course, and providing ease of mind that their club heads are protected.

The PACT apparel is a waterproof jacket and an insulated vest that are packable and easily stowed in the golf bag. Golfers that are prepared often pack essentials in their bag pockets. Current and typical bags only allow users to fit either a jacket or a vest in their bag, both limiting space for other equipment and reducing ease of access (Golf.com, 2023). Easily packable apparel gives the golfer more space for other supplies, offers quick and easy application, and provides a worry-free packing experience during fall, winter, and spring golf. With the growing popularity of destination golf, and the current hindrances of traveling with golf clubs, these design questions have been formulated…

Golf Bag: How can we create a golf bag for traveling golfers that eliminates the need for an extra golf bag, while offering increased head protection, and storage options for the convenience of the traveling golfer?

Apparel (Jacket and Vest): How can we create packable golf apparel that can be packed efficiently, creating a comfortable distraction free experience in the cold and/or rainy weather?

User

The targeted user for this thesis project is intermediate to advanced golfers. There is no gender associated with the PACT travel bag. The user in mind for the bag is someone that enjoys destination golf and is excited to participate in golf during the off-season. The users for the apparel are males in the age range of 18-70. These users will most likely be dedicated golfers that play at least once a week.

Jobs To Be Done

For this project, there are many elements and features that need to be considered. To break it down into smaller pieces, the "jobs to be done" analysis was be used to make it more manageable and to make sure the designs fulfill its requirements.

For the bag, the jobs to be done are:

1. Carry and transport golf clubs safely,
2. Have convenient on course storage for supplies,
3. Quick access to golf equipment,
4. Protect clubs during flight,
5. Durable and abrasion resistant,
6. Rollability for airport transport.

The apparel jobs to be done are uniquely different from the bag, but still pose a challenge to design for. These jobs to be done include:

1. Storage options,
2. Easily packable and deployable,
3. Stay dry and protected,
4. Zoned for mobility,
5. Comfortable with layering.

History of Golf

The origins of golf have been a subject of debate. While it is widely believed that golf started in Scotland, some researchers believe it began in China. The real beginning of golf was in Leonen can de Vecht in 1297 (Johnson, n.d.), where the Dutch participated with a leather ball

and a stick. However, the modern sport we know today started in Scotland in the 15th century (Johnson, n.d.).

During this time, Scotland was under the constant threat of invasion, this meant that the men needed to focus on training which led to golf being banned. It wasn't until 1502 when King James IV of Scotland became the world's first monarch that actively played golf (Johnson, n.d.). Golf quickly spread throughout Europe. By 1750, golf evolved to a sport that is similar to what we know today, however, it was just three holes per round. The pivotal golf moment in golf history came in 1764 when the first ever 18-hole course was developed in St. Andrews, Scotland (Figure 1), solidifying the country's reputation as the home of the sport (Johnson, n.d.).

Figure 1 Historic image of St. Andrews (Dunhilllinks, n.d.)

Shortly after, in 1774, a group of Edinburgh golfers decided to write an official rule book for golf (Bellis, 2020). This sparked major growth in the century, where golf started to spread around the world. Golf crossed the Atlantic and came to New York in 1869, which coincided with a flurry of Scottish immigrants coming to the United States. Within 15 years, numerous tournaments and competitions called for the standardization and enforcement of golf rules. This

led to the formation of the USGA (United States Golf Association), that oversaw the sport of golf in the United States (Nochud, n.d.).

History of Golf Apparel and Equipment

As a result of golf becoming more regulated in the 1880's, the need for golf equipment became more pronounced by the public, leading to the creation of the first golf bag. Initially crafted from canvas and leather (Figure 2), these bags featured metal bottoms for protection and stability with a much smaller circumference for clubs than the modern bags we see today (Kellerman, n.d). This type of bag was adequate for the short holes and rounds that they were playing at the time.

Following World War II, golfers more consistently played 9-hole rounds that the existing bag was not suitable for. The need for innovation was clear as players needed to carry more clubs, required new storage for balls and equipment, and the old bag was too heavy, and the shape was not well suited for fitting in golf carts. Today's golf bags are focused on similar guidelines. That being the weight, durability, and storage of clubs and other accessories (History of Golf Clothing, 2022).

Figure 2 Original golf bags used in the 19th century (Kellerman, n.d)

Golf apparel in the 1930's (Figure 3) started as short pants and tweed jackets (History of Golf Clothing, 2022). The next round of apparel focused more on style while sacrificing comfort and breathability. Players in the 1940's started to become more focused on performance and were seen wearing specialized spiked golf shoes, golf hats, and water-resistant jackets. The focus during this time was on comfort, quality, and durability. Now, golf apparel is moisture wicking, lightweight and stretchy. The apparel on the market today also tailors to different styles, from traditional to bold and vibrant patterns (Figure 4).

Figure 3 Golf apparel in the 1930's (Allen, 2022)

Figure 4 John Daly golf apparel (Caruso, 2022)

Market

The COVID-19 pandemic forced more people to play sports outside, and golf was an ideal game for that. As a result, "in 2021, we saw more rounds of golf played in the US than any other year in history" (LoRé, 2023). Growth has not been restricted to the US as 66 million people play across the world, and that number has steadily been increasing since 2016. The sizable increase in golf participation led to more golf tourism, also known as destination golf, which can be described as people that make trips with the intention of playing golf at new

courses around the nation or world. In 2023, golf tourism brought in 23.1 billion dollars (Micheal, 2023).

This project is for intermediate and advanced golfers as they are willing to play in the rain and destination golf. However, beginner golfers should also be kept in mind, as they also may desire to travel or play golf in all weather. Adding beginners in this market also opens a broader market for the products in this project. According to USGA index tracking in 2020, roughly 65.5% of golfers fall into the range of 10-25 handicap (beginner to intermediate) (Berhow, 2020). Assuming there is a similar bell curve in 2023 and using the estimation of 66 million players around the world (currently), that means about 263 million players are in the market for these products.

Environment

The focus environment is the pacific northwest in the United States and similar regions, nationally and internationally. Which, during the summer, is moderately warm and dry. The average is around 75 degrees Fahrenheit (National Weather Service, 2023). The winter, however, is quite variable. While the temperature stays around 40-50 degrees Fahrenheit, the wind and rain is commonly on and off throughout the day. Storms can also roll in quickly, making it hard to adjust on the golf course. The apparel in this project is geared toward fall, winter, and spring months when the weather is more variable.

The golf bag will be used year-round as it is focused on destination golfing. This often happens when there is an off-season in one state, so golfers often opt to travel to a warmer location to golf. Other circumstances, however, include golfers wanting to experience scenic courses and new challenges. Regardless of the occasion or destination, it is still essential that users are prepared for any weather, as destination courses can reach prices of up to $720

(Golfshake, 2022). Golfers need to be prepared for any weather conditions when scheduling non-refundable, expensive tee times.

As a result of increased golf participation, more athletes are having to play in all weather conditions. This applies to both those who can't afford to travel to warmer areas during the off season, and destination golfers as they often experience unexpected weather while traveling. Fall, Winter, and Spring bring inclement weather across the world, adversely impacting off season golf. While it's often assumed most people would stay inside during the off season and opt out of a golf round or training, that is not the case, as 66.4% of people will play golf in light rain, and 49.8% of people will play in heavy rain (Golfshake, 2020). This brings the need for wet and cold weather golfing gear such as jackets, and vests that not only protect the athlete and equipment from rain, but also frigid winds. Even though golfers are willing to play in rain and wind, most golfers are planning on good weather when they call-in tee times. This makes it necessary to pack garments for weather protection in the golf bag, which can be a challenge to remember when bringing a long list of equipment such as water bottles, snacks, alignment sticks, and more. To be fully prepared on the course, it is recommended that golfers always have weather protection packed in their bag (Golf.com, 2023). When forgotten, this results in a wet, miserable day, or a canceled tee time. Having a rain jacket and warmer layer, like a vest, that live in a golf bag is essential for remaining prepared for any weather on the course and will lead to more fun and increased performance.

While the focus is the off season (fall, winter, and spring), the golf bag should be usable year-round. Both destination and weekend golfers are required to put their clubs in the car or even a plane. The bag needs to protect against these harder surfaces when loading and unloading golf clubs as well as protection from falling or thrown luggage. In addition to external impacts,

clubs excessively clanking together also causes damage to clubs. While the everyday weekend golfer has control over their clubs and how they treat them, the destination golfers do not. Golf bags, being treated as standard luggage, are subject to rough handling. Which can result in broken heads, and disappointment when arriving at the destination. With some sets of golf clubs being worth $3000 or more. Club protection during travel is a top priority.

Rules

The golf rules worldwide are regulated by the USGA (United States Golf Association) and the R&A (The Royal and Ancient Golf Club of St. Andrews) (Rules of Golf, 2024). Rules apply to the apparel the players are wearing, not the bags. Apparel cannot assist the player with alignment, store and release energy, and lastly it cannot inhibit or enhance movement (Equipment Rules, 2023). While the USGA is the main regulatory body, many golf clubs and courses have their own rules. Each club varies, though the main course rule that applies across the board is players must wear pants (no jeans) with a collared shirt (Golf Etiquette, 2023). However, clubs do not have rules against any cold weather apparel. While most of these rules don't apply to this project, they are still good to keep in mind.

Current Golf Bags

The current bags on the market are either meant to carry golf clubs on the course, or they are meant to hold and protect club bags for transportation. While some standing golf bags offer a hood for traveling, none offer additional travel protection. The current travel bags on the market wrap around the golf bag and are not meant for use on the course. Popular stand and travel bags on the market include the Vessel Player Pro Stand Bag (Figure 6) for $435, and the Tour Trek

TC Pro (travel) Bag for $160 (Figure 7). The chosen bags were some of the highest rated bags on the market.

Golf Bag Product Anatomy

The common standing golf bag comprises seven different parts: the legs, the leg deployment system, back straps, the club divider, the back padding, and storage pockets (Vessel Player IV, n.d.) (Figure 5). The legs and the deployment system ensure that the bag stands on its own and deploys quickly. The club divider organizes clubs and prevents some clanking. The padded back straps are for carrying the clubs while walking. The back panel for padding, and comfortable walking. The current bags also feature an array of storage pockets for drinks, equipment, and more. Travel bags, on the other hand, are simpler than stand bags. They have three common parts on them: handles, storage pockets, and a rolling base. Multiple handles allow for easy lifting. Outer pockets which are meant for shoes and other equipment. The rolling wheelbase is for easy transportation in the airport or other hard surfaces (Figure 6).

Each part of the golf bag is made of different materials. The common materials used for the outside of the bag is a high denier polyester, nylon, or a synthetic leather, all of which repel water (Figure 5) (Pamela, 2022). The club divider is made from a high-density polyethylene with a nylon microfiber lining that dampens sound and protects the club shafts. The straps for the bag are made from the same material as the bag but also consist of a spacer mesh that is used to pad the shoulders for walking. The back panel of the bag is either made of a spacer mesh or neoprene material to prevent impacts and bruising. The stand system is often made from a high-density polyethylene that is durable and can withstand repeated impacts with the ground (Vessel Player IV, n.d.).

Figure 5 Golf Bag Anatomy Vessel Player Bag (Vessel Player IV, n.d.)

Travel bags on the other hand, have different parts and materials that are meant to protect clubs during travel (Figure 6). The outside of the bags is commonly made from a high denier polyester which protects from abrasion. Travel bags also feature a polyester padding that goes across the top of the bag to protect the heads of the clubs from impacts. The bottom of the bag consists of PU wheels with a vinyl wrap that establishes durability and easy rolling on hard surfaces (TourTrek, n.d.).

Figure 6 Travel Bag Anatomy (TourTrek, n.d.)

Bag Manufacturing

The bag manufacturing process consists of five steps (PGM Bag Process, 2022) (Figure 7). First, fabric pieces will either be cut out by a factory worker, or a computer automated machine. Next, the fabric pieces are embroidered with graphics. While this is happening, smaller pieces of the bag are being built by production workers. This includes pockets, handles, and the carrying straps. Next, the smaller pieces are sewn to the bigger pieces and outer layer of the bag has been assembled. The injection molded bag base is attached to two long metallic poles on each side to give the bag structure. The fabric parts of the bag are then slid onto the bag. After this, the club divider is hammered on top and both sides of the bag are riveted down to ensure stability and durability. The bag is then passed onto quality assurance before it is packaged and delivered.

Figure 7 Golf bag manufacturing (PGM Bag Process, 2022).

Bag Competitor Analysis

The golf bags chosen for the SWOT are the Vessel Player Pro golf bag (Figure 8)., and the Tour Trek TC Travel Golf Cover (Figure 9). These are two of the current top products in the golf bag space (conventional bag, and travel bag). The Vessel Pro bag features multiple pockets, a club divider lined with microfiber fabric, back straps for walking, multiple handles, and waterproof durable materials. The Tour Trek Cover has specified storage pockets, club head padding, minimal weight, wheels for transportation, and quality materials. The weaknesses for these bags are that they are not interchangeable, they cannot be used as a travel bag and vice versa. This is one of the main opportunities. Other opportunities include packable back straps, divider for a putter, and specifically for the travel bag, a way to strap the clubs in to reduce clanking and club damage. However, the threats to these design opportunities involve addressing the complex integration of travel without compromising the ease of use. These innovations need to be easy for the athlete to use while allowing for an easy transition between “travel mode” and “course mode.”

Vessel Player Pro Golf Bag

$435

	Strengths	Weaknesses	Opportunities	Threats
Storage	Multiple pockets	No travel storage	Hard pockets for travel storage	Hard pockets could change aesthetics
Legs	Easily fold out	no clear weaknesses	Exploration of alternate devices to hold the bag up	Durability
Club Divider	Prevents clubs from clanking Organization	No specific divider for putter	Specific dividers for short vs long distance clubs	Must be removable for club storage
Back Straps	Adjusts automatically	No easily packable	Specific storage or multi use back straps	Accessibility of the straps
Ease of Transport	Multiple handles, grip areas, and straps	Not protective of club heads	A bag that can be used for more than just playing	Needs to be easy and fast to go from transport mode to play mode
Materials	Waterproof Durable	Not abrasion or impact resistant	Making the bag abrasion and impact resistance by changing structure and material	Expense of materials and weight of the bag

Figure 8 SWOT for Carry Bag (Vessel Player IV, n.d.)

Tour Trek TC Travel Golf Cover

$160

	Strengths	Weaknesses	Opportunities	Threats
Storage	Specified pockets for show storage	Hard pocket storage for club heads	Hard pockets storage for driver/ wood/hybrid heads	Hard pockets could change aesthetics
Ease of Use	Full zip in the front	Bag must be laid down to put clubs in	Easier way to store clubs for travel	Maintain max protection
Club Protection	360 Padded cover for clubs	Doesn't prevent clubs from clanking Club shafts at risk of snapping	A way for the clubs to snap in to prevent movement	Durability
Weight	Only 6.6 pounds by itself	Still have to pack club bag inside it	Make the club bag transferable to a protective travel bag	Complexity of design
Ease of Transport	Multiple handles, grip areas, and wheels	Not ergonmic	A bag that works with your body and provides an easy way to carry	Bag should still maintain a nice shape
Materials	Waterproof Abrasion resistant	Nylon can rip easily	Use materials that are durable and transferable to the course	Expense of materials and weight of the bag

Figure 9 SWOT for Travel Bag (TourTrek, n.d.)

Current Golf Outerwear

Some of the top apparel brands in the golf market are Adidas and Galvin Green. Galvin Green is much more premium than Adidas and features more material and fit innovation. Adidas, however, does have a more aesthetically pleasing look to it, and is more affordable for the general public. The Adidas rain golf line is called Rain.Rdy, which includes both a jacket and pants. Both of which feature waterproof material that is made from recyclable materials, stretch fabric, and adjustable cuffs to fit different body types (Figure 10). This set features a $280 jacket (Rain.Rdy Review, 2023). On the other end of the price spectrum, there is Galvin Green. Galvin Green top of the line rain set has a $720 jacket (Figure 11) (Alister, n.d.). This jacket has features unlike any other golf apparel on the market and have given a lot of thought to materials, patterning, and fit. Galvin Green Alister Jacket features breathable, waterproof material. The jacket also has unique methods of adjustment to ensure proper fit for each body. They also have strategic zoning throughout the jacket that allows for full range of motion during the golf swing.

Figure 10 Adidas Rain.Rdy Jacket (Rain.Rdy Review, 2023).

Figure 11 Galvin Green Alister Jacket (Alister, n.d.).

For golf vests, there are two stand-out products on the market, the Callaway Chevron Welded Puffer Vest (Figure 12) and the Sun Mountain Colter Vest (Figure 13). Each has their own advantages. The Chevron Welded Puffer Vest retails for $135 and is a high lofted vest that is meant to keep the golfer warm, but still mobile in cold weather (Chevron Puffer, n.d.). The Colter Vest on the other hand is cheaper and retails for $120. This vest is a low-loft vest that has higher thermal efficiency and is zoned with stretch panels for optimal mobility (Colter, n.d). Both vests feature a stand collar that protects from wind, however, can get in the way when layering with a rain jacket or other golf apparel.

Figure 12 Callaway Chev Vest (Chevron Puffer, n.d.)

Figure 13 Sun Mountain Colter Vest (Colter, n.d).

Apparel Anatomy

For state-of-the-art golf jackets, there are a lot of pieces that come together to make a high-quality product. For this exercise, the Galvin Green Alister jacket will be analyzed (Figure 14). The main body of the jacket is made from Gore-Tex C-Knit™. This fabric is used for the body, the collar, and the lower back panels of the jacket. Gore-Tex C-Knit™ fabric allows the jacket to simultaneously vent while also protecting from the rain. The collar of the bag is essential for protection from the wind and elements, especially since the jacket does not have a hood. The shoulder panels are made from a Techsteel™ fabric that is added for abrasion resistance when carrying the bag. The jacket has adjustments on both the torso and the sleeves. A hook and loop system is used to allow for quick and easy adjustment. The jacket pockets are made from the same Gore-Tex™ fabric, but also have Aquaguard zippers to ensure no rain can penetrate the jacket. The stretch zones on the jacket are the elbow and lower back panels which

are both made from a Gore-Tex C-Knit™ fabric (Alister, n.d.).

Figure 14 Galvin Green Alister Jacket Anatomy (Alister, n.d.).

A high-end insulated vest on the market is Callaway's Welded Chevron Puffer Vest from (Figure 15). This vest features a nylon fabric for durability as well as a textured fabric to bring dimension to the piece. The lightweight insulation helps keep the user warm during a cold round of golf. The sleeveless design is used to promote unrestricted movement. This also features a full double-zip closure for easy layering. An extra feature on the vest is the sinch hem that allows a sense of adjustability for the user.

Figure 15 Anatomy of Callaway Welded Chevron Puffer (Chevron Puffer, n.d.)

Apparel Manufacturing

The rain apparel manufacturing process has five steps (Figure 16). The first step is treatment of the fabric. Since this is waterproof fabric, it must be treated with specific chemicals that make it water resistant. The fabric is then heated to ensure evenly dispersed chemicals for water resistance. The second step is pattern cutting. While this step is commonly performed by a laborer, there are also computer operated systems that make this step go faster. The third step is where small parts of the raincoat are sewn together. This includes sleeves, zippers, and pockets. Step four is adding the smaller constructed parts of the jacket sewn to the larger pattern pieces to complete the jacket. The final step is adding the hardware and trim pieces such as zippers and zipper pulls. After this, the jacket is often seam sealed using a machine to fully seal any sewing holes made from construction. Then, the apparel is sent to quality assurance before it is packaged and shipped (Fibre2Fashion Jacket Production, n.d.).

Figure 16 Rainwear manufacturing process (Fibre2Fashion Jacket Production, n.d.).

To manufacture a insulated vest, there are five steps (Figure 17). The process begins by cutting out pattern pieces, layering the fabric, and cutting all layers at once with a blade that improves efficiency. Then, there is a computerized quilting system that sews in the baffles more accurately than a production sewer. Next, the cotton is pulled apart and stuffed into the baffles sewn by the computerized machine. After that, production sewers sew in other details and

construct the jacket. Once that process is complete, trims such as buttons and zippers are sewn on before it is sent to the final quality control check where they check for defects before packing the garments and transporting them (How to Make a Good Quality Puffer, 2021).

Figure 17 Insulated garment manufacturing process (How to Make a Good Quality Puffer, 2021)

Apparel Competitor Analysis

The two competitors for the rain jackets in the golf space are the "Adidas Rain.RDY Full Zip Jacket" (Figure 18) and the "Galvin Green Alister Jacket" (Figure 19). These products were each split into six different parts, the collar, stretch zones, cuffs, pockets/storage, fit adjustment, and materials. The Rain.Rdy Jacket is the more affordable of the two and features a classic collar with stretch fabric, adjustable cuffs, and multiple pockets. The Galvin Green Alister Jacket has similar features such as a windproof collar, stretch zones throughout the jacket, adequate storage, and quality materials.

Overall, some of the weaknesses of the two jackets are hooded protection, strategic pocket location, and material choices for aesthetics. Most golf jackets on the market currently do not have hoods. As a result, there is an opportunity to add hood protection for rainy days on the course. Another opportunity that was found is strategic pocket location. The chest placement pocket on the Adidas jacket interferes during a right-handed swing with objects in this pocket. The last opportunity identified is the need for a more aesthetic jacket. Additional zoning would

increase overall visual interest and mobility. The Alister jacket includes various materials and textures that don't flow well, creating a crowded garment, that is not aesthetically pleasing. There is an opportunity here to capitalize on by having efficient zoning while still maintaining aesthetic appeal.

Figure 18 SWOT Rain.Rdy Jacket (Adidas Rain.rdy, 2023).

Galvin Green Alister Jacket

$719

	Strengths	Weaknesses	Opportunities	Threats
Collar	Neck wind protection Nice looking	Limited functionality Could rub against chin	Hooded protection Customization of collar	Hooded protection Customization of collar
Stretch Zones	Improved mobility Comfortable	High cost Aesthetics	Patterning innovation Selective on material appearance	Abrasion Resistance Cost of materials
Sleeve Cuff	Adjustability Easy to use	Durability of velcro	Innovation in fastening methods	Increasing complexity
Pockets	Waterproof Soft interior	No clear weakness	Easily cleanable pockets (dirty golf balls)	Material should still be soft
Fit Adjustment	Hem and Torso Great adjustment area	Velcro can catch during swing	Make it less strappy	Should be esy to adjust
Materials	Waterproof Breathable	Not aesthetically pleasing	Make the pattern and material choices blend well	Expense of fabric

Figure 19 SWOT Alister Jacket (Alister, n.d).

For the golf vest, an analysis was conducted on the Callaway Welded Chevron Puffer Vest (Figure 20) and the Sun Mountain Colter Golf Vest (Figure 21). These were chosen based on their high-rated reviews and the functionality of each. The Callaway Welded Chevron Vest is a higher lofted vest that maintains more warmth than other lower lofted vests such as the Sun Mountain Colter Vest (Colter, n.d). Some advantages of the Chevron Vest are its high warmth properties, storage options and unique quilting pattern (Chevron Puffer, n.d.). For the Colter Vest, the top features are the high warmth to weight ratio, and the stretch panels for mobility. A hybrid between these two vests would be ideal for on course and packing functionality. Merging the warmth to weight ratio and stretch zones of the Colter Vest with the aesthetics of the Chevron Welded Vest would be ideal. Some notable improvements on both the vests include strategic stretch panels that still offer enough coverage for warmth, as well as a pattern optimized for mobility. There is a unique opportunity to omit material on the back of the vest to offer

maximum mobility while keeping fabric interference to a minimum. However, the main threat to that is that the vest still needs to provide warmth to the golfer. Taking off too much material can be detrimental to the functionality. Finding a balance between these two factors will create a mobile, functional, warm, and packable vest that can be layered with a rain jacket efficiently.

Callaway Welded Chevron Puffer Vest

$135

	Strengths	Weaknesses	Opportunities	Threats
Storage	Multiple pockets	NA	Chest pocket addition	No clear threats
Insulation	Warm	Bulky	Packable insulated jacket	Retain warmth
Two way zipper	Easy adjustment	Can be distracting	Single zip or other fastening methods	Make it as least distracting as possible
Collar	Wind protection	Doesn't integrate well with a stanading jacket collar	Low profile collar	Retain protection from wind
Quilting	Welded chevrons for unique aesthetic	No clear weakness	unique baffling pattern	No clear threats

Figure 20 SWOT analysis of Callaway Chevron Welded Puffer (Chevron Puffer, n.d.)

Sun Mountain Colter Golf Vest

$110

	Strengths	Weaknesses	Opportunities	Threats
Storage	Multiple pockets	NA	No clear opportunities	No clear threats
Insulation	Weight to warmth ratio	No clear weakness	Packable insulated jacket	Retain warmth
Materials	Water resistant Quiet	Durability	Durable lightweight material	Durability often means heavier fabric
Collar	Wind protection	Doesn't integrate well with a stanading jacket collar	Low profile collar	Retain protection from wind
Paneling	Stretch panels	Stretch panel areas aren't insulated	Retaining warmth throughout vest	Maintain mobility

Figure 21 SWOT analysis of Sun Mountain Colter Vest (Colter, n.d).

Intellectual Property Landscape

The current landscape for intellectual property for golf bags is not overcrowded with patents that would hinder the ability to make the PACT golf bag. The most important patent to note is the pocket patent for the use of magnets.

Patent US783703B2, presents an invention that keeps the pocket in a closed configuration and allows for easy opening of the pocket with the addition of magnets (Figure 22). In addition to easy opening of the pocket, the patent also states that it closes itself without any additional manipulation of the user. This patent is expired, which makes it possible to take inspiration and possibly use this method in the thesis project (Smeltzer, 2007).

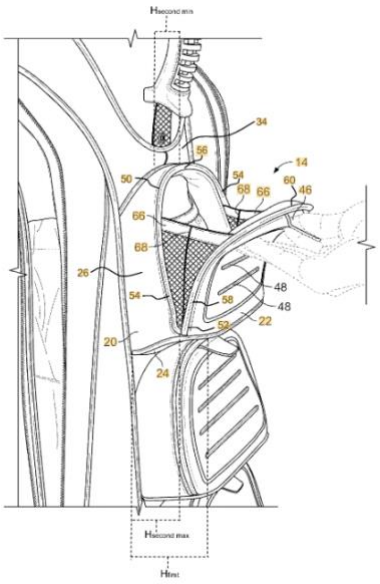


Figure 22 Patent US783703B2 (Magnetic Pocket) (Smeltzer, 2007).

For apparel, there are two patents that were found that relate to this project. The first is patent US6654963B2 - an outdoor jacket hood. The innovation in this patent is an adjustable drawstring arrangement which provides simultaneous tightening around the head as well as vertically tensioning of the hood to ensure the hood stays on the head, allows for one tensioning pull, and keeps the shape of the brim of the hood (Figure 23). This patent is not an active patent allowing a similar version of this to be used in the project if desired (Fayle et al, 2001).

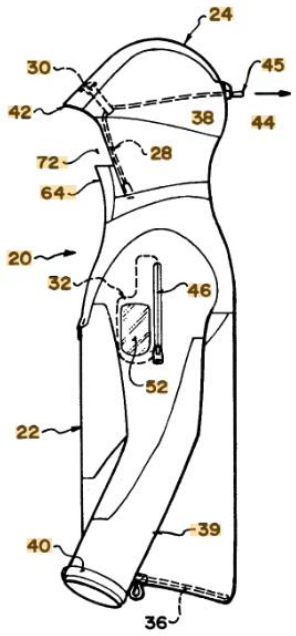


Figure 23 Patent US6654963B2 (Adjustable hood) (Fayle et al, 2001).

The other apparel patent is an active patent for a golf rain jacket collar. Patent US10092050B2 summarizes an invention where the height of the collar in the center is longer than the height of the first and second sections of the collar (Figure 24). This provides weather protection to the back and around the neck, while also maintaining comfort in the chin and front neck area (Skurla, 2014).

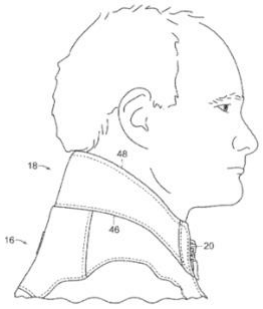


Figure 24 Patent US10092050B2 (Weather collar) (Skurla, 2014).

Current and Future Trends

Color

Current color trends for golf apparel are bold, bright colors (Alford, 2023). These colors are eye-catching and pop on the apparel and equipment as well as retro inspired colors. For example, the market currently features colors from electric blue to vibrant greens and bright yellows (Diary, 2023) (Figure 25). These colors are often considered retro as they reference the 80's and 90's. These colors are used from sportswear to equipment and accessories in the golf industry.

The aim for this brand is versatile functionality, designed to withstand tough travel environments. It is for this reason, the chosen forecasted colors are from the "Future Terrains, Prepare-Wear" trend for 2024 and 2025 (Paget, 2023). The Future Terrain, Prepare-Wear trends feature colors that are familiar but can be used in unexpected combinations (Figure 25). This theme focuses on otherworldly colors as well as how we use our resources on earth which inspires surreal combinations and creates excitement (Paget, 2023). The colors used on the PACT project are a Sea Kelp green, Intense Rust, and Timeless Taupe (Figure 25). These colors were chosen to convey durability while maintaining a high class look to the collection.

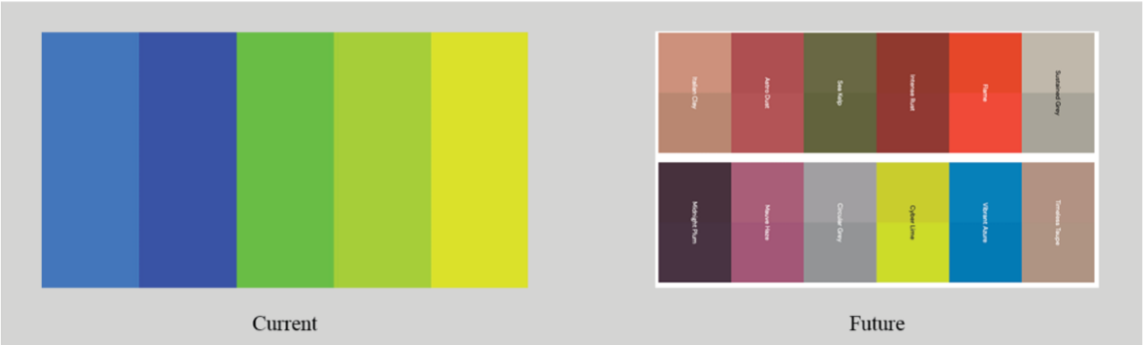


Figure 25 Current and Future Color Trends (Pagent, 2023)

Graphics & Logo Trend

Similar to the current color trends, the graphics trend features loud geometric prints as well as retro inspired patterns (Alford, 2023). The loud prints include the previous colors as well as microprints that are eye-catching. For the retro trend, current garments feature vintage patterns such as argyle or classic stripes. The future graphic trends for 24/25 is a minimalist design aesthetic (Chow, 2023). This minimalist design aesthetic will not only inspire logo design, but also the placement and size of the logo.

Current logos in the golf market are basic and do not stand out. While they are minimal, they are not visually interesting (Figure 26). The PACT logo is a minimal, geometric logo that can be resized and applied to tie the whole collection together (Figure 27). To lend itself to the future trend, the PACT logo uses abstract geometry that involves basic shapes combined to make an interesting logo (Innovative Logos, n.d.). The logo retains the classic high class golf aesthetic by maintaining a similar size and placement throughout the collection.

Figure 26 Current and Future Logo Trends (Innovative Logos, n.d)

Figure 27 PACT logo

Most current golf apparel and bags have similar logo placement throughout all brands. In figure 28, this can be seen as the conventional branding for bags are often on the big pocket, or spine pocket of the golf bag. The golf bag branding is focused on maintaining a minimal, high class feel as seen in the unconventional section of figure 28. The branding of these bags follows a conventional placement; however, the logos are smaller and more strategically placed. Branding appears on the side and spine of the bag, ensuring they are visible whether the bag is being carried or stored in a cart.

Figure 28 Current golf bag branding location (Hamel, 2024)

Current golf apparel branding goes well with the minimal theme throughout this project. As shown in figure 29, branding for golf apparel is typically a small logo on the front chest that is seen when the golfer is facing the viewer (not swinging). An additional small logo is also

placed on the back of the garment so it can be seen after the golfer has finished their swing. Logos and wordmarks are often minimal to avoid distracting the golfer and maintain the tradition of a well-dressed golfer.

Figure 29 Current golf apparel branding location (Tremlett, 2022)

With logo application, most golf brands stick to the same method of application. These applications include heat bonding, and embroidered logos. In this project, heat bonded logos were used for the branding in both the apparel and the bag. In the future, more durable branding methods should be explored to ensure the logos stay intact while traveling.

Golf Physiology

A typical male golfer will recruit 30 pounds of muscle and will use nearly every joint and limb in their body to generate an output that translates to 900 kg of force going into the ball at a

bit more than a half a millisecond impact of the ball (Wells et al, 2009). More advanced golfers have the ability to consistently level the clubface within 2 degrees from shot to shot to keep a consistent ball flight. This swing is done around 30-40 times per round which can be physically taxing for the body and the mind throughout a 5-hour round (Wells et al, 2009).

Some of the main physiological factors for golf include balance, flexibility, abdominal (core) muscle performance, peripheral (limbs) muscle performance, and cardiovascular function (Wells et al, 2009). Balance and flexibility are some of the biggest factors when creating a successful golf swing. A balanced swing ensures consistent contact while increased flexibility results in increased ball speed and carry distance. The cardiovascular demand of this sport is less than others, however it is still important to keep in mind. VO2 max refers to the amount of oxygen that athletes can utilize during the exercise (VO2 Max, 2023). Golfers only use about 35-41 percent VO2 max (Talukdar, 2019). While cardiovascular training shouldn't be overlooked, golfers should focus on more anaerobic (explosiveness and power) and mobility training.

Swing Biomechanics

The biomechanics of a golf swing is rather complicated. There are many moving parts that come together to make a golf swing. The focus will be on the hips, back, leg and shoulder muscles as those are the most active muscles in the swing. The swing is broken down into four parts, the setup, the backswing, the downswing, and the follow through (Figure 30).

Figure 30 The Stages of a Golf Swing (Howard, 2022)

The setup is how you stand over the ball and prepare to make your backswing. While this seems insignificant, a small change in the setup can change the flight of the ball. Correct setup establishes proper static and dynamic balance which is crucial to the golf swing. To start, a correct set up means a good posture, where the knees are slightly bent, the ball is in the middle of the stance, and the legs are around shoulder width apart. Too wide of a stance, will limit hip rotation while too narrow of a stance can affect the balance during the swing (Sharma, 2021). The shoulders should also be at a slight tilt (roughly 16 degrees) (Sharma, 2021). It should also be noted that 50-60% of the golfers weight should be on the back foot.

The next phase of the golf swing is the backswing. During the backswing, kinetic energy is stored in the hips, back, and feet which is then released during impact. During the backswing, sheer force is stored on the lateral side of the back foot, while it is stored on the medial side of the front foot. At this time, the shoulders, spine, knees, shoulders, and other body parts tend to rotate as the club is taken back. This is why it is required that golfers have good flexibility. Minimal to no rotation of one or more of these body parts can cause a decreased torque and inconsistent bad shots. (Sharma, 2021).

After the backswing, the player moves into the downswing portion. During this part of the swing, the weight of the golfer is shifted from the back foot to the front foot while moving the pelvis toward the target. The kinetic energy is produced in this stage, which is how torque is loaded prior to hitting the ball. The torque created by the lower body gets transferred to the torso, which is linked to the shoulders and the back and creates the high impact speeds with the ball.

The follow through is the final portion of the swing. After impact, the kinetic energy of the swing is released with the follow through. While some energy is released with impact of the ball, the rest is dissipated in the form of heat and friction (Sharma, 2021). The follow through includes the deceleration of the swing where all body parts and club return to a resting position. The final position of the swing includes the rotation of the body and club. The chest and hips will end facing the target, while the club finishes behind the golfer's head and neck area. While the follow through seems like a second thought, releasing the club, and having proper rotation during the backswing translate to a higher club speed, and smoother, more tempoed swing.

Golf Psychology

Golf is a mental game, especially while competing at a high level (The Mental Game of Golf, 2011). Controlling emotions during golf is a key to having fun while playing. Having control of the mind will lead to lower scores and create an environment with less pressure that fosters a better mood for the player and the group.

Having confidence on the golf course comes down to the pre shot routine and the thoughts that are going through the athlete's head before the swing is initiated (Stabler, 2020). While the pre shot routine is different for every player, consistency in this routine can alleviate nervousness and increase the chances of hitting a good shot. Some common pre shot routines include, golf club waggles, checking for alignment, number of steps you take to the ball, and

more. Many of these routines can be strung together as well. Once an athlete makes a routine, it should be a seamless process that is natural, no matter the pressure on that particular shot. If this process is a struggle to remember and is inconsistent it will lead to a stiffer, more thought-out swing, instead of a free and smooth swing.

Swing-thoughts are also critical during the swing. If you tell yourself not to hit the ball in the water, it automatically makes it a more difficult task. Instead of having thoughts about what not to do, a common practice is to think about and envision where to hit the ball. This creates a more positive mindset and allows the body to follow the thoughts. Another practice is thinking about a previous round or shot which will give the mind confidence and increase the chances of a good shot. Several golfers at all skill levels also have swing-thoughts about where they want to position certain parts of their body to have a successful stroke. These types of swing-thoughts are often metaphors that lead your brain and muscles into executing a specific task (Golf Swing Thoughts, n.d.). While some swing-thoughts are beneficial, having more than one or two can be disorienting and lead to a lack of focus. This method also varies from player to player. Some players may feel that any thought is distracting and focus on other things, such as the desired flight or direction of the ball.

User Research

A user interview was carried out with an experienced golfer. The goal of this interview was to understand the lifestyle of the athlete, how they travel with their bag, what can be improved, and how their current golf rain apparel works for them. It is important to note that this user may not golf in the rain, but similar questions can be asked about golfing in long sleeves, and where mobility can be increased. The format for this interview was semi structured, meaning

it is a candid conversation about the topic. This will aid in collecting qualitative information. Below are interview questions in no particular order:

1. What specific products do you bring when you golf in the rain? How is this packed (from house, to course, what if it stops raining?)?
2. How often do you find yourself in situations where packable rainwear would be beneficial?
3. What specific features are important for golf rainwear? (waterproofing, breathability, storage, mobility, warmth etc.)
4. Are there any features or design elements you would like to see in golf rainwear that you have or haven’t found in existing products?
5. Can you describe your experience with traveling for golf and the challenges you've encountered when it comes to transporting your golf clubs and equipment?
6. Have you ever used a travel golf bag designed for carrying golf clubs during your trips? If yes, could you describe your experience with it?
7. What specific features do you believe are most important in a travel golf bag for protecting your golf clubs during travel? (e.g., club protection, durability, ease of transport)
8. Are there any features or design elements that you would like to see in travel golf bags that you have or haven't found in existing products?
9. Is your travel golf bag easy to use? Describe your experience and what can be improved.
10. Would it be convenient to have a pushcart option on your golf bag when you play?

A survey was sent out to multiple experienced golfers. In this survey a broad understanding of what these athletes are looking for was gained. These findings contribute to designing for the broader population, extending beyond focusing on the athlete who has been interviewed.

The survey questions are below:

1. How often do you play golf in wet weather?
2. Would having easily deployable, packable rainwear make you more likely to play a round of golf in the rain?
3. Do you prefer a hood when you golf in the rain?
4. Rank the most important features in a golf jacket (waterproofing, breathability, etc.)
5. Where would you like to see increased mobility with long sleeves or jackets?
6. Where would you like to see increased venting?
7. How often do you travel with your clubs by plane?
8. Do you have issues protecting your clubs when travelling by car?
9. On a scale of 1-10, how is the experience of packing your clubs into a travel bag?
10. What kind of travel bag do you use?
11. Do you prefer to walk, pushcart, or ride when you golf?
12. What challenges do you face while travelling for golf?

13. How important is your safety of your clubs during flight?

14. Rank the most important features of a golf bag.

15. Are there any other essential features on current golf bags?

Survey Feedback

The rainwear and golf bag survey was completed by 25 male golfers with handicaps ranging from 10 to 25 (V. Edwards, personal survey, November, 2023). This demographic was ideal for this project scope. When analyzing current golf rain apparel, 16 participants stated that current designs hinder mobility and are a source of distraction during the swing. One participant shared that “the hood gets flung around and the material of the jacket isn’t stretchy” so instead of compromising proper mobility, they are forced to size up leaving them with a very baggy and inadequate fit. Due to this dilemma, eight survey participants avoid wearing rain jackets entirely. This seems to summarize the complaints with current golf rain jackets. However, 70% survey participants agreed that having packable rain apparel would be a good addition to their current golf gear and would allow them to feel more confident while going out on a questionable weather day. As far as the desire to have a hood on the golf jacket, there was a 50/50 split, which means that having a detachable or stuffable hood is ideal. Survey subjects were asked to rank the most important features for golf outerwear. Based on survey results, the number one most important feature was waterproofing along with breathability, mobility, style, thermoregulation, and insulation in that order. Participant feedback is critical in prioritizing the most desirable features and identifying the problems with current products.

The travel golf bag responses brought good insight as well. 85% of survey applicants stated that they travel to play golf multiple times per year. 90% of participants also selected that

their club protection is “very important” during travel. Designing for club protection is a main priority that is essential for a bag that users can have confidence in while traveling. These responses also indicate a preference for prioritizing the ‘on course’ mode for the bag over the ‘travel mode.’ Similar to the apparel survey, subjects were asked to rank the most essential features for travel golf bags. The results, in order were, club protection, durability, ease of transport, and storage (V. Edwards, personal survey, November, 2023). Other features that were also essential to users were traveling luggage wheels, a rigid collar so clubs don’t get squished in the cart, and lots of storage space for items like balls, tees, rangefinder, and speakers (any items that would be used on the course).

Interview Feedback

An interview was conducted with Alex Barajas, a research and development technician at Cobra Golf (V. Edwards, personal communication, November 20, 2023). Barajas is a very experienced golfer and has been playing the game for over ten years. His skill level and technical expertise is ideal for gaining insights on golf apparel and equipment. Below are some takeaways from the interview:

Apparel Feedback:

- Make it easy to have layers underneath
- Worries about the hood messing with peripheral vision, especially at the address of the ball.
- Likes to keep hands warm in the jacket as well as a few golf balls because warm golf balls go further in the cold. Bummed that the current jacket doesn’t have a pocket for hands. Fan of kangaroo pockets for these scenarios.
- Likes the chest pocket for tees, ball marker, air pods, and other small items.

- Having a vest would be a great addition to the apparel as well.
- Protection from cold and rain (multi layer)

Bag Feedback:

- Currently uses a soft travel bag.
- Takes off the driver, and wood heads and puts inside pockets during travel (part of regular routine).
- Packs any extra space in the bag with clothes or pillows or protection
- Hard shell bags are too heavy and cumbersome for his preferences.
- Some features that he sees in current travel bags that he likes are straps for security, wheels for transport, and a suitcase handle to carry upstairs.
- Some features he is looking for is an air tag pocket in the bag to track clubs, quality big teeth zipper, and a unique aesthetic to know what bag is his when it is on the luggage carousel.

Barajas's interview provided useful insights on the golf bag and apparel. An interesting insight from this interview was not only the need for a waterproof jacket, but also a garment to retain warmth during cold days on the course. Some other features Barajas mentioned that will directly impact the design is his response about pockets on the jacket. Since he uses pockets for his hands, balls, and smaller items, the jacket will include multiple storage pockets for hand warmth, storage of balls and tees as well as personal items like a phone or earbuds.

For the golf bag, the most useful insight was about the taking off the club heads when traveling. This bit of insight opens new design opportunities and new ways to iterate on the bag functionality. Additionally, making this bag TSA lockable would also enhance the travel

experience and lessen the stresses of traveling. Besides travel safety and security, the other biggest piece of information was the dislike of hard-shell bags due to how clunky and large they are. The new design should be a softshell bag that isn't too large to travel with easily. This design can also include hard parts if they are strategically placed and don't add to the overall volume of the bag.

Performance Testing Plans

The testing plan for the packable golf apparel (vest and jacket) involves three different tests, two volume test to determine much volume the PACT prototypes can cut down compared to the competitor (a folding test, and a volume submersion test to validate), and golf range testing with a survey. For each test that uses a human subject, a human subject form will be signed to gain consent.

For the packability test, the jacket and vest will be folded up by folding the shoulders inward and then folding the jacket vertically. This method was used as the main test for volume because this is how the garments would be stored in the golf bag while traveling or on the course. Once the apparel is at its smallest volume it will remain folded, the volume will be measured with a ruler to determine the height, length and width in inches. From this, a final volume can be calculated. Then, the volume of each jacket and vest will be compared. To validate the folding test, a measuring beaker will be used to submerge the jacket and vest individually to get a more precise volume reading. Each jacket and vest will be put into a vacuum bag, the air will be taken out, and then the jacket and vest will be put into a beaker where the change in water level will determine the volume of the apparel.

For the second test, the subjects will wear the apparel on the golf range and compare the mobility, comfort, and overall aesthetics of the PACT garments to the competitor garments. Each participant will hit five golf balls while just wearing their shirt as a control test. Then they will hit five balls in the PACT garment, and then the competitor garment. The order in which these are tested will be randomized to ensure accurate data. After this test, each participant will fill out a survey gauging which garment they preferred for each of the three categories previously mentioned.

The testing for the golf bag will include five different tests, and a specification comparison. The five tests include a luggage drop test (for the competitor bag, and the ABS cap), a simulation test on SolidWorks, a storage test to ensure that all items needed on the course can fit into the bag, a user survey that will be sent out to 25 golfers, and a packing test to determine the speed and ease of packing. The first, and most important test is the luggage drop test. As a result of clubheads often being broken during travel, the bag collar (and head protection area) needs to be able to withstand a 50 lb luggage drop from multiple heights. For this test there will be three varying heights to drop the bag from, 30.5 inches, 24 inches, and 17.5 inches. A drop from each height will be repeated four times. Each trial will be recorded and dropped from the same location to minimize error. The recording will show where the fail points are for my bag cap and the competitor bag. When testing the competitor bag, after each drop, the clubs inside the bag will be observed for damages. For this test it is important to note I assembled separate ABS parts to pose as my golf bag cap that will protect the club heads. Different thicknesses (.125”, .25”) were tested to determine what wall thickness the final bag should have.

Another test for the PACT bag that will more accurately determine whether this bag can withstand the impact of a dropped luggage will be a SolidWorks impact simulation. In this test, a

force will be applied to the walls of the PACT (ABS) cap, and the simulation will calculate the Von Mises values for each part of the cap. If these Von Mises stress values are less than the fracture strength of ABS, then the cap can withstand luggage drops.

The next test is a storage test where all on course essentials will be gather such as 14 golf clubs, shoes, towel, sunglasses, phone, keys, wallet, shoes, rain jacket, pants, a vest, a rangefinder, balls and tees. These objects will be placed in the bag. This test is pass or fail depending on if the bag can fit all the on-course essentials.

For the golf bag usability survey, a small slide deck will be sent out to the users that showcases the functionality of the bag, along with specifications and pictures. Participants will be asked about the convenience of converting the bag from travel to on course, whether it will enhance their travel experience, and if they are confident in the protection offered by the PACT golf bag.

The specification and packing test will consist of basic measurements of each bag. These numbers will be compared see an overall comparison between the PACT travel bag and its competitors. These specifications are the overall travel weight of the travel bag (and of course bag), and the space needed to store the travel bag, the travel height. The speed to go from on course to travel will also be tested and compared to determine if the packing process is more efficient.

It is important to note, the competitor bags that were used in these tests changed from the previous section. While those gave a great comparison of features and benefits. It was a challenge to find these at a reasonable price for my thesis budget. As a result, lightly worn Ogio

Majestic bag, and a used Club Glove Bag were used for the specification comparison (weight, storage volume of the bag, travel height), luggage drop, storage, and packing time tests.

Testing Results

The PACT prototype garments were able to beat the competitors by 66% total volume, resulting in 2.8L saved in space. This additional storage not only allows golfers to pack more equipment into their bag, but also gives them the option to let this gear live in the golf bag, which results in the user being consistently more prepared on the golf course.

The apparel was also tested on the range with ten participants. The survey results were positive for both. Eight of ten preferred the PACT jacket over the competitor for all three scales that were tested, mobility, comfort and overall aesthetics of the jacket. For the vest the results were similar. All ten subjects agreed that the PACT vest allowed for more mobility than the competitor. Eight of ten subjects agreed that it was more comfortable than the competitor. Overall, including aesthetics, nine out of ten testing subjects preferred the PACT vest over the competitor.

First, the bag testing started with the luggage drop for the competitor soft cover travel golf bag. As seen in the appendix, after dropping a 50 lb luggage from three different heights, four times from each, the clubs inside the competitor travel bag begin to scuff up on the edges. This is detrimental to club safety during travel. For ABS cap testing, two different thicknesses of ABS were analyzed in this test, 1/8” thick, and 3/16” thick. While the 1/8” cap fractured at the highest luggage drop. The 3/16” thick ABS was able to survive. A SolidWorks simulation was also conducted to further validate the efficacy of this product. The bag collar and top were imported into to SolidWorks. After applying 50 pounds of force to the bag cap from different

angles, the simulation was conducted. A Von Mises scale was used to show where the maximum stress values were, and what these values were. The von mises scale is used to predict when the material will begin to yield. If this value is above the compressive yield strength of the chosen material, the material will not yield (Von Mises Yield Criterion, 2024). The compressive strength of ABS is 6.5e+7 N/M^2 (Compressive Strength of ABS, 2024), while the highest Von Mises strength calculated from the simulation was 4.6e+05 N/M^2. Therefore, the strength of ABS is much higher than the forces it would take to fracture the material.

For storage testing, PACT was able to beat the competitor and fit all ten travel items, whereas the competitor could only fit 7. The competitor product was unable to fit sunglasses, shoes, and the alignment sticks.

The Final Designs

As seen in the appendix, the PACT bag is a feature driven golf bag meant for both on course and destination golf travel. Use of modular ABS cap, with a rolling luggage handle, and travel wheels make this an ideal bag for airport protection and transportation. This bag also features a club organization and lockdown system that not only reduces internal club head impacts to eliminate club damage while traveling, but also offers club organization while playing, allowing users to be more efficient and confident on the course. The bag also has various storage options, with all large pockets having the option of being TSA lockable, so the golfer can travel stress free knowing their equipment arrives at their destination safe.

The PACT jacket is a performance-based golf jacket meant for occasions beyond the course. The jacket includes stretch panels for mobility, a cinch hood that is stuffable for the preference of the golfer, and multiple storage pockets for phone storage, hand warmth and other

items. All of these features are meant to benefit the golfer on the course. However, due to the nature of the colorway, the jacket can be also used for lifestyle needs of the traveling golfer. These lifestyle occasions can include clubhouse dinners, traveling through the airport, and throughout your trip whenever an extra layer is needed. This eliminates the need to bring multiple jackets on a golf trip, further lightening the travel load.

The PACT vest features a racer back design, specifically crafted for on course performance. The racer back is intended to reduce fabric interference with the user's backswing, allowing for increased mobility and focus. The 2.5 Oz Apex insulation offers high thermal to weight ratio, increasing the packability of the garment. The Polartech Grid Fleece stretch panels not only provide mobility, but also help to retain the warmth of the golfer. Another notable feature is the bomber style knit collar which integrates well with the jacket, and any polo worn underneath, further increasing the comfort of the user.

Professional Statement

This thesis project was a formidable and time-intensive undertaking. Crafting golf rain apparel and a travel bag was an extremely complicated, and time-consuming challenge, demanding a unique set of personal strengths. My journey through this project was led by the innate qualities of restorative, achiever, and learner.

The restorative strength, characterized by ability for solving intricate problems, holds particular significance. Within the context of this project, the restorative strength proved invaluable in refining existing designs and rising above the inherent challenges associated with the construction of both apparel and bag.

The achiever's strength of setting lofty goals and having constant motivation is another cornerstone of this thesis. This strength became a guiding force, ensuring that project timelines

were met, culminating in a high-quality final product. Simultaneously, the role of a perpetual learner was also crucial on this creative journey. The commitment to continually enhancing design and construction skills was invaluable throughout the intricate process. This relentless pursuit of knowledge was not only an internal journey but became particularly beneficial when engaging with mentors, absorbing their invaluable insights and advice.

This thesis project serves as a fusion of my passion for product design and love for golf. The opportunity to design and create distinctive golf products stands as a gateway to further honing my ability to think innovatively and tackle complex design challenges that may arise in future design endeavors.

This project not only granted me the canvas to explore the intricacies of patterning and material selection for outer wear but also pushed me to explore the world of golf equipment design. As my professional career begins, I aspire to establish myself as a designer within a team dedicated to creating high-quality golf equipment or apparel. My ultimate goal is to enhance performance and maximize potential by empowering athletes through the creation of innovative apparel and equipment.

Clifton Strengths

1. Restorative
2. Achiever
3. Learner
4. Analytical
5. Deliberative (Rath et al, 2007)

Golden Circle Statement

Empower golfers facing inclement weather and the challenges of traveling with golf clubs by driving innovation in crafting cutting edge apparel and equipment. The goal of this project is to instill confidence, enhance athletic performance, and streamline the experience of traveling with golf gear. Through these endeavors the aim is to empower athletes, enabling them to unlock their full potential on the golf course.

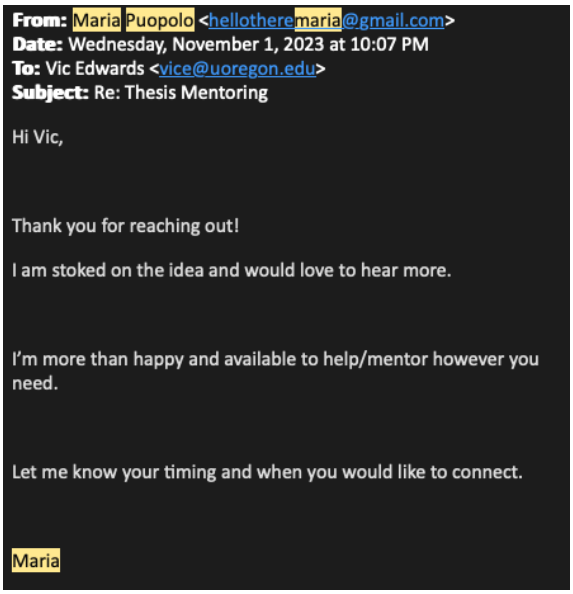
Mentors

Maria Puopolo:

Puma Golf

Director of Apparel Design

Can meet weekly



From: Maria Puopolo <hellotheremaria@gmail.com>
Date: Wednesday, November 1, 2023 at 10:07 PM
To: Vic Edwards <vice@uoregon.edu>
Subject: Re: Thesis Mentoring

Hi Vic,

Thank you for reaching out!

I am stoked on the idea and would love to hear more.

I'm more than happy and available to help/mentor however you need.

Let me know your timing and when you would like to connect.

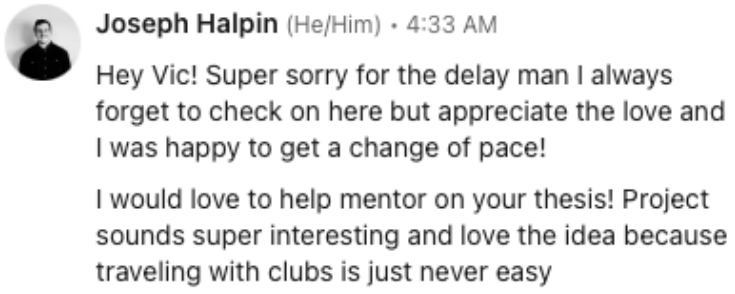
Maria

JP Halpin:

Acushnet (Titlelist)

Senior Associate Product Designer

Can meet Monthly



Appendix

SPORTS PRODUCT DESIGN '24

USER INSIGHTS

SURVEY RESULTS

*Surveyed 25 golfers of varying experience levels

85% TRAVEL TO PLAY GOLF MULTIPLE TIMES PER YEAR

92% CONCERNED ABOUT CLUB PROTECTION WHILE TRAVELING

75% WORRIED ABOUT FORGETTING OUTERWEAR

70% WOULD PLAY IN COLD WEATHER WITH PACKABLE GEAR

"THE TRAVEL EXPERIENCE WITH GOLF CLUBS IS JUST NEVER EASY"

SPORTS PRODUCT DESIGN '24

PACT OVERVIEW

EQUIPMENT

HOW COULD WE...

Create a golf bag for traveling golfers that eliminates the need for an extra travel bag, while offering increased head protection, and storage options for the convenience of the traveling golfer?

APPAREL

HOW COULD WE...

Create packable golf apparel that can be layered efficiently creating a comfortable, distraction free experience in cold and/ or rainy weather?

SPORTS PRODUCT DESIGN '24

ATHLETE BENEFITS

01 QUICK ACCESS TO ESSENTIALS

- No rummaging through other bags
- Be prepared, leading to comfort, and increased performance
- Self-sustaining, ready for on course action, no stress

02 PACKING CONVENIENCE

- Everything you need on the course is in the bag
- Luggage reduction (ease of travel, less stress)
- Not worried about forgetting any item or being ill prepared

03 CLUB PROTECTION

- Offers increased club head protection
- Damaged clubs can ruin a trip
- Clubs are intact and in good condition upon arrival


TRAVEL BAG
FUTURE TECH
PROTECTION
ELEVATED


APPAREL MOOD
H2OFugerholt

SPORTS PRODUCT DESIGN '24

PLATFORM TECHNOLOGIES

01

SWINGSAFE

Club organization and lockdown system
Reduce internal club head impacts
Holds 14 clubs (regulation)

02

RAPIDGRAB POCKETS

Increased storage options
11 separate pockets, each with a purpose
Organization for quick access

03

PROPACK

Packable golf vest and jacket
Beats the packability of the competitor
Efficient layering

SPORTS PRODUCT DESIGN '24

BAG COMPARISON

COMPETITORS

OGIO Majestic Bag

Club Glove Bag

TRAVEL WEIGHT

5 LBS

Weight Reduction

STORED TRAVEL BAG

2 FT^3

Volume Reduction

TRAVEL HEIGHT

7 IN.

Height Reduction

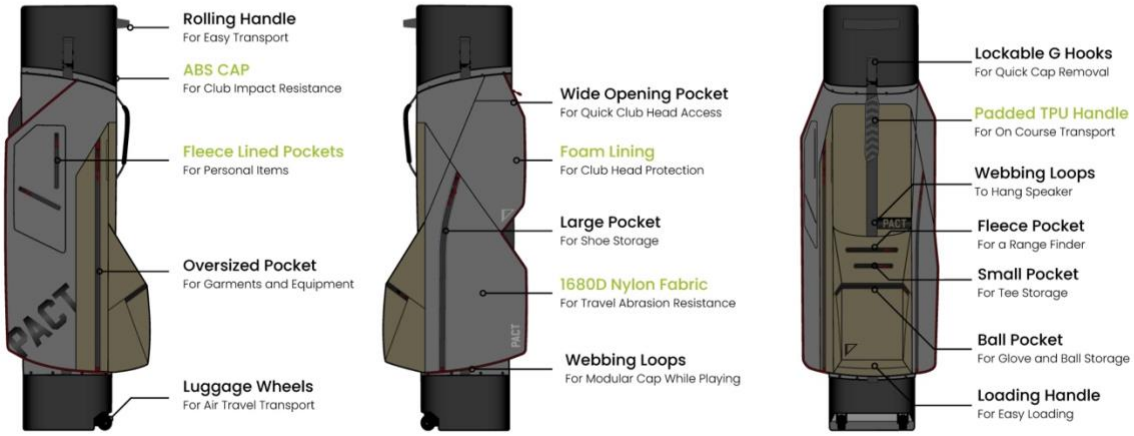
PACKING SPEED

40 SEC

Faster than Competitor

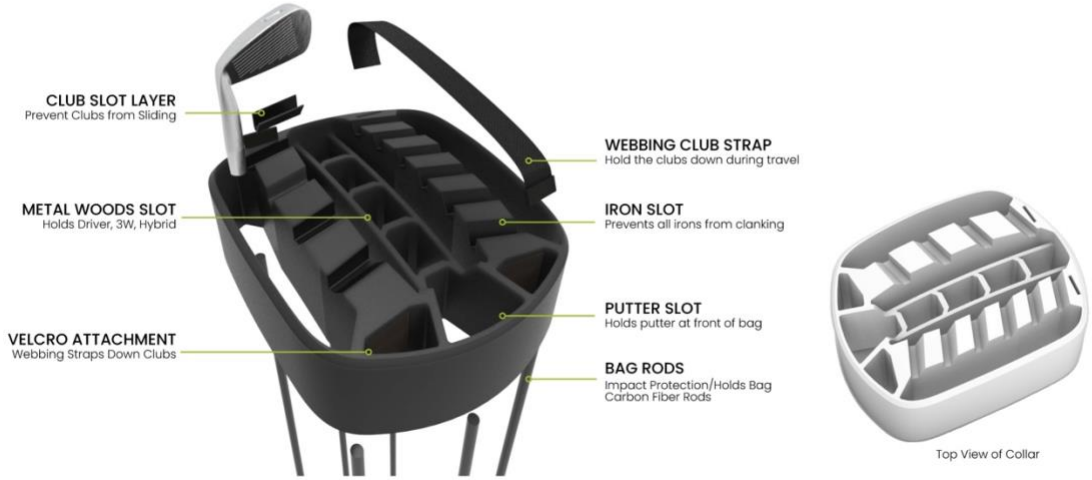
SPORTS PRODUCT DESIGN '24

PACT TRAVEL BAG



SPORTS PRODUCT DESIGN '24

BAG EXPLODED VIEW



SPORTS PRODUCT DESIGN '24

RAPIDGRAB SYSTEM

PACT RAPIDGRAB		COMPETITOR	
NUMBER OF POCKETS:	11	NUMBER OF POCKETS:	7
TRAVEL ITEMS FIT:	10+	TRAVEL ITEMS FIT:	7
PADDED HEAD POCKETS:	3	PADDED HEAD POCKETS:	0

TRAVEL EQUIPMENT

1. 14 golf clubs (regulation)
2. Balls, tees, glove
3. Wallet, phone, keys
4. Alignment Sticks
5. Rain Jacket and pants, vest
6. Speaker
7. Sunscreen, sunglasses
8. Rangefinder
9. Shoes
10. Towel

SPORTS PRODUCT DESIGN '24

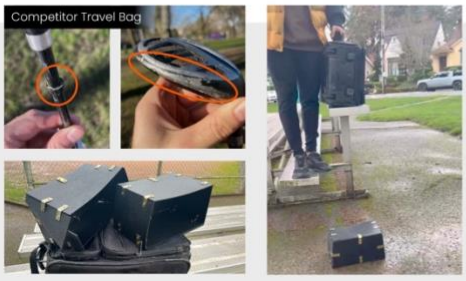
SWINGSAFE TESTING

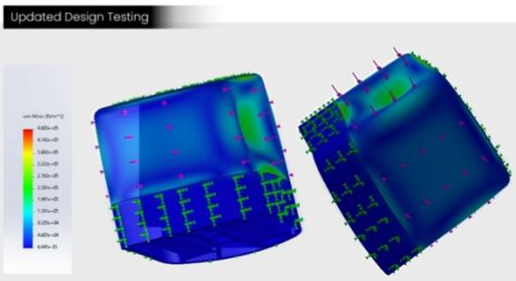
01 LUGGAGE DROP

- Drop 50 lb luggage from 3 different heights (17.5 inches, 24 inches, and 30.5 inches)
- Repeat each drop 4 times
- Observe cap for any damage
- Test different thicknesses of ABS

02 SOLIDWORKS SIMULATION

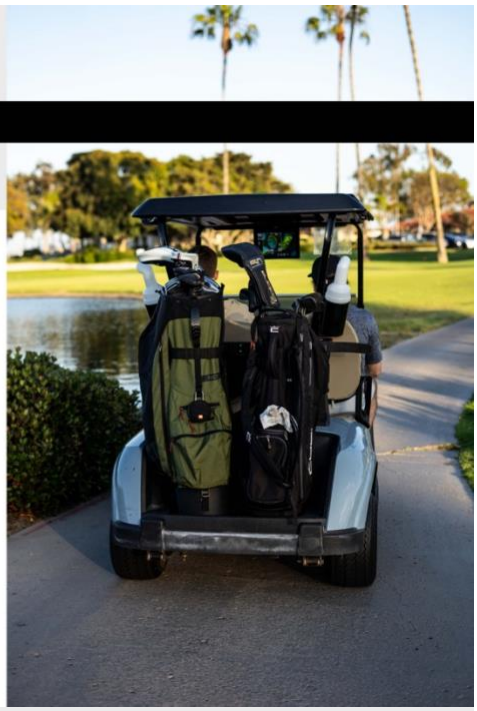
- 50 lbs of force applied from a 3 foot drop
- Results in 216 N of force applied to the cap
- ABS Fracture strength is about 4e+07 N/m^2 well above the Von Mises values in simulation
- Cap and collar combined can withstand the drop





SPORTS PRODUCT DESIGN '24

PACT BAG TESTING



PACT TRAVEL BAG SURVEY

95% AGREED BAG WAS EASIER TO CONVERT TO TRAVEL THAN COMPETITOR

75% THOUGHT THE PACT COLLECTION ENHANCES TRAVEL EXPERIENCE

78% WERE CONFIDENT IN THE PROTECTION OFFERED FROM PACT BAG

ON COURSE QUOTES

"Definitely the best organization out of any bag I've seen."

"Felt very durable and was confident that I could leave my clubs in it without any damage on the flight"

*Surveyed 25 golfers of varying experience levels after sending PACT bag features

SPORTS PRODUCT DESIGN '24

PROPACK TESTING

TEST METHOD

- Fold the garments by tucking each shoulder inward and then folding them vertically
- Analyze the smallest volume of the folded vest
- Measure the length, width, and height, then calculate the volume

Competitor Products

Adidas RDY Jacket

Callaway Chev Vest

JACKET

18% (0.3L)

Volume Reduction

VEST

66% (2.5L)

Volume Reduction

COMBINED

42% (2.8L)

Total Volume Savings

SPORTS PRODUCT DESIGN '24

PACT VEST

01
1 Oz NYLON RIPSTOP
For Packability & Durability

02
POLARTECH GRID FLEECE
For Comfort and Warmth

03
1x1 POLYESTER RIB KNIT
For Comfort and Warmth

04
2.5 Oz APEX INSULATION
For High Thermal Efficiency

SPORTS PRODUCT DESIGN '24

PACT VEST FEEDBACK

METHOD:

- Subject hit 5 balls without a garment (control condition)
- 5 balls with competitor garment (test condition)
- 5 balls with prototype garment (test condition)
- Subjects completed a survey comparing the garments

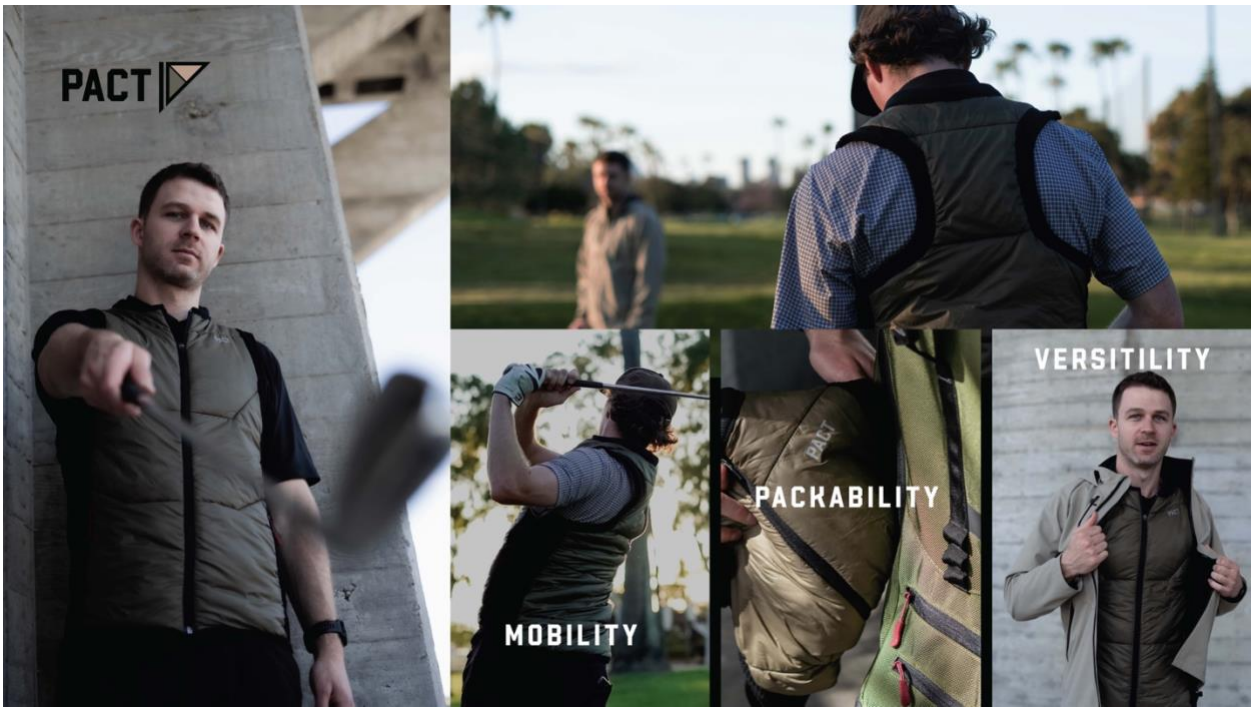
MOBILITY	COMFORT	OVERALL
10/10	8/10	9/10
Preferred PACT	Preferred PACT	Preferred PACT

TESTER QUOTES:

"Nice comfy fit that allowed me to reach the full ranges of my swing without getting any resistance from the vest."

"The insulation on this vest is a lot less bulky which is comfortable."

"The slimmer fit and compact feel of this vest is great while swinging."



SPORTS PRODUCT DESIGN '24

PACT JACKET FEEDBACK

METHOD:

- Subject hit 5 balls without a garment (control condition)
- 5 balls with competitor garment (test condition)
- 5 balls with prototype garment (test condition)
- Subjects completed a survey comparing the garments

MOBILITY	COMFORT	OVERALL
8/10	8/10	8/10
Preferred PACT	Preferred PACT	Preferred PACT

TESTER QUOTES:

"This is a jacket I would wear on and off the golf course."

"Sleek fit that was perfect for temperatures below 60. Did not feel overheated but had a comfy warmth too it."

"Layering this just with the vest is very natural and comfortable."

SPORTS PRODUCT DESIGN '24

PACT JACKET

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