

Extreme Heat

Product Design 4

Jordan M. Moore

Week 1

Group research on an extreme heat athlete and location.



"Our group started with a definition of 'extreme heat' and what types of heat existed.

We all agreed on 'fire' and the brave men and women who fought wildfires in California."

<p>SMOKE JUMPERS</p> <p>6 EXTREME</p> <p>“... A firefighter is as close as you get to being a modern day soldier in your home country.” - Tom Dawson - retired Firefighter LAFD</p> <p>4 FIRE EXPOSURE</p> <p>48-72hr SHIFT FREQUENCY</p> <p>Aerial 1st Response</p> <p>Advanced skilled firefighters who travel to contain or extinguish fires via airplane and parachute.</p> <p>SALARY: \$53,766 (MIDRANGE ANNUAL SALARY LAFD 2024)</p> <p>PREP: Hot Shot crew experience + specialized aerial training</p> <p>CREW SIZE: 3-4</p> <p>QUALIFICATIONS: 3-4 Fire Seasons + Hot Shot Crew with performance</p>
<p>HOT SHOTS</p> <p>5 EXTREME</p> <p>“I'd rather die in boots than live in a suit.” - Fallen Granite Mountain Hotshot - Robert Caldwell</p> <p>6 FIRE EXPOSURE</p> <p>24hr SHIFT FREQUENCY</p> <p>Fire-Line Starters</p> <p>Handed crew members work upline with the fire work longer hours and perform the standard firefighting tasks on hot line and are expected to perform at a higher level.</p> <p>SALARY: \$53,766 (MIDRANGE ANNUAL SALARY LAFD 2024)</p> <p>PREP: Hand crew and vigilance experience</p> <p>CREW SIZE: 20</p> <p>QUALIFICATIONS: 2 Fire Seasons + Hot Shot Crew + advanced physical condition</p>
<p>HELITACK CREW</p> <p>5 EXTREME</p> <p>“We're rappelling out of a hovering helicopter to piss on Satan's front yard.” - LAFD Helitack crew member</p> <p>5 FIRE EXPOSURE</p> <p>1-3 FREQUENCY DAILY</p> <p>1st Responders CALLED TO REMOTE AREAS</p> <p>SALARY: \$49,330 (MIDRANGE ANNUAL SALARY LAFD 2024)</p> <p>PREP: Rappeller's Academy</p> <p>CREW SIZE: 13-24</p> <p>QUALIFICATIONS: 2 Fire Seasons + EMT/FA/IC/RTS/HECM CREW</p>
<p>HAND CREW</p> <p>5 EXTREME</p> <p>“Firefighters don't go on stike.” - Denis Leary</p> <p>5 FIRE EXPOSURE</p> <p>16+hr SHIFT FREQUENCY</p> <p>Fire-Line Starters</p> <p>Hand Crews battle on hotlines and are expected to perform longer hours and perform the standard firefighting tasks on hot line and are expected to perform at a higher level.</p> <p>SALARY: \$43,766 (MIDRANGE ANNUAL SALARY LAFD 2024)</p> <p>PREP: California emergency medical technician training</p> <p>CREW SIZE: 18-20</p> <p>QUALIFICATIONS: 2 Fire Seasons + EMT/FA/IC/RTS/HECM CREW</p>
<p>ENGINE CREW</p> <p>3 EXTREME</p> <p>“Fighting a fire is kind of like a ballet. Things have to happen simultaneously.” - James Winkley, a retired New York firefighter</p> <p>3 FIRE EXPOSURE</p> <p>1-2 FREQUENCY DAILY</p> <p>Engine Operators</p> <p>Operating the engines that pump and distribute water or foam, driving the fire engines and communicating to facilitate suppression operations.</p> <p>SALARY: \$53,766 (MIDRANGE ANNUAL SALARY LAFD 2024)</p> <p>PREP: California emergency medical technician training</p> <p>CREW SIZE: 5-7</p> <p>QUALIFICATIONS: Work Capacity Test</p>
<p>FUELS CREW</p> <p>2 EXTREME</p> <p>“Don't train till you get it right, train till you can't get it wrong!..The future belongs to those who prepare.” - Doug Dine, ISFSI</p> <p>3 FIRE EXPOSURE</p> <p>16hr FREQUENCY DAILY</p> <p>Fuel Management</p> <p>Fuel Crews are used primarily for working on fuel projects which include hazardous fuel reduction and maintenance of fire adapted ecosystems.</p> <p>SALARY: \$31,200 (MIDRANGE ANNUAL SALARY LAFD 2024)</p> <p>PREP: Fire Academies and Work Capacity Test (WCT)</p> <p>CREW SIZE: 7-10</p> <p>QUALIFICATIONS: 2 Fire Seasons + EMT/FA/IC/RTS/HECM CREW</p>

“The multiple firefighters at a wildfire was intriguing to all of our group, so we each took a personal deep dive into their responsibilities and experiences.

Not only do they deal directly with fire and extreme heat, they are physically and mentally fit just like an athlete.”

WILDFIRE SUPPRESSION

CONTROL LINE
"Fuel-free boundaries"

BURNING OUT
"Burn the brush inside a control line"

AERIAL ATTACK
"Dump water, fire retardant and chemicals"

TECHNOLOGY
"Monitor fires, create maps and info"

PRINCIPLE: Deprive the fire of its fuel and let it go out by itself

NATURAL MANMADE

GEAR

LINE GEAR (WEIGHS UP TO 75 lbs)

TRAVEL BAG (A.K.A RED BAG) 45 lbs

HELMET 6.000
FACE SHIELD 2.00
TURNOUT COAT 3.000
GLOVES 0.50
TURNOUT PANTS 4.000
BOOTS 2.000

RADIO 1.000
BREATHING APPARATUS 12.000
FLASHLIGHT 1.00
AXES 1.00

NOURISHMENT
SAFETY/MEDICAL GEAR
FOR OVERNIGHTS
OTHER HELPFUL ITEMS

MATERIALS
Vulcan® FireBlocker
DTEX Specialty Narrow Fabrics™
Kevlar® AS 450X

MARKET
LOCAL DISTRIBUTOR: CURTIS
Oakland, CA
877-488-0469

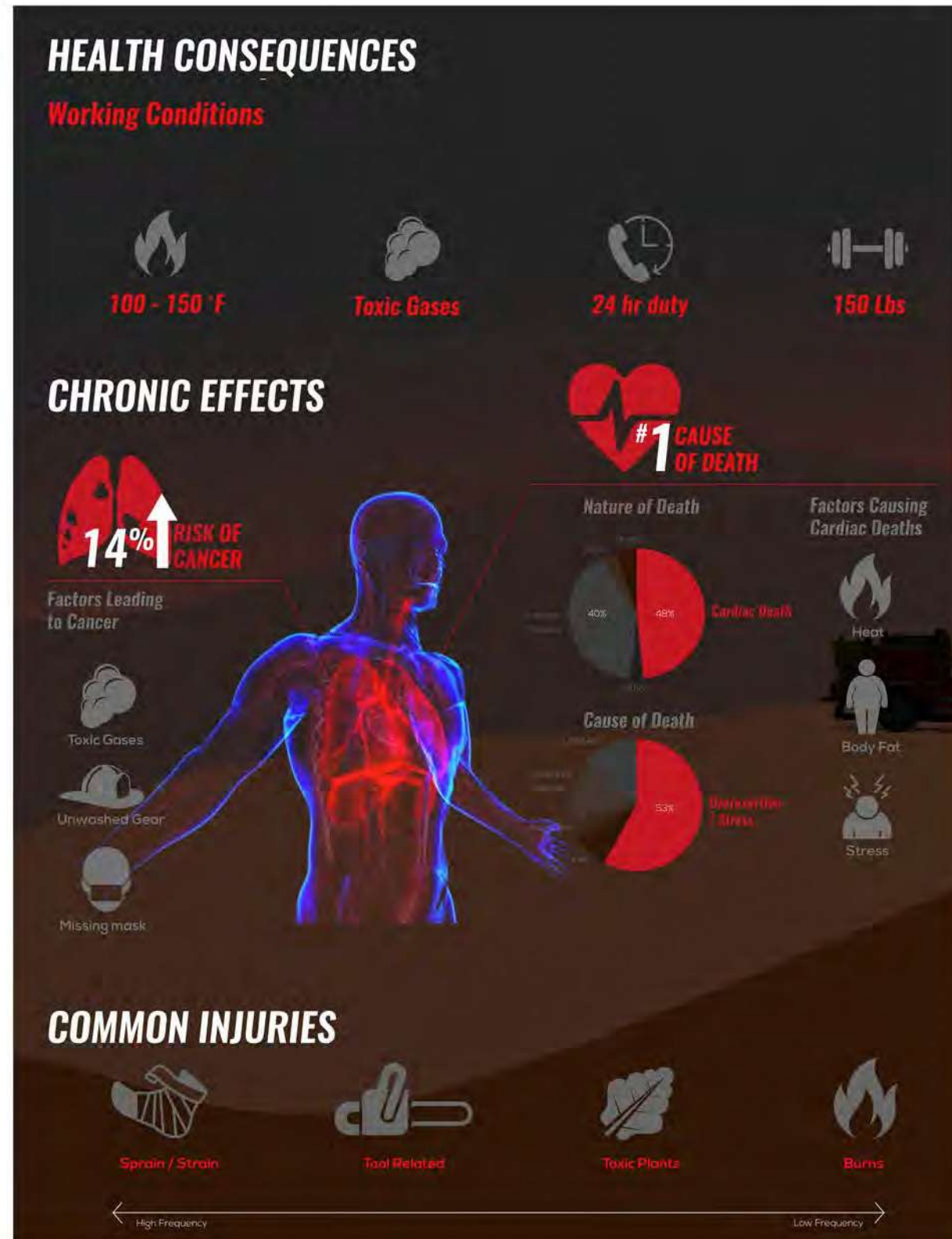
Featured Partner Brands

CURTIS TOOLS FOR HEROES

MSA PARATECH RESCUE 92

"Using the fire fighter as a user, we look at their duties and gear."

Each fire fighter is assigned different tasks and has different gear for their specific job."



“Since the job of fire fighting is so dangerous, we looked at painpoints and health consequences for wildfire fire fighters.”



"We wrapped up the week with a user scenerio and how a wildfire is attacked."

Week 2

Group research on specific athletes that perform in locations with extreme heat.

EXTREME HEAT

The discomfort felt by the combined effects of air temperature and humidity.

HEAT MAP

Caution 80°F Extreme Condition 90°F Extreme Heat 105°F Unsurvivable 130°F

50% of Amazon's species to be wiped out by 2100

South Asia to be Unsurvivable By 2100

Estimated To Die Because Of Heat By 2100

8 Wadi Halfa, Sudan - 127°F 7 Ahwaz, Iran - 128°F 6 Tirat Tzvi, Israel - 129°F 5 Arassame, Mali - 130°F 4 Timbuktu, Mali - 130.1°F 3 Kebili, Tunisia - 131°F 2 Ghadames, Libya - 131°F 1 Death Valley USA - 134°F

DEATH VALLEY, CA

"The hottest place on Earth."

Size: 3.1 million acres
Record High Temp: July 10, 1913 134 degrees F
Avg Deaths: 2 dead a year

Activities / Sports

Badwater Basin Ultra Marathon
Hiking/Backpacking Sand Boarding Star Gazing

"As a group we had to pick an extremely hot location and look at what type of events took place there."

Death Valley, CA met a large number of our design criteria and so we started our research on what's known as the hottest place on Earth."

HEALTH CONSEQUENCES

- YOUR BODY STARTS ACTING WEIRD
- YOUR BRAIN DOESN'T WORK RIGHT
- HEAT EXHAUSTION SETS IN
- HEAT STROKE TAKES YOU TO DEATH'S DOOR** 📺
The most serious type of heat illness
Body temperature greater than 41°C
Requires immediate first aid
- HEAT WAVES CAN KILL THOUSANDS

HEAT DAMAGE PREVENTION

- STAY COOL**
FIND AN AIR-CONDITIONED SPACE OR WEAR LIGHTWEIGHT, LIGHT COLORED CLOTHING
- STAY HYDRATED**
AVOID VERY SUGARY OR ALCOHOLIC DRINKS. REHYDRATE SLOWLY AND REGULARLY
- STAY INFORMED**
CHECK FOR UPDATES. MONITOR THOSE AT HIGH RISK
- ADULTS OVER 65, CHILDREN UNDER 6, PEOPLE WITH MEDICAL PROBLEMS, AND PEOPLE WITHOUT ACCESS TO AIR CONDITIONING

HEALTH CONSEQUENCES (Callouts):

- MORE FREQUENT HEAT WAVES
- URBAN HEAT ISLAND EFFECT
- DEHYDRATION
- HEAT STROKE
- AGGRAVATED CARDIOVASCULAR ILLNESSES
- AGGRAVATED RESPIRATORY ILLNESSES

Statistics:

- 7,100 DEATHS** BETWEEN 1999 AND 2000 **618 DEATHS PER YEAR**
- According to Centers for Climate Change and Health, **extreme heat causes more deaths** than any other type of natural disaster.
- Continuously rising temperatures from climate change are projected to result in an increase of between **2,100 – 4,300** deaths in California in 2025 and **6,700 – 11,300** deaths in 2050.

BENEFIT:

- FLEXIBILITY
- HEART HEALTH
- MINDFULNESS
- WEIGHT LOSS

“Our ultimate focus is to design soft-goods and wearables for an extreme athlete.”

A lot of our research and time were devoted towards the health consequences and effects that heat has on an athletes bodies.”

Week 3

Group research on extreme heat athletes and their experience during an event.



EXTREME HEAT

The discomfort felt by the combined effects of air temperature and humidity.

HEAT MAP

Caution Extreme Condition Extreme Heat Unsurvivable

80°F 90°F 105°F 130°F

50% of Amazon's species to be wiped out by 2100

South Asia to be Unsurvivable By 2100

Estimated To Die Because Of Heat By 2100

1	2	3	4	5	6	7
Heat, India - 127 F	Alaska, USA - 128 F	Heat, India - 129 F	Arizona, USA - 130 F	Turkey, USA - 131 F	India, India - 131 F	Death Valley USA - 134 F

DEATH VALLEY, CA
"The hottest place on Earth."

Size: 31 million acres
Record High Temp: July 10, 1913 134 degrees F
Avg Deaths: 2 dead a year

Activities / Sports

- Badwater Basin
- Ultra Marathon
- Hiking/Backpacking
- Sand Boarding
- Star Gazing

HEALTH CONSEQUENCES

618 DEATHS PER YEAR
According to Center for Climate Change and Health, extreme heat causes more deaths than any other type of natural disaster.

2,100 - 4,300 deaths in California in 2025
are projected due to continuous rise in heat.

How serious is this?

Nervous System
-Headaches
-Altered state of consciousness
-Seizures
-Coma

Skin
-Perspiration increases
-Small blood clots formed in vessels
-Blood oxygen kept from vital organs

Renal System
-Low blood flow to kidneys
-Low urine output
-Kidney failure

HEAT PREVENTION

- STAY INFORMED**
CHECK FOR UPDATES
MONITOR THOSE AT HIGH RISK
- STAY COOL**
FIND AN AIR-CONDITIONED SHELTER
WEAR LIGHTWEIGHT, LIGHT COLORED CLOTHING
- STAY HYDRATED**
AVOID BEER, SUGARY OR ALCOHOL BEVERAGES
REPLACE SALT AND MINERALS

HEAT ILLNESSES

- DEHYDRATION
- HEAT STROKE
- AGGRAVATED CARDIOVASCULAR ILLNESSES
- AGGRAVATED RESPIRATORY ILLNESSES

Heart
Increased heart rate
Weakened coronary arteries
Risk of Cardiac Infarction

Muscular System
Straining, lactic acidosis
Increased duration of recovery

BENEFIT

- FLEXIBILITY
- HEART HEALTH
- MINDFULNESS
- WEAVING LOGS

EXTREME HEAT

The discomfort felt by the combined effects of air temperature and humidity.

HEAT ILLNESS

- DEHYDRATION
- HEAT STROKE
- AGGRAVATED CARDIOVASCULAR ILLNESSES
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HEAT PREVENTION

- STAY INFORMED
- STAY COOL
- STAY HYDRATED

HEAT MAP

Caution Extreme Condition Extreme Heat Unsurvivable

80°F 90°F 105°F 130°F

Death Valley USA - 134°F

National Geographic
3/4 People Estimated To Die Because Of Heat By 2100

- Skin**
 - Perspiration increases
 - Small blood clots forms in vessels
 - Blood oxygen kept from vital organs
- Renal System**
 - Lack of blood flow to kidneys
 - Low Urine output
 - Kidney failure
- Nervous System**
 - Headaches
 - Altered state of conscience
 - Seizures
 - Coma
- Heart**
 - Increase heart rate
 - Blood pressure drops
 - Risk of Cardiac failure
- Muscular System**
 - Cramping (Dehydration)
 - Decreased function

▶ **START** ◀

0 MILES 11:00pm Badwater -880 ft

17 MILES Time Station #1 Furnace Creek

42 MILES Time Station #2 Geopline Wells Sea Level

72 MILES Time Station #3 Panamint Springs 2000

91 MILES Time Station #4 Darwin Turn-Off 3000

123 MILES Time Station #5 Lone Pine 5000

131 MILES Time Station #6 Gateway Road (Dead) 5000

▶ **FINISH** ◀

135 MILES 8360'

“This was the final week of our group research. We summarized the info we found on the subject of extreme heat and the bodies reaction to it.

We also looked at Death Valley and the Badwater 135 Ultramarathon.

This would be the focus of my project.”

Week 4

First week of individual research on extreme condition locations and athletes performing in those conditions.

HIGH PERFORMANCE IN HIGH HEAT

JORDAN M. MOORE
PRODUCT DESIGN 4

Big Ideas

- Keep the athlete dry but hydrated
- Provide sun and dust relief while performing
- Prevent any heat stress

Automotive Racing

Baja 1000

The Baja 1000 is a point to point race that takes place in November and has been occurring for over 50 years.

Trophy Trucks

Some of the fastest and most dangerous ways to complete the race is in a trophy truck. They can go up to 120 mph and their cockpits can reach up to 140°.

Dust and Heat

The Baja 1000 is considered the hardest race to navigate and complete. The course is often sabotaged with trash and obstacles unknown to the drivers. One of the largest obstacles is the dust, and the trophy trucks kick up so much of it that the track often has only 3 - 5 feet of visibility.

Smoke Jumper

Smokejumpers fall into wildfires and are the first on the scene to create a fire line to keep the fire from spreading. They can stay in the wild for days.

Formula 1

Daniel Ricciardo is one of the most popular Formula 1 drivers in the sport. He constantly battles heat in his races. Some of the hottest races he's had have been in Singapore. With the humidity being at around 80%, the in-car temperature can reach up to 140° F. These temperatures paired with the high stress levels of driving can lead to crashes and in extreme cases, death.

NASCAR

It's no secret that NASCAR drivers face extreme conditions while performing under extreme stress. A factor that adds to that stress is the high and extreme heat that occurs during a race. Recently, Kyle Busch and Kasey Kahne have had to cancel races because of their fight with heat exhaustion. Some drivers will lose approx. 10% of their body weight over the course of a race. To combat the heat, drivers will drink liters of water and consume about 1500 calories extra to make up for what they will lose. If proper adjustments to their diet aren't made, a driver can suffer severe consequences.

Badwater 135 Ultra Marathon

135 mile course

Finished 2nd 2006
25hrs 58min 42sec

Mendocino Complex Fire

459,123 acres burned

Baja 1000 Track

1,000 mile race

Akos Konya

"Why would you do this Akos?"
"Just for the love of it..."

Trains for race wearing 8 layers of clothing.

Start at 6 am

"Psychotic Side Kicks"

Akos only had a 2 member support team, while most racers have 5-6.

Because smokejumpers stay in the forest for days at a time, they have to pack all of their gear into one bag and jump out of the plane with it. The bag contains everything they need to fight the fire and to stay alive for at least 48 hours.

3 hours into race the temp is 104°F 6 hours into race the temp reaches 120°F. Akos survived by drinking Gatorade and being sponged with water.

Akos was almost totally covered to get out of the sun's rays when the temp reached a high of 129°F.

When the sun goes down, Akos changes his shoes and socks. The rest of the race he runs in a tank top and shorts. For his first time running the race he finished second overall.

"I looked at heat exhaustion and non-traditional forms of heat. I found it interesting how extreme heat had an effect on athletes and how they prepared beforehand for it."

Akos Konya



Badwater 135 Ultra Marathon

Finished 2nd 2006
25hrs 58min 42sec

"Why would you do this Akos?"

"Just for the love of it..."



Trains for race wearing 8 layers of clothing.



"YouTube has a 2.5 hour long movie about Ados Konya's first attempt at running the Badwater 135."

What helped me the most about the documentary was his training regimen and learning how he physically prepared."

Start at 6 am

"Psychotic Side Kicks"



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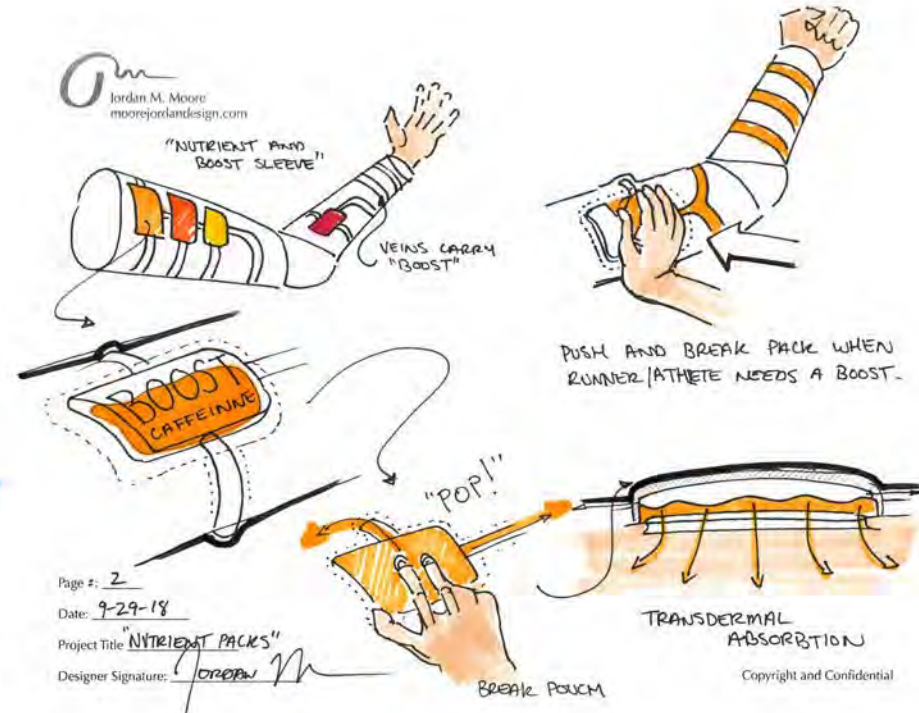
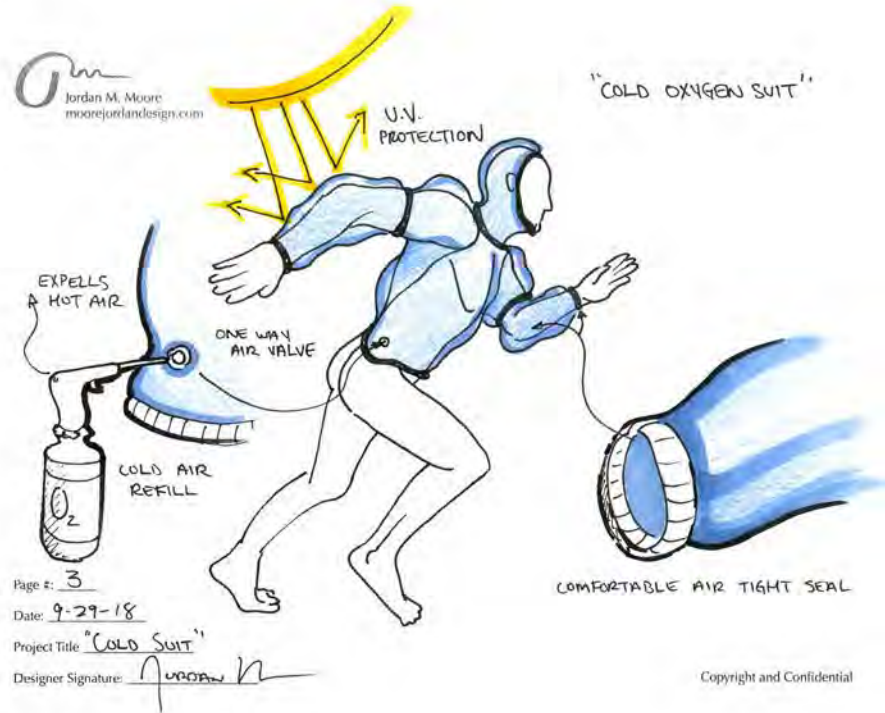
When the sun goes down, Akos changes his shoes and socks. The rest of the race he runs in a tank top and shorts. For his first time running the race he finished second overall.

"Throughout the race there were many difficulties and painpoints that intrigued me a lot.

The heat endured throughout the race was amazing to watch, and initially I decided that dealing with the heat during the race was going to be my design focus."

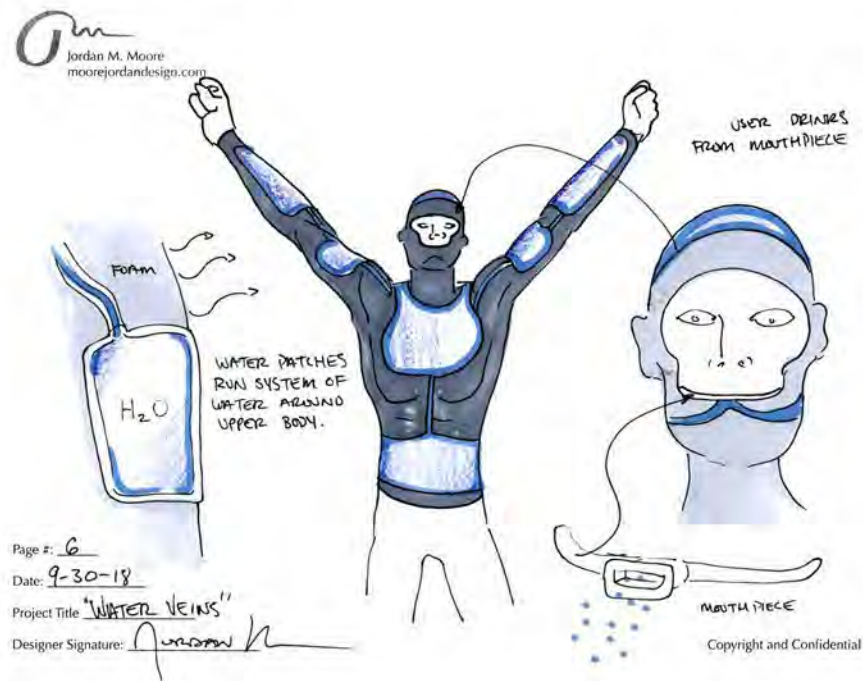
Week 5

Finalized location research and start of ideation on athlete's condition and their event.



"Beginning ideation was focused on enhancing the athlete's performance during the race.

Hydration and cooling the core temperature were painpoints I was focused on while also looking at nutrition and adding stimulants during the race."





“To get an idea on how the athletes train I bought a vinyl sweat suit and started testing that with different combinations of running and sweat gear to get an idea of materials currently on the market and how they feel during a run.

I ran at night and during the day.”



“Through the tests I came to the conclusion that a vinyl suit works the best to raise internal body temperature, but maybe it doesn’t need to totally encapsulate the whole body.

I took a neoprene waste belt and modified it to fit the main ‘heat zones’ on the upper part of the torso.”



“Considering that conditions during a training schedule are not always ideal, I made this jacket that would act as an exterior shell that would keep the athlete dry while running.

Made from Ripstop Nylon, the thought was that it would be light weight, but also hold in heat.

The cuffs and waist had elastic bands to trap body heat as well.”



"One morning I went out and tried the different combinations of clothing and mockups that I made.

I ran a half mile in each combination.

The Nike Dry Fit tee absorbed my sweat, but couldn't keep up with the large amounts generated with the neoprene and vinyl gear.

The vinyl suit still did the best job with raising my body temperature, but generated too much sweat to accurately replicate the dry conditions of Death Valley during Badwater 135."



Running in heat is not fun or comfortable at all.

Normal sweat wicking materials are no match for the amount of sweat generated during training.

Neoprene doesn't breathe enough for this application.

Thermal heat and sweat zones for a male athlete need to be taken into consideration for these garmets.

Training and preperation for the race is more important than the race itself.

New materials are needed for sweat wicking, heat traping, and comfort.

Neoprene and vinyl are not the answer.

Week 6

Ideation and mockups based on three 'Big Ideas' for athlete in extreme heat.

Search for new technology.

RUNNING IN HELL

35 - 40% of athletes who start the BadWater 135 do not finish.
We can help athletes prepare with heat training and heat acclimatization.



Heat Map of a Runner

How to replicate HELL

- Raising internal body temperature to mimic race day conditions
- Heat train regularly at least a month before race
- Increase heart and sweat rate to extreme levels
- Run with a high internal body temperature for at least 100 minutes per day

"I learned from lectures and reading collegiate research that heat acclimatization is incredibly beneficial for athletes in any sport. The amount of runners that do not finish Badwater is outstanding, and so my thoughts about my project were coming back to training for the race."

Benefits of Heat Training & Acclimatization



Body temperature is lower
Reductions of 0.5 to 1.5% helps fight heat stroke and fatigue



Sweating begins earlier
Thermal regulation starts earlier and works more effectively



Sweat is less salty
Electrolyte loss is reduced and thirst better matches body needs



Blood supply increases
Body makes up to 27% more blood to carry oxygen to muscles



Heart rate decreases
Cardiac reserve increases and blood pressure is better defended



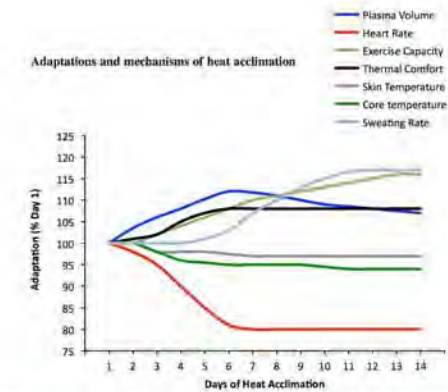
Increased thermal tolerance
Organs less likely to fail, cellular adaptations protect against heat



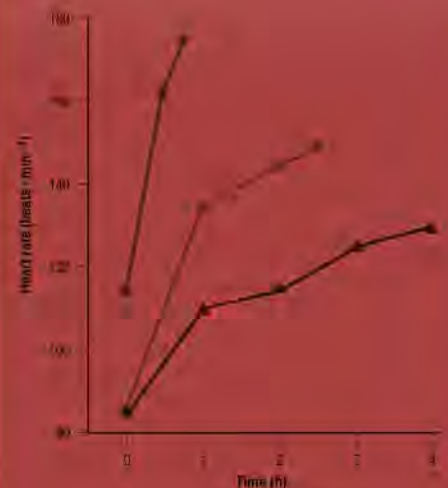
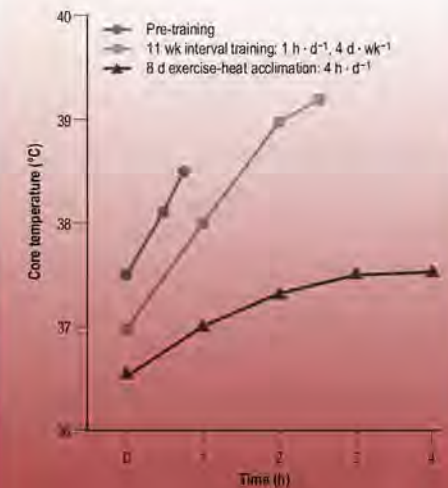
Exercise more efficiently
Higher max blood flow and an increase in VO2 max



Decrease of injury
Better regulation of blood and fluids provide better support for body



Périard, J. D., Racinais, S., & Sawka, M. N. (2015)



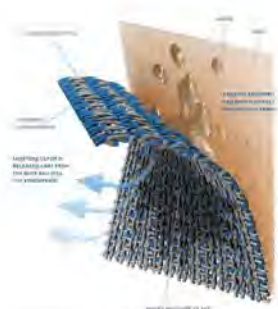
Cohen and Gisolfi (1982)

“Once I started reading about the bodies adaptations to heat training and the almost immediate effect it had on athletes, I couldn’t stop thinking of ways this would benefit a runner in Death Valley.

The problem was to make a training suit that replicated the extreme heat and dryness of running through Badwater.

How can I make an athlete’s body temperature rise, while also keeping them dry?”

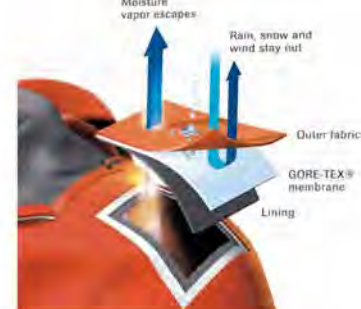
Brands & Materials



TransDRY Tech

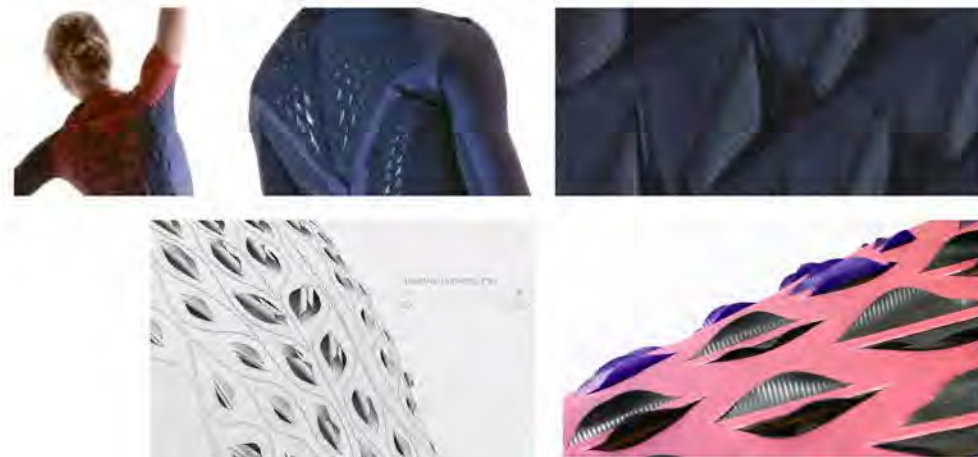


SympaTex



Gor-Tex Tech

New Technologies



MIT Breathable Wear

WGSN

Loro Piana Storm System Wool



Vest Material Exploration

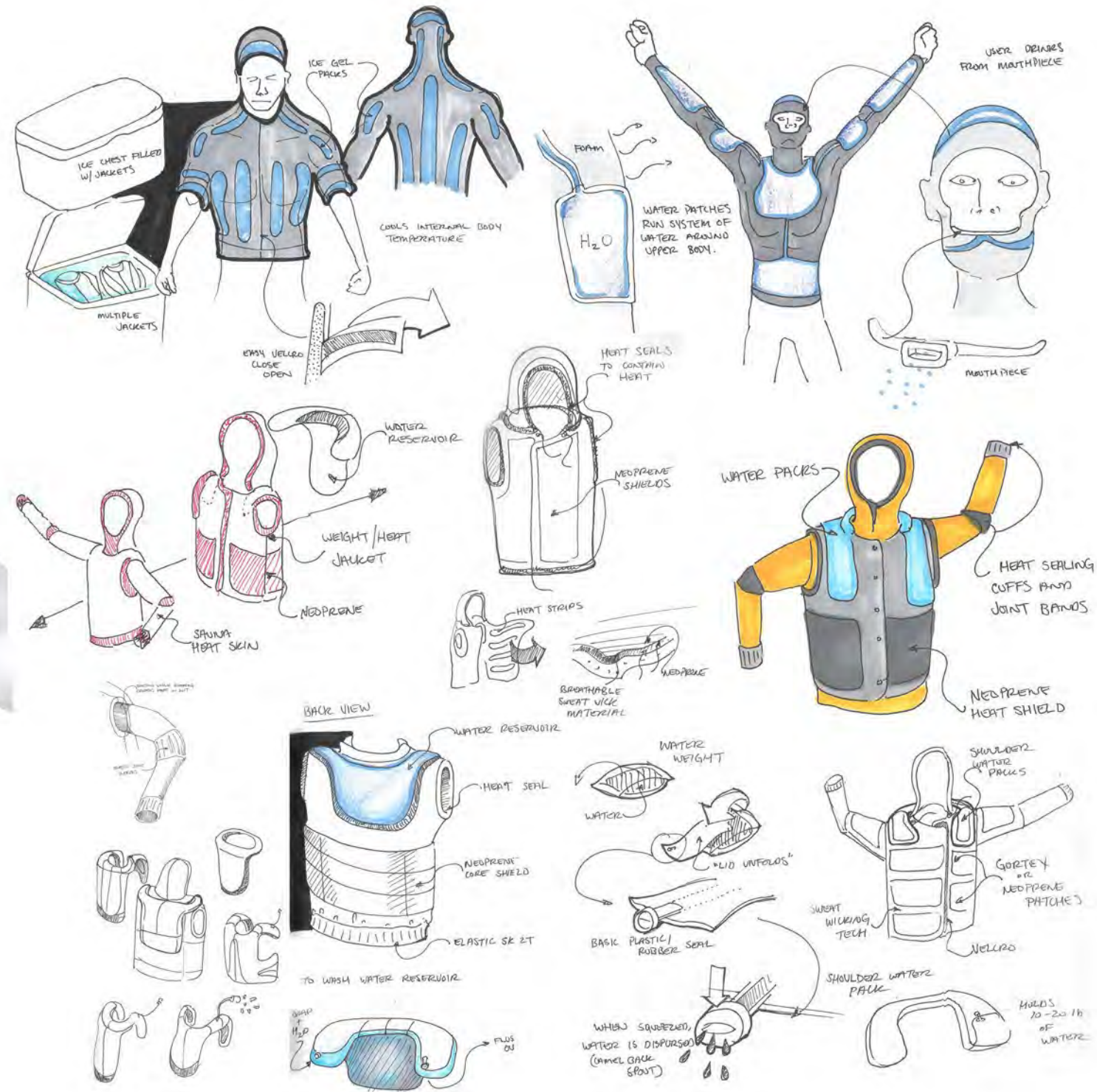


“There are many brands on the market that keep their user cool, and many products that have sweat wicking tech. I need a combination of sweat wicking, weather proof, thermal heat warmth, and movable athletic material.

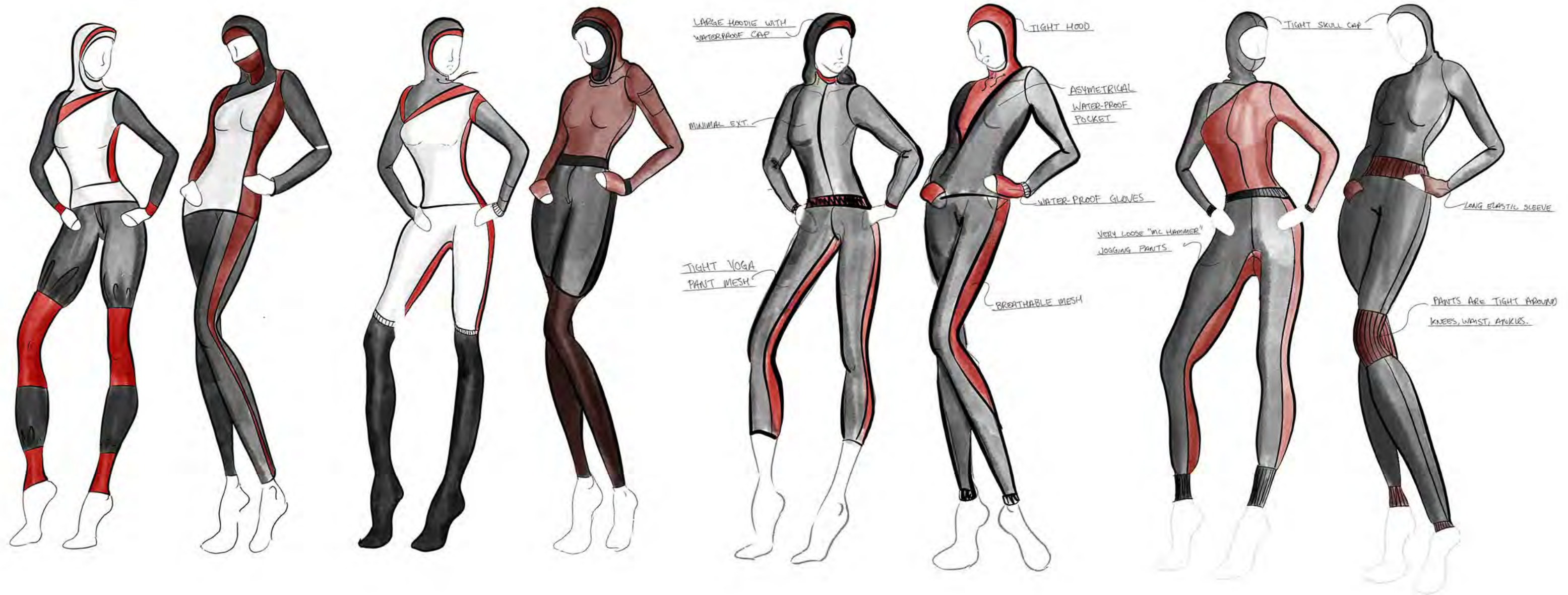
M.I.T. has new gear featuring microbiology that has a natural venting system that regulates an athlete's body temperature. This could be an interesting solution.

WGSN is an invaluable resource for new materials and helping me start a fashion aspect to the athletic training wear. My goal is for the training suit to be fashionable enough to wear during the day or at the gym.”

Concept 1



“Ideation started with a ‘heat vest’ with water packs for hydration.”



"My thoughts wandered to a fashionable women's track suit. My problem was that I wanted to implement new tech and style to a totally new product, not a variation on something existing."

Interview

Dr. Claire Castiglioni, P.T., D.P.T.
Highlights of Interview:



"I use clay filled hot packs that I warm in hot water to increase blood flow to certain muscle groups for rehabilitation."
"For athletic performance, stretching and physical movement is the best way to warm up their muscles."

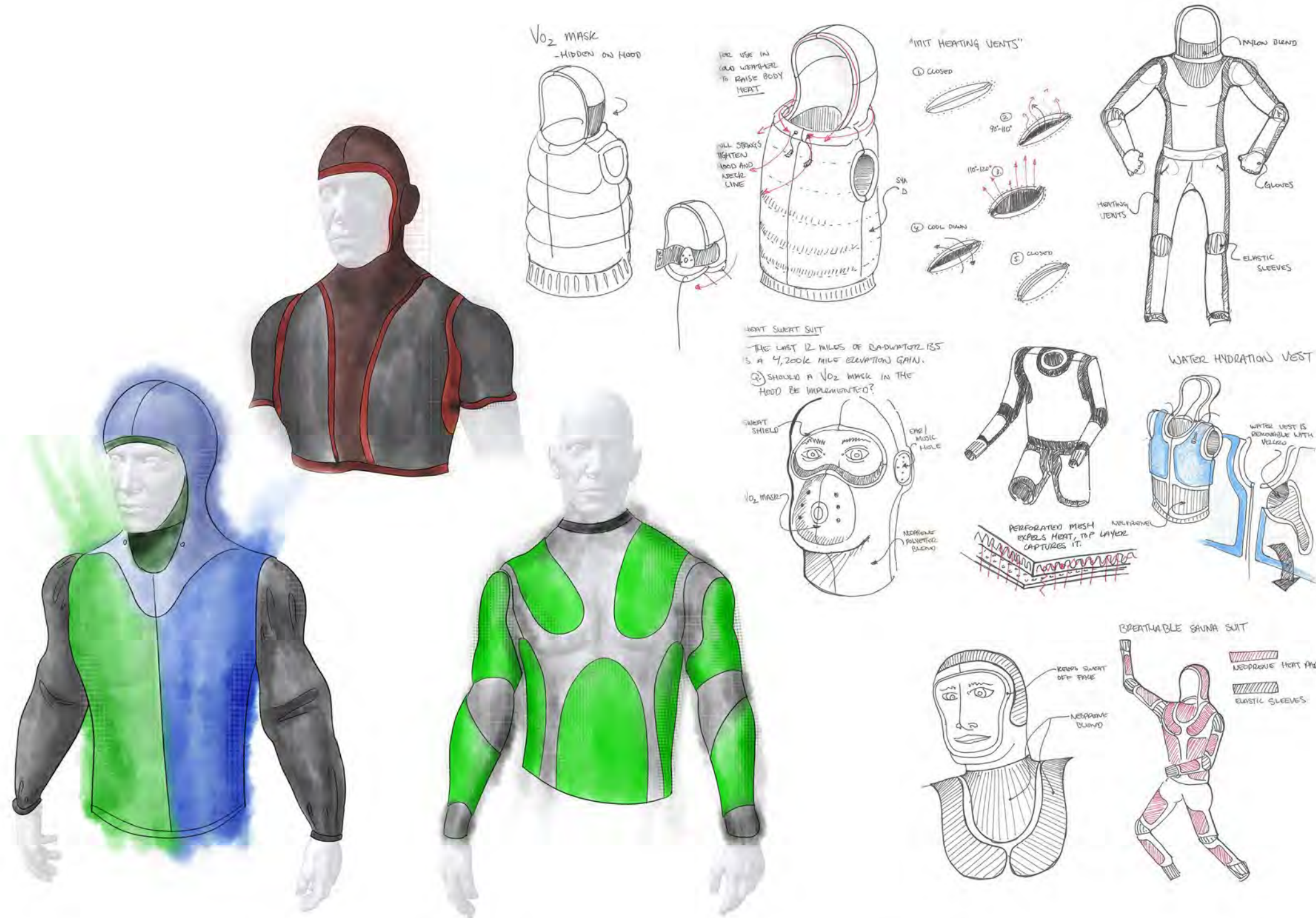
User

Ran 3,000-miles from coast of California to New York City
Ran 50 Marathons, in 50 US States, in 50 Consecutive Days
1st place, 4 Deserts Race Challenge
1st place, Badwater Ultramarathon
Men's Health Top 100 Athletes of All Time
American Ultrarunning Team member
Men's Journal "Adventure Hall of Fame"
12 X Western States 100 Mile Endurance Run Silver Buckle
Outside magazine "Ultimate Top 10 Outdoor Athletes"



Dean Karnazes
56 years old
Inglewood, CA





“After the interview and establishing an idea of a User, it helped me ideate more about what functions the suit needed to have.”

Jordan M. Moore
Product Design 4

RUNNING IN HELL

35 - 40% of athletes who start the BadWater 135 do not finish. We can help athletes prepare with heat training and heat acclimatization.



Heat Map of a Runner

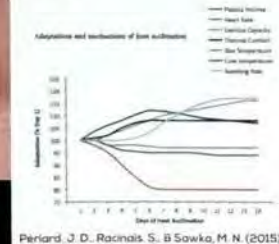


How to replicate HELL

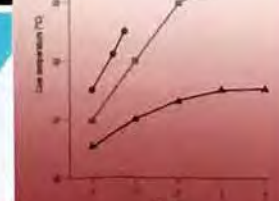
- Raising internal body temperature to mimic race day conditions** - Heat train regularly at least a month before race
- Increase heart and sweat rate to extreme levels** - Run with a high internal body temperature for at least 100 minutes per day

Benefits of Heat Training & Acclimatization

- Body temperature is lower**
Reduction of 0.5 to 1.5K helps fight heat stroke and fatigue
- Sweating begins earlier**
Thermal regulation starts earlier and works more effectively
- Sweat is less salty**
Electrolyte loss is reduced and thirst better matches body needs
- Blood supply increases**
Body makes up to 27% more blood to carry oxygen to muscles
- Heart rate decreases**
Cardiac reserve increases and blood pressure is better defended
- Increased thermal tolerance**
Organs less likely to fail, cellular adaptations protect against heat
- Exercise more efficiently**
Higher max blood flow and an increase in VO2 max
- Decrease of injury**
Earlier regulation of blood and fluids provide better support for body



Periard, J. D., Racinais, S., & Sawka, M. N. (2015)



Cohen and Gault (1982)

Brands & Materials

- TransDRY Tech** - Diagram showing moisture wicking away from the body.
- SympaTex** - Diagram showing moisture wicking away from the body.
- Gor-Tex Tech** - Diagram showing moisture wicking away from the body.

New Technologies

- MIT Breathable Wear** - Images of a blue and black fabric with a porous structure.
- WGSN** - Images of a blue and green fabric with a porous structure.

- Loro Piana Storm System Wool** - Image of a blue fabric with a porous structure.
- Key Colours** - Image of a green fabric with a porous structure.
- Vest Material Exploration** - Images of various vest materials and designs.

- Ideation** - A collection of hand-drawn sketches and diagrams for a vest design.
- Concept 1** - A 3D model of a vest with blue and orange accents.

Interview

Dr. Claire Castiglioni, P.T., D.P.T.
Highlights of Interview



"I use clay filled hot packs that I warm in hot water to increase blood flow to certain muscle groups for rehabilitation."
"For athletic performance, stretching and physical movement is the best way to warm up their muscles."

User

Ran 3,000-miles from coast of California to New York City
Ran 50 Marathons, in 50 US States, in 50 Consecutive Days
1st place, 4 Deserts Race Challenge
1st place, Badwater Ultramarathon
Men's Health Top 100 Athletes of All Time
American Ultrarunning Team member
Men's Journal "Adventure Hall of Fame"
12 X Western States 100 Mile Endurance Run Silver Buckle
Outside magazine "Ultimate Top 10 Outdoor Athletes"



Dean Kamazes
56 years old
Inglewood, CA



Concepts & Ideation

Week 7

**Midterm presentation on
final design direction.**



Name: Joe Parker

Age: 31 yrs

Location: Reno, Nevada

Occupation: Bar owner

Hobbies: Coaching high school cross country, fishing, travelling, sports betting

Accomplishments: 4X NV team State Champion, 2X first place finisher, 6X R.T.O. finisher

Goals: Start competing in Ultramarathons and eventually finish Badwater 135.

Why running: "My whole family runs and I am naturally very good at it."

Benefits of Heat Training & Acclimatization



Body temperature is lower
Reductions of 0.5 to 1.5% helps fight heat stroke and fatigue



Sweating begins earlier
Thermal regulation starts earlier and works more effectively



Sweat is less salty
Electrolyte loss is reduced and thirst better matches body needs



Blood supply increases
Body makes up to 27% more blood to carry oxygen to muscles



Heart rate decreases
Cardiac reserve increases and blood pressure is better defended



Increased thermal tolerance
Organs less likely to fail, cellular adaptations protect against heat



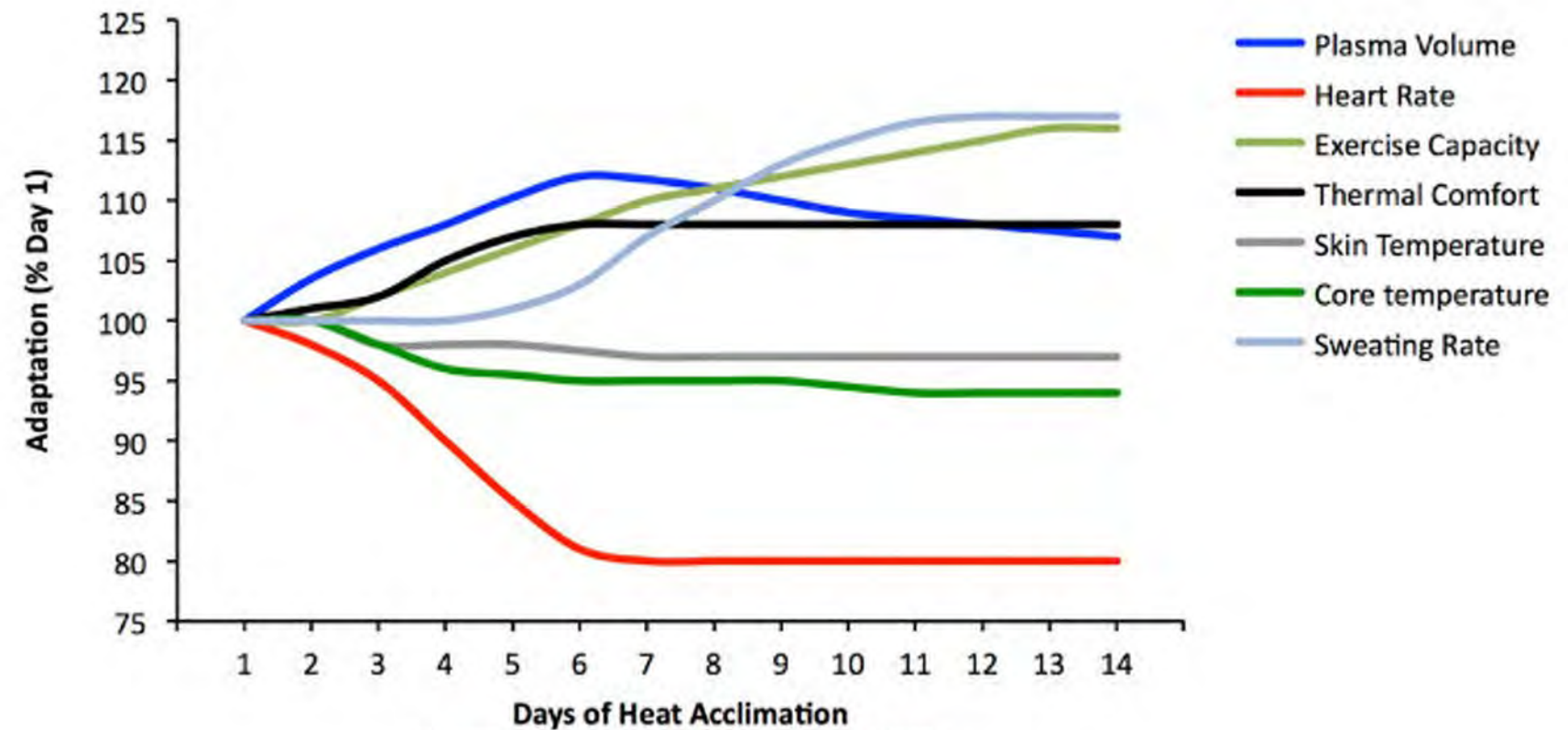
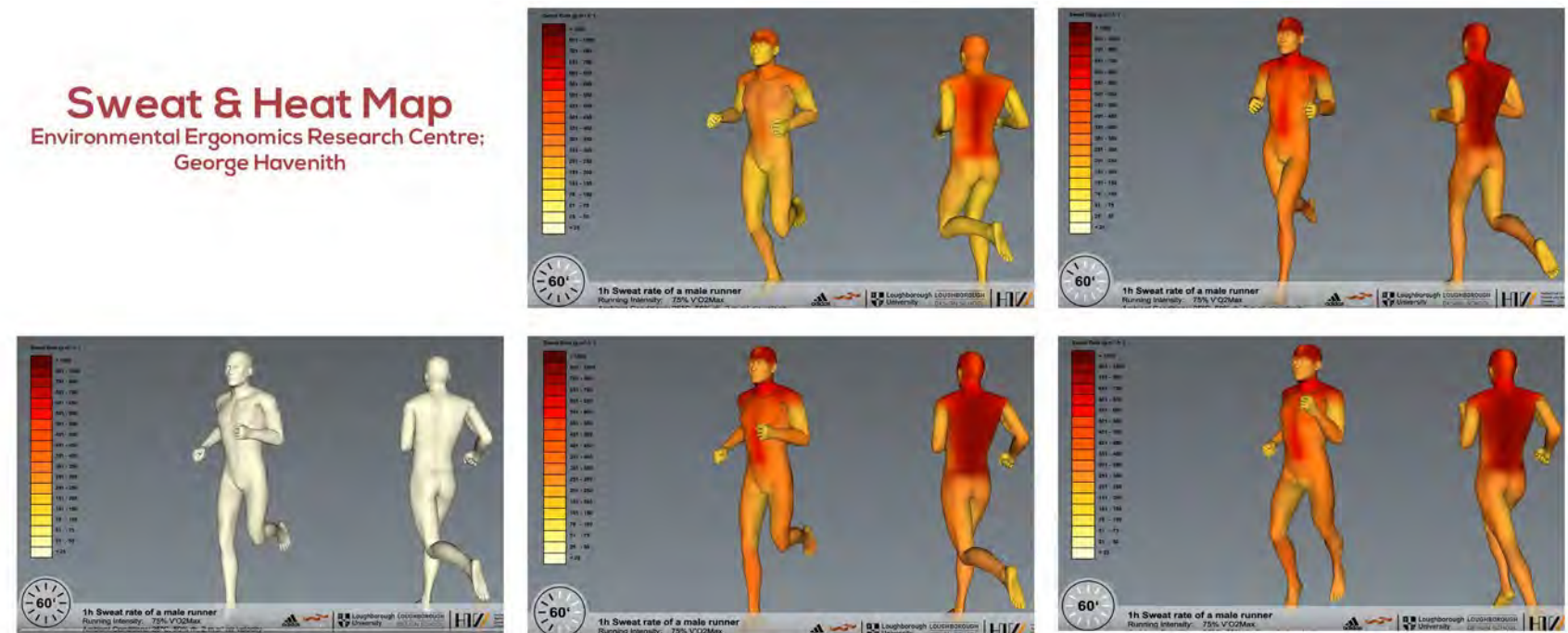
Exercise more efficiently
Higher max blood flow and an increase in VO2 max



Decrease of injury
Better regulation of blood and fluids provide better support for body

Sweat & Heat Map

Environmental Ergonomics Research Centre;
George Havenith

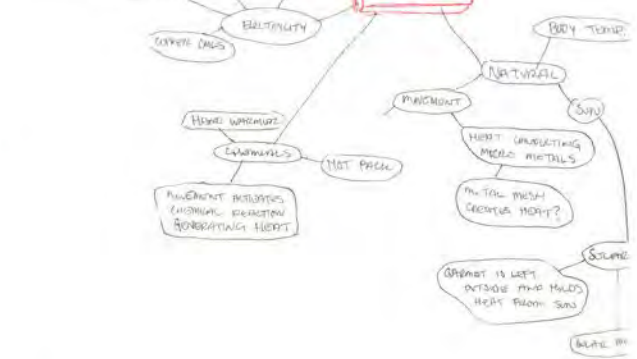


Périard, J. D., Racinais, S., & Sawka, M. N. (2015)

CREATING HEAT IN ADDITION TO BODY HEAT

- HEATER
- LIQUID COILS
- WIND GENERATOR
- BATTERY
- CLOTH

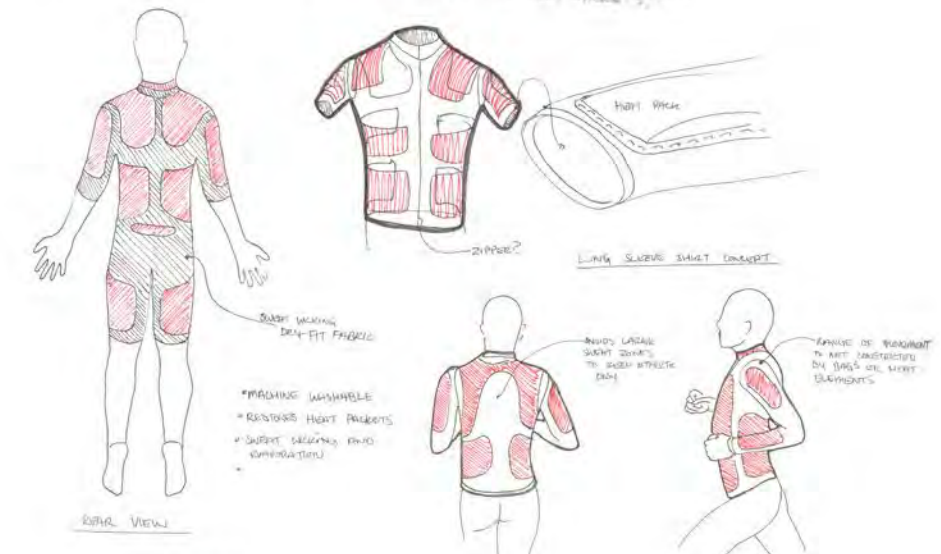
- SOLAR HEAT?
- WARM WATER?
- HOT CLAY BRICKS?
- EMBROIDERED
- SUN



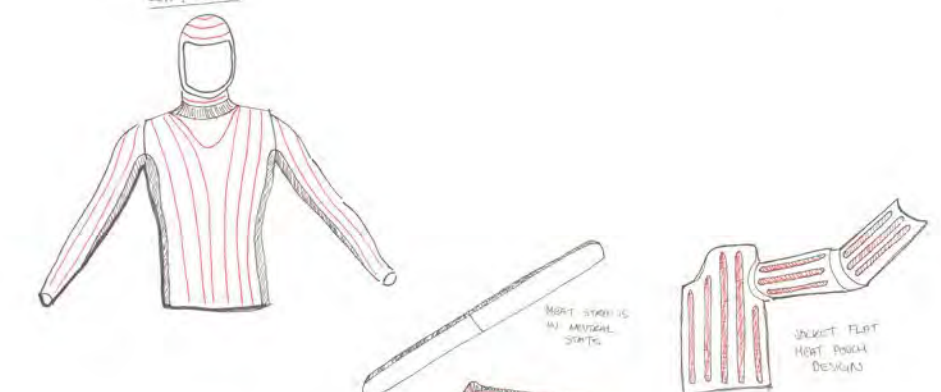
HEAT IDEAS

- COPPER WIRE SKELETON
- WIND GENERATOR/CHEMICAL REACTIONS
- PHENOMENON GENERATES HEAT ON CLOTHS
- SOLAR VEST
- SUN T-SHIRT

COULD A REMOVABLE LINER BE LASHED AND REMOVE THE HEAT PACKETS?

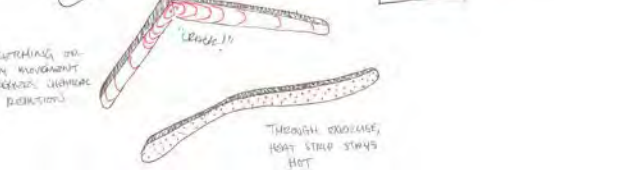


LONG SLEEVE

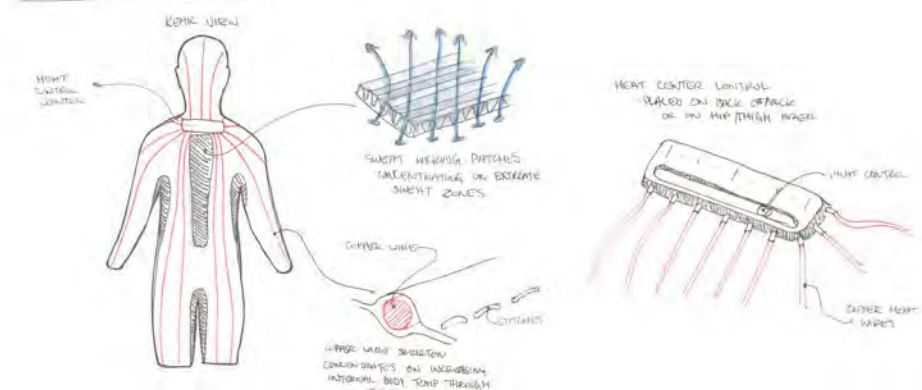


REMOVABLE HEAT PACKETS

- REMOVABLE HEAT PACKETS
- SUPER SATURATED SOLUTION OF SODIUM ACETATE
- SOLID PACKETS REVERSE SUPERSATURATED STATE



COPPER WIRE SKELETON



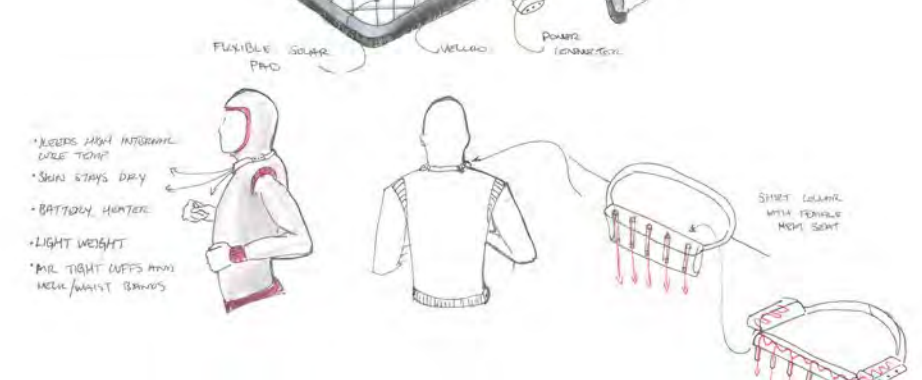
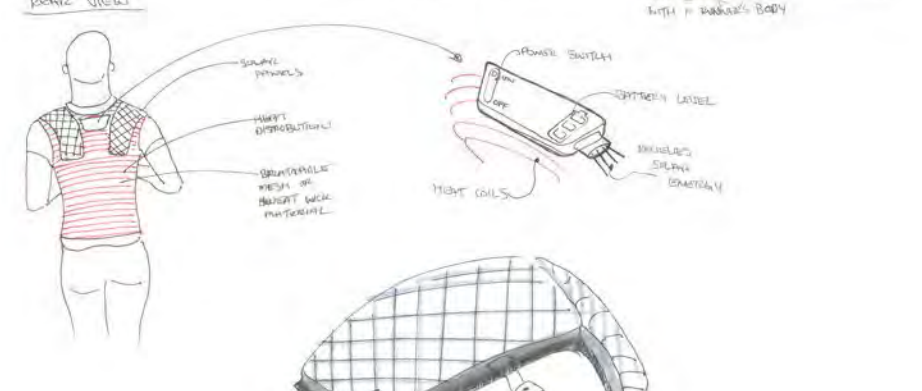
MOVEMENT GENERATING HEAT



- PROBLEMS I CAN ALREADY SEE:
- HIGH MOVEMENT AREAS = HIGH SWEAT AREAS
- HIGH MOVEMENT = MORE HEAT OVERHEATING
- TOO HOT FOR SKIN CONTACT?
- TRANSFER HEAT TO LOW MOVEMENT AREAS?
- BPO IDEAS?
- HEAT FOR SENSITIVE SKIN AREAS, NOT FOR THE PROBLEMS...



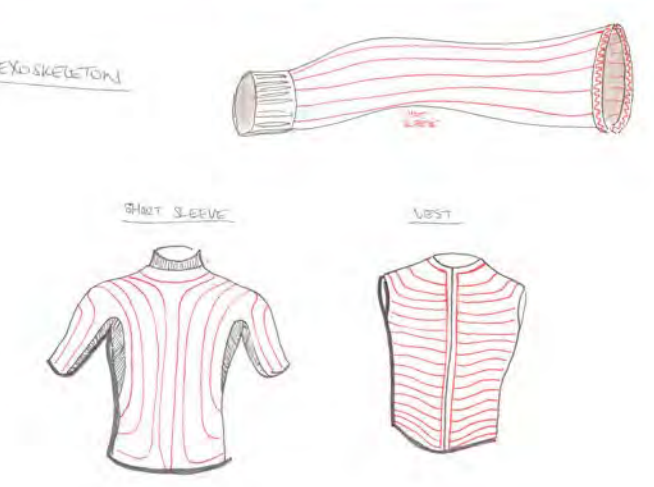
FRONT VIEW



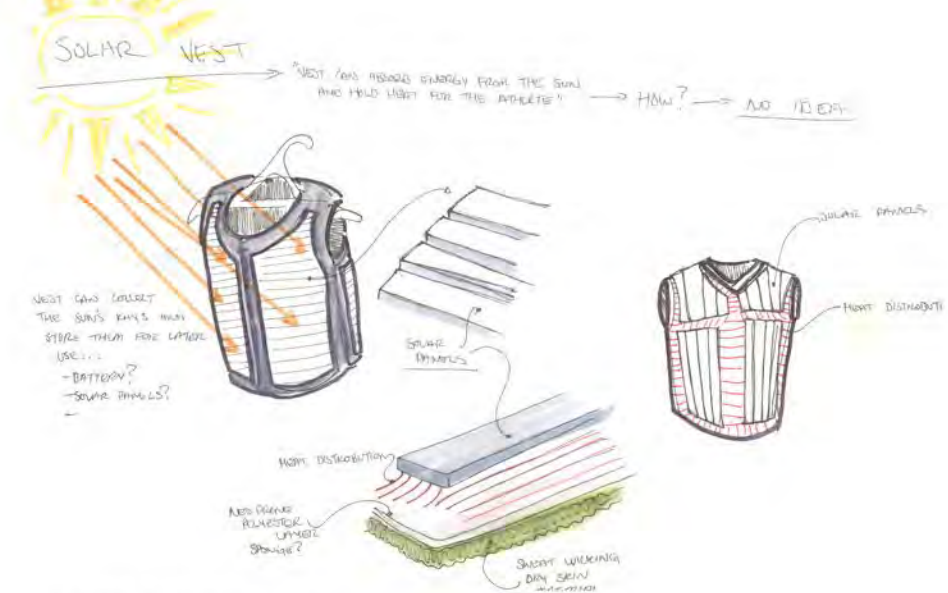
- KEEPS HEAT INTERNAL WHILE WALKING
- SKIN STAYS DRY
- BATTERY HEATER
- LIGHT WEIGHT
- AIR TIGHT CUFFS AND NECK/WAIST BANDS

DIFFERENT VERSIONS OF EXOSKELETON

- HANGING/LOOSELY
- FULL UPPER BODY COVERAGE
- SHIRT SLEEVE
- WARM UNDER LAYER
- VEST
- MAIN PURPOSE TO GENERATE HIGH TEMPERATURES

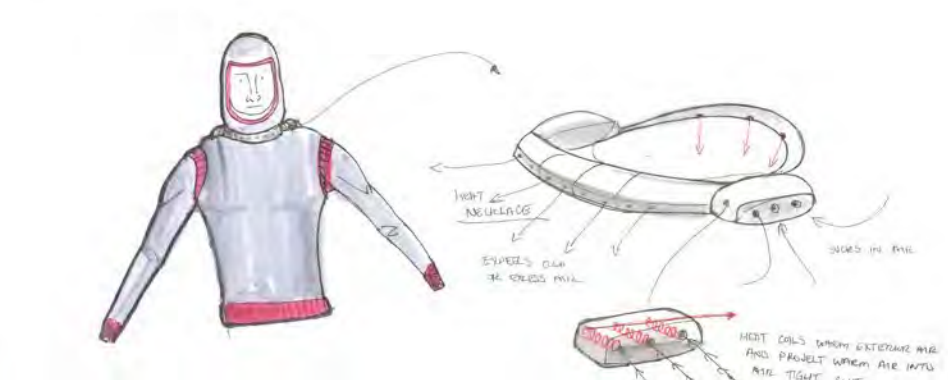


SOLAR VEST



LONG SLEEVE AND HEATER SYSTEM ON VEST?

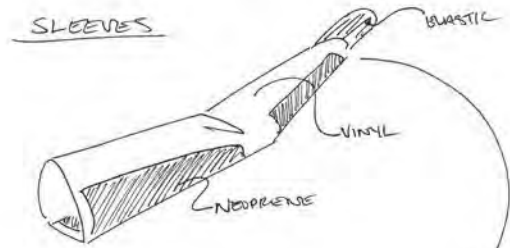
- HEATER (BATTERY POWERED)
- BPO IDEAS?
- SOLAR PANELS?
- LONG SLEEVE AND HEATER SYSTEM ON VEST?
- HEATER (BATTERY POWERED)
- BPO IDEAS?
- SOLAR PANELS?



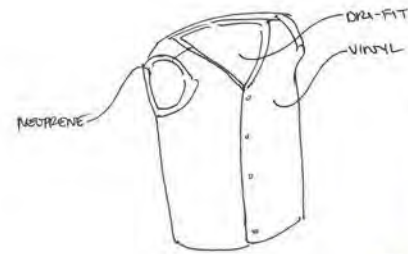
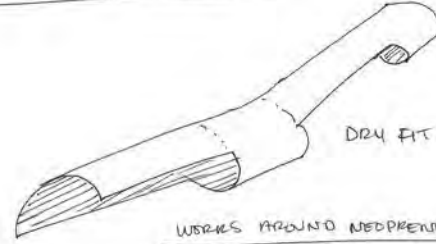
HOW DO WE USE NEOPRENE?

- BELTS?
- STRIPS
- CONCENTRATE ON LOW TEMP POINTS?

SLEEVES



IF WE USE BOTH OF THESE, WHERE CAN WE PUT DRY-FIT?

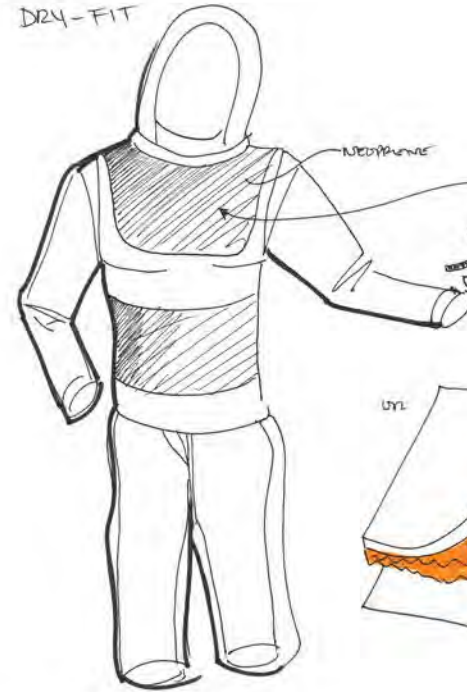


DO WE NEED NEOPRENE?
TOO HEAVY?
DOES NOT BREATHE



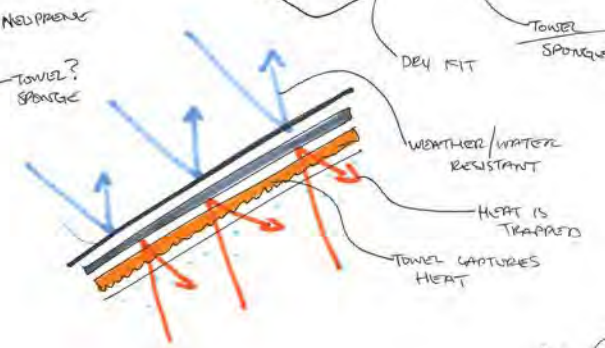
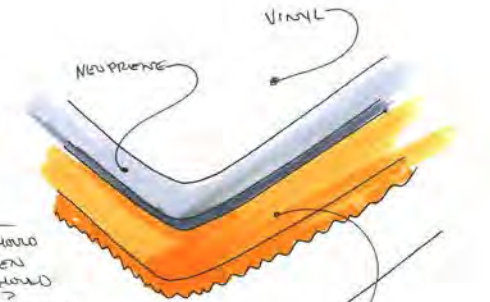
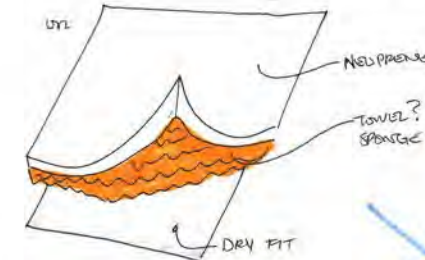
"CAN THE VEST AND HOODIE MORPH INTO EACH OTHER?
CAN THEY FIT INTO EACH OTHER?
MALE → FEMALE"

NEOPRENE + DRY-FIT

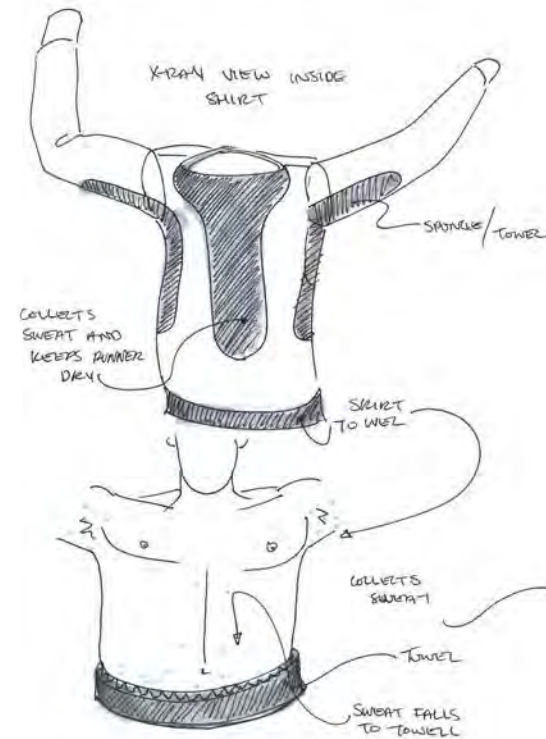


2x DRY FIT

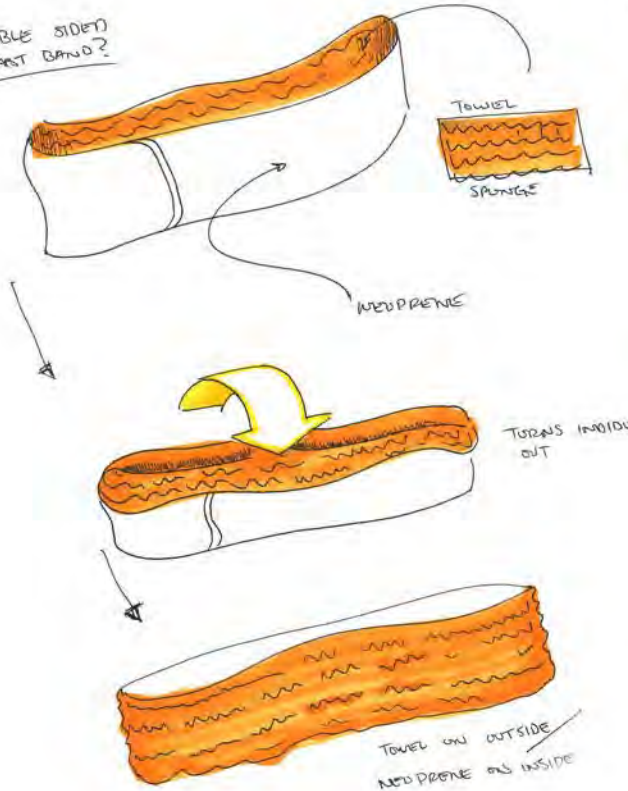
MULTI-LAYERS
- WHAT LAYERS SHOULD WE USE AND THEN WHAT LAYERS SHOULD WE ABANDON?



PUT TOWELS IN HIGH SWEAT SPOTS?



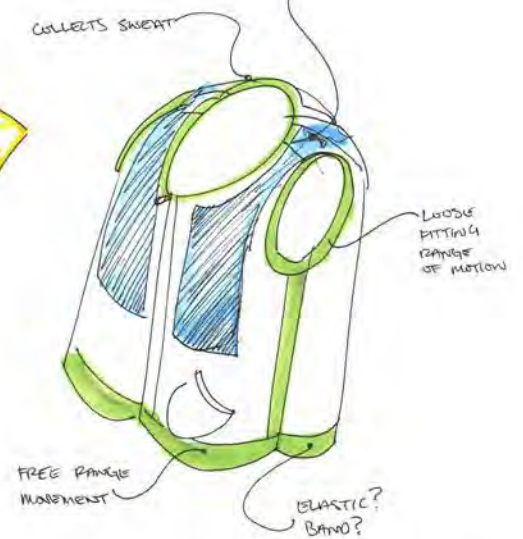
DOUBLE SIDED WAIST BAND?



HOODIE FITS → VEST



DO WE NEED A VEST?



POST MOCK-UP IDEAS AND THOUGHTS...

- VINYL SUITS - VERY IMPORTANT. → UPPERCAND LOWER VEST? HOODED LONG SLEEVE PANTS? SHORTS?

- LARGE VEST? - EXTREME TEMPERATURES (WHEN DOES JOE TRAIN?)

- EARLY MORNING →

→ RENO DURING SUMMER IS ABOUT 90°F → 102°F

→ RENO DURING WINTER IS ABOUT 60°F → 32°F

WHAT DO WE DO WITH THE SWEAT?

- NIKE DRY FIT JUST ABSORBES -

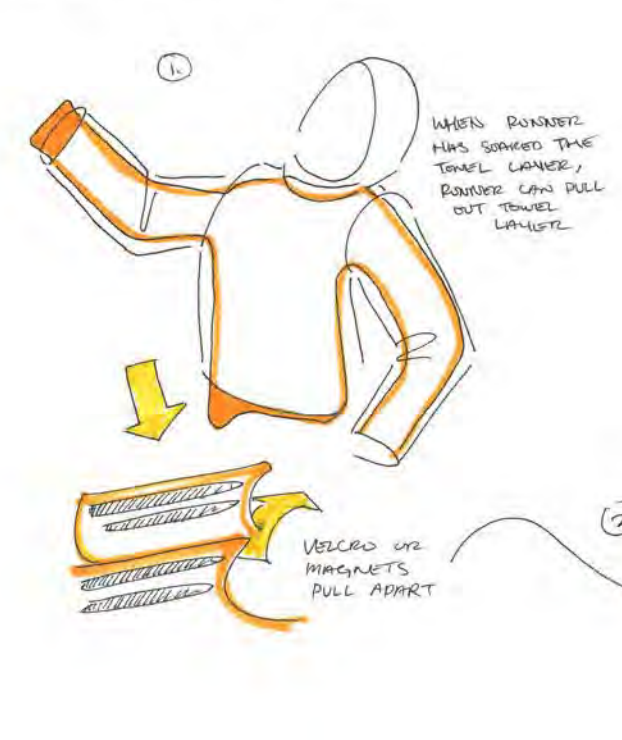
Q: HOW MANY LAYERS OF DRYFIT DO WE NEED TO ABSORB THE LARGE AMOUNTS OF SWEAT?

SO MUCH SWEAT!

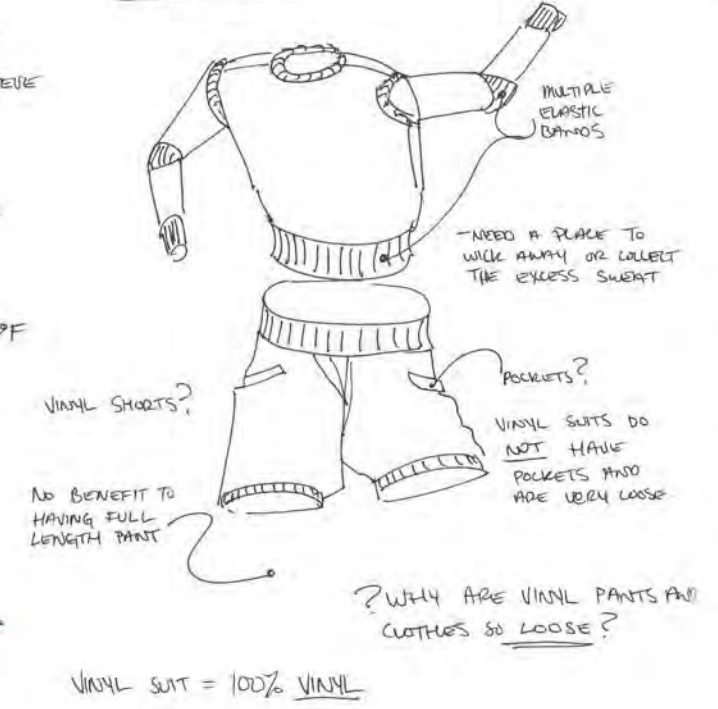
"SHEDDING A SKIN"

- PULLING OUT A USED OR WET TOWEL

- POCK FOR HOLDING USED TOWEL

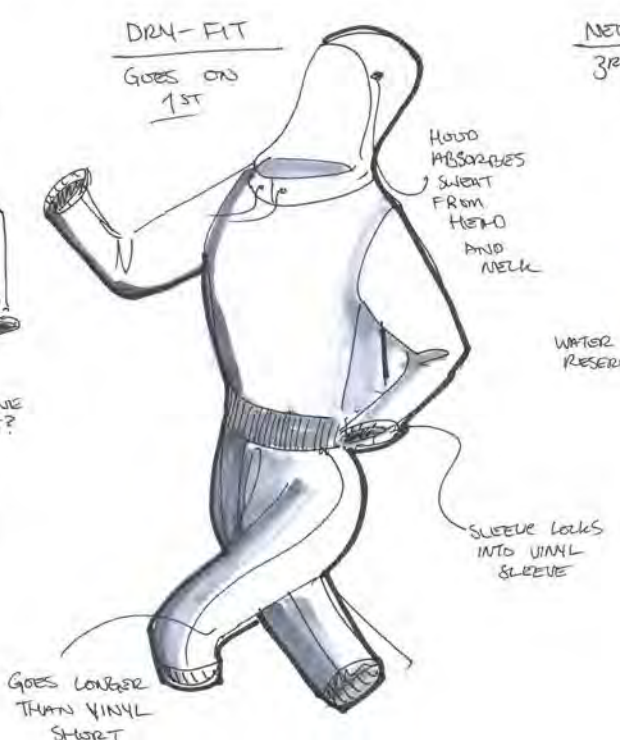
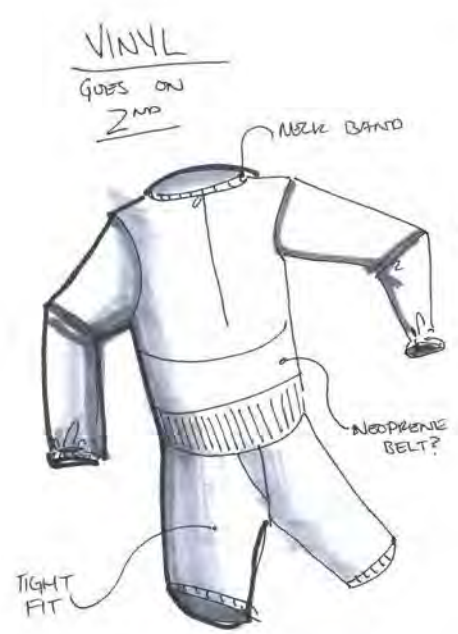
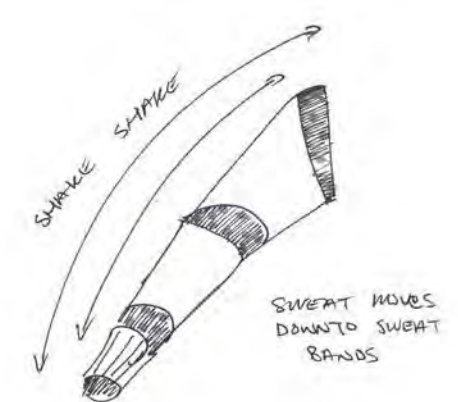
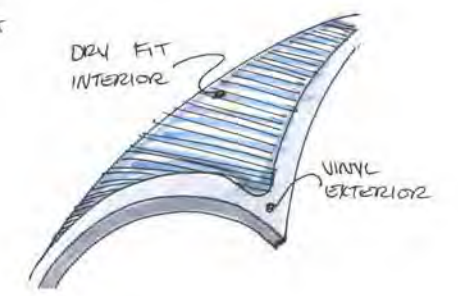
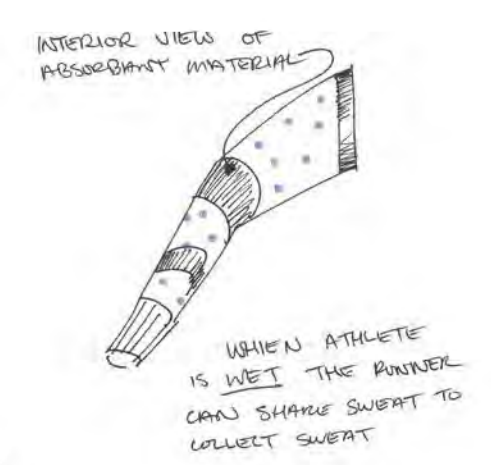
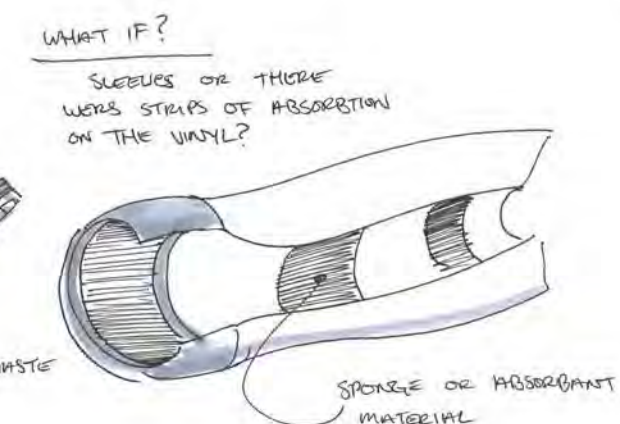
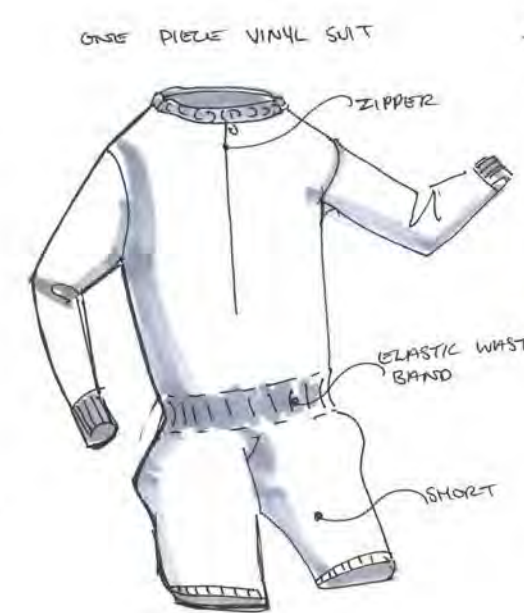


VINYL SUIT



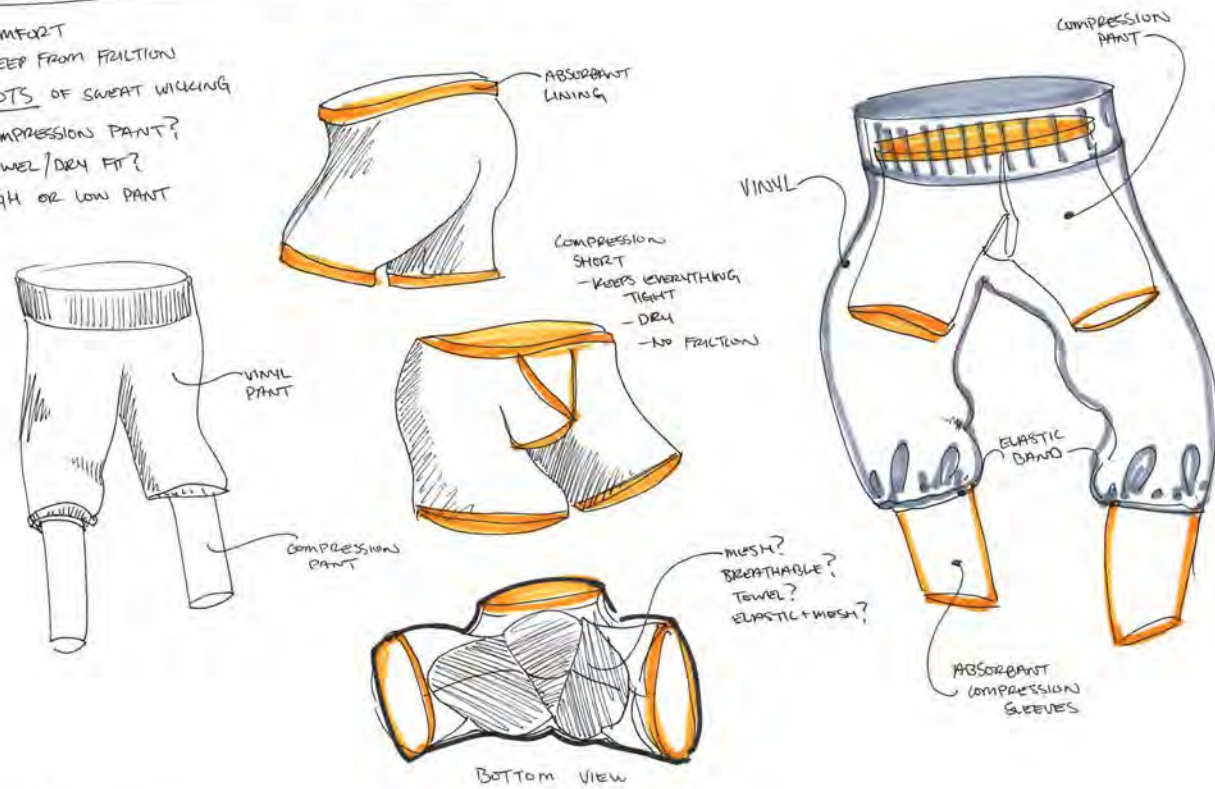
FULL BODY SUIT

VINYL + DRY FIT + TIGHTER FIT



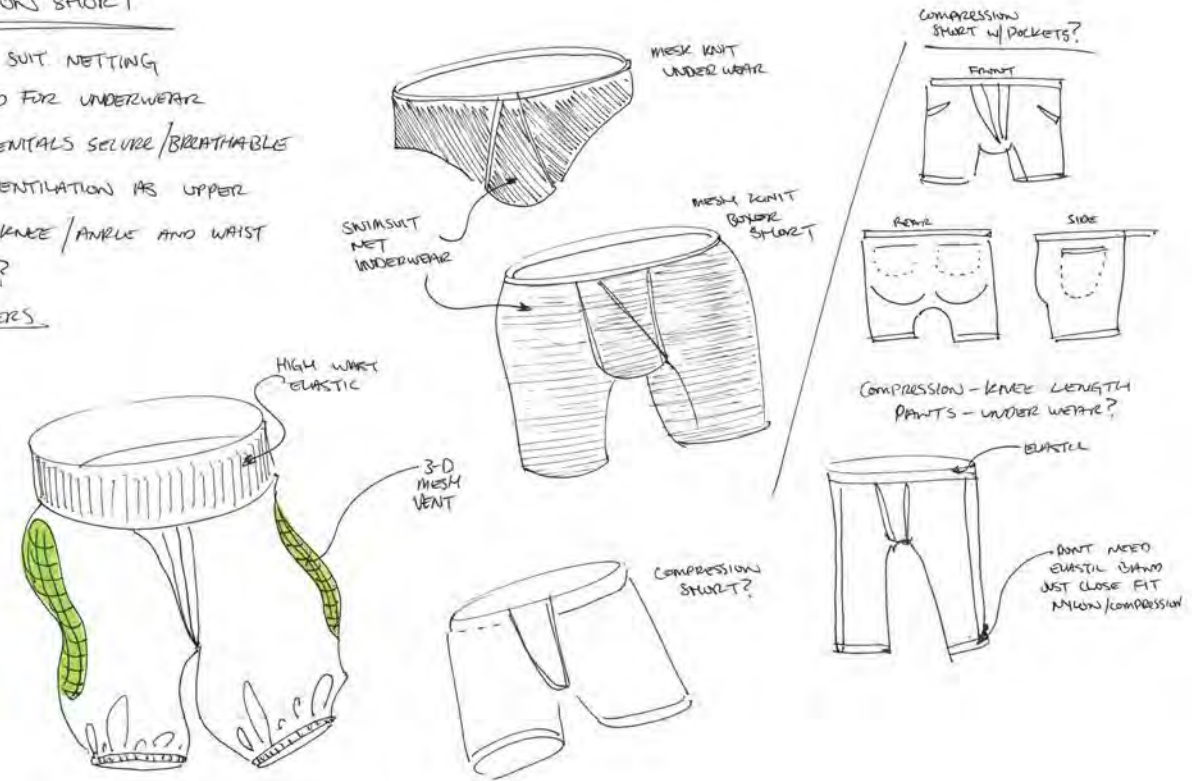
PANTS + LEGS + FAMILY JEWEL S

- COMFORT
- KEEP FROM FRICTIONS
- LOTS OF SWEAT WICKING
- COMPRESSION PANTS?
- TOWEL / DRY FIT?
- HIGH OR LOW PANT



COMPRESSION SHORT

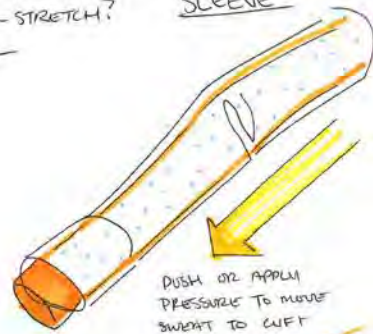
- BATHING SUIT NETTING
- NO NEED FOR UNDERWEAR
- KEEPS GENITALS SECURE / BREATHABLE
- SHADIE VENTILATION AS UPPER
- ELASTIC KNEE / ANKLE AND WAIST
- POCKETS?
- NO ZIPPERS



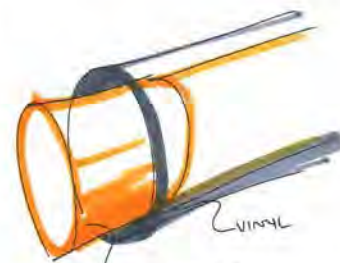
IS THERE A WAY TO KEEP TOWEL LAYER ON?

- PULL?
- STRETCH?

SLEEVE

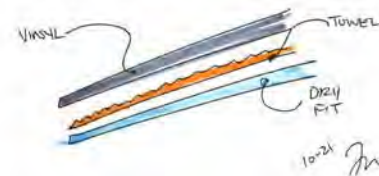


CHEST



NEED TO TEST

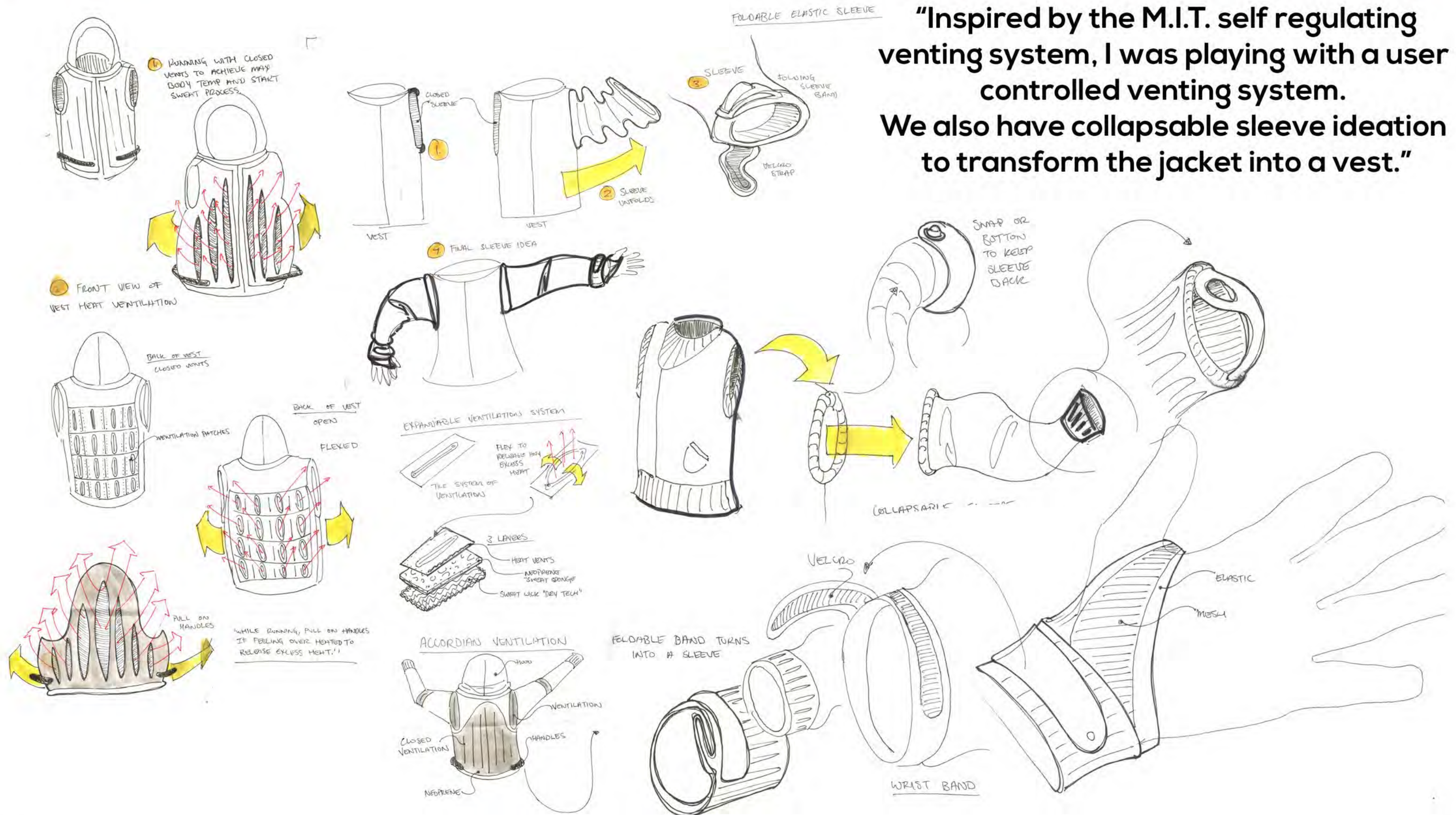
- CAN THE VINYL SUIT WORK IF THERE IS AN INTERIOR LAYER OF TOWEL?
- HOW DOES THE VINYL WORK?
- CAN THE VINYL WORK WITH VENTS?

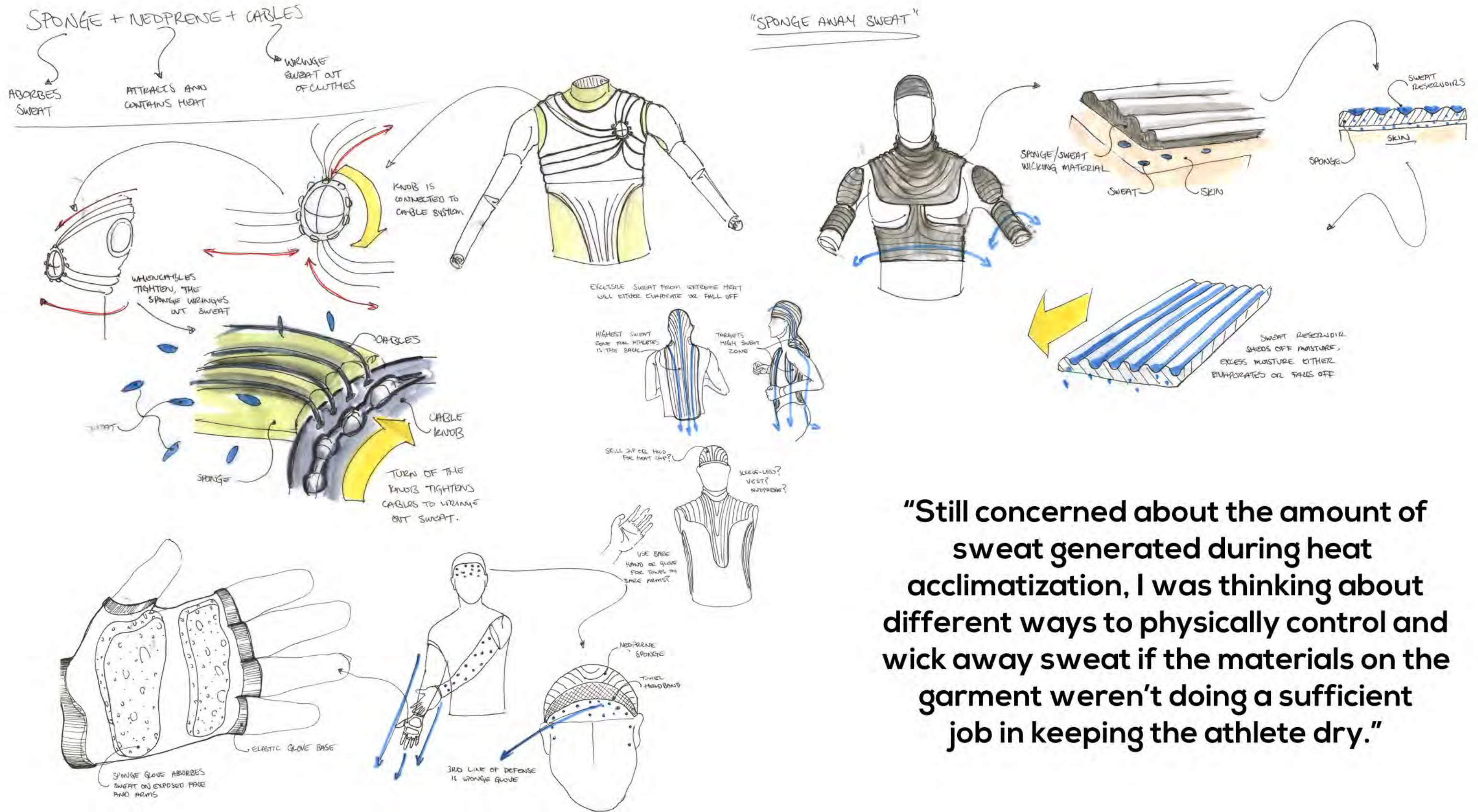


“Up until this phase of ideation I knew the main problems that I had to solve: excess sweat, over heating, and temperature regulation.

I started to think about multiple layers and creating ‘atmospheres’ around the athletes body.”

"Inspired by the M.I.T. self regulating venting system, I was playing with a user controlled venting system. We also have collapsable sleeve ideation to transform the jacket into a vest."





"Still concerned about the amount of sweat generated during heat acclimatization, I was thinking about different ways to physically control and wick away sweat if the materials on the garment weren't doing a sufficient job in keeping the athlete dry."

“We had a ‘round robin’ midterm presentation where we presented our ideation and design direction to four groups of designers.

My main feedback was about clarifying the User’s problem with training currently, and how my product will better help him with preparing for the Badwater 135 Ultramarathon.

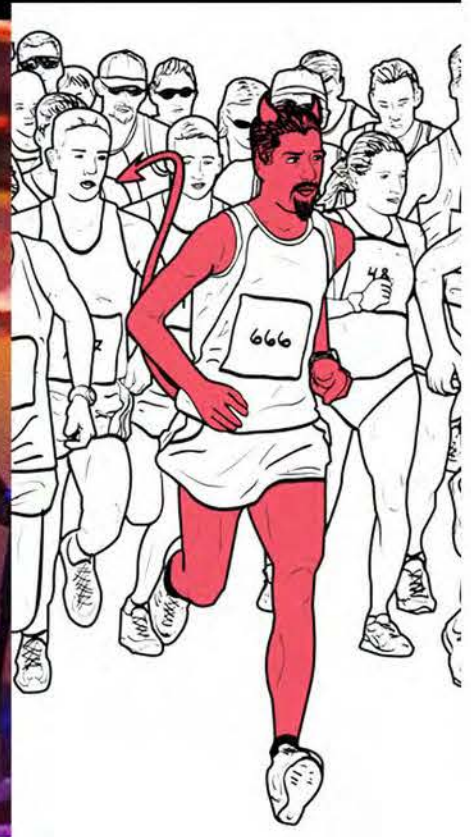
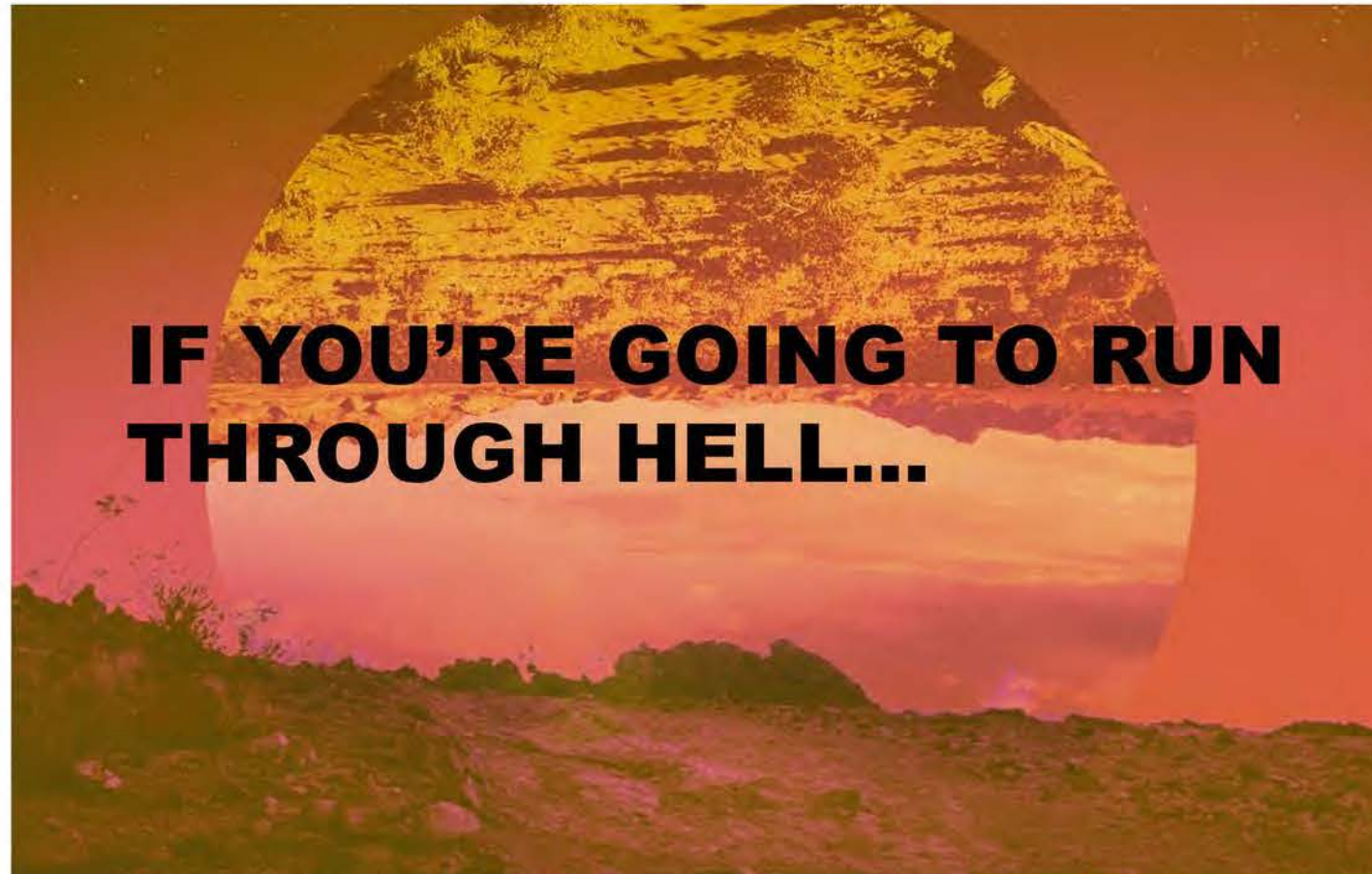
Material research and more ideation was needed, but my final design direction was decided.

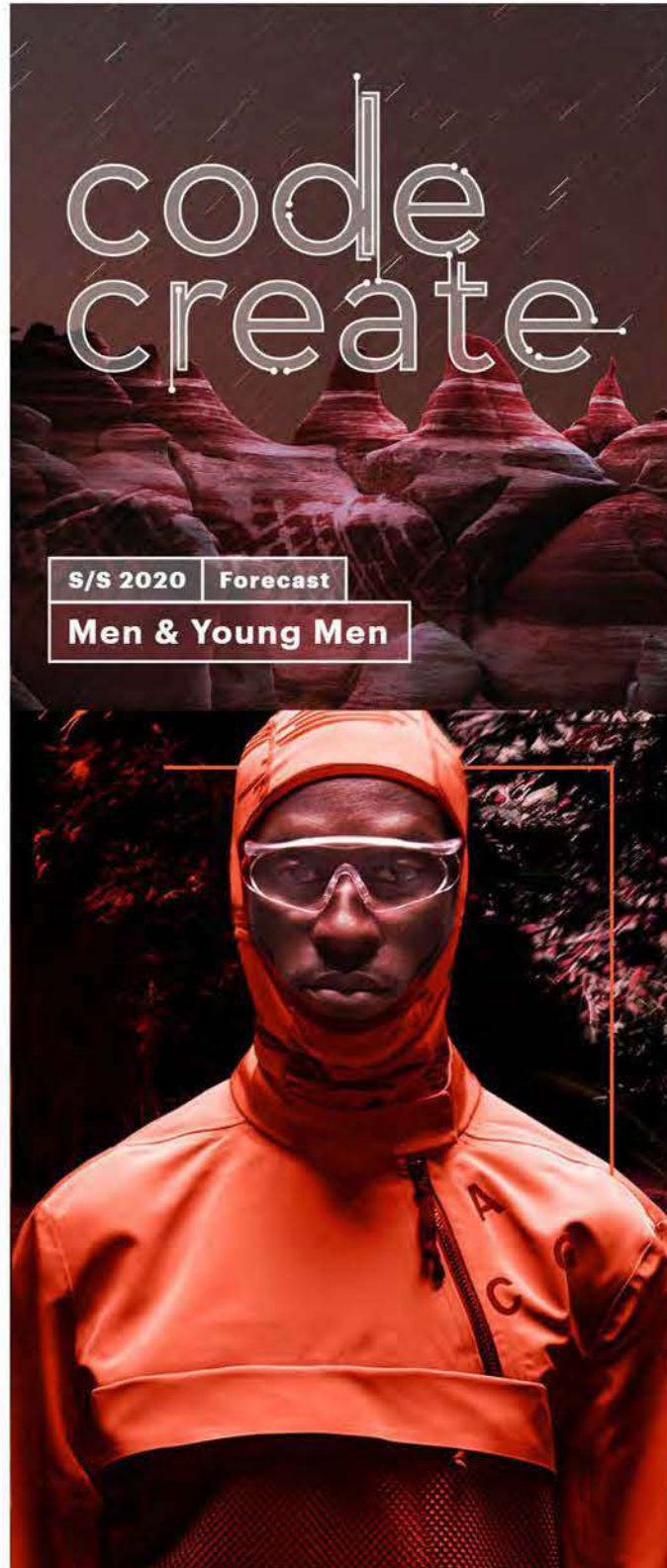
A heat acclimatization running suit for a male runner preparing for the Badwater 135 Ultramarathon in Death Valley.”



Week 8

CMF and design response to midterm critique and comments.





Golden Coral

Frankie & Clo

Pantone: Golden Coral (16-1443 TCX)
Colors: Golden Coral (024-57-26)

Michael Melford

Rosie Matheson

Pioneer Orange

- This warm colour will be especially relevant for high-summer accessories and occasionwear, and will also offer strong appeal for the US casual market.

- Golden Coral will work well with earthy core tones, and is broad enough to have gender-neutral appeal across a range of applications and prints.

To find out more about Colours click here

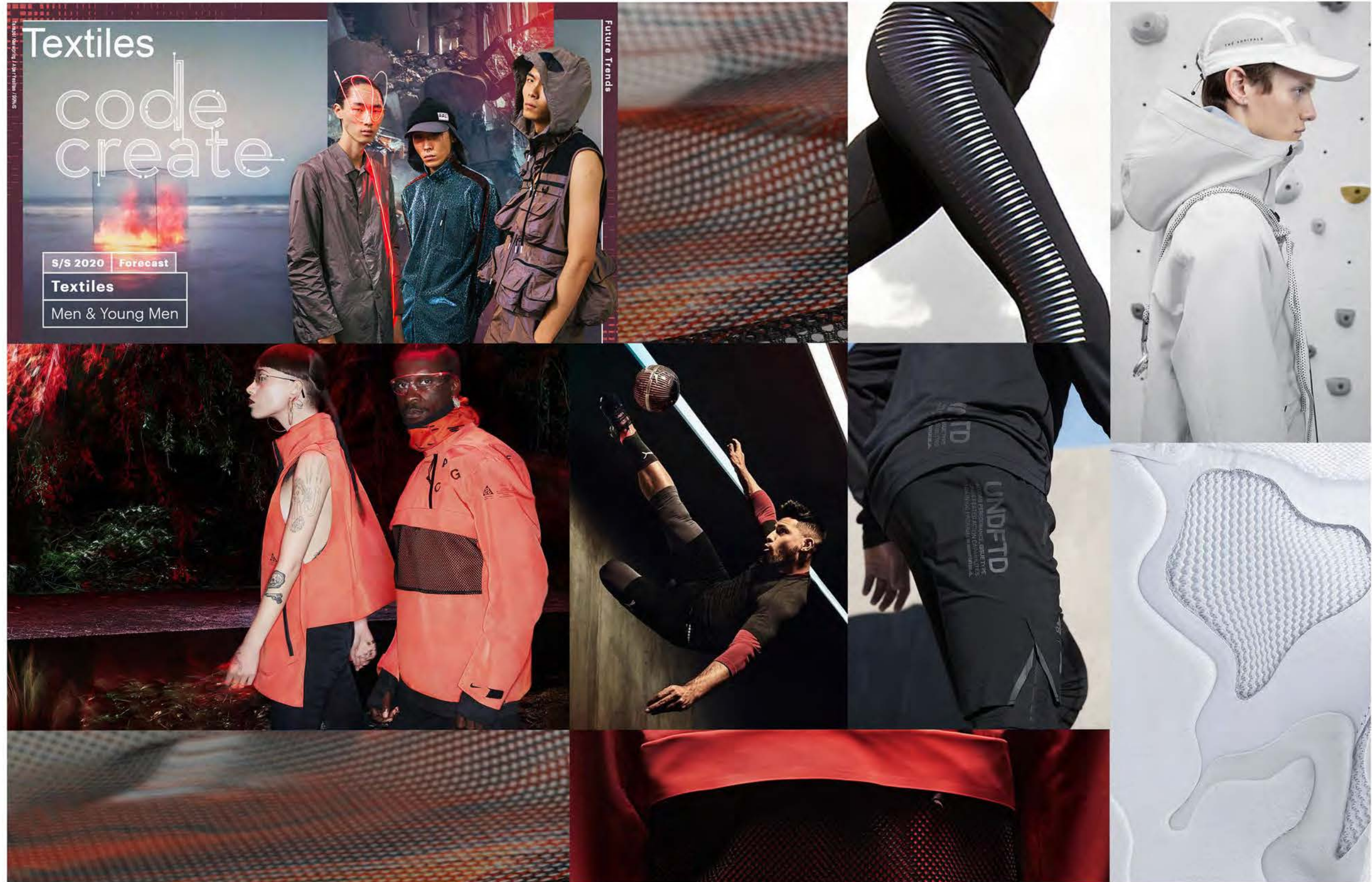
Colour Evolution A/W 20/21

Orange

A/W 20/21
Oranges are bold and robust for A/W 20/21. Electric Kumquat (15-1164 TCX/028-67-41) and Marmalade (16-1361 TCX/020-60-35) have a digital quality that feels fresh, while Choccy (18-1163 TCX/028-43-28) is versatile enough to have transseasonal appeal.

S/S 20
Orange emerges as a key seasonal colour - and one with gender-neutral appeal. The milky subdued tone of Cantaloupe (15-1239 TCX/020-72-30) and the bright Hot Tigerlily (17-1456 TCX/016-53-33) are especially important this season.

A/W 19/20
Oranges have a strong presence for A/W 19/20, taking the form of pure, punchy, truly pigmented tones. These levels fall in line with a broader shift for the season towards colours that are bolder and more energetic.



OMNI-HEAT®
THERMAL REFLECTIVE

**KEEP YOUR WARMTH
NOT YOUR SWEAT**

Omni-Heat Thermal Reflective is breathable material with little silver dots that reflect body heat.



 **KEEP YOUR WARMTH
NOT YOUR SWEAT**

ABOUT OMNI-HEAT THERMAL REFLECTIVE

Omni-Heat Thermal Reflective manages body heat. The patented technology helps regulate your temperature with little silver dots that reflect and retain the warmth your body generates. Omni-Heat Thermal Reflective's breathable material also dissipates moisture and excess heat.

OMNI-DRY®
ULTRABREATHABLE
WATERPROOF

Superior breathability for serious wet-weather performance, Omni-Dry keeps you dry when you're working hard, regardless of the weather.



 **ULTRABREATHABLE
WATERPROOF**

ABOUT OMNI-DRY
Designed to keep you dry during highly physical activity, whatever the weather. This extremely air permeable waterproof fabric transfers the moisture vapors you generate out of the garment at an extremely high rate for a waterproof fabric, while still retaining its wind blocking properties and shedding the elements in the worst of conditions. Omni-Dry is the ultimate in waterproof technology for the outdoors.

OMNI-WICK®
KEEPS YOU DRY
AND COMFORTABLE

This moisture transferring technology moves and disperses sweat away from the body for quick evaporation, keeping you comfortable during physical activity.



 **ADVANCED
EVAPORATION**

ABOUT OMNI-WICK
Omni-Wick is the ultimate moisture management technology for the outdoors. Omni-Wick wicks moisture away from the body and enables perspiration to evaporate quickly. You stay dry, which helps prevent chafing, and keeps you comfortable all day. Go farther and faster in search of fun, and work up a sweat without getting all wet.

“Material studies around Columbia’s new Omni- line and 3D printed textiles provided inspiration for new ideation.”



OMNI-WICK EVAP

+

OMNI-HEAT

+

MIDDLE LAYER?

• MICRO-FIBER POLYESTER/POLYAMIDE
POLYESTER/NYLON BLEND

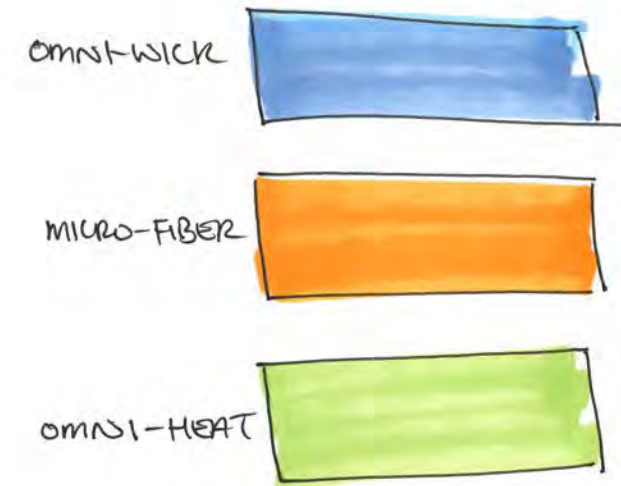
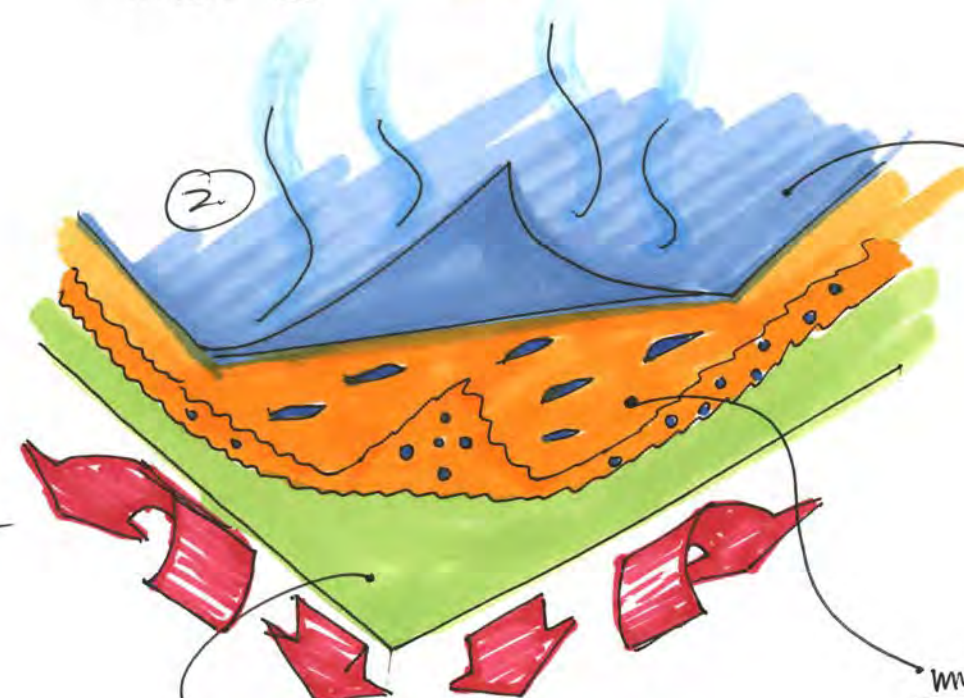
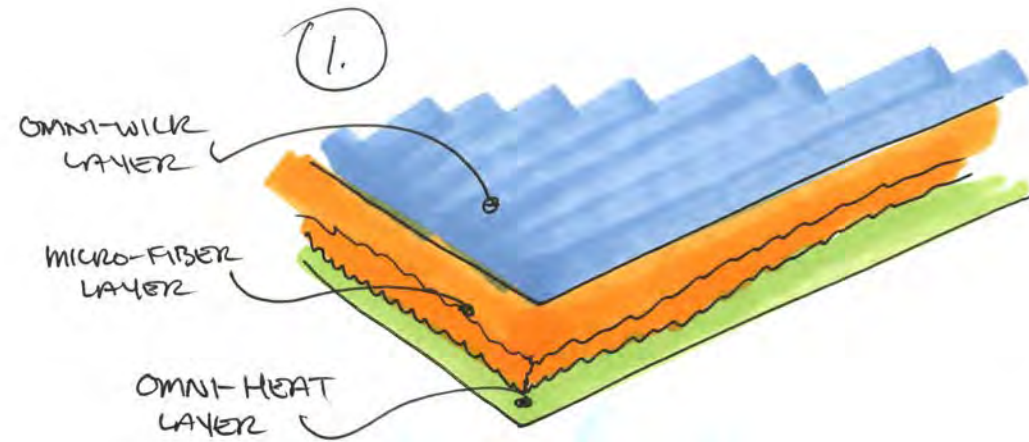
- MICRO FIBER IS LESS BREATHABLE
THAN COTTON

QUESTIONS:

DO WE STILL NEED A RUBBER OR VINYL
OUTER LAYER?

WHY MICRO-FIBER?

- ① ABSORBS WATER
- ② WICKS WATER
- ③ KEEPS SYSTEM FLOWING



- OMNI-WICK
- EVAPORATES MOISTURE
 - WATER PROOF
 - TAKES MOISTURE AND MOVES IT AWAY FROM BODY

- MICRO-FIBER
- MOVES LIQUID/SWEAT THROUGH
 - ABSORBS HIGH MOISTURE LEVELS
 - HELPS KEEP ATHLETE DRY

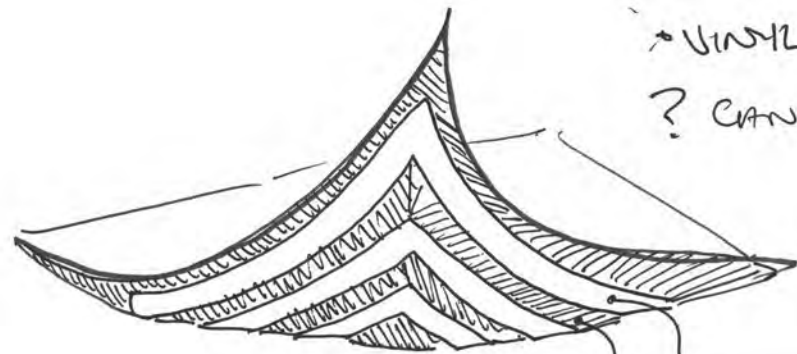
- OMNI-HEAT
- CREATES HEAT
 - CREATES SWEAT
 - SWEAT WICKING
 - BODY HEAT
 - VERY FLEXIBLE

MID-TERM DESIGN RESULTS

- COLUMBIA OMNI-HEAT TELM -

BIGGEST TAKEAWAY → MATERIALS AND HEAT SWEAT MAPS

- DOES NOT NEED TO BE VINYL
 → VINYL IS NOT BREATHABLE
 ? CAN WE PUT VENTS ON VINYL?



INCREDIBLY EFFECTIVE SWEAT WICKING MATERIAL

REFLECTIVE ALUMINUM EMERGENCY BLANKET MATERIAL

MOCK-UPS

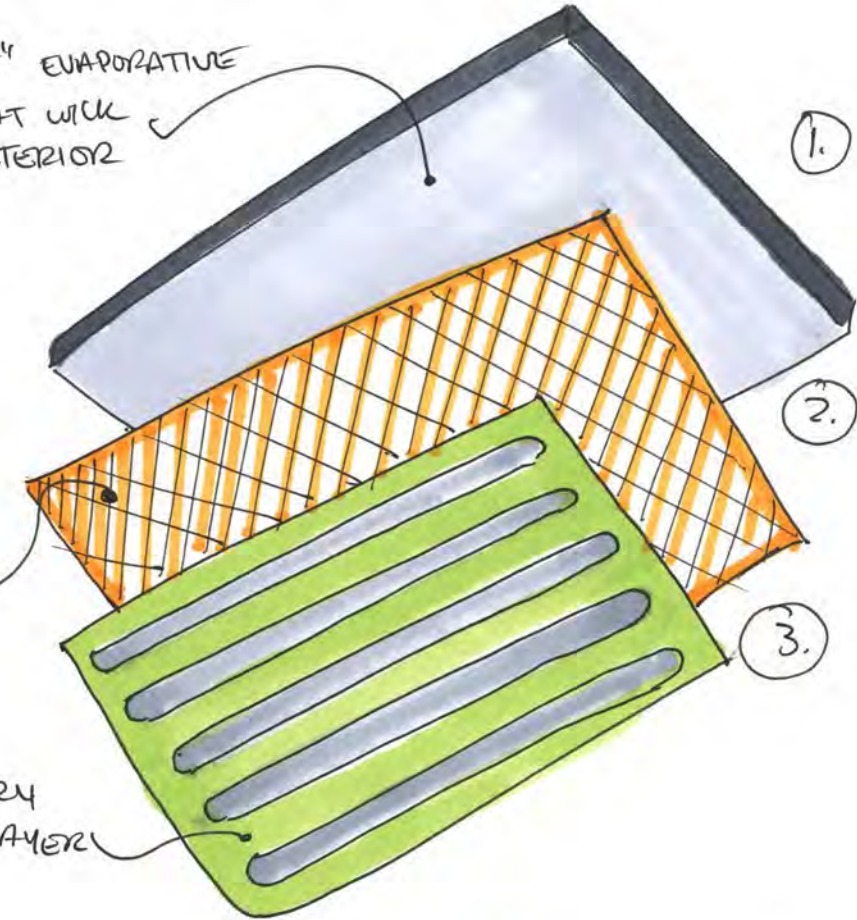
- CAMPING BLANKET
- TOWEL/SPONGE
- VINYL SUIT
- OMNI-HEAT LAYER
- SWEAT WICKING WOOL
- COMPRESSION SHORT
-

★ IT'S ALL ABOUT LAYERS ★

- HEAT CONDUCTING MATERIAL
- SWEAT WICKING MATERIAL
- ABSORBANT LAYER
- EVAPORATIVE SPONGE LAYER

LAYERS OF MATERIALS

"HOT" EVAPORATIVE SWEAT WICK EXTERIOR



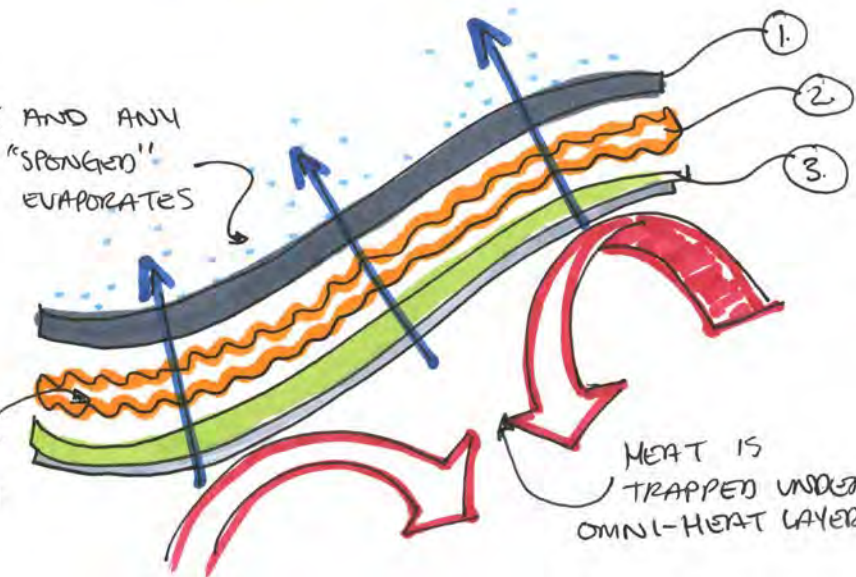
TOTALLY NON ABSORBANT WOOL LAYER

OMNI-DRY HEAT LAYER

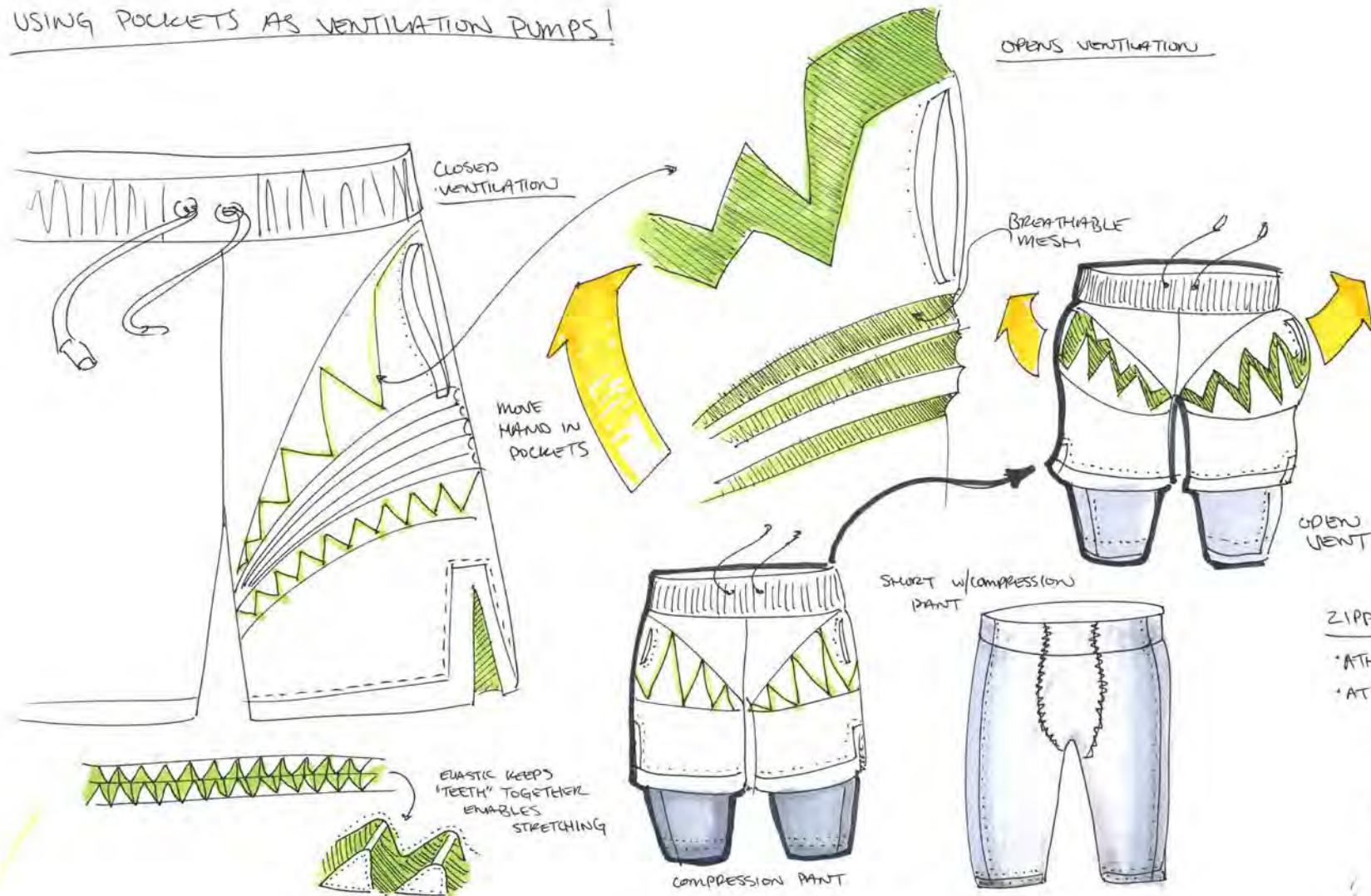
SWEAT AND ANY WATER IS "SPONGED" OUT AND EVAPORATES

WOOL LAYER ONLY PULLS SWEAT AWAY FROM BODY

HEAT IS TRAPPED UNDER OMNI-HEAT LAYER



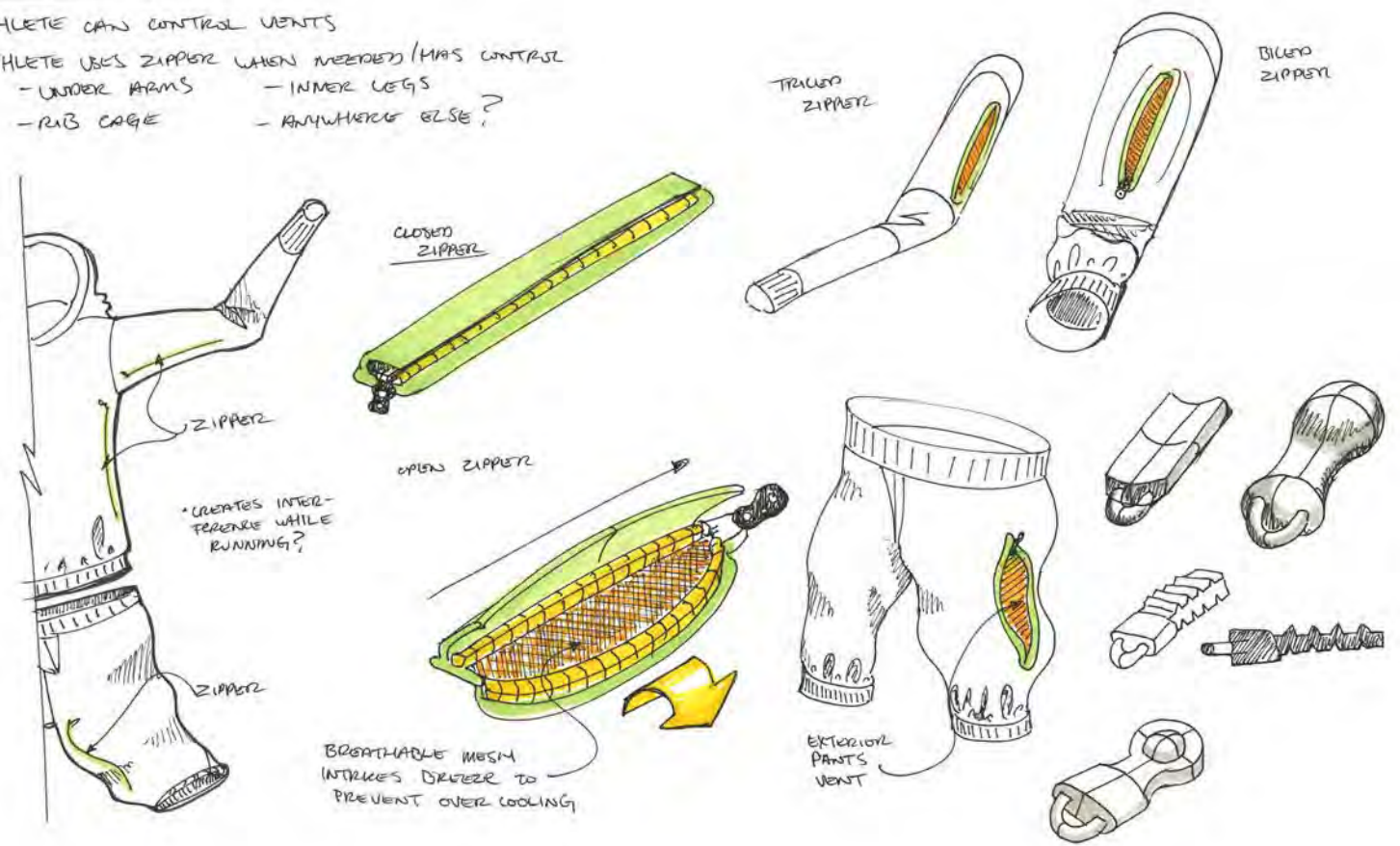
USING POCKETS AS VENTILATION PUMPS!



“Taking the idea of 3D printed textiles and applying that to an expandable part of the garment for ventilation is a path I am following. It goes back to letting the athlete physically ‘pump’ cool air into the suit to control their heat.”

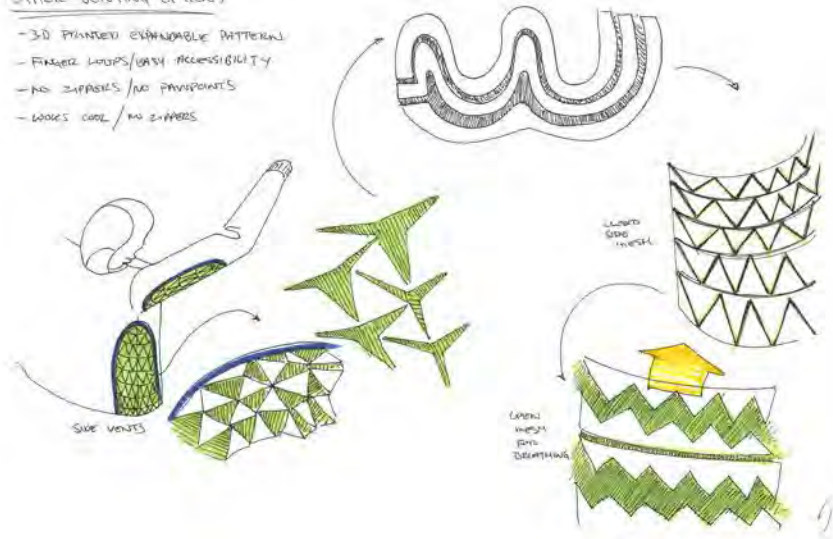
ZIPPER VENTS

- ATHLETE CAN CONTROL VENTS
- ATHLETE USES ZIPPER WHEN NEEDED/HAS CONTROL
 - UNDER ARMS
 - INNER LEGS
 - RIB CAGE
 - ANYWHERE ELSE?

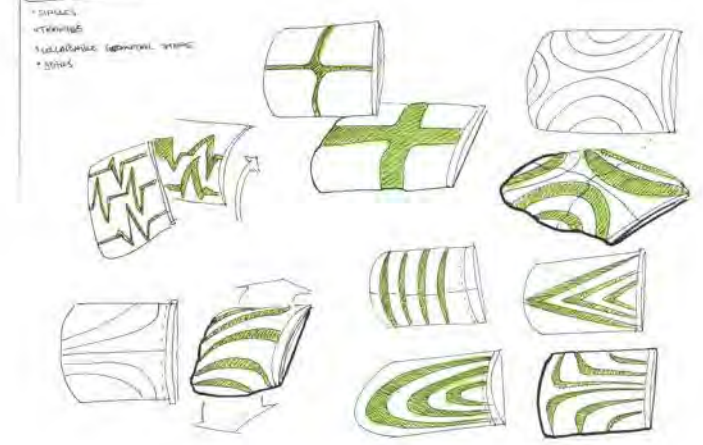


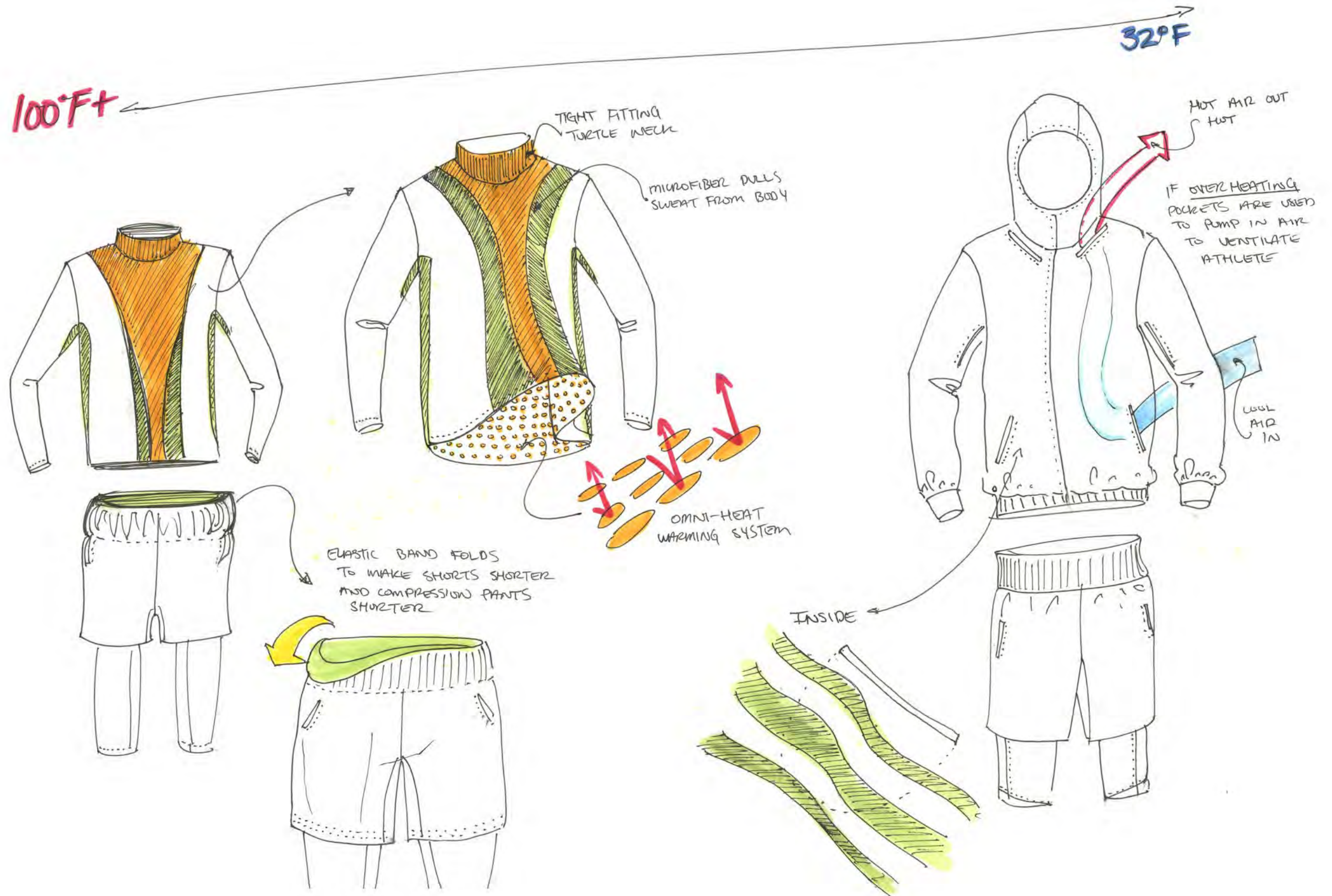
OTHER VENTING OPTIONS

- 3D PRINTED EXPANDABLE PATTERNS
- FINGER LOOPS/GRIP ACCESSIBILITY
- NO ZIPPERS/NO PARTIALS
- WORKS COOL/NO ZIPPERS



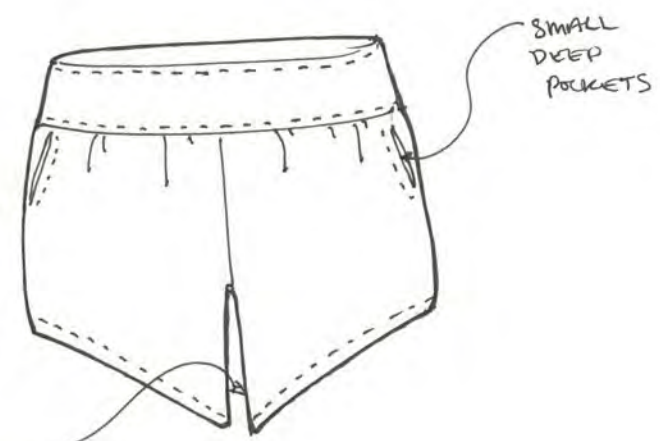
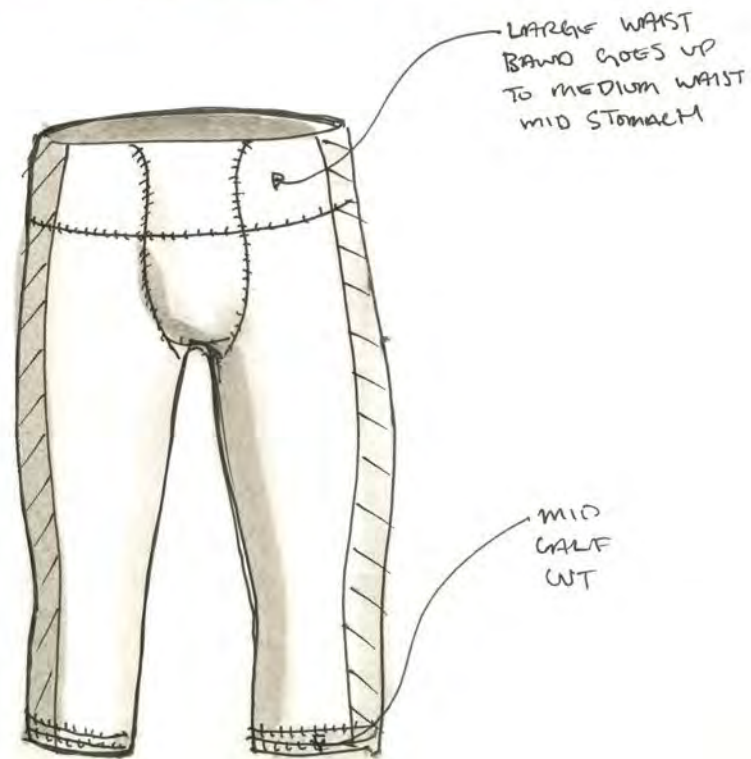
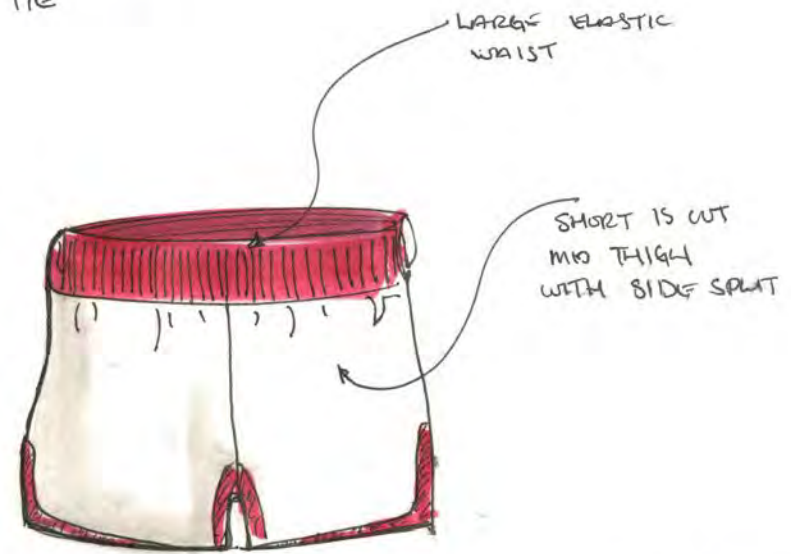
POCKET VENT



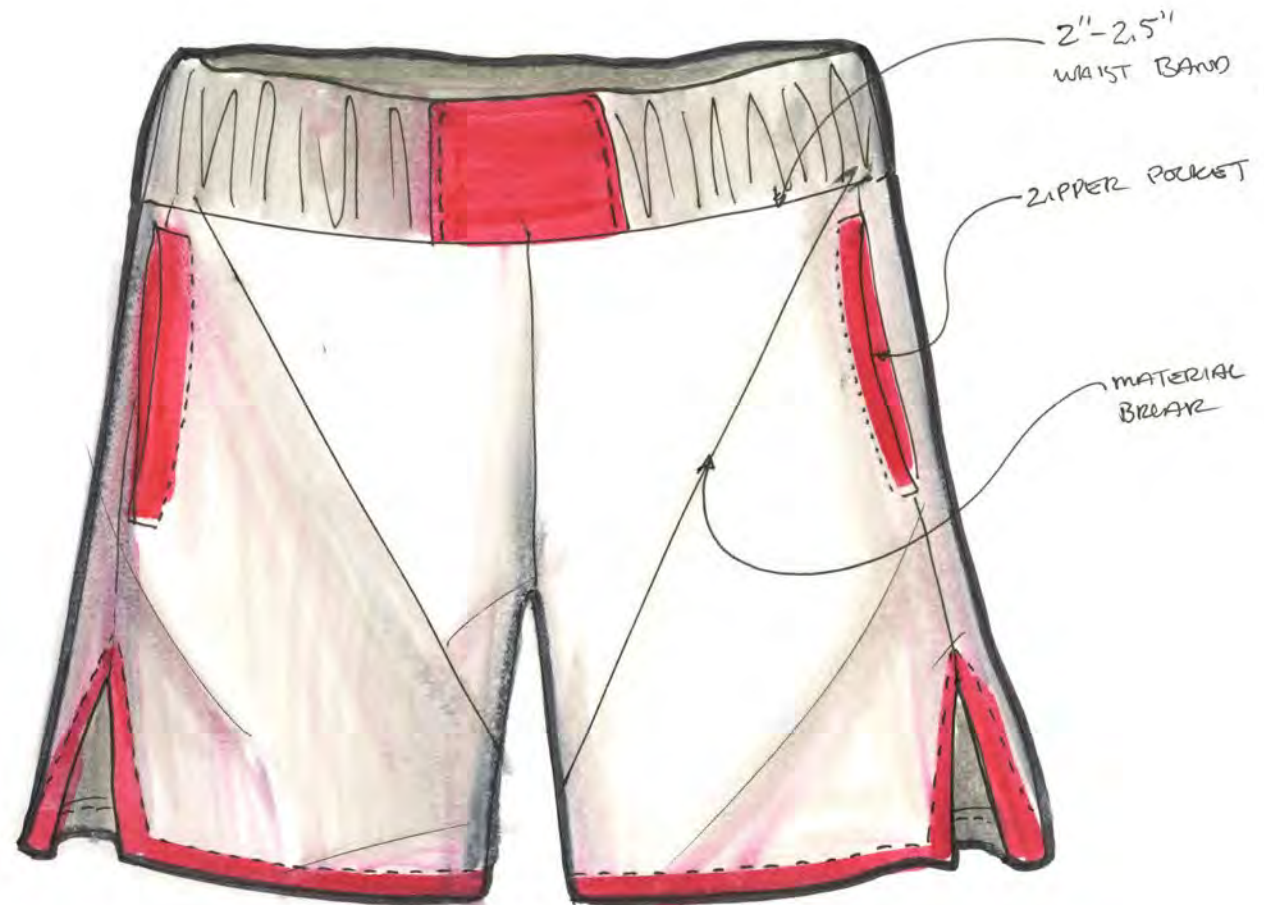


SHORT AND COMPRESSION PANT

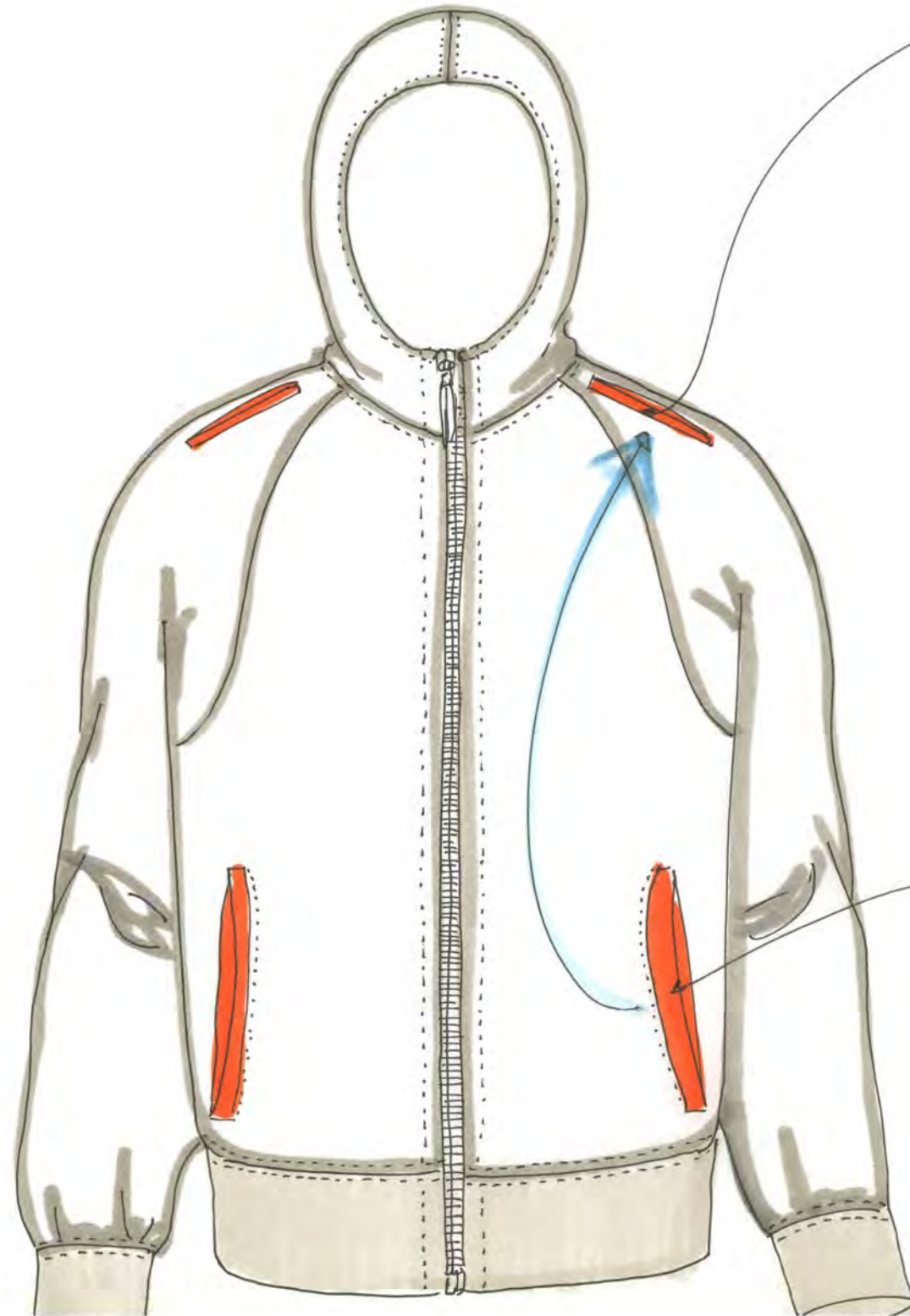
- 2-1 SHORT PANT
- POCKETS X 2
- MID THIGH SHORT
- WAIST TIE



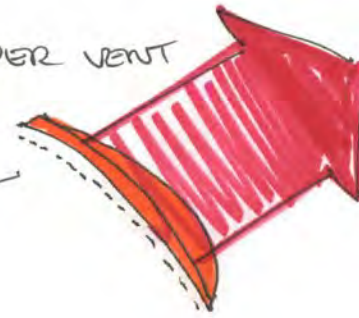
PREVENTS CHAFFING



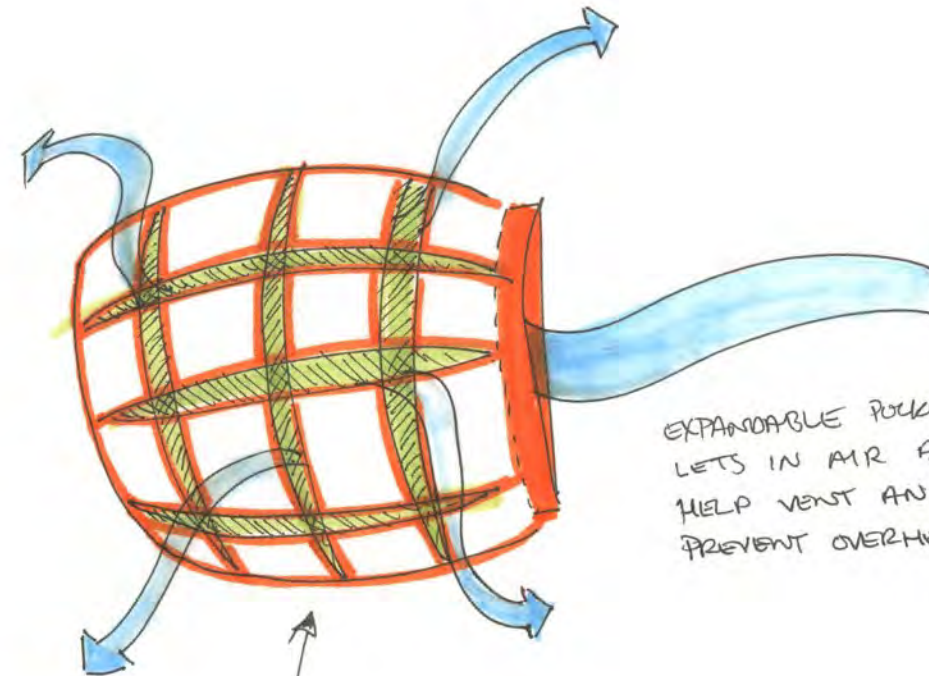
MOVING TOWARD FINAL DESIGN



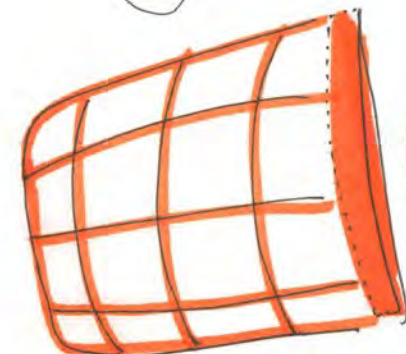
ZIPPER VENT



EXCESS AMOUNT OF HEAT ESCAPE AND "PUMPED OUT THROUGH SHOULDER VENT



EXPANDABLE POCKET LETS IN AIR AND HELP VENT AND PREVENT OVERHEATING



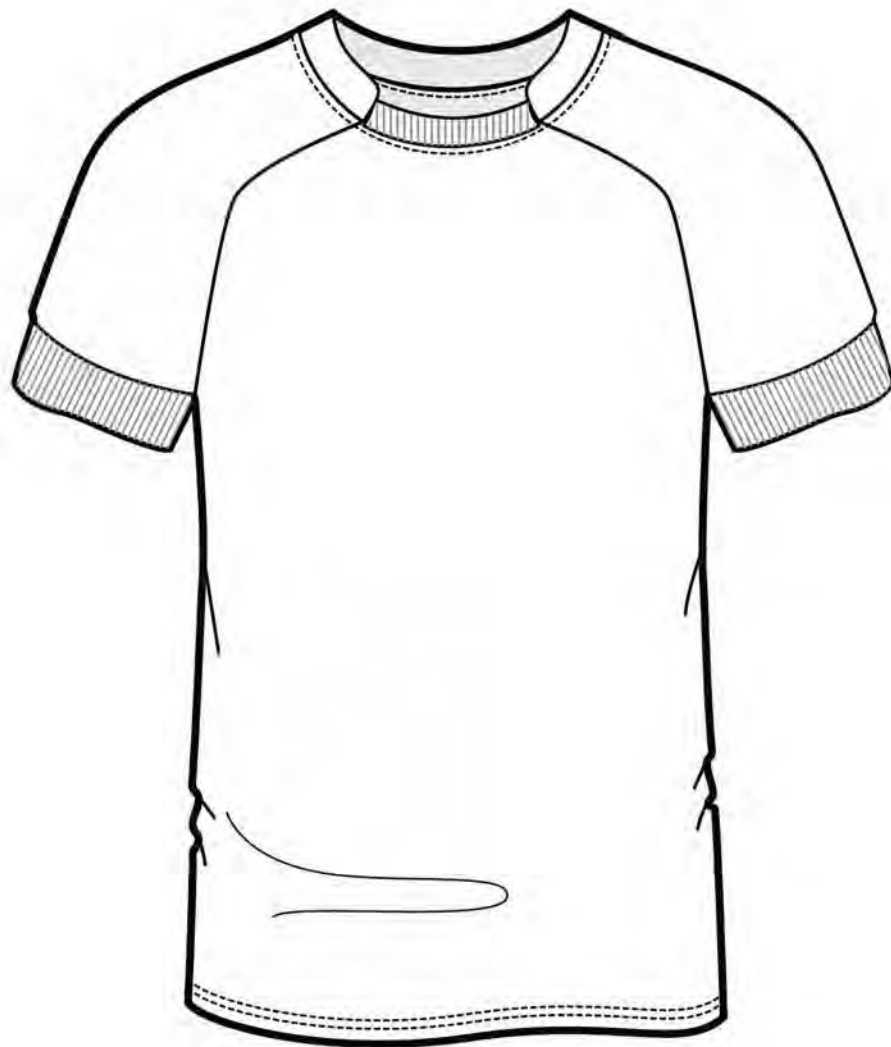
CLOSED AND SEALED INTERIOR POCKET



COLD AIR CANT GET PASSED CLOSED SEALED POCKET

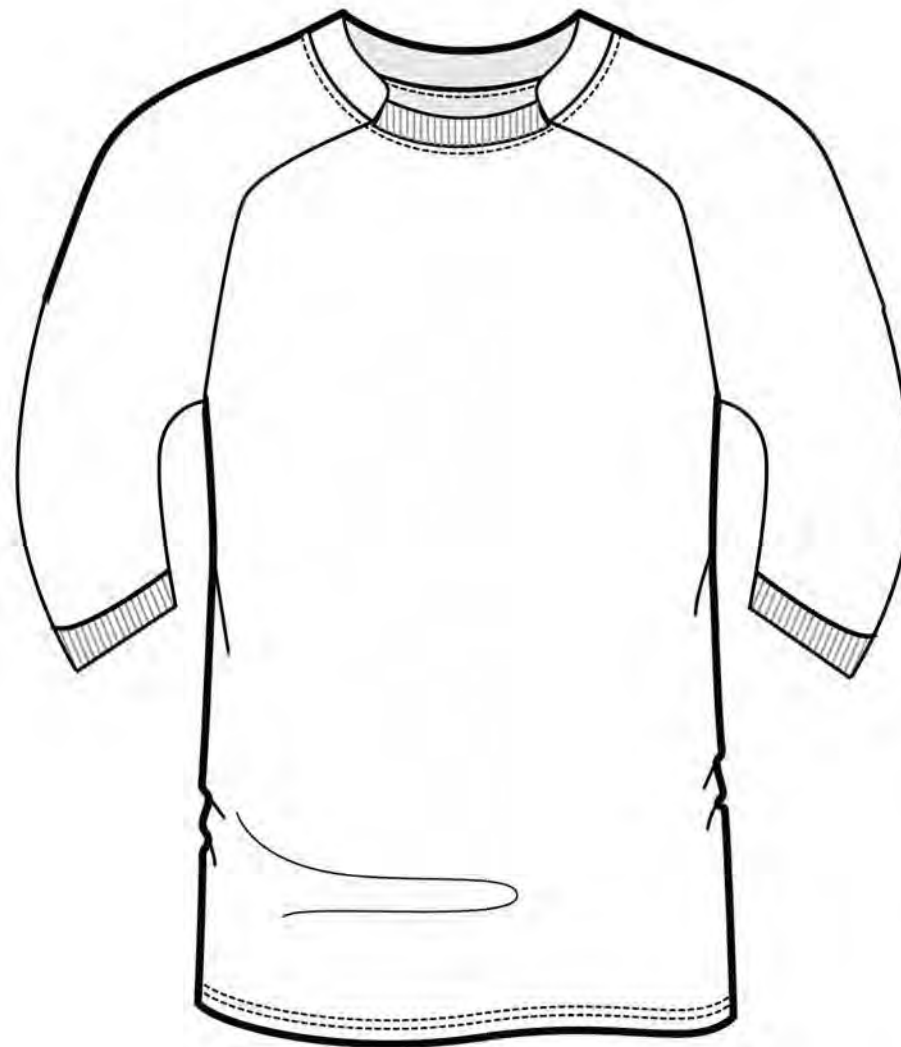
Base Layer 1

Elastic cuffs and collar



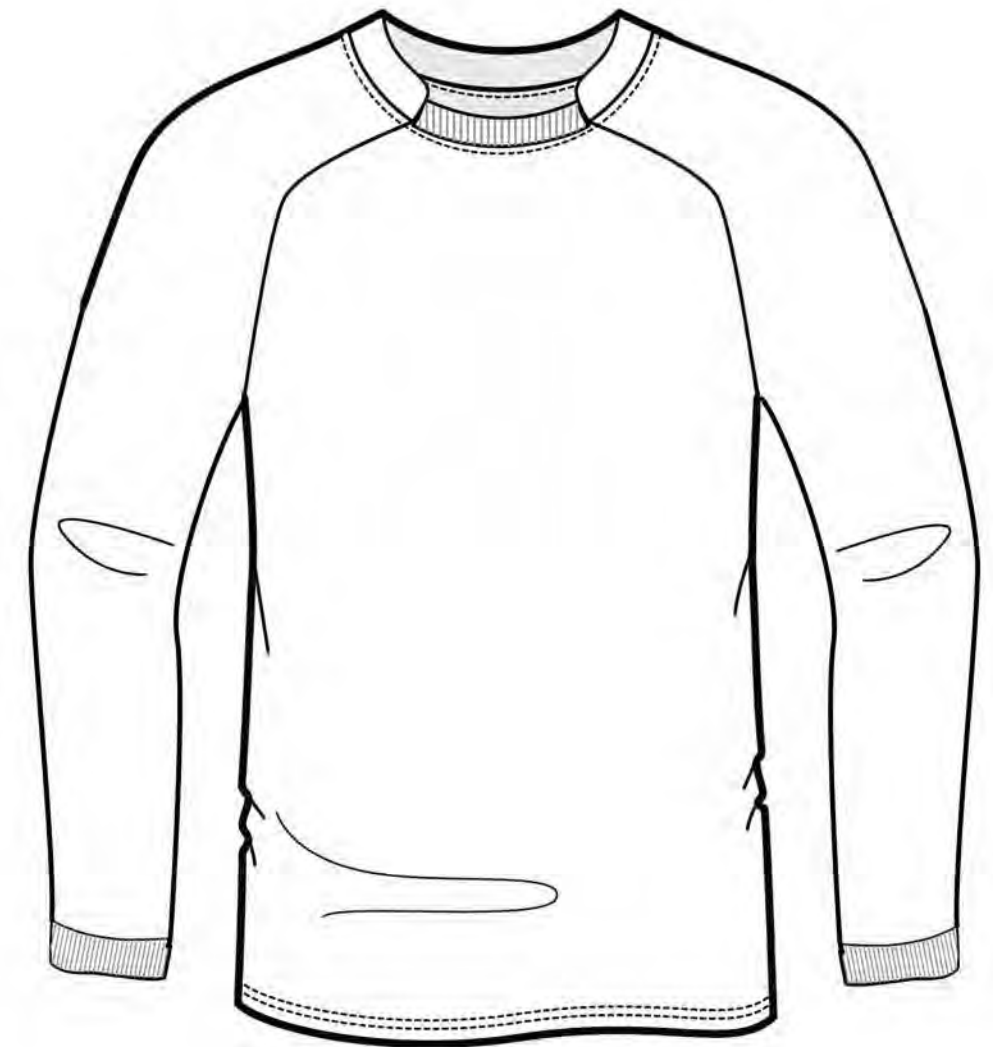
Base Layer 2

Baseball tee flat with elastic cuffs

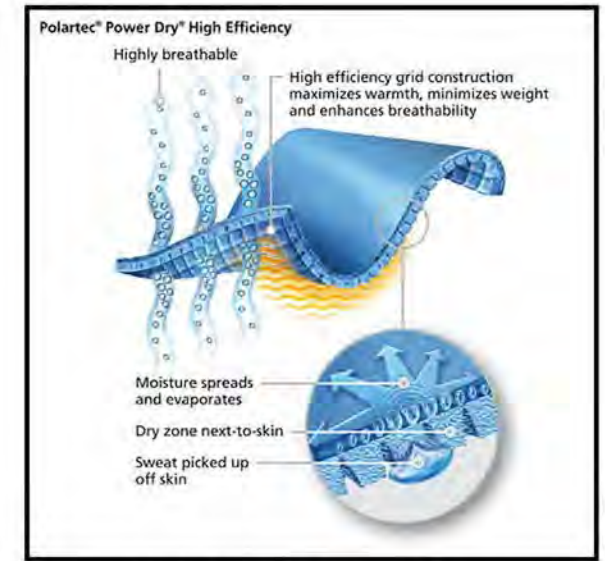
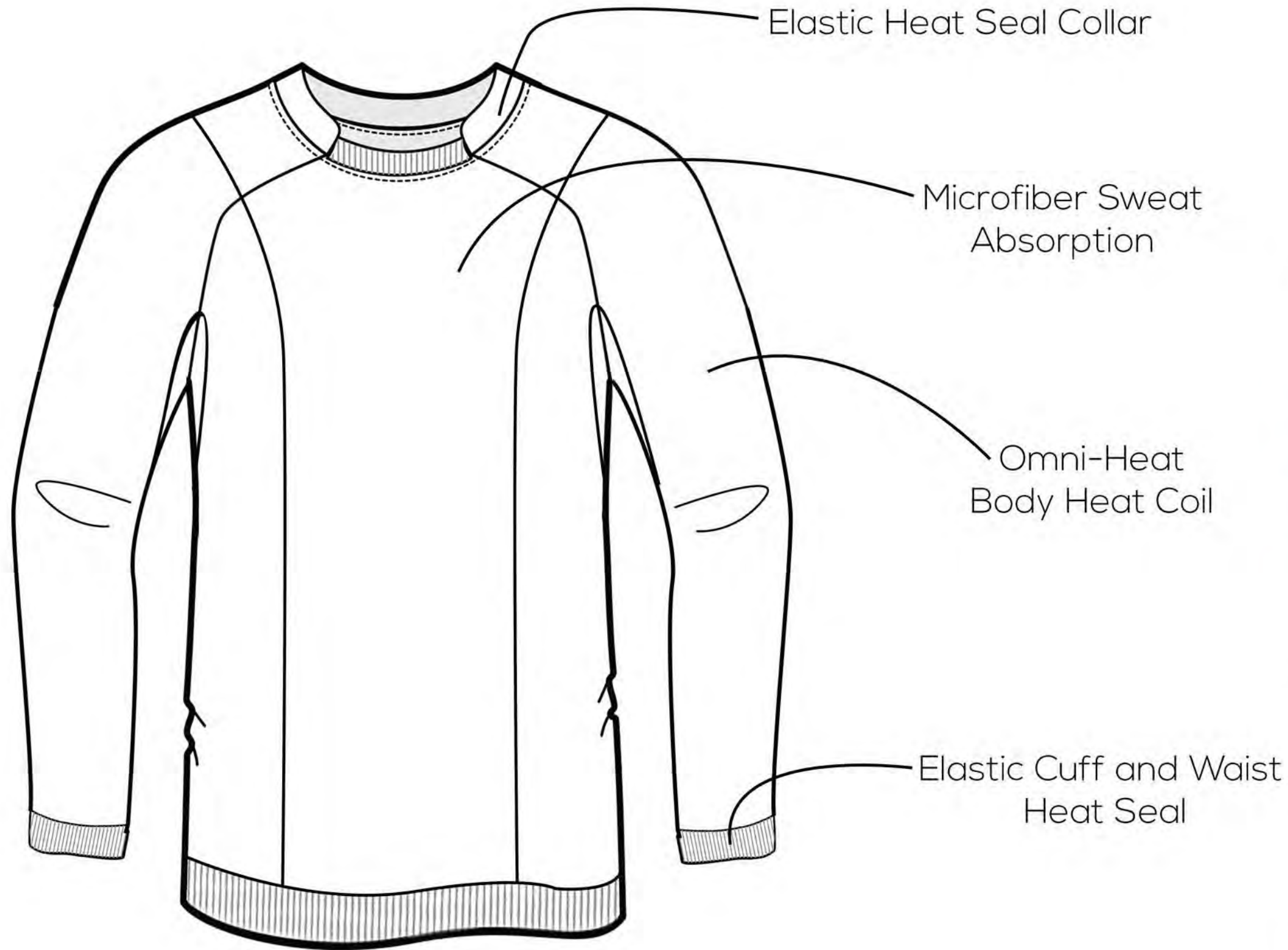


Base Layer 3

Long sleeve with elastic cuff



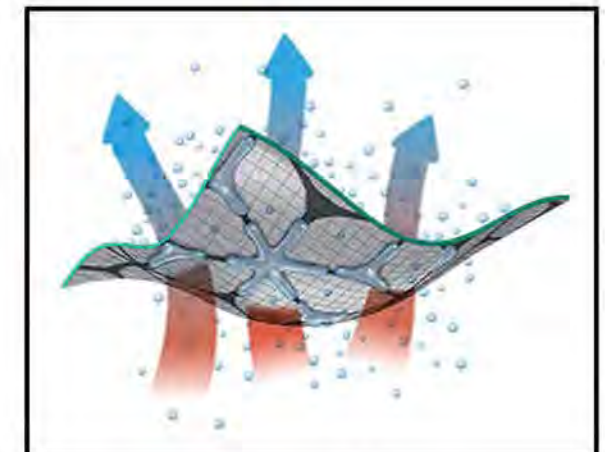
Long Sleeve Base Layer



PolarTech Microfiber



Omni Heat



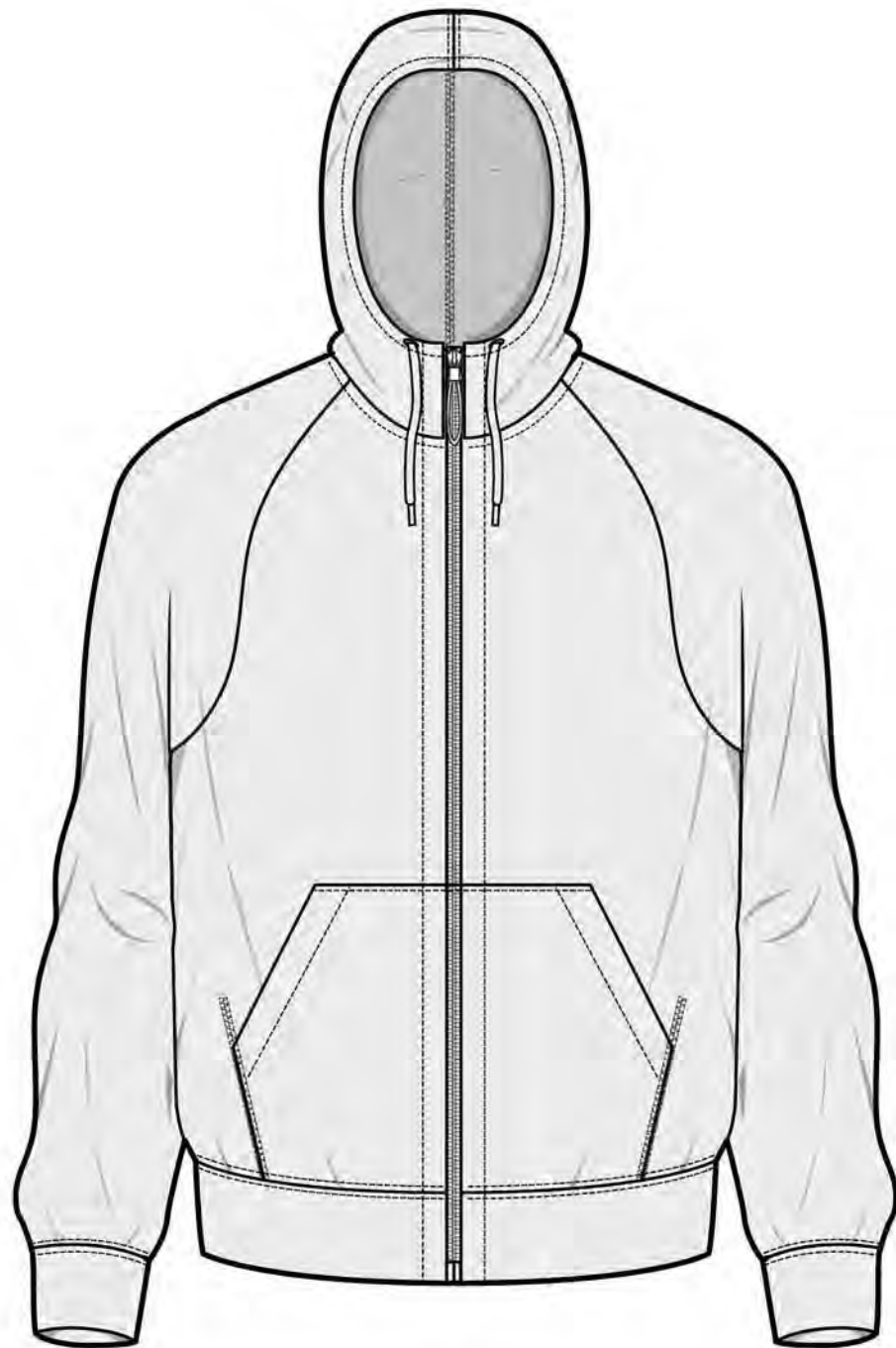
Omni Wick





Hoodie Concept 1

Front pockets with pull tie hoodie



Hoodie Concept 2

Elastic hoodie opening with minimal front design

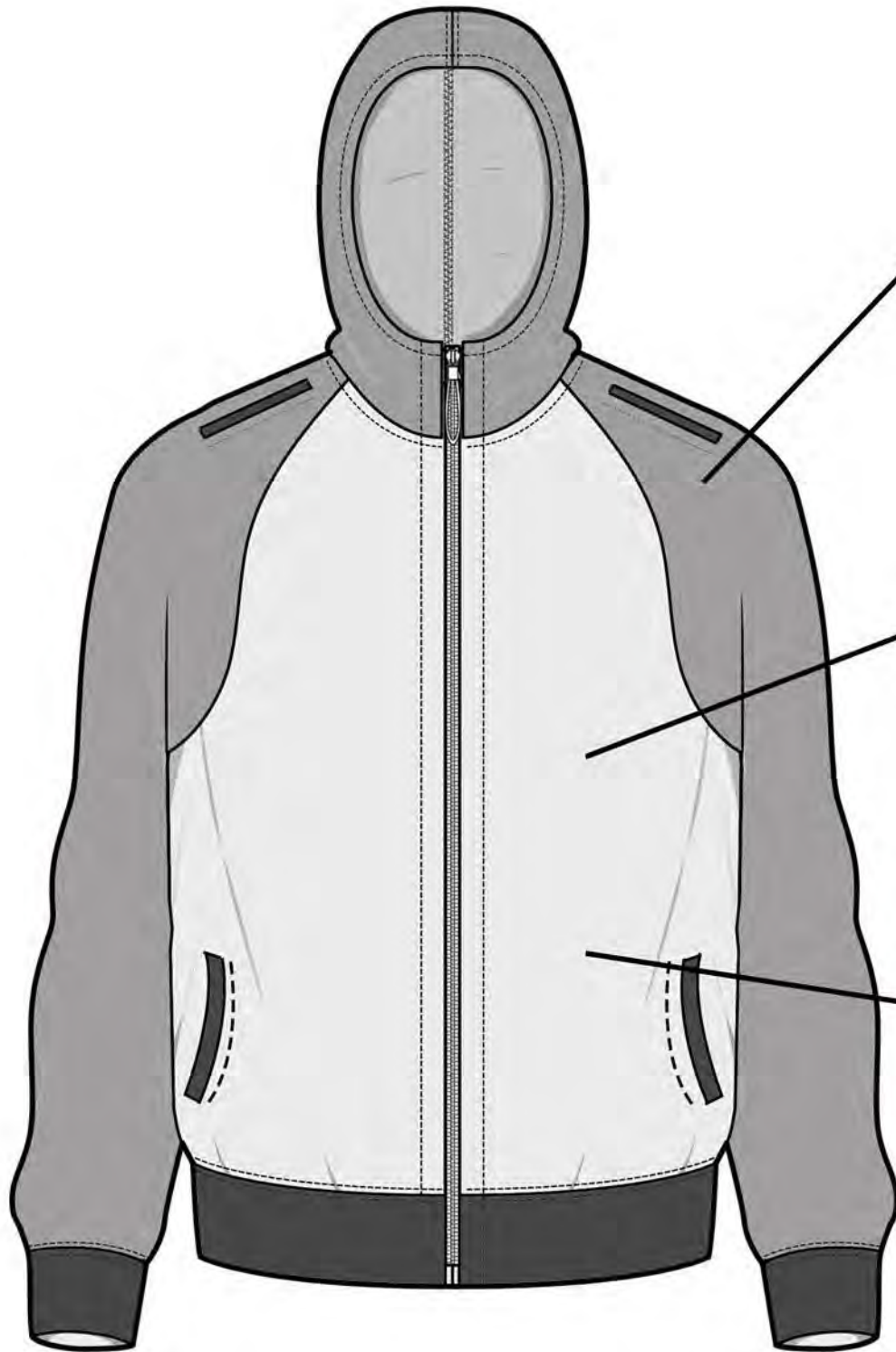


Hoodie Concept 3

Expandable pockets with shoulder vents



Exterior Vented Heat Hoodie



Shoulders and Hood deflect water

Core is kept warm through Omni Heat technology

Sunlight is deflected from garment to keep athlete from over heating



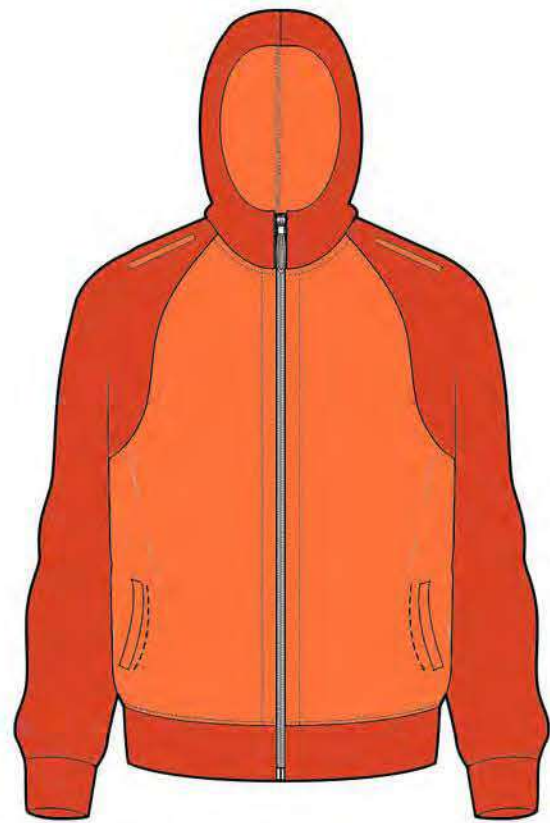
Water Proof Exterior



Deflects Harsh Sunlight



Keeps Body Warm







Short & Compression Pant Concept

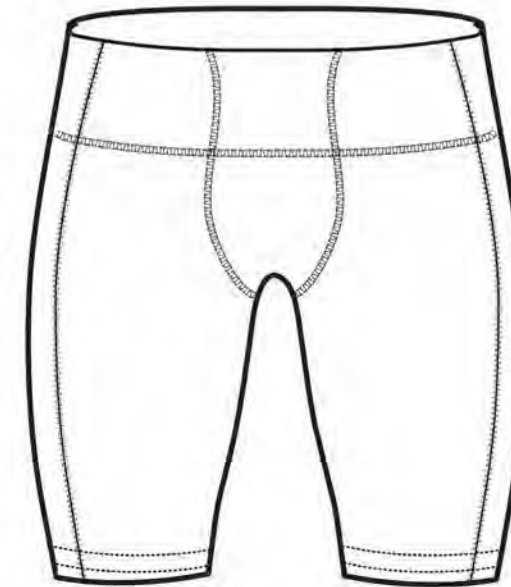
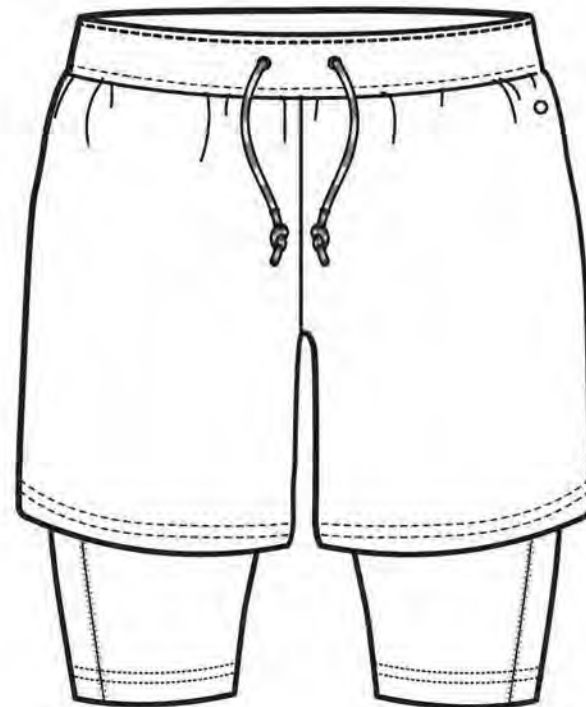
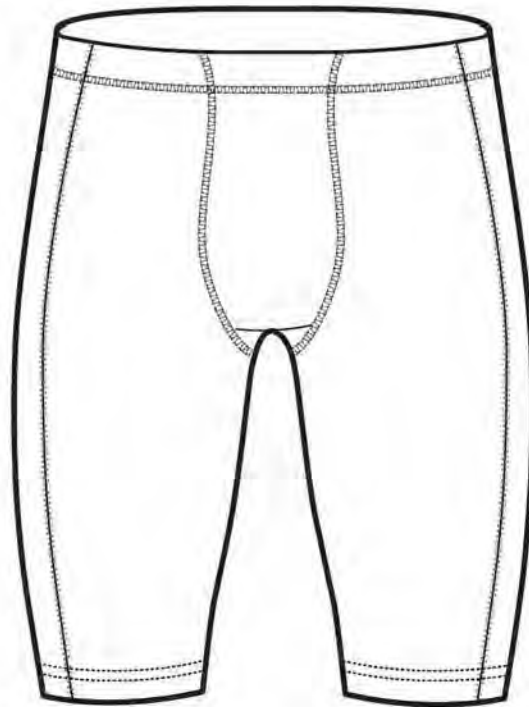


Concept 1

"Basic short with a compression mid-thigh compression pant. Draw string would tighten waist."

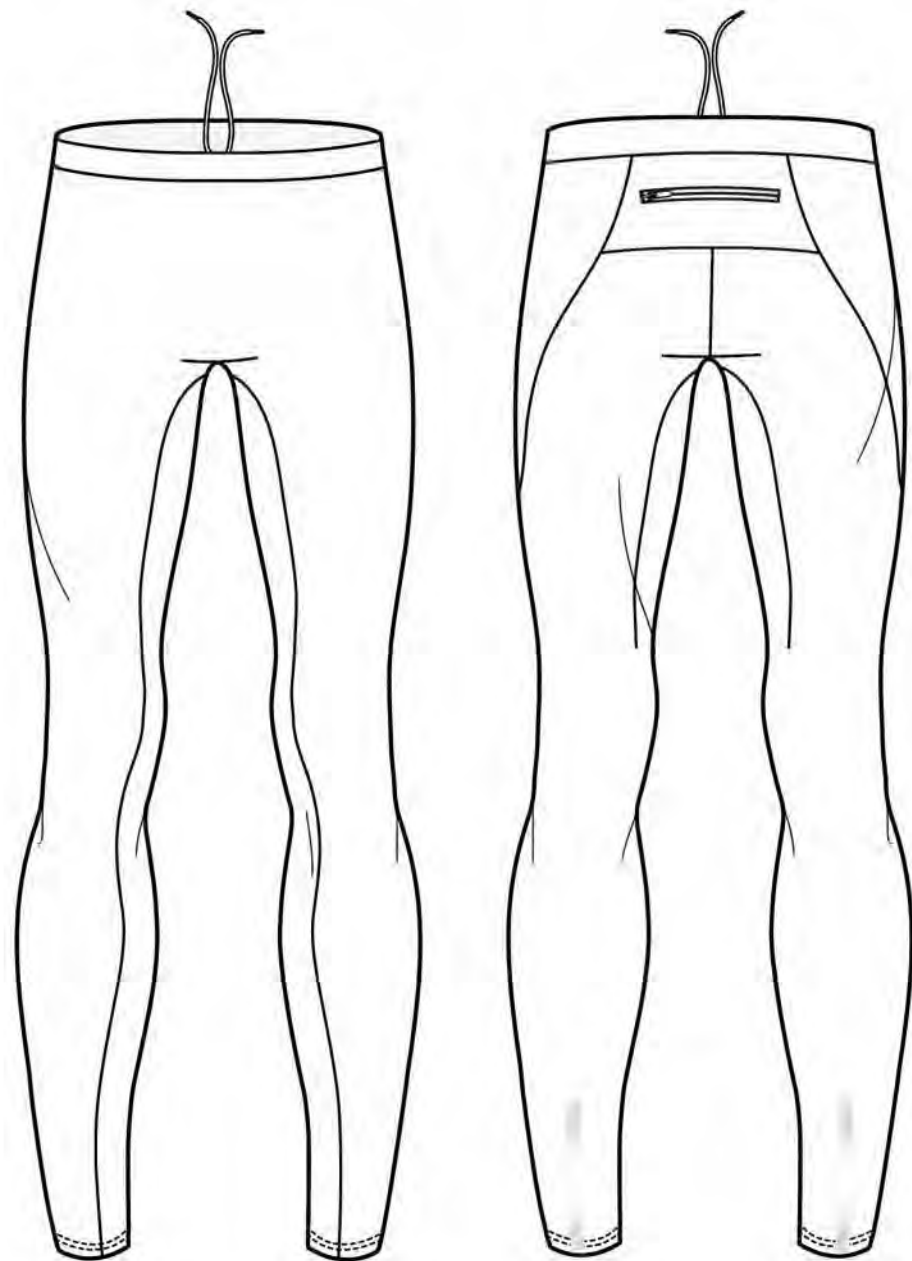
Concept 2

"Shorter pant and a shorter compression short. Higher waist band with no tie string. Minimal with no pockets."



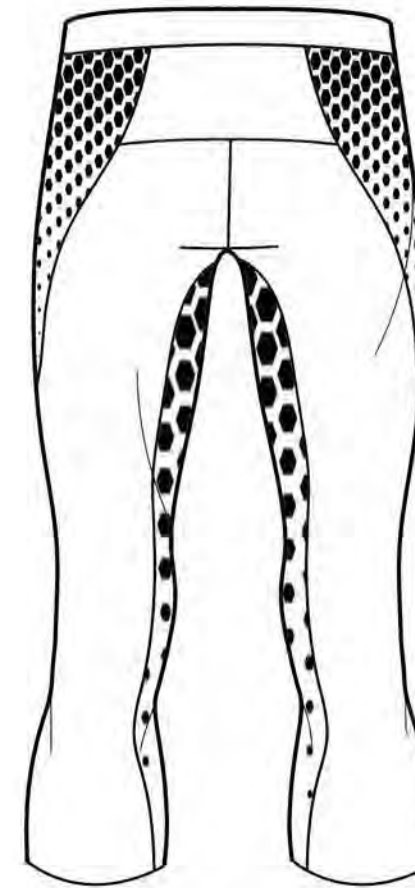
Concept 3

"Long compression pant keeps thermal leg heat trapped while short covers groin area."



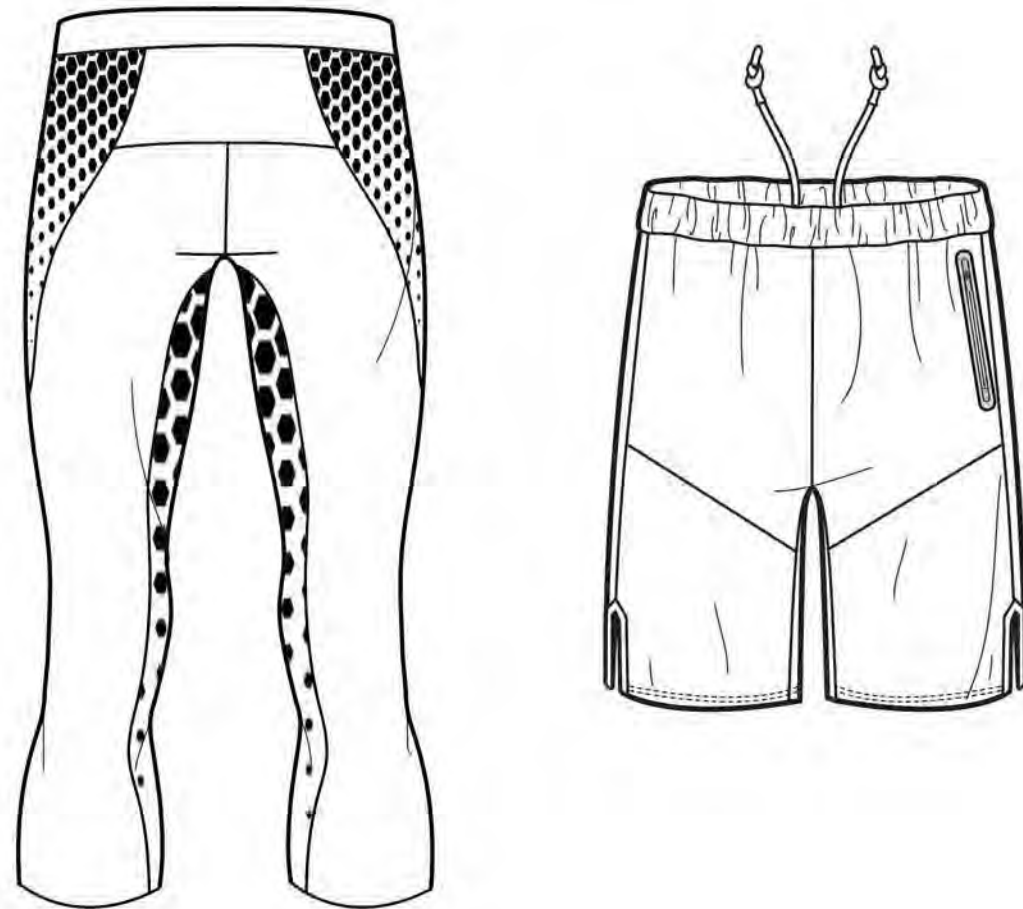
Concept 4

"Mid calf compression pant with Omni Heat shields to trap high heat zones while staying breathable and comfortable."



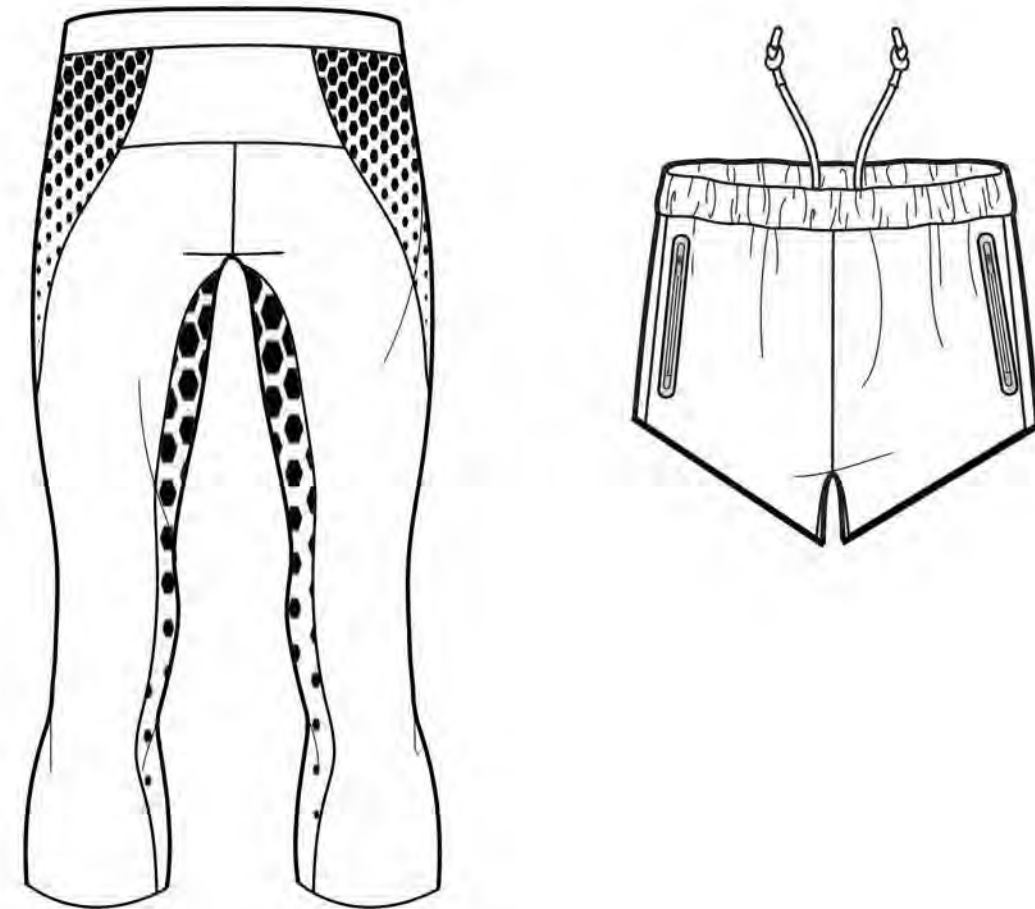
Concept 5

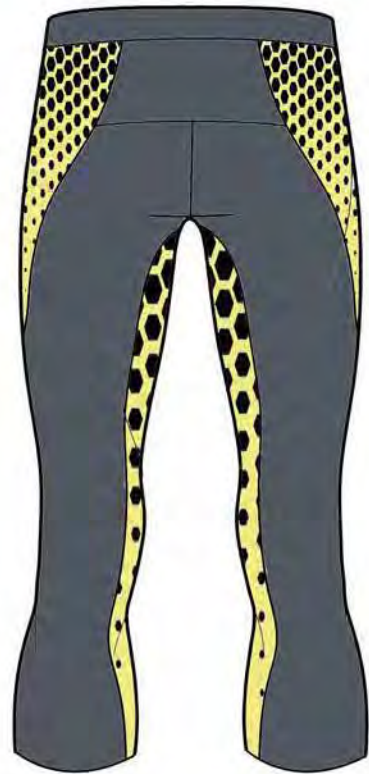
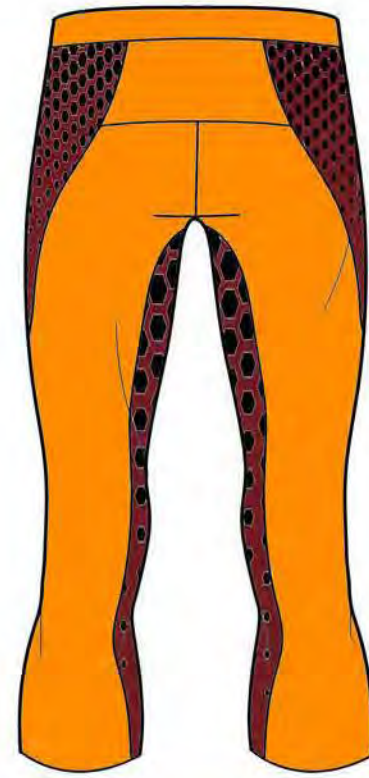
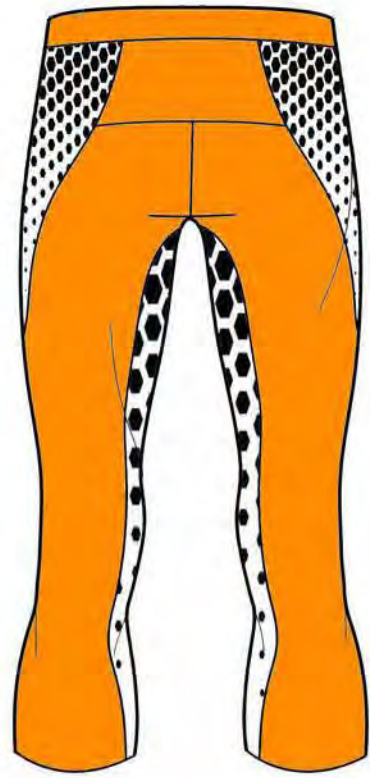
"Mid-calf compression pant paired with training short. Training short has functional pocket and foldable waist."

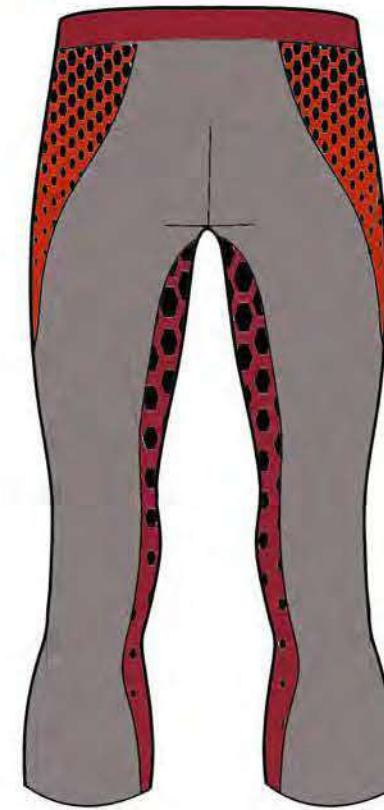
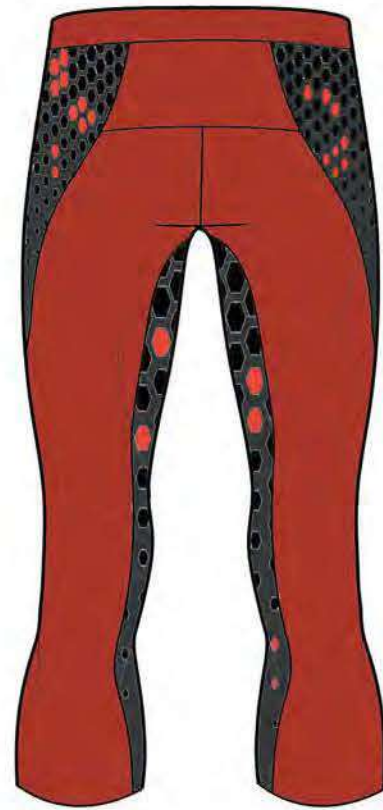
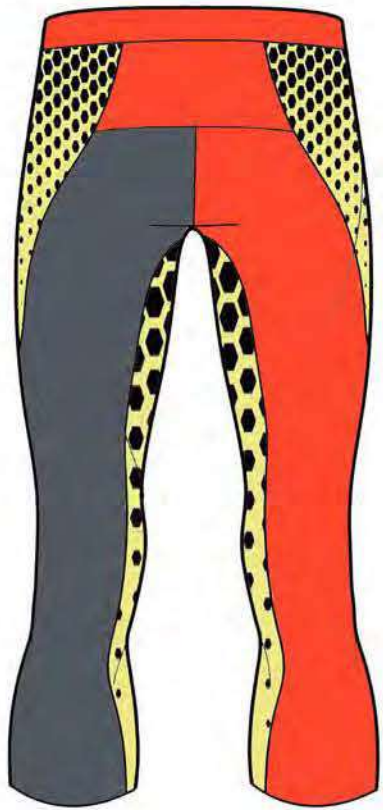
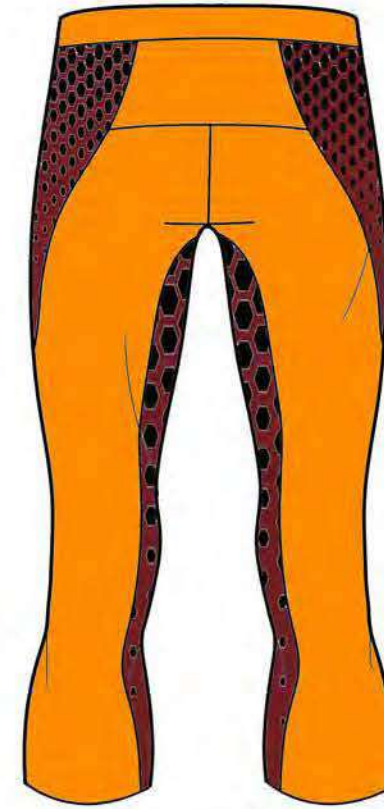


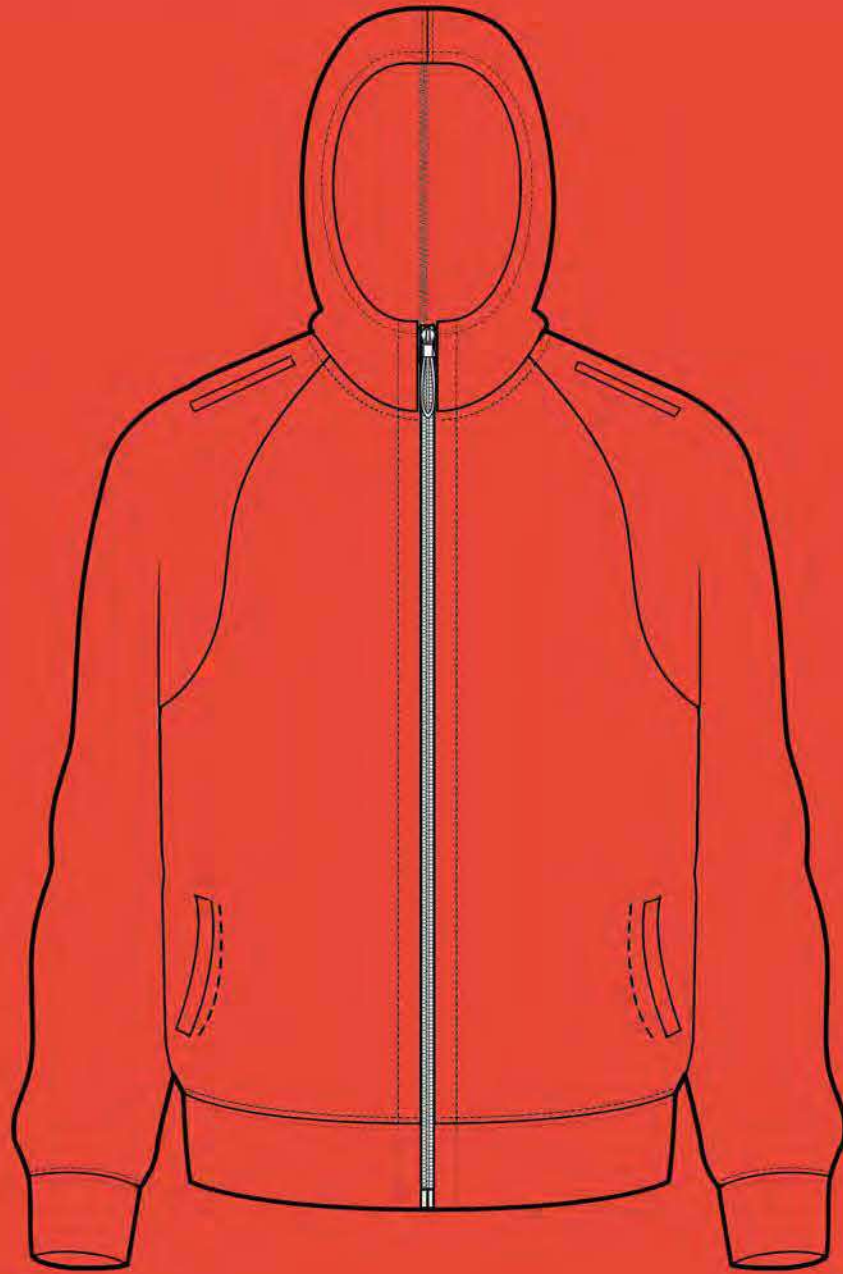
Concept 6

"Mid calf compression pant with high thigh short and duel pocket."





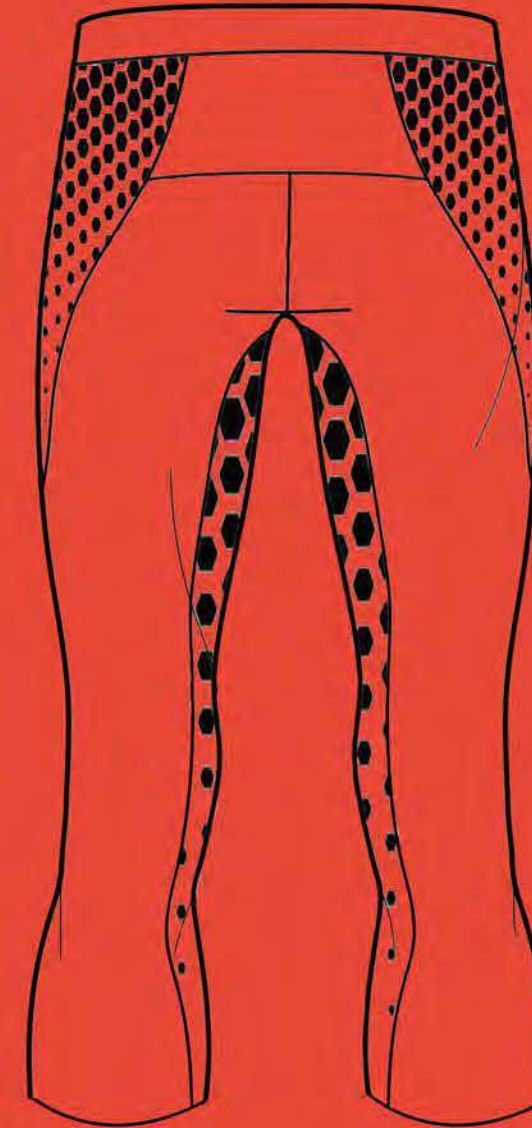




Heat Hoodie



Thermal Base Long Sleeve



Thermal Mid Calf Compression



Sport Short



Heat Hoodie



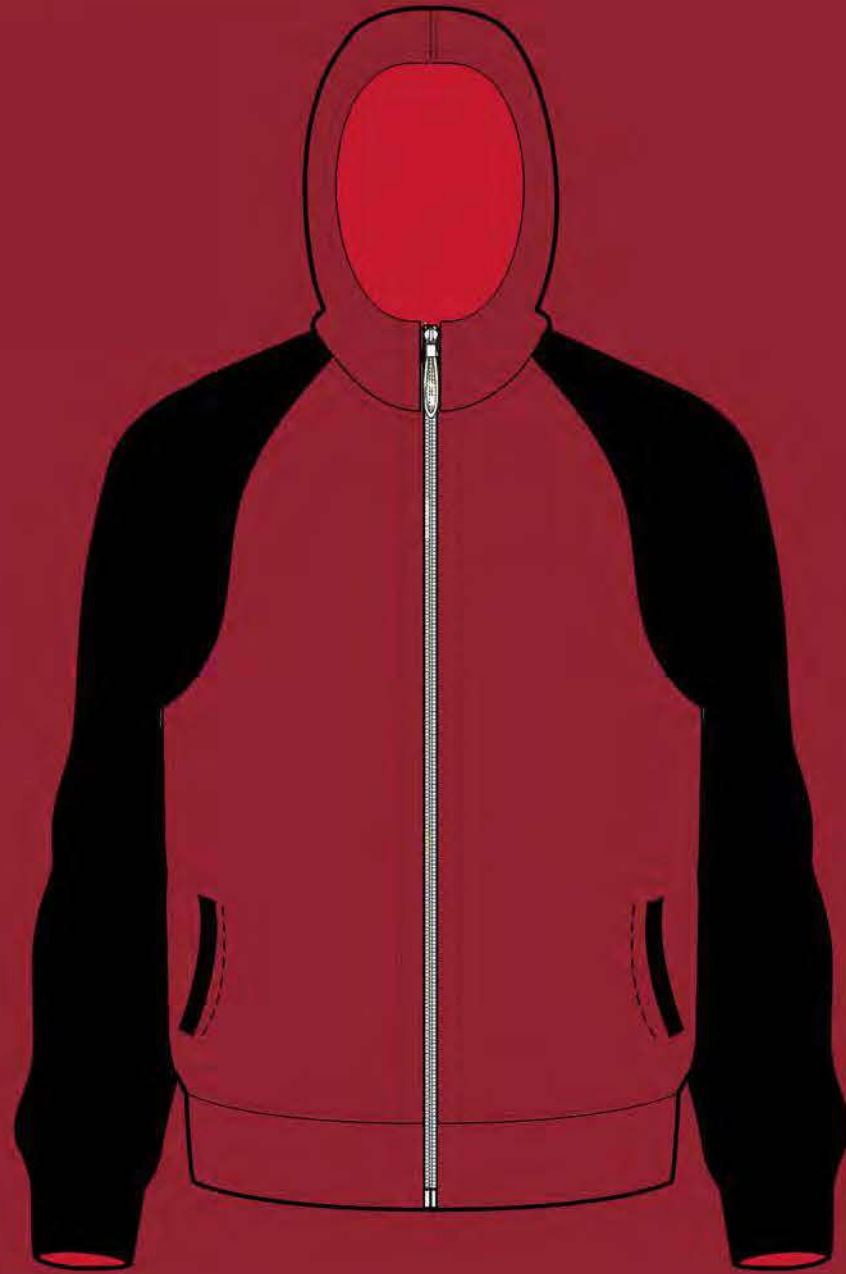
Thermal Base Long Sleeve



Thermal Mid Calf Compression



Sport Short



Heat Hoodie



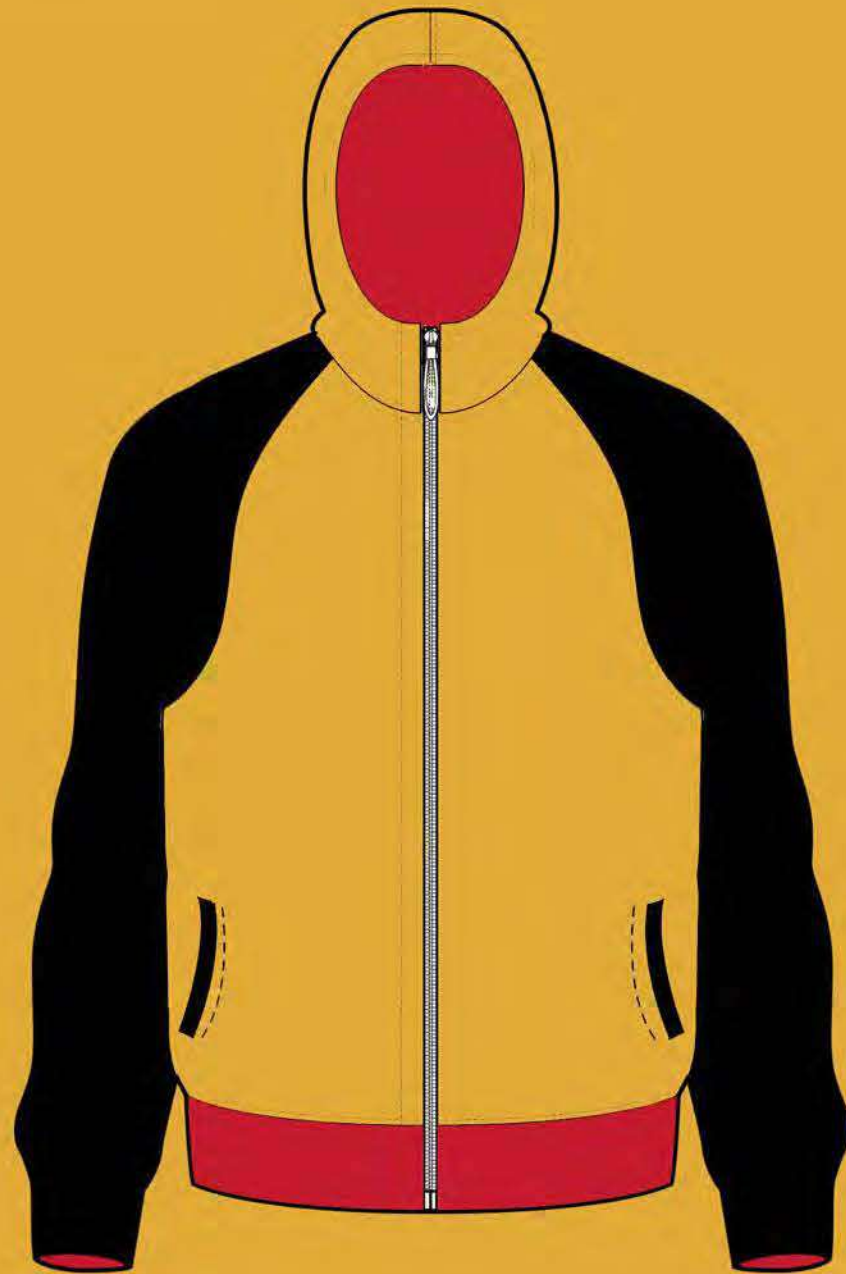
Thermal Base Long Sleeve



Thermal Mid Calf Compression



Sport Short



Heat Hoodie



Thermal Base Long Sleeve



Thermal Mid Calf Compression



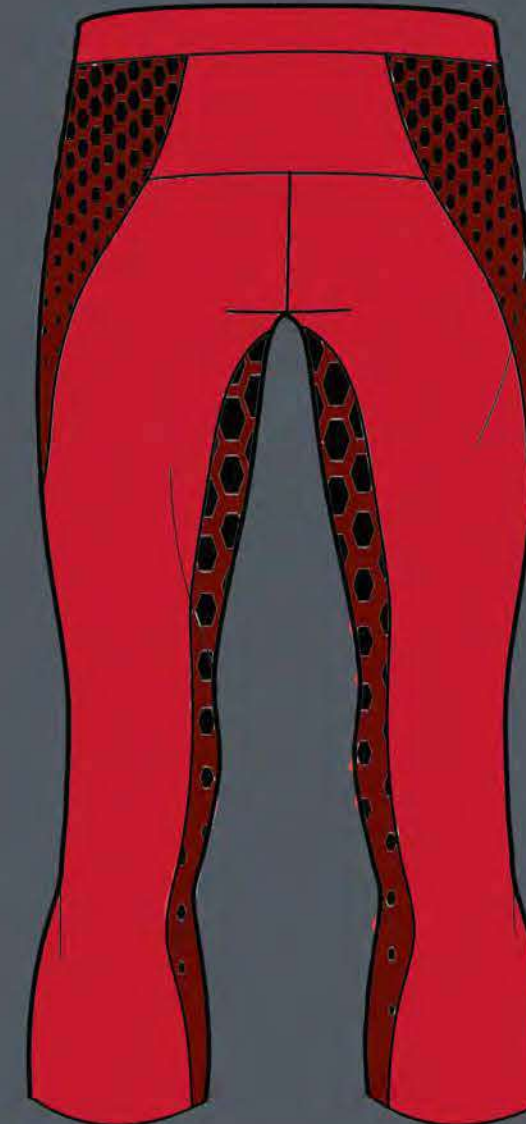
Sport Short



Heat Hoodie



Thermal Base Long Sleeve



Thermal Mid Calf Compression



Sport Short



Heat Hoodie



Thermal Base Long Sleeve



Thermal Mid Calf Compression



Sport Short

Week 9

**Columbia brand history and exploration.
C.M.F. and final ideation to prepare
for Week 10 design freeze.**



“Looking at Columbia’s history and their ideology, the take away is ‘tested tough’. The gear they produce is tested thoroughly to guarantee high performance in a multitude of weather conditions.

The color scheme is bold and simple. New technology through the Omni- line is where I am pulling most of my inspiration. Textiles that naturally generate heat through the athlete’s body temperature are going to be a main component in my design.”



25/50

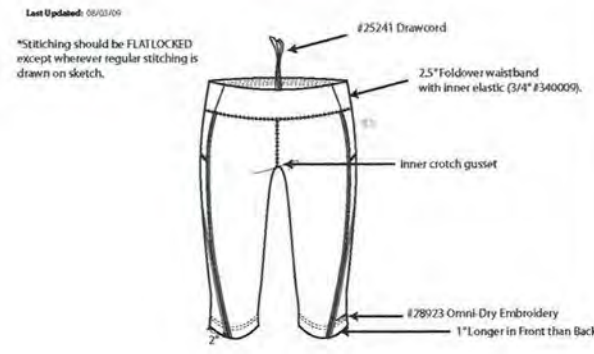
Hoodspout Pullover™ Men's • 100% texturized nylon Perfecta Cloth™ with laundered finish • Mesh hood and yoke
• Two on-seam pockets • Drawcord waist with toggle • Radial Sleeve™ • Imported

25/50

Hoodspout Pullover™ Ladies' • 100% texturized nylon Perfecta Cloth™ with laundered finish • Mesh hood and yoke
• Two on-seam pockets • Drawcord waist with toggle • Radial Sleeve™ • Imported

FRONT SILHOUETTE

Team:	Armed & Dangerous	Ref Style #	5,6459 (per the Store)
Sket Name:	2x4 Running Knee Tight (Legging)	Description:	REF: 16"
Design Number:	208237218	Notes:	Reference TL3439 with mensa event changed below
Division:	Sat 1		



	Proto Info	Sub Info	Colors
Shell 1:	055641 Heavyweight 20x20 Nylon Jersey		Dark Grey (P1)
Shell 2:	23300 Nylon Lays Mesh (P1) 10541		Available
Lining 1:			
Lining 2:			
Wash Down:			
Emb Color:			

BACK SILHOUETTE

US - MEASUREMENT INFO

Stock Reference:	TL3439
Hip Width:	22"
Hip Position @ 15:	6.25"
Hip Position @ CF:	7.625"
Front Rise:	16.5"
Back Rise:	18.5"
Thigh:	21"
Knee Position:	22.25"
Knee Width:	17"
Leg Opening:	12"
Other:	#



“Flats and color studies from the current line show how Columbia constructs their clothing and demonstrates their approach to minimalism and performance.

The heat suit will take large color blocking that Columbia is known for, and apply new and current technology to achieve the goals set for heat training and heat acclimatization.”



Base Layer: Used at all times during heat acclimatization, and is the main tool used to capture body temperature and use the bodies heat for acclimatization.

Outer Jacket: During the start of colder runs or during any harsh outdoor weather. Totally weather-proof with venting system to prevent over heating.

Running Short: Used as for weather proofing lower body as well as modesty while training. Elastic cuffs help hold lower body heat and providing an extra layer of weather protection while training outdoors.

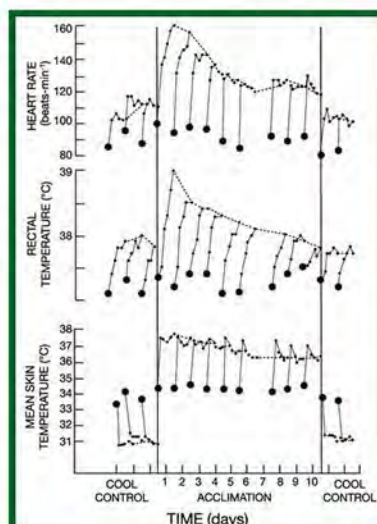


Figure 1: Heart rate, rectal temperature and mean skin temperature responses of persons before and during exercise each day of a 10 d dry heat acclimation program. Large circles show data before start of exercise and small circles connected to solid lines show data during exercise to initial values. Adapted from Eitzinger et al. (1990).

“From this graph you can see for optimal heat acclimatization an athlete needs to train for at least 90 minutes a day at temperatures that reflect conditions that occur during race day. Our goals for the User are as follows:

- 1. 90% of skin coverage with heat applied**
- 2. Average skin temperature to reach minimums of 100° F**
- 3. Replicate 10-15% dry humidity levels”**

"During the summer months of training our user Joe Parker runs in the Sierra Foothills near his home in Reno, NV three to four times a week.

While heat acclimating, he would wear the Omni-Heat Base Layer and the Running Short. He would run a distance of 20 - 30 miles, three times a week, to raise his core and skin temperatures to properly prepare for his race in Death Valley."

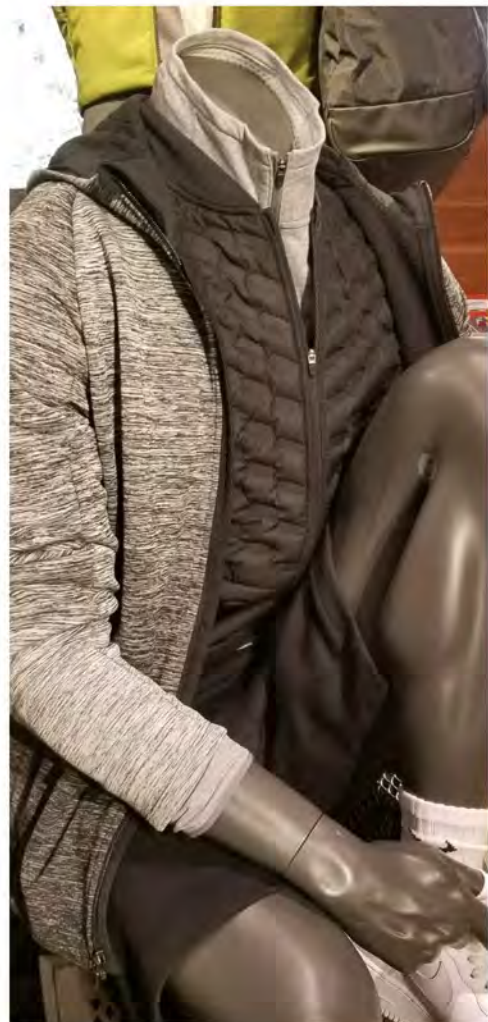


"In the colder, winter months Joe would wear the Outer Jacket in addition to the Omni-Heat Base Layer and Running Short. This would help him raise his core and skin temperature faster, while also protecting him from the elements encountered while running outside.

The Outer Jacket would help wick away excess sweat, while also keeping him dry from rain or snow."



“Visiting the Nike Running store in Pasadena gave me a few ideas about the current market and some technology that I could adopt for my own designs. The compression pant construction and waist band layers gave me a few ideas on how to effectively trap heat. They had a few new technologies focused on warmth, but nothing to the degree in which I am working on.”

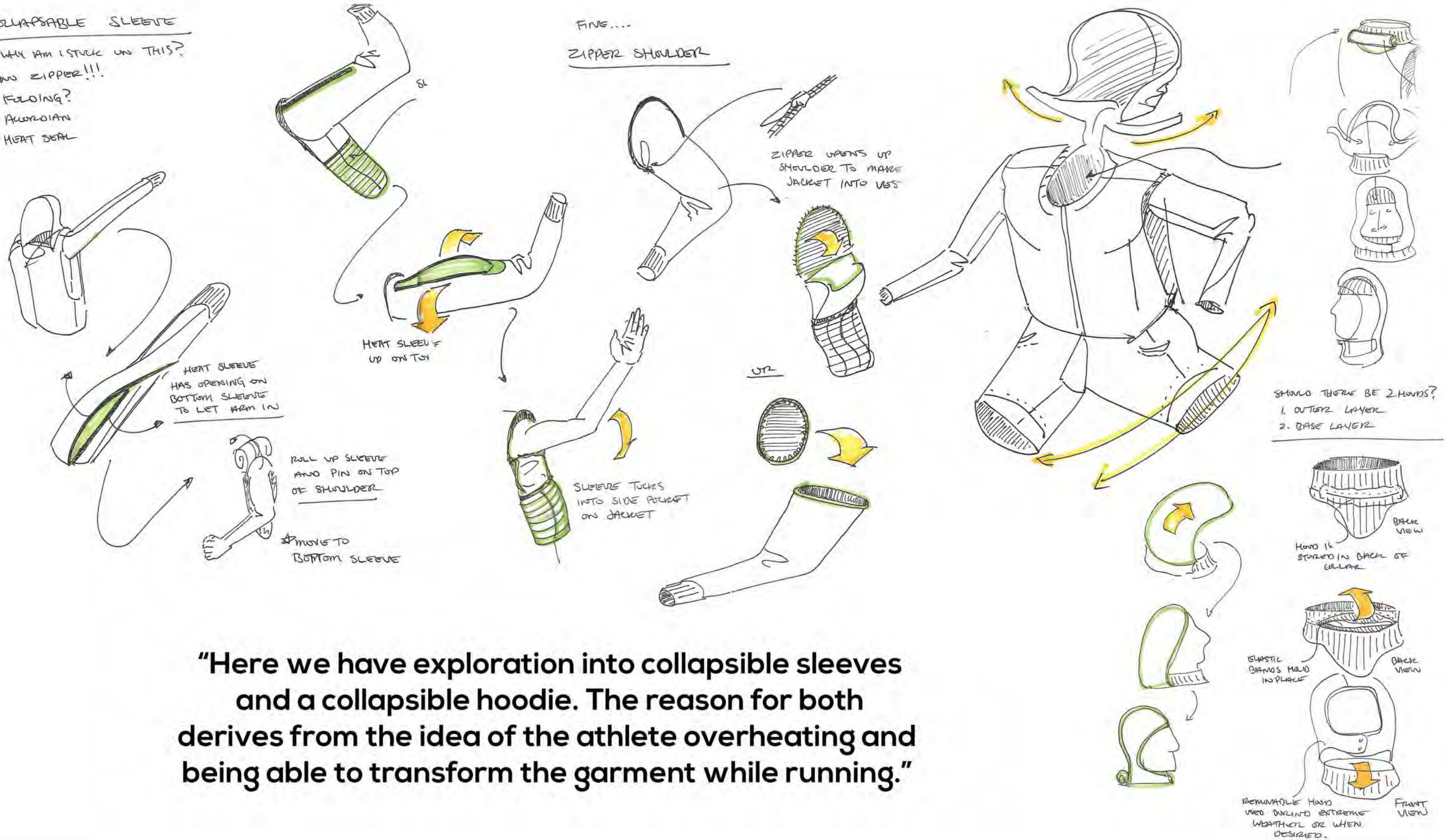


COLLAPSABLE SLEEVE

- WHY AM I STUCK UP THIS?
- NO ZIPPER!!!
- FOLDING?
- AERODYNAMIC
- HEAT SEAL

FINE....

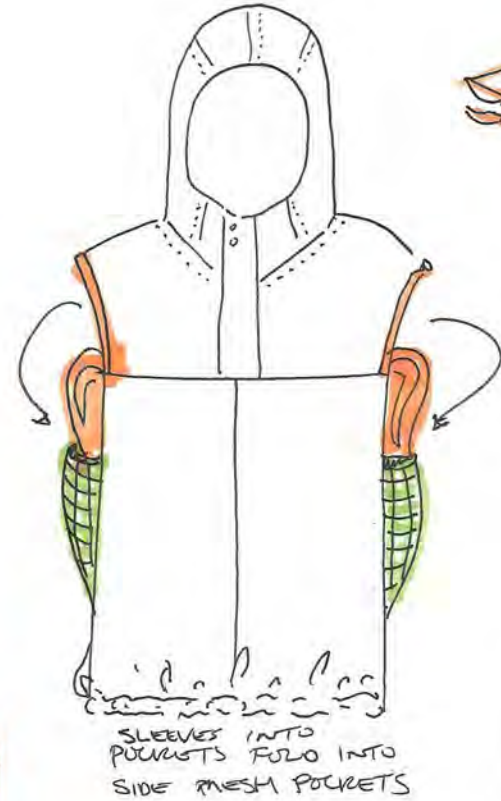
ZIPPER SHOULDER



“Here we have exploration into collapsible sleeves and a collapsible hoodie. The reason for both derives from the idea of the athlete overheating and being able to transform the garment while running.”

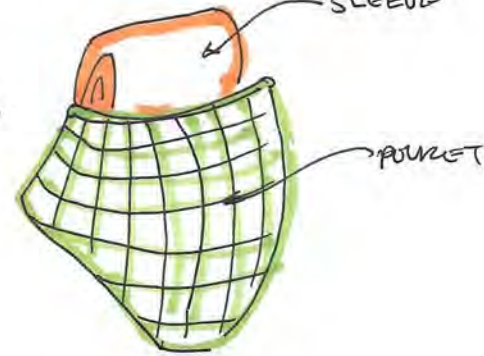
ZIPPER POCKETS

- WHERE DO THEY GO?
THE BENEFIT IS TO
STOP OVER HEATING



SLEEVES INTO
POCKETS FOLD INTO
SIDE MESH POCKETS

ONCE SLEEVE IS
ZIPPED OFF,
IT CAN BE STORED
IN SIDE POCKET



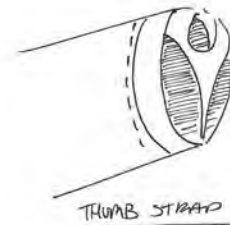
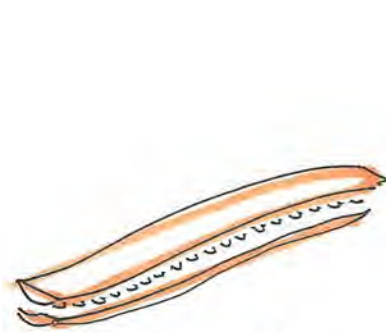
SLEEVE

POCKET

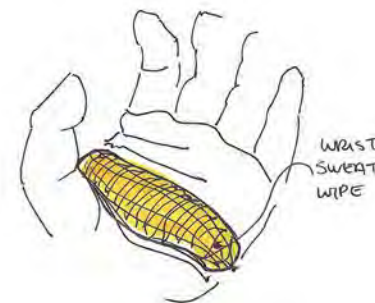
ELASTIC
SHOULDER
ZIPPER
CUFF



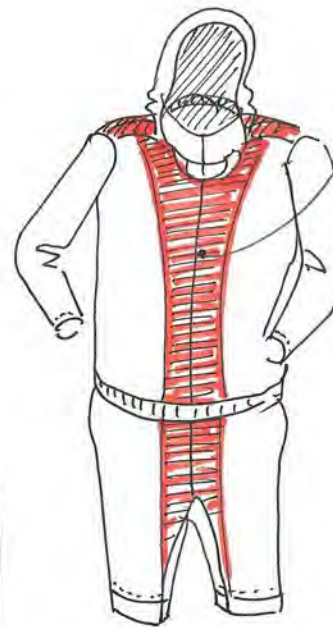
ZIPPER SLEEVES TAKE
OFF AND STORED INTO
FRONT POCKET



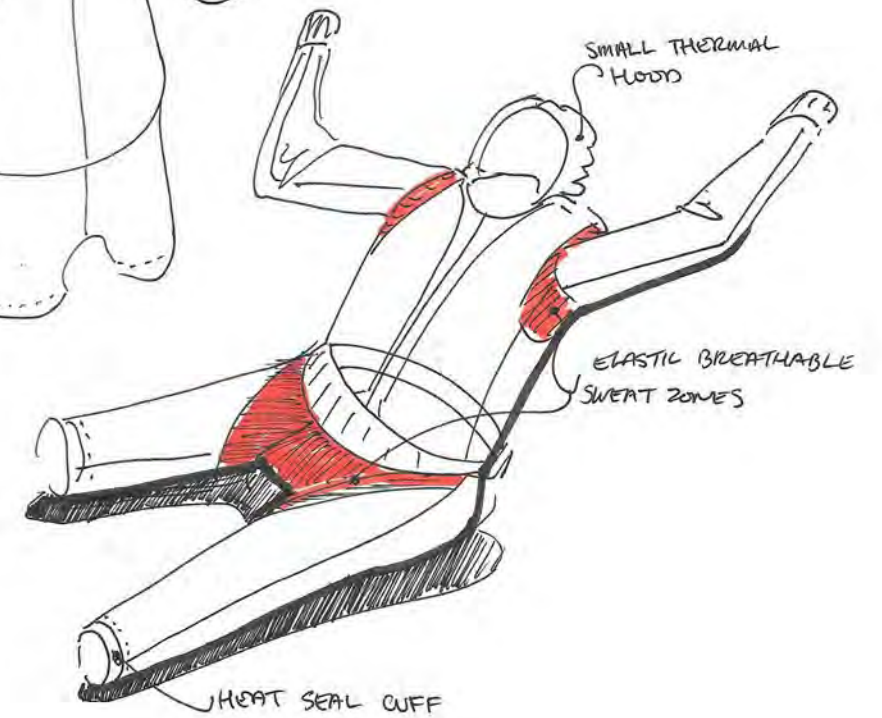
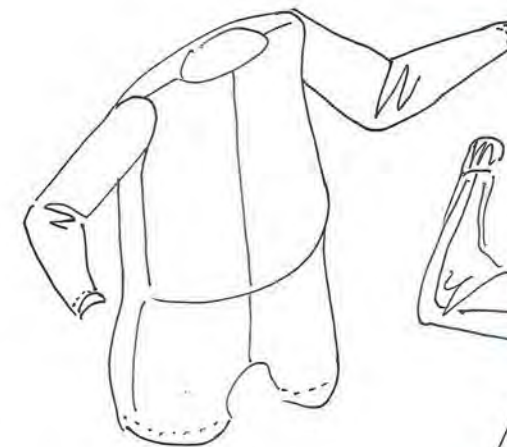
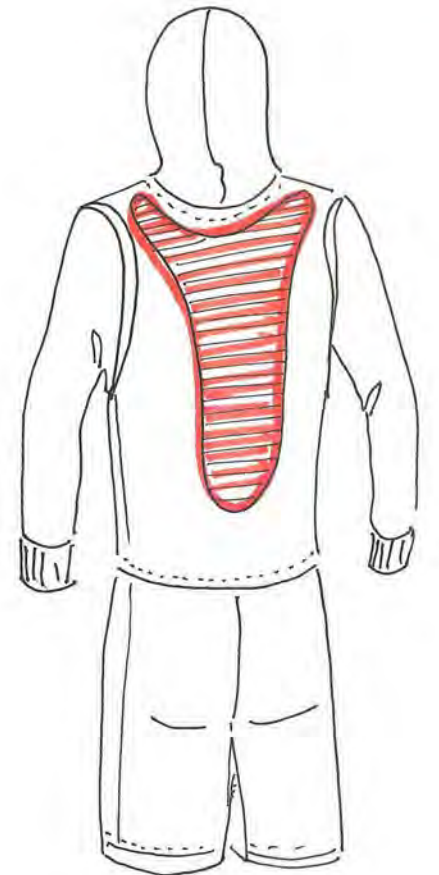
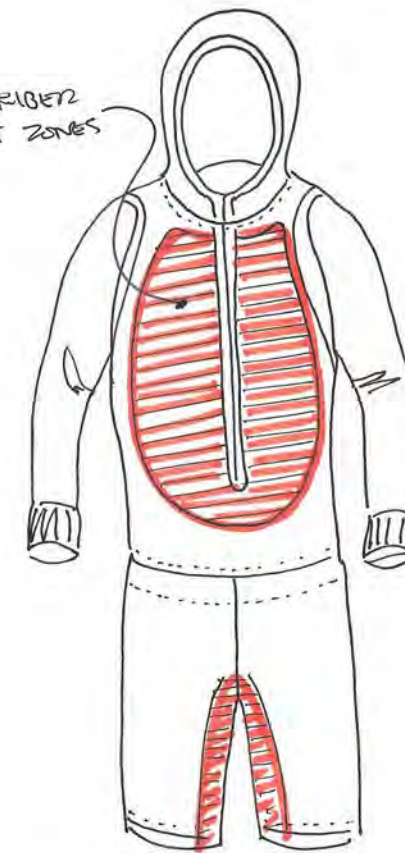
THUMB STRAP



WRIST
SWEAT
WIPE



MICRO RIPPED
SWEAT ZONES



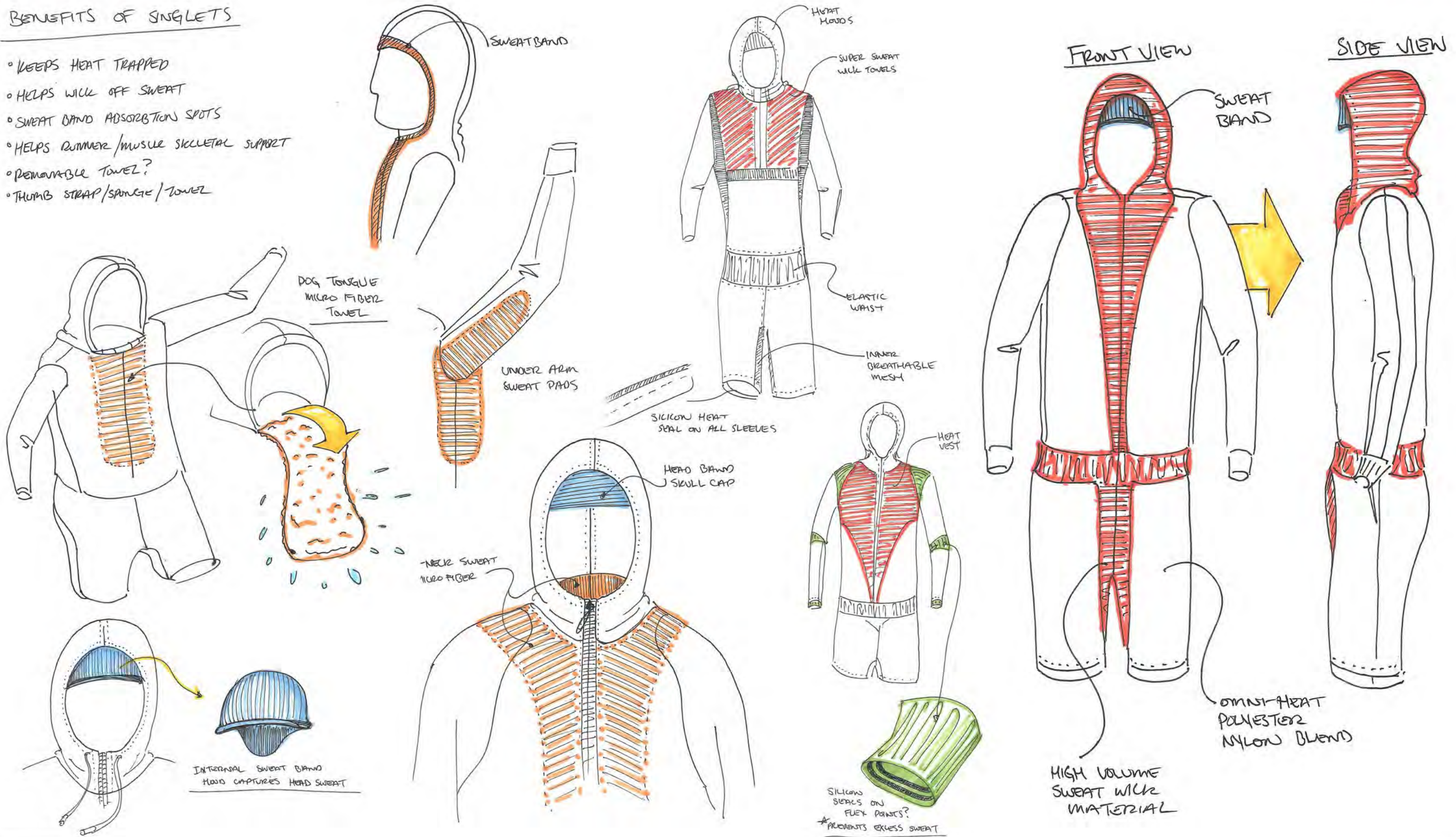
SMALL THERMAL
HOOD

ELASTIC BREATHABLE
SWEAT ZONES

HEAT SEAL CUFF

BENEFITS OF SINGLETS

- KEEPS HEAT TRAPPED
- HELPS WICK OFF SWEAT
- SWEAT BAND ABSORPTION SPOTS
- HELPS RUNNER / MUSCLE SKELETAL SUPPORT
- REMOVABLE TOWEL?
- THUMB STRAP / SPONGE / TOWEL



OUTER JACKET

- WEATHER PROOF
- NEEDS HEAT REGULATION
- INNER SWEAT ABSORPTION?
 - TOWELS
 - REMOVABLE
- CONVERTS INTO VEST

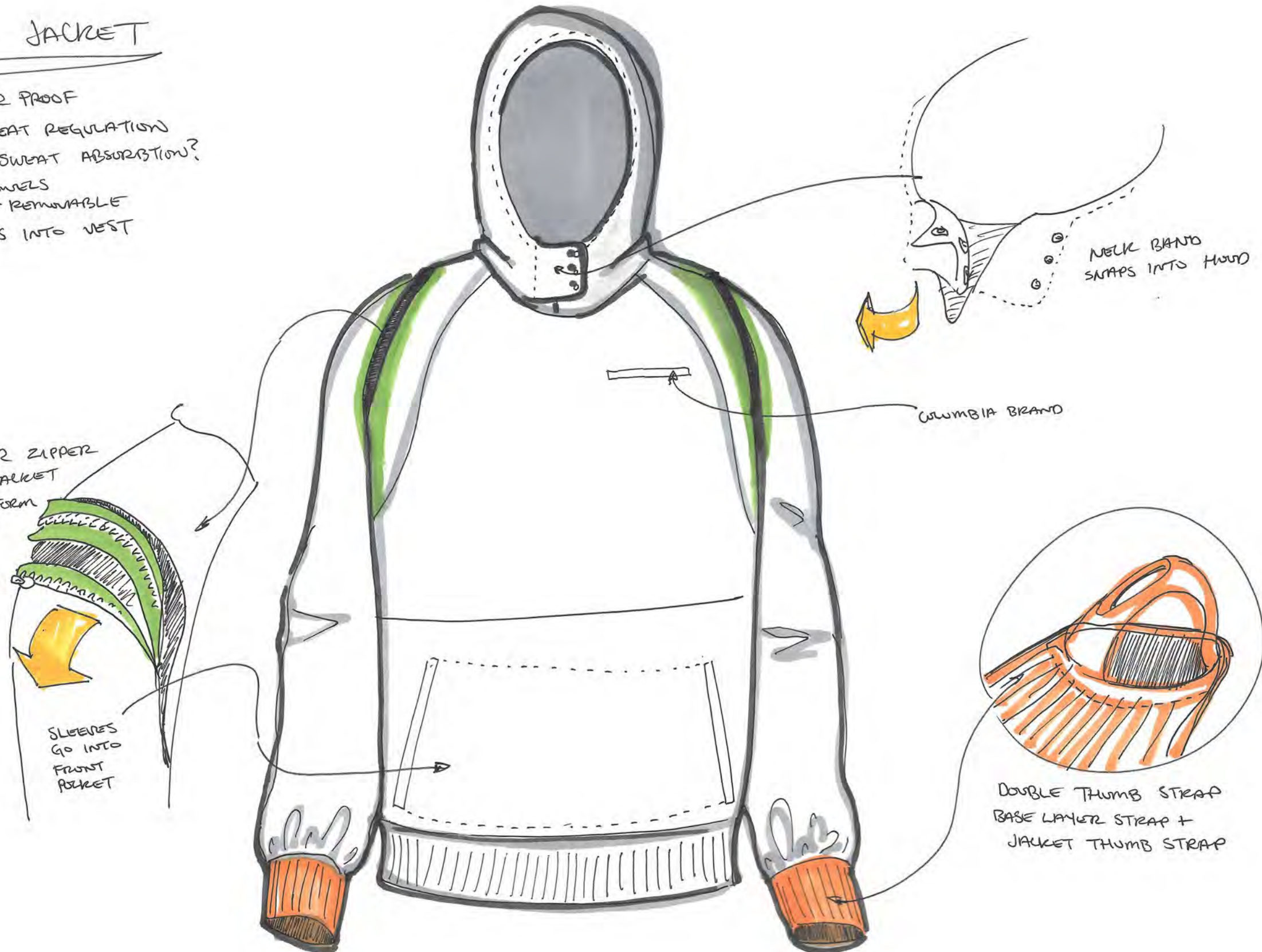
SHOULDER ZIPPER
OPENS JACKET
TO TRANSFORM
INTO VEST

SLEEVES
GO INTO
FRONT
POCKET

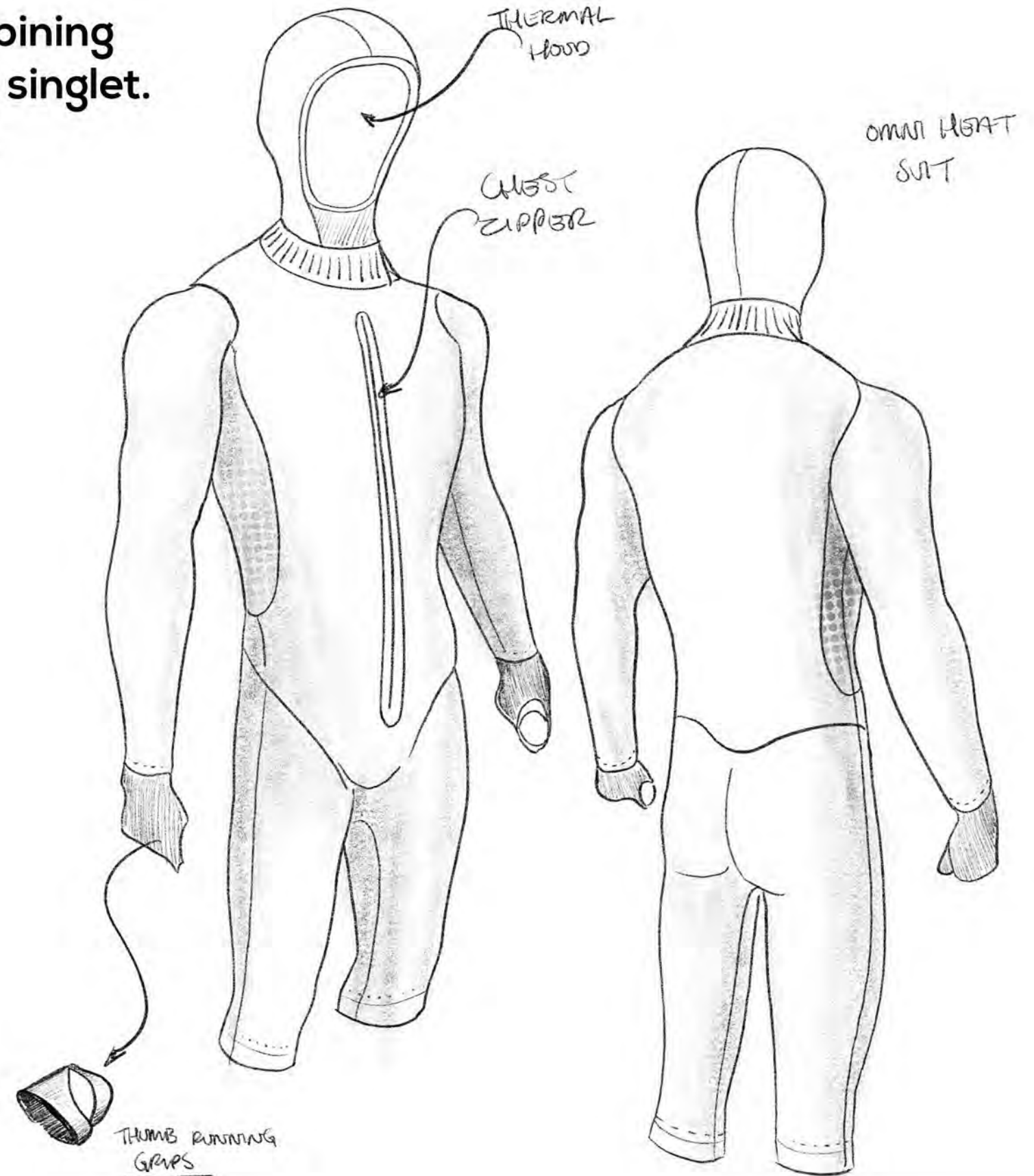
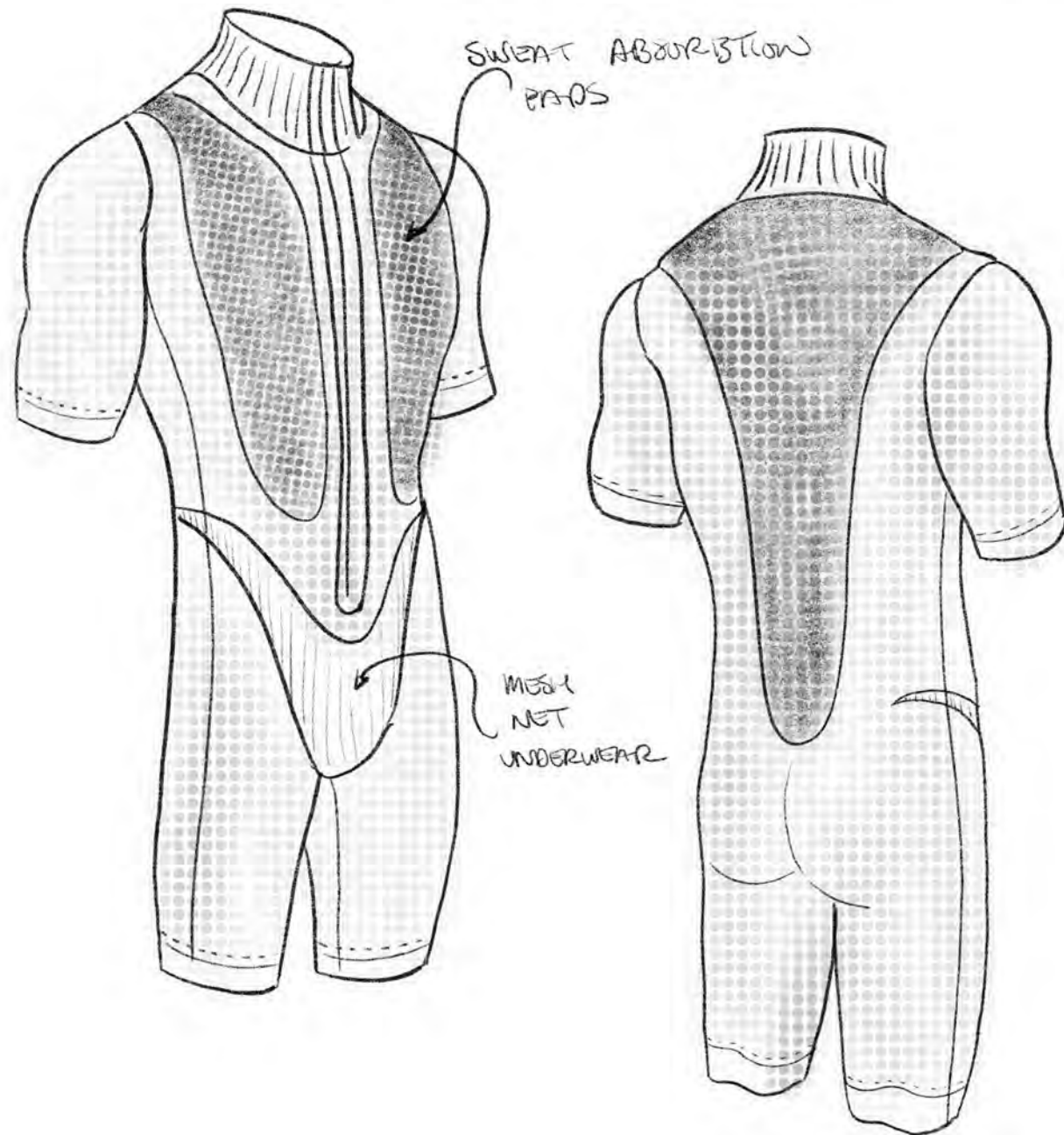
NECK BAND
SNAPS INTO HOOD

COLUMBIA BRAND

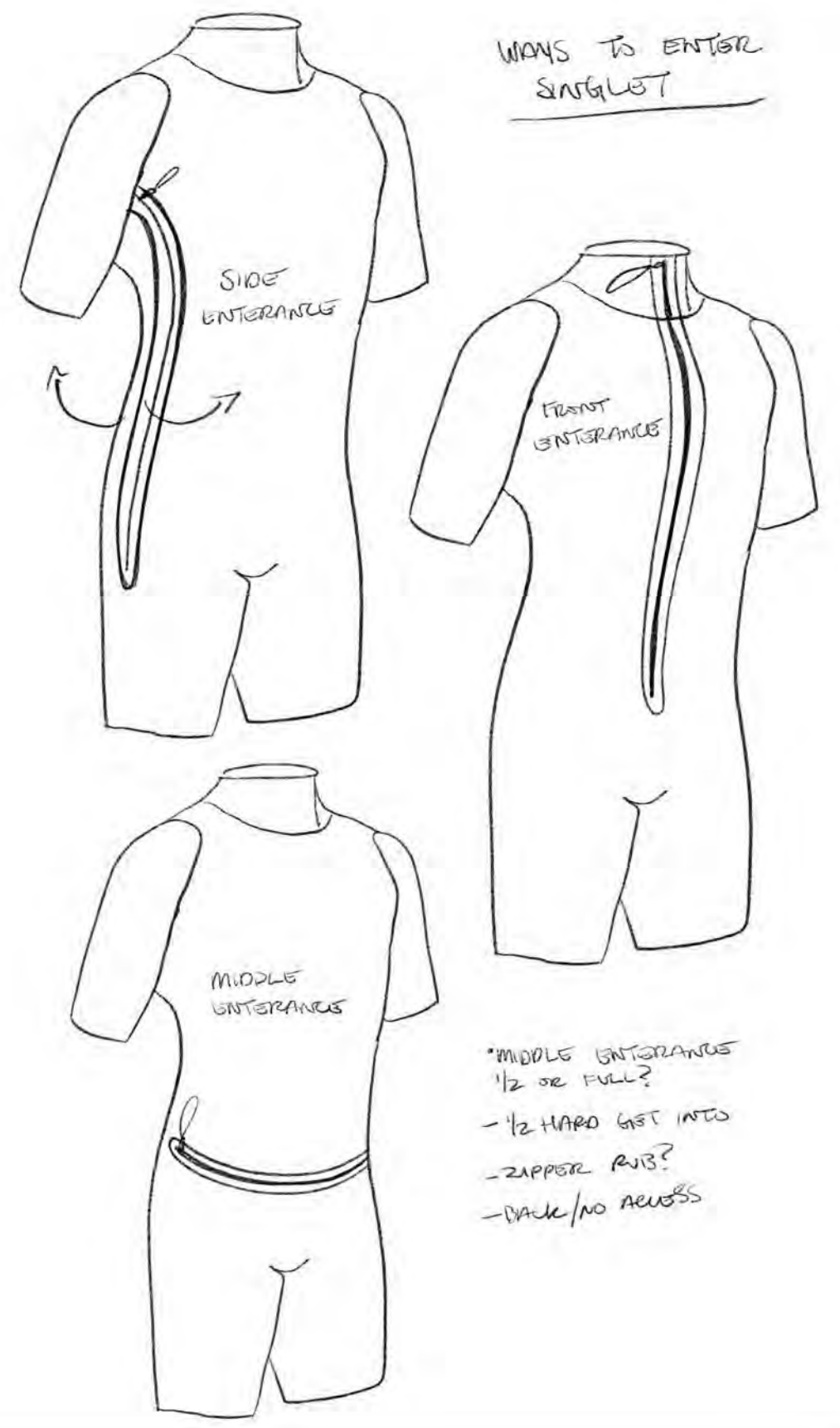
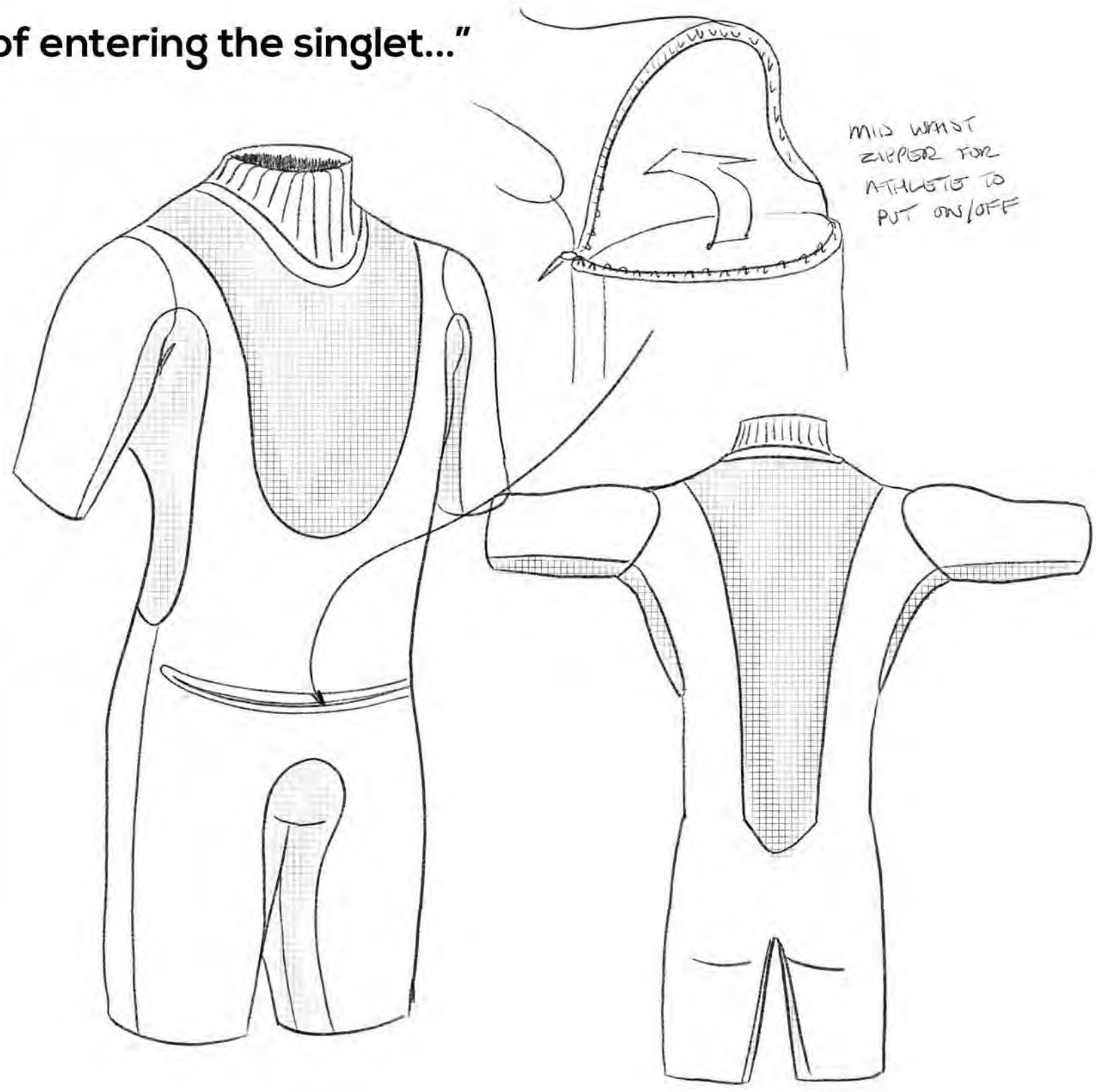
DOUBLE THUMB STRAP
BASE LAYER STRAP +
JACKET THUMB STRAP

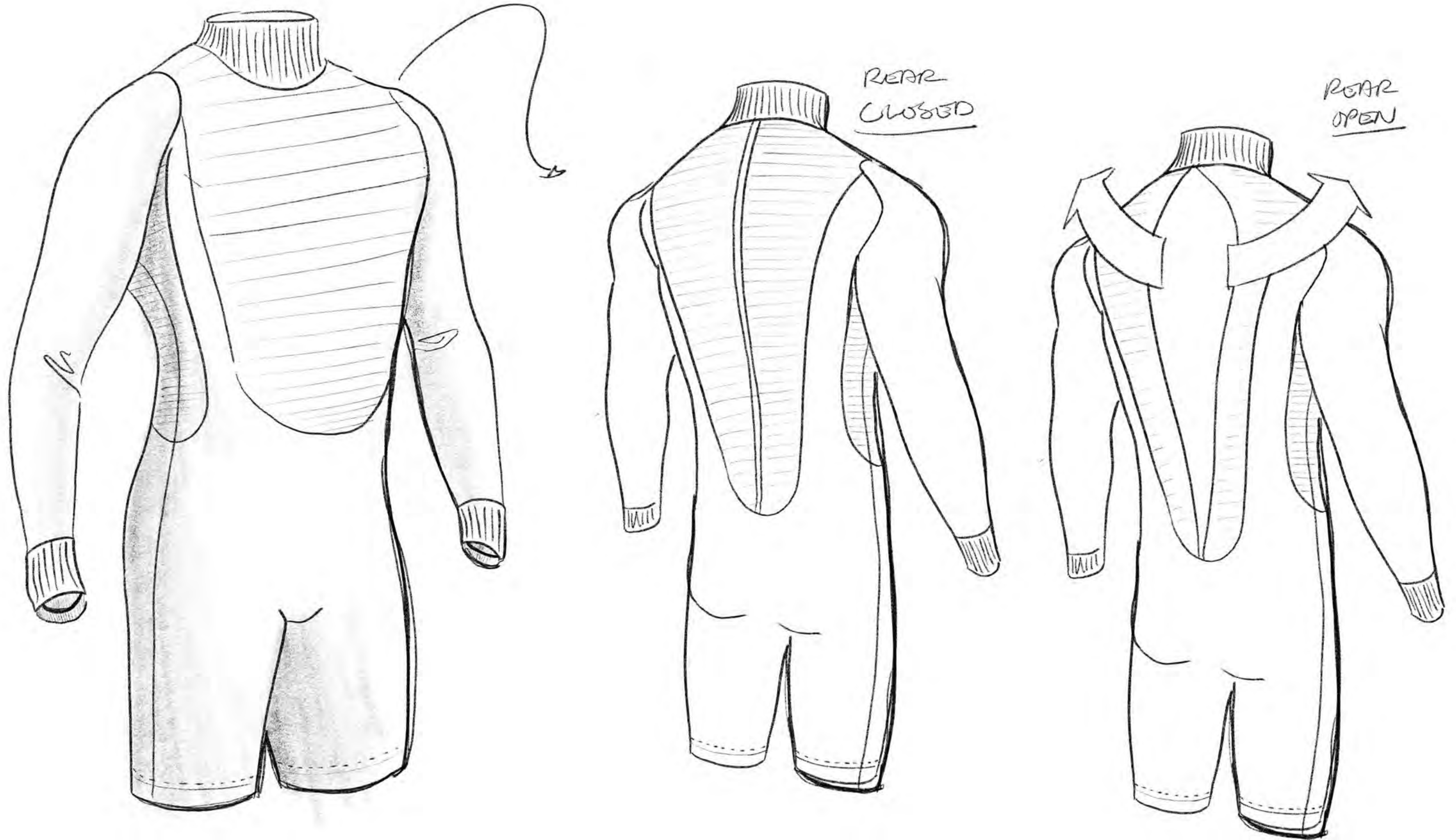


"The beginning of this week's ideation is combining the top and bottom base layer into a one piece singlet. The benefits of a single base layer are heat creation and maintenance."



"Ways of entering the singlet..."





“The idea here is a two-piece Base Layer that would be easily zipped into a singlet. The main benefit of this concept would be the option to use the upper or lower Base Layer on separate occasions.

The upper layer will have a sweat absorption area made up from microfiber polyester blend. This will help sponge away sweat from the athlete and keep them dry during training.”







I WANT A HOOD

LIKE THIS
LARGE RUNNING
BAND

ZIPPER
TO ENTER SUIT

SWEAT
ABSORPTION

INTERESTING SEW LINES

INTERNAL
SWEAT SKULL CAP

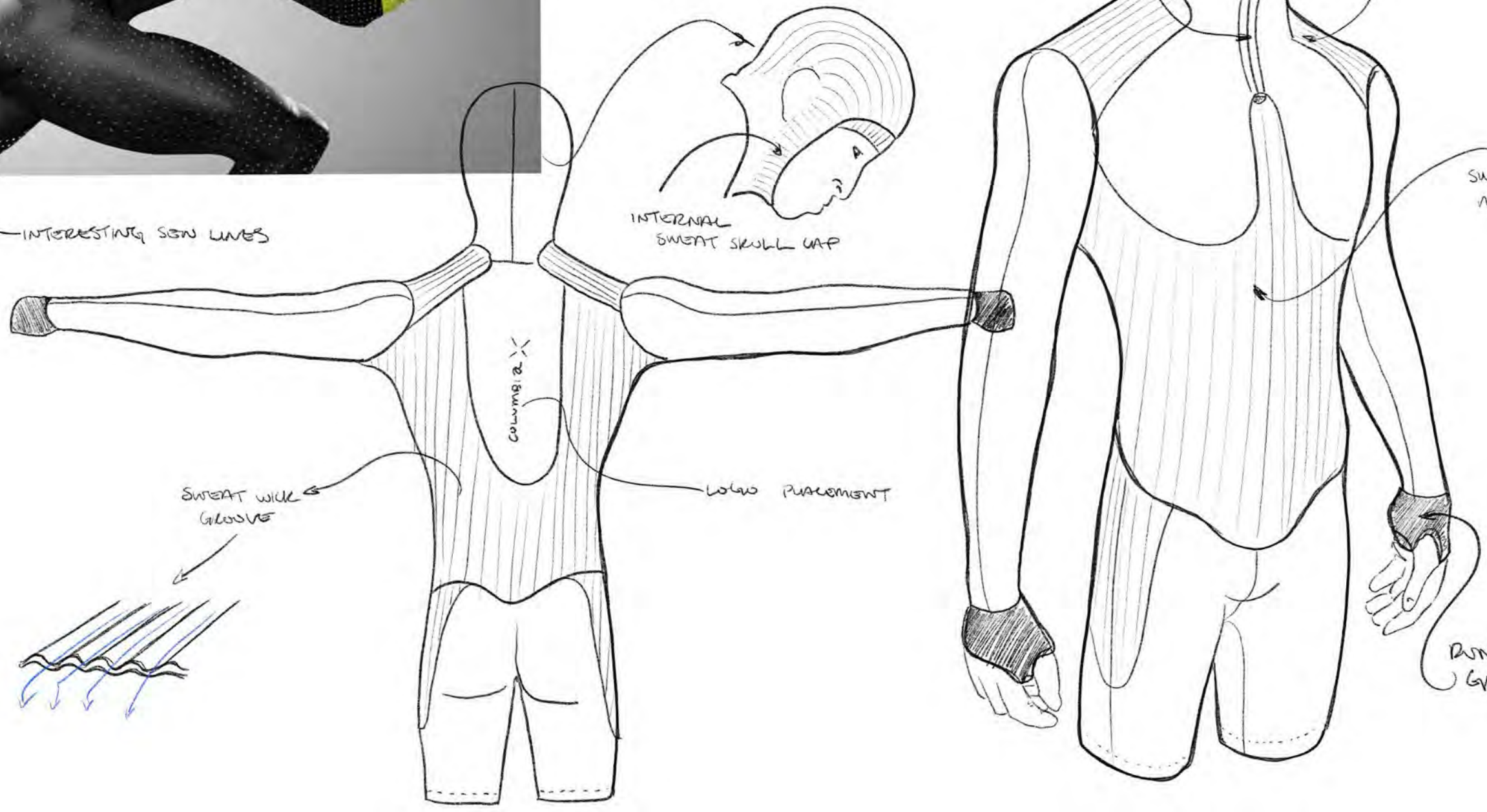
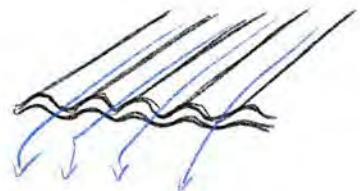
WRAP
SWEAT WICK
MATERIAL

COLUMBIA

LOW PLACEMENT

SWEAT WICK
GLASSES

RUNNING
GLOVES



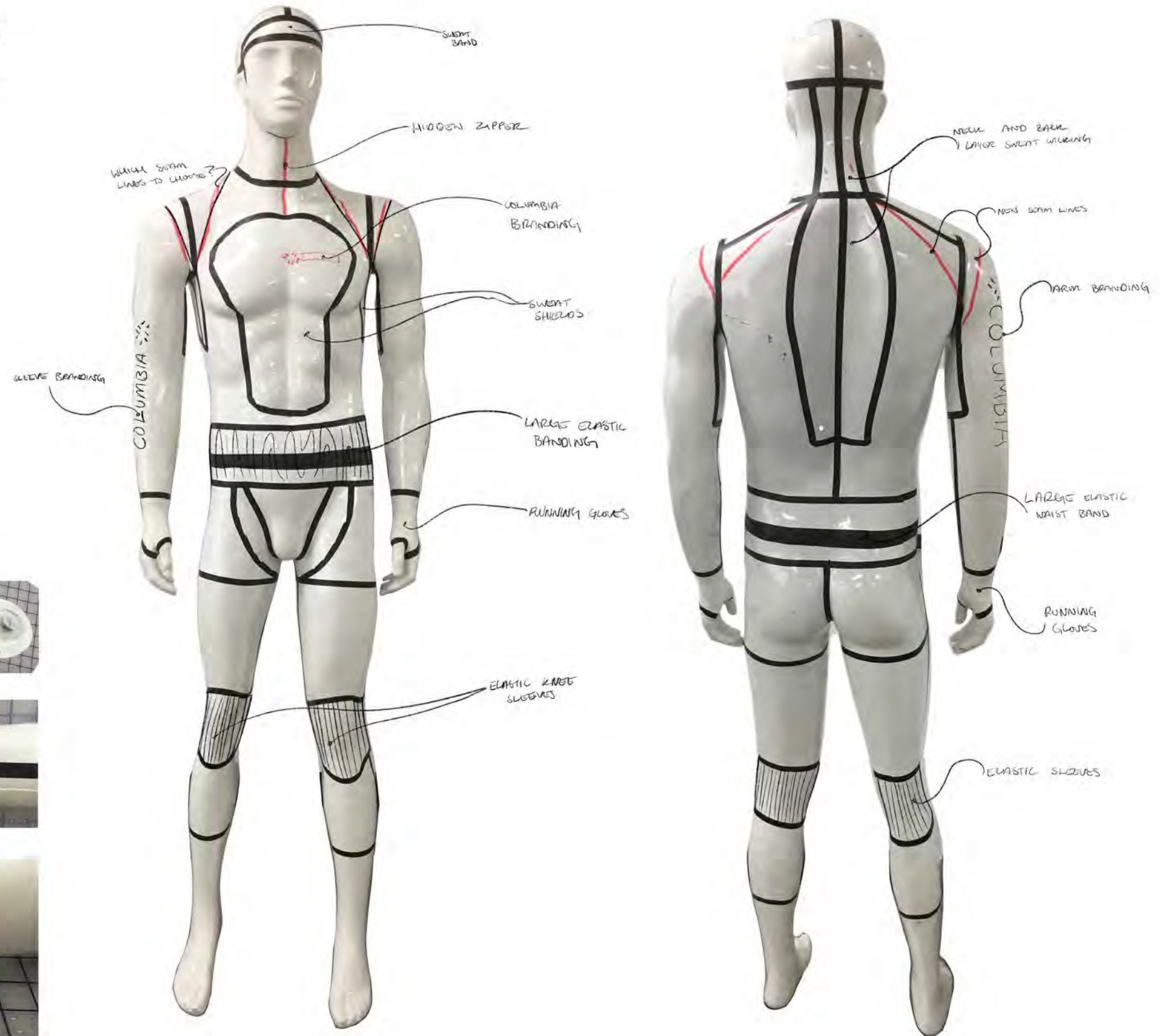
Week 10

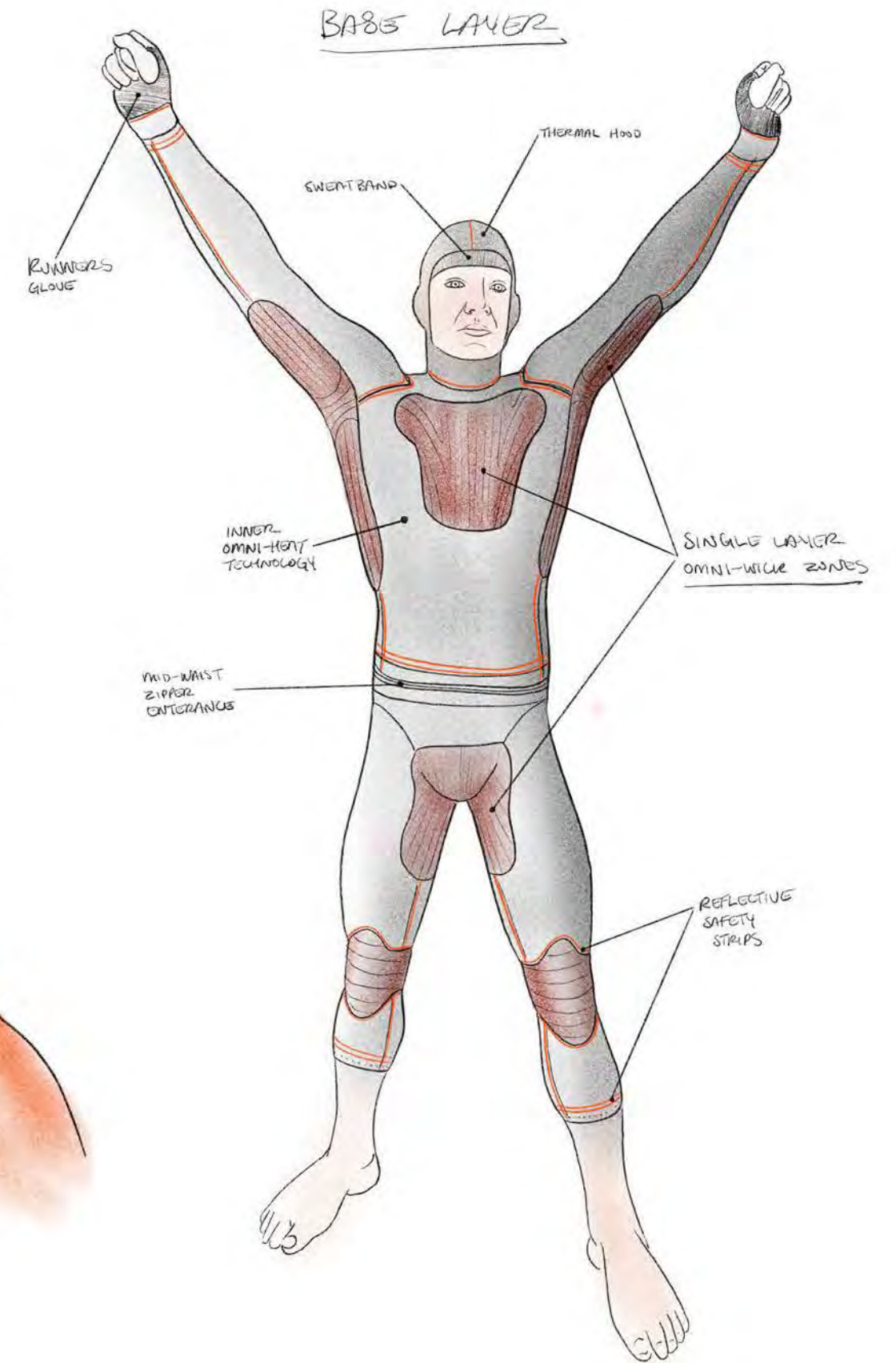
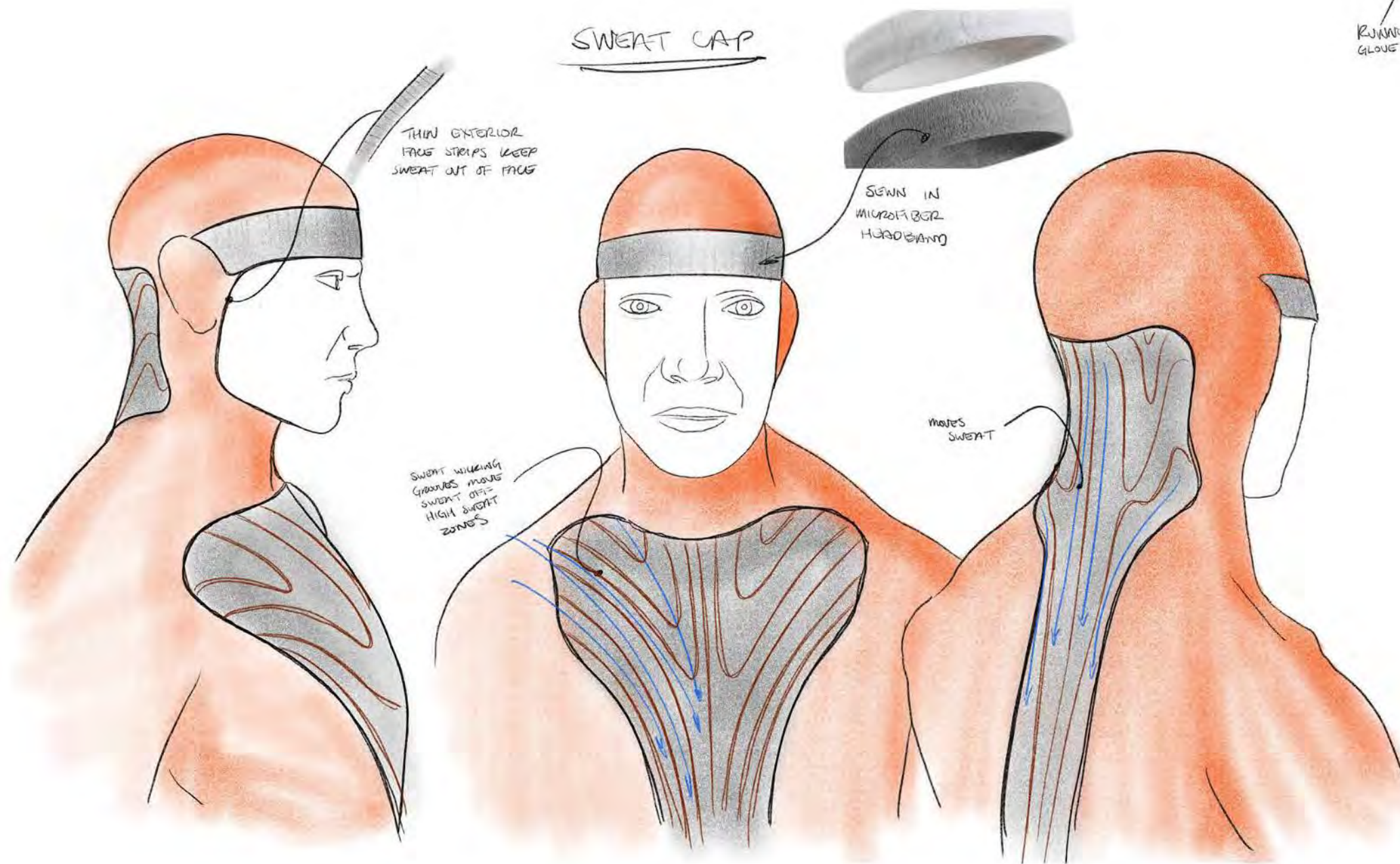
Design Freeze

Finalization of flats and colorways.

“Working on the base layer singlet started out with trying to finalize the seam lines and whether I can optimize the athletes movements while training.

The sweat zones paired with zones where excess heat was going to be added made for fun and interesting lines on the mannequin.”





“Using the mannequin and the taped seam lines as an underlay reference, I started to color block the base layer and fix the seam lines so they would improve gait movement.

I used current Columbia gear as a guide to try and make the base layer fit into their line of clothing.

While this is the base layer, patches of thicker vinyl will be added to zones of the body that need to generate more heat. These are the weaker thermal heat zones.”



"Concentrating more attention on zones of the body that don't generate as much heat as the chest and back, the dark pads of thin vinyl will help create and hold more heat on the athlete's body.

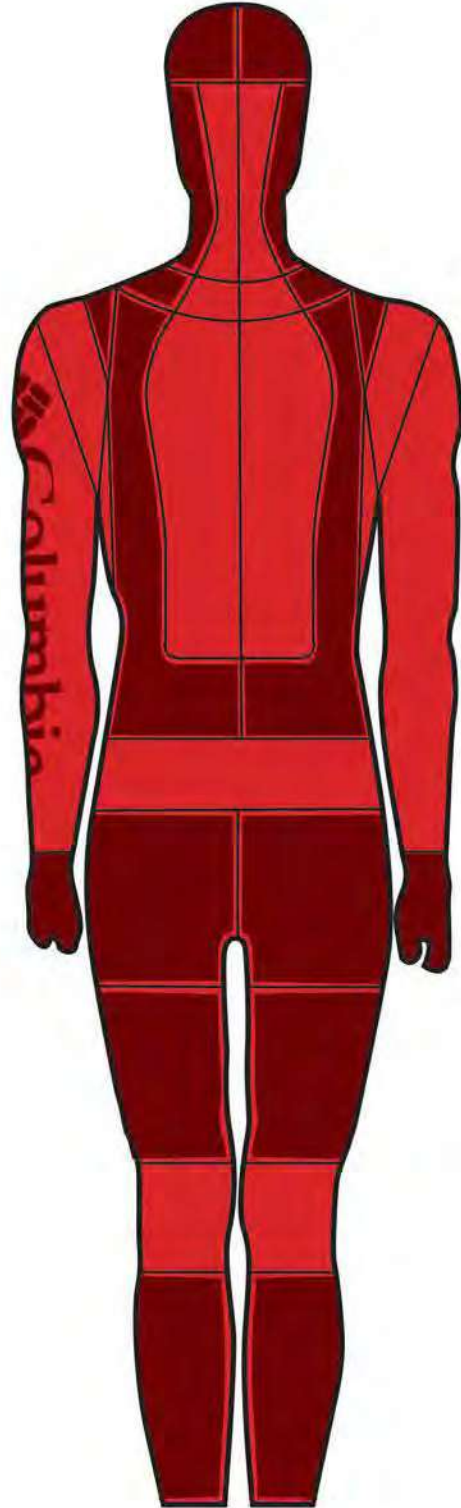
The areas that are left open, are high sweat zones where we will be pulling off all of the excess sweat. I wanted to leave them as open as possible for the athlete to stay dry and to prevent buildup of moisture.

I kept the design fairly blocky and geometric to go with Columbia's design language."

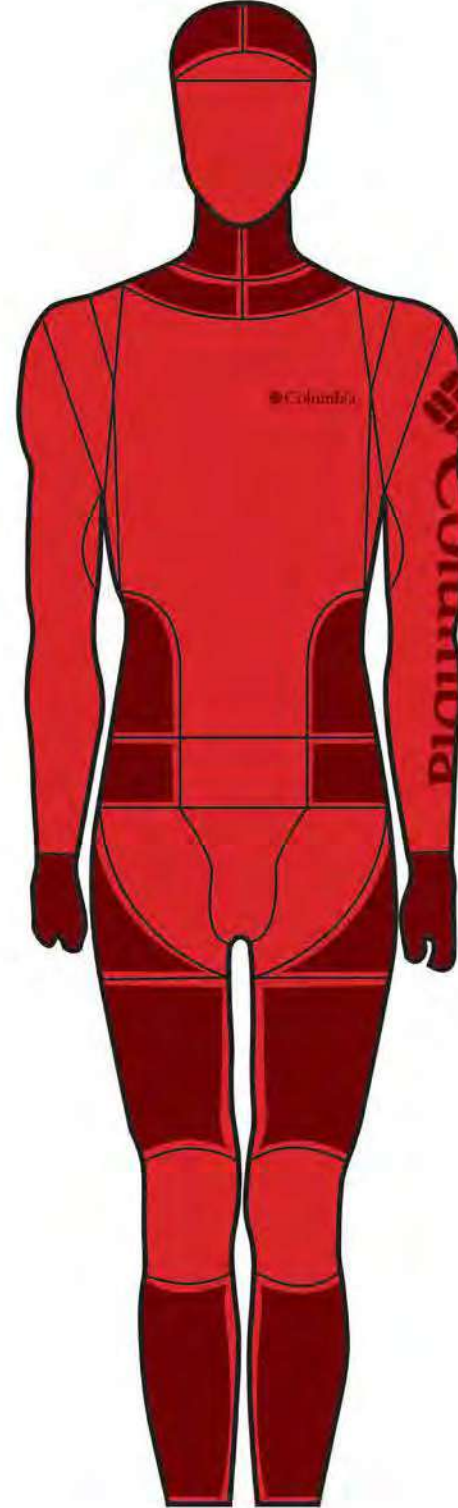


Final Flats Base Layer Singlet

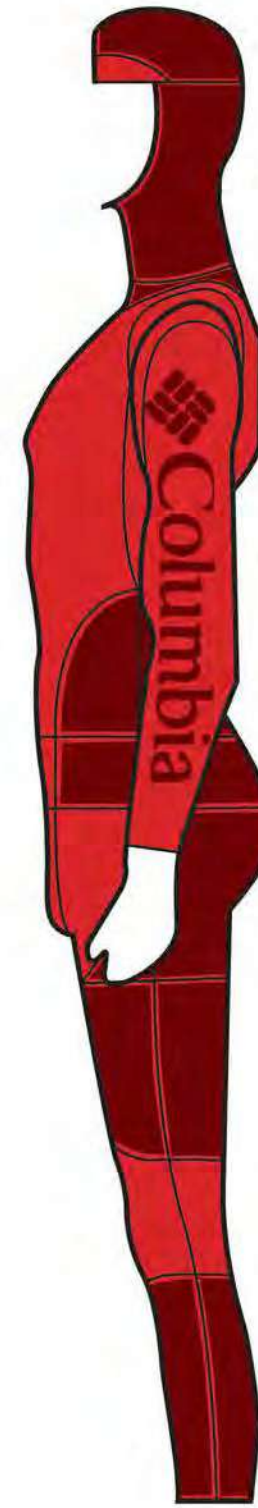
Rear



Front

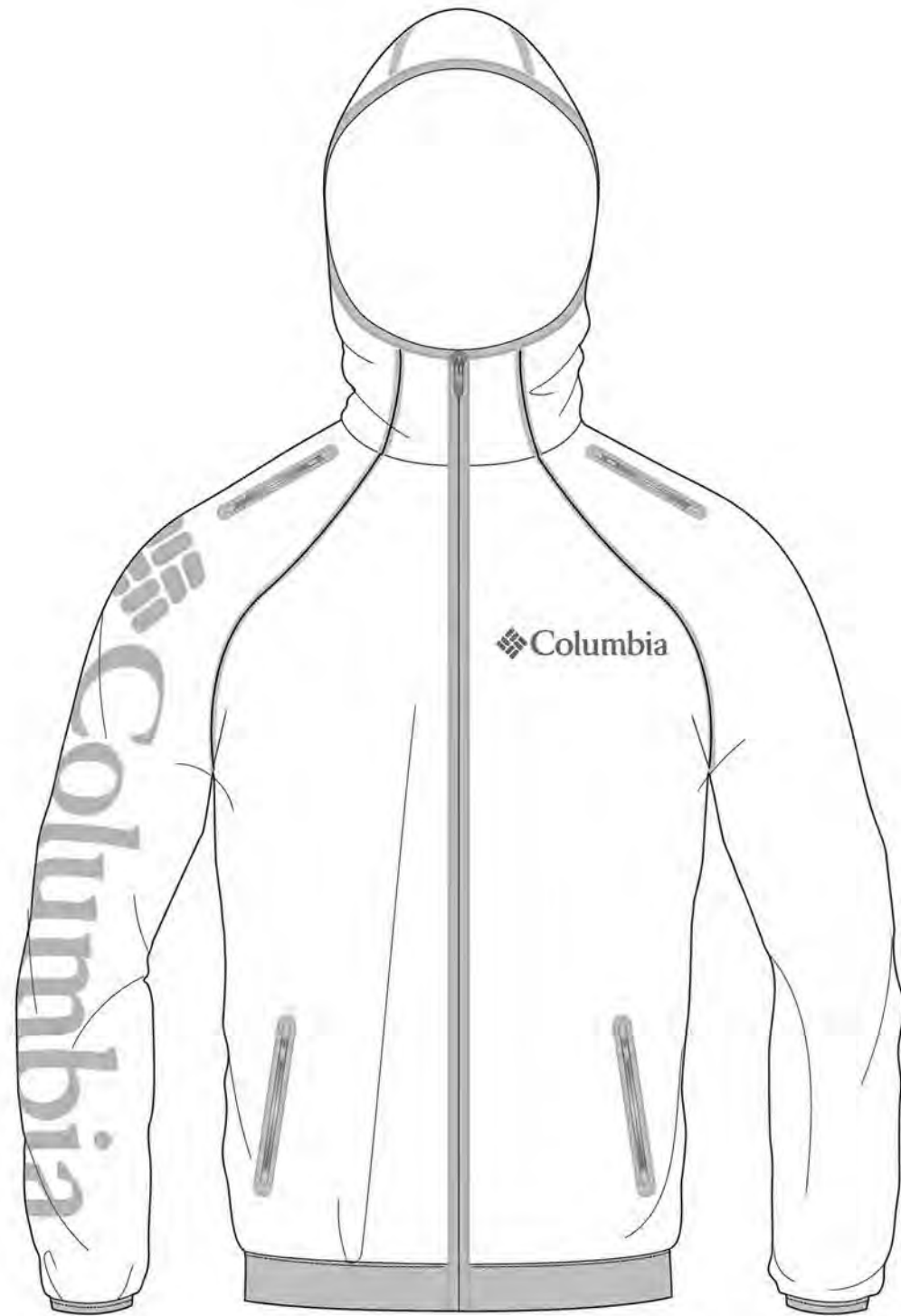


Side

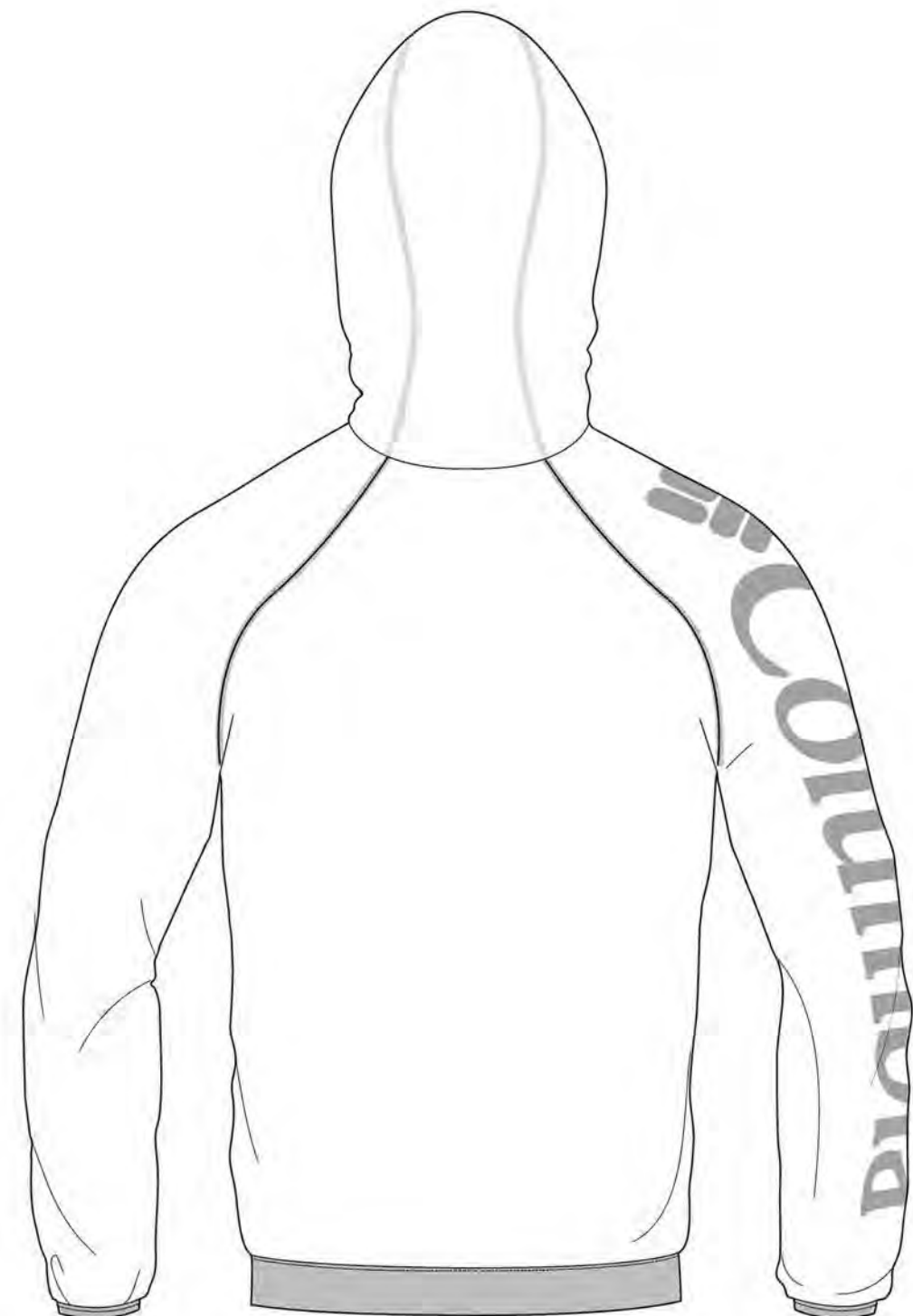


Final Flats Jacket

Front



Rear

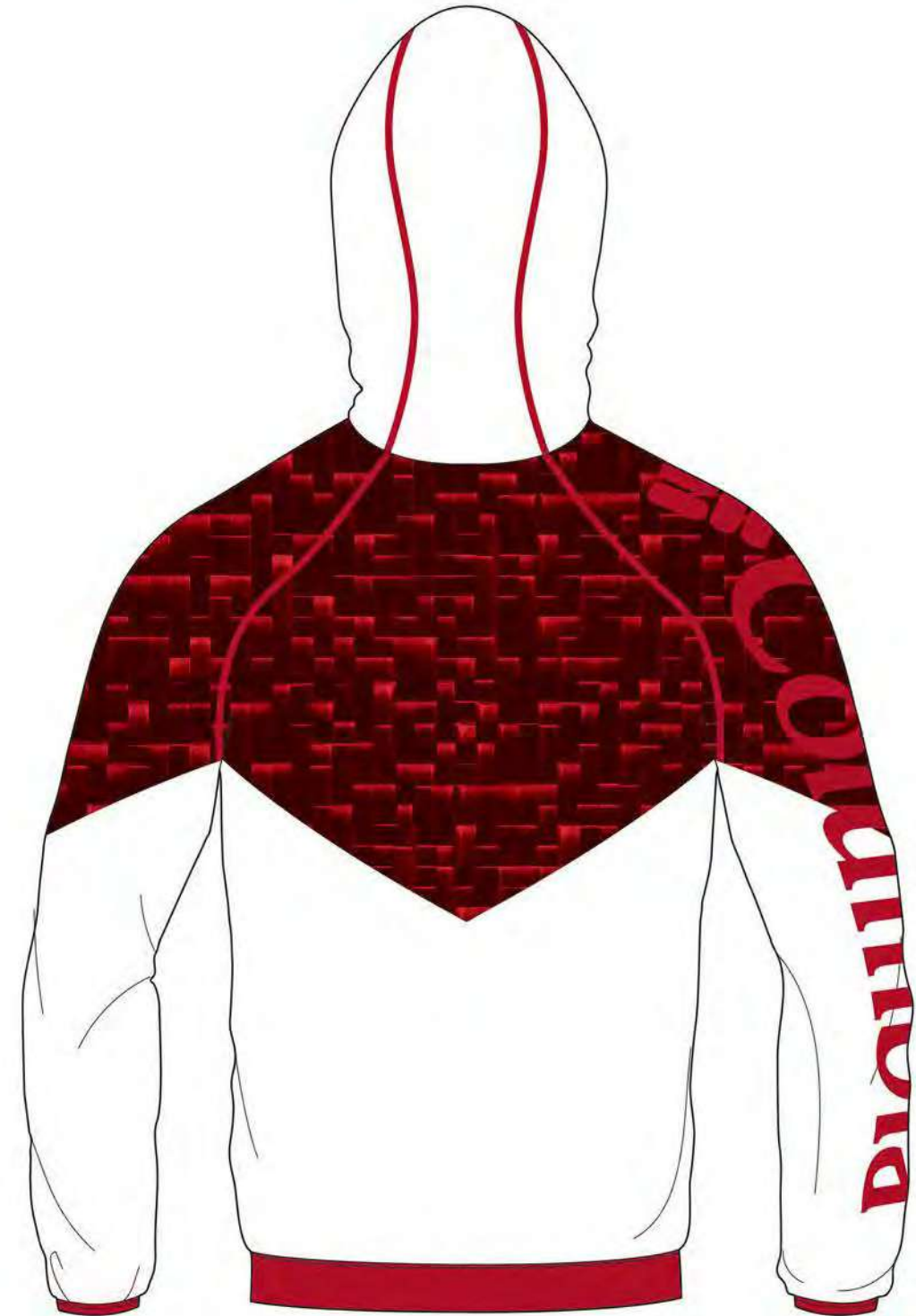


Final Color Flats Jacket

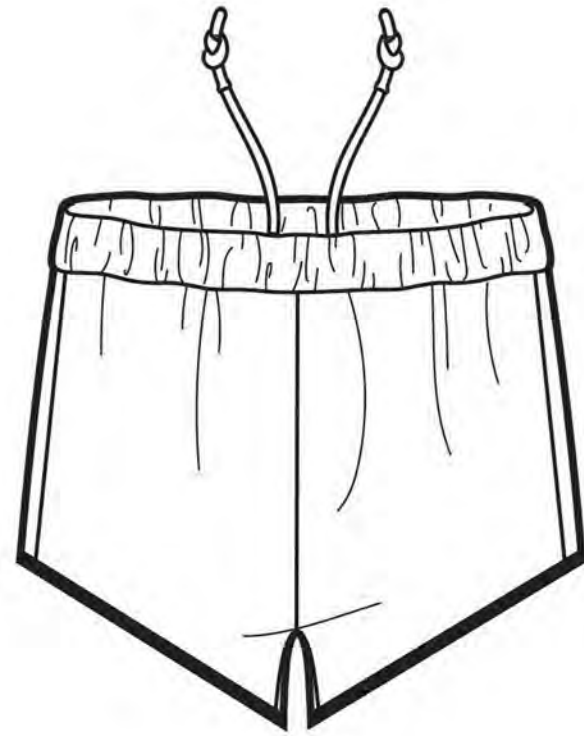
Front



Rear



Final Flats Short

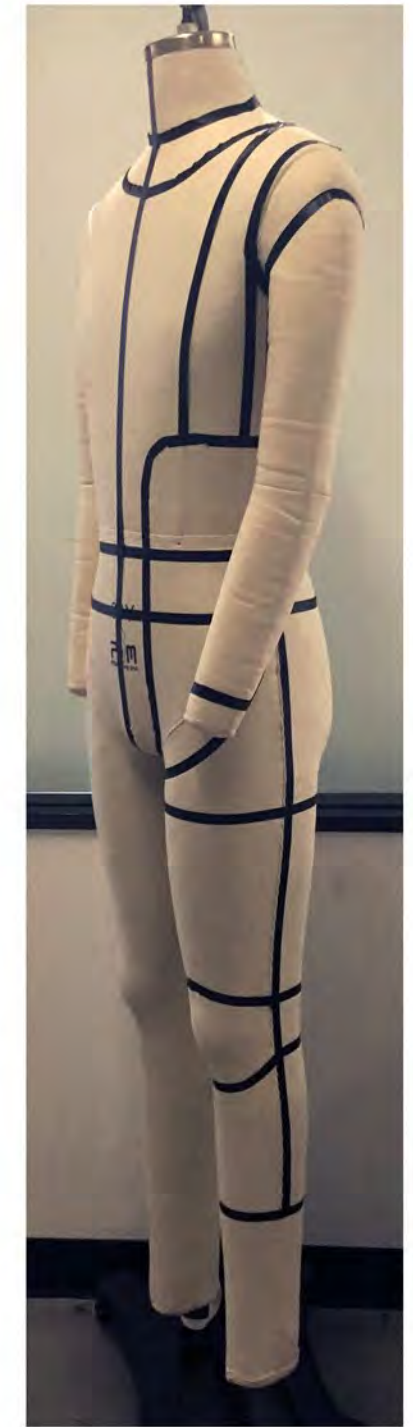
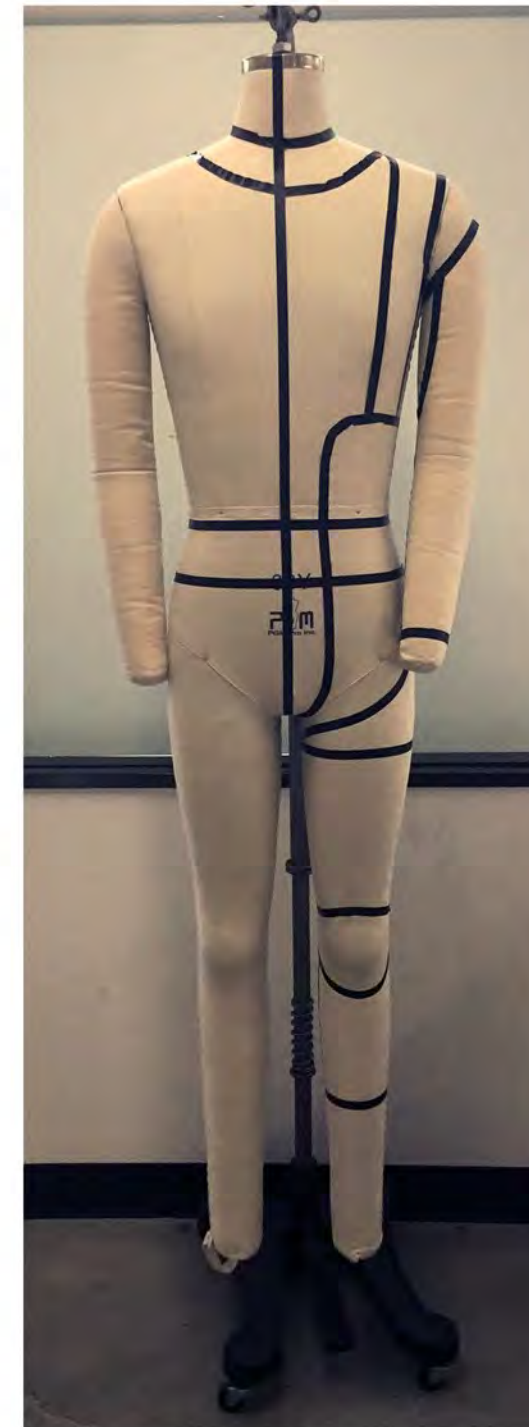


Week 11

**Base layer mock-ups
and start of final models.**

After finishing the first seam lines on the mannequin, I did some final adjustments and transferred the design on to a male dress form.

This helped me visualize possible production problems and how it was going to fit on a real model.





Using a four way stretch Spandex/polyester blend, I started the Base Layer mock-up.

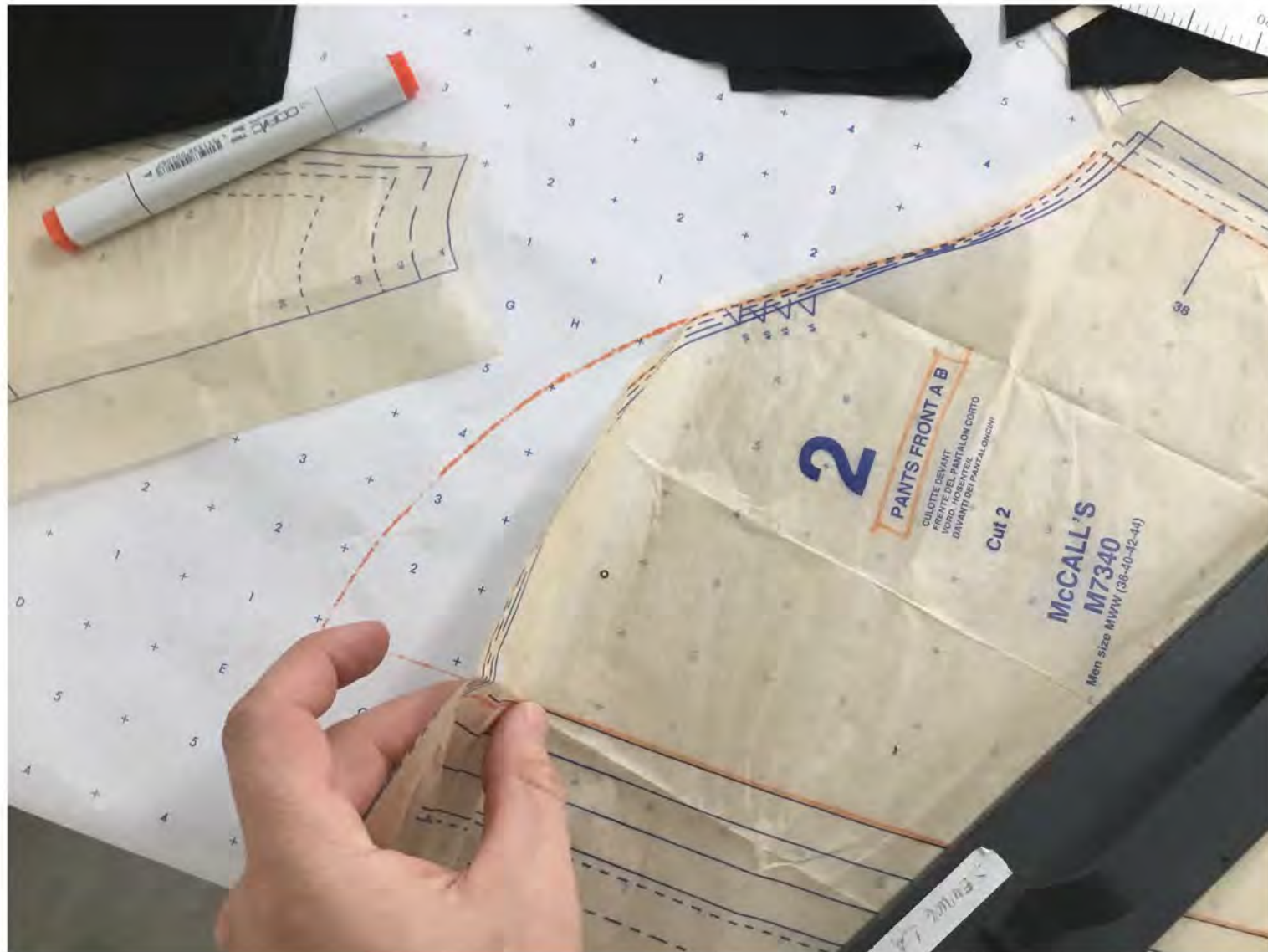
Draping the material over the dress form, I designed and developed the pattern from scratch.

Since the design is symmetrical, I only had to create a pattern for half of the dress form.

This was the first time I have ever made a pattern, so I wanted to triple check it against an existing one to make sure it was going to fit together.







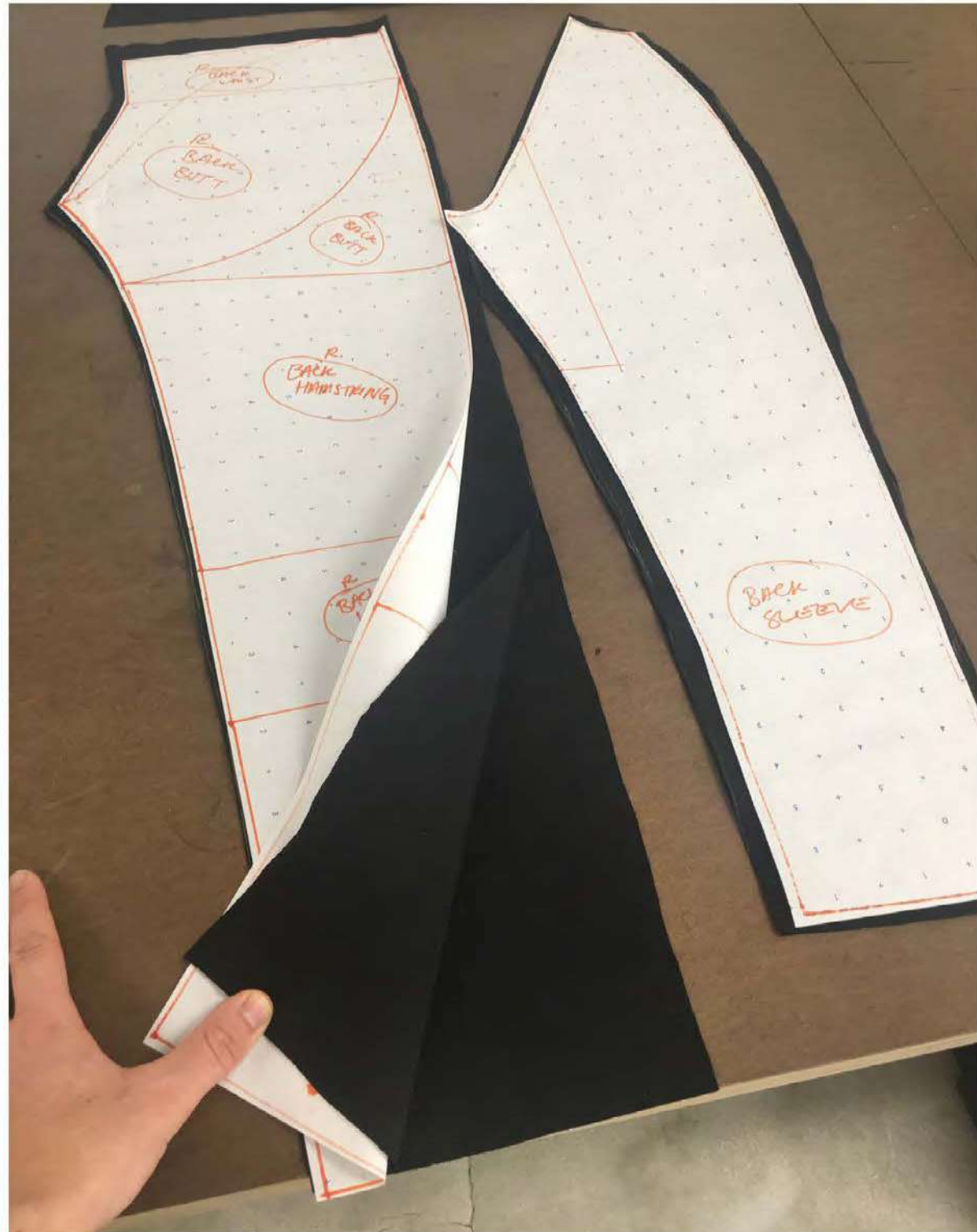
Using a pattern from McCall's and my original design, I overlaid the two to get my final pattern.

It involved a lot of touching up the original black cut-out pattern to fit within the boundaries of the McCall's pattern.

It took a lot of patience and time, but it resulted in a final pattern.

Week 12

First base layer mock-up.

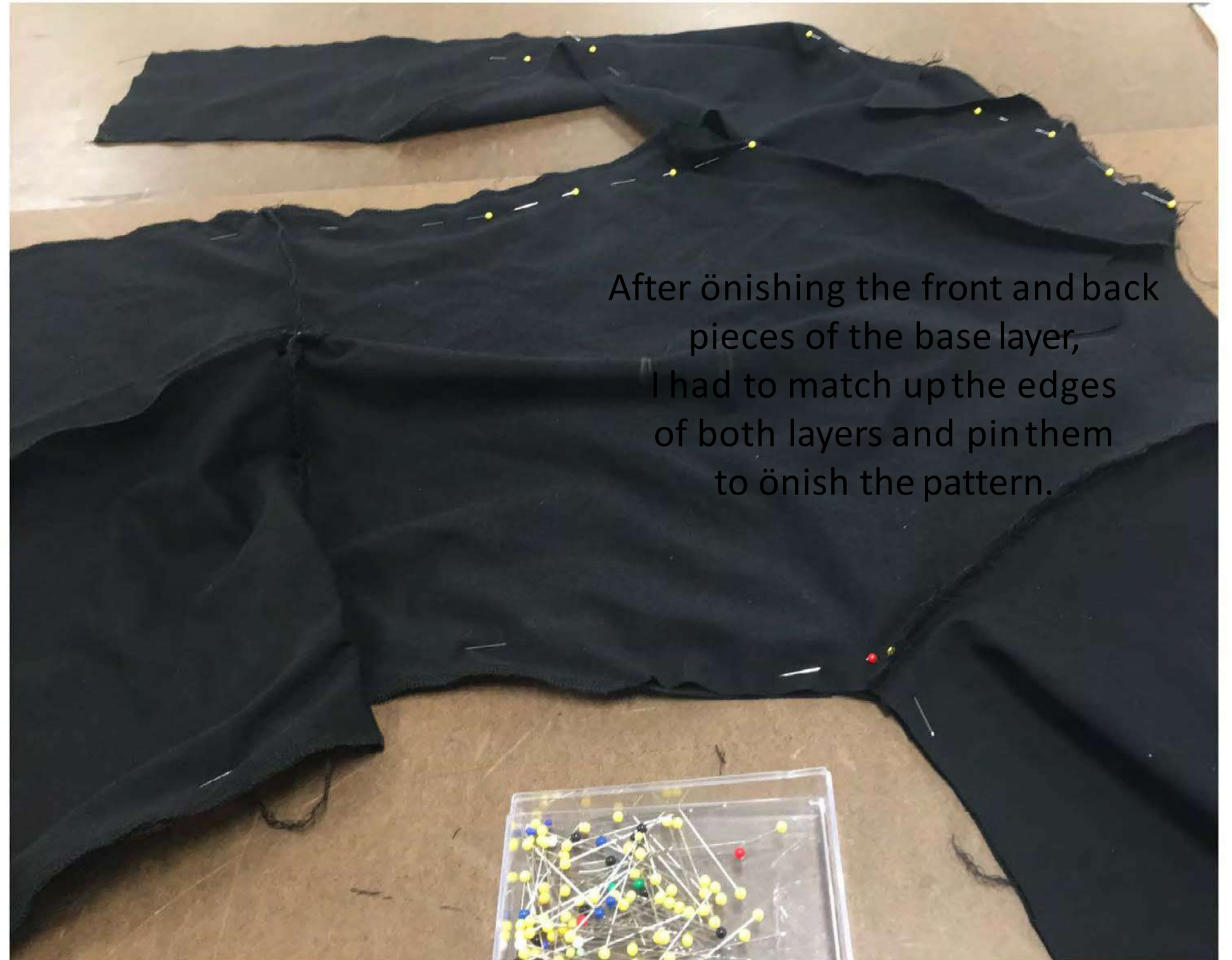


Using a standard McCall's pattern, I overlaid my custom pattern with the McCall's pattern to get a standard outline for my mock-up.

I had never used the overlock sewing machine so it was also good practice to use the machine.

After finishing the front and back pieces of the base layer, I had to match up the edges of both layers and pin them to finish the pattern.

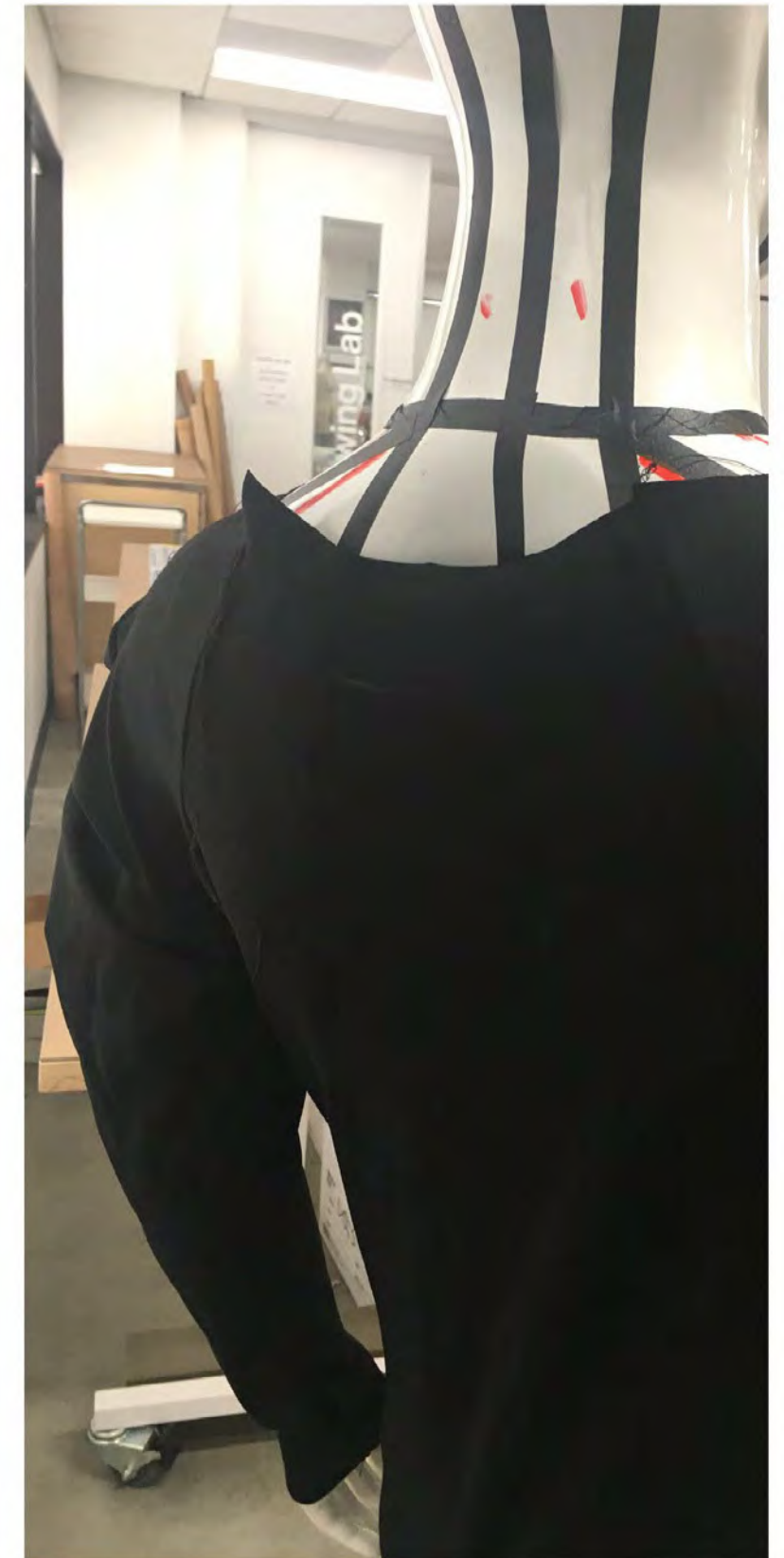
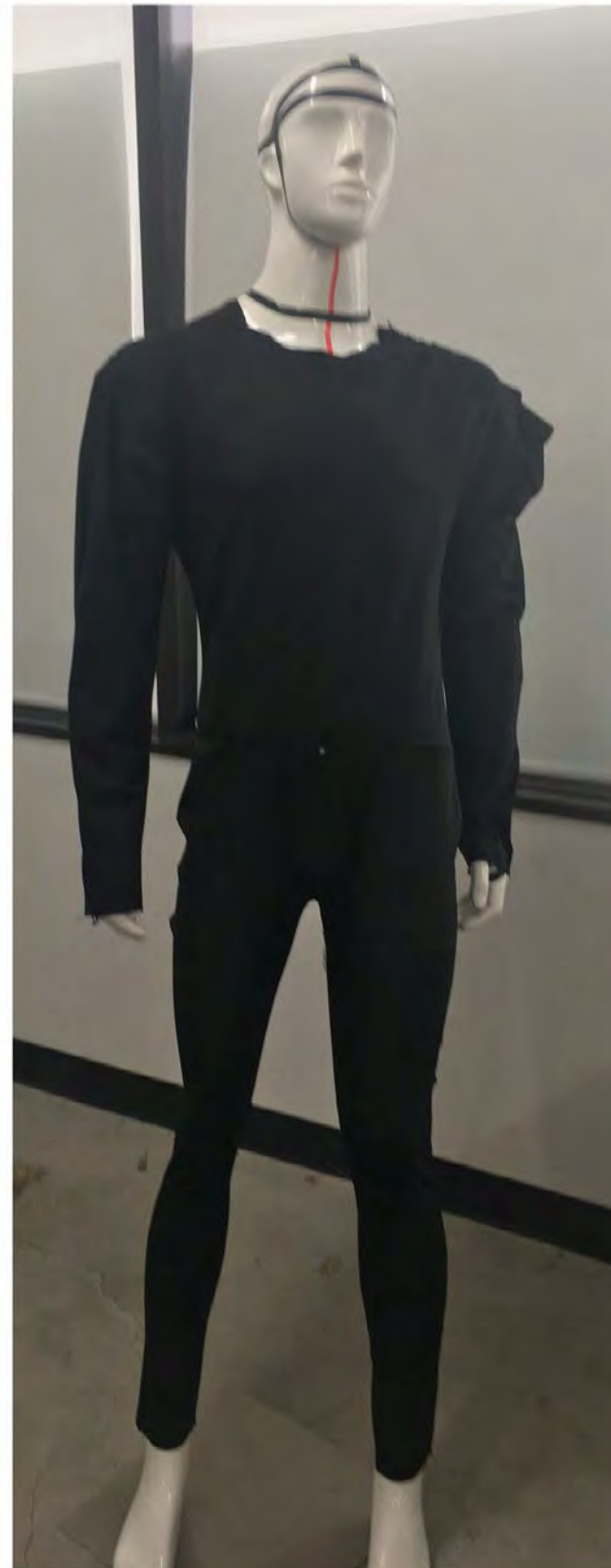




After the front and back pattern were sewn together, a hard lesson was learned.

My custom pattern was formed onto a dress form that had very different proportions and sizes than the mannequin.

I had to decide which size I wanted the pattern to be, and finally chose the mannequin because it was going to be used for the final.





Since this was a mock-up and I had a dress form available to me, I used it to form fit my base layer to get as close and tight of fit as possible.

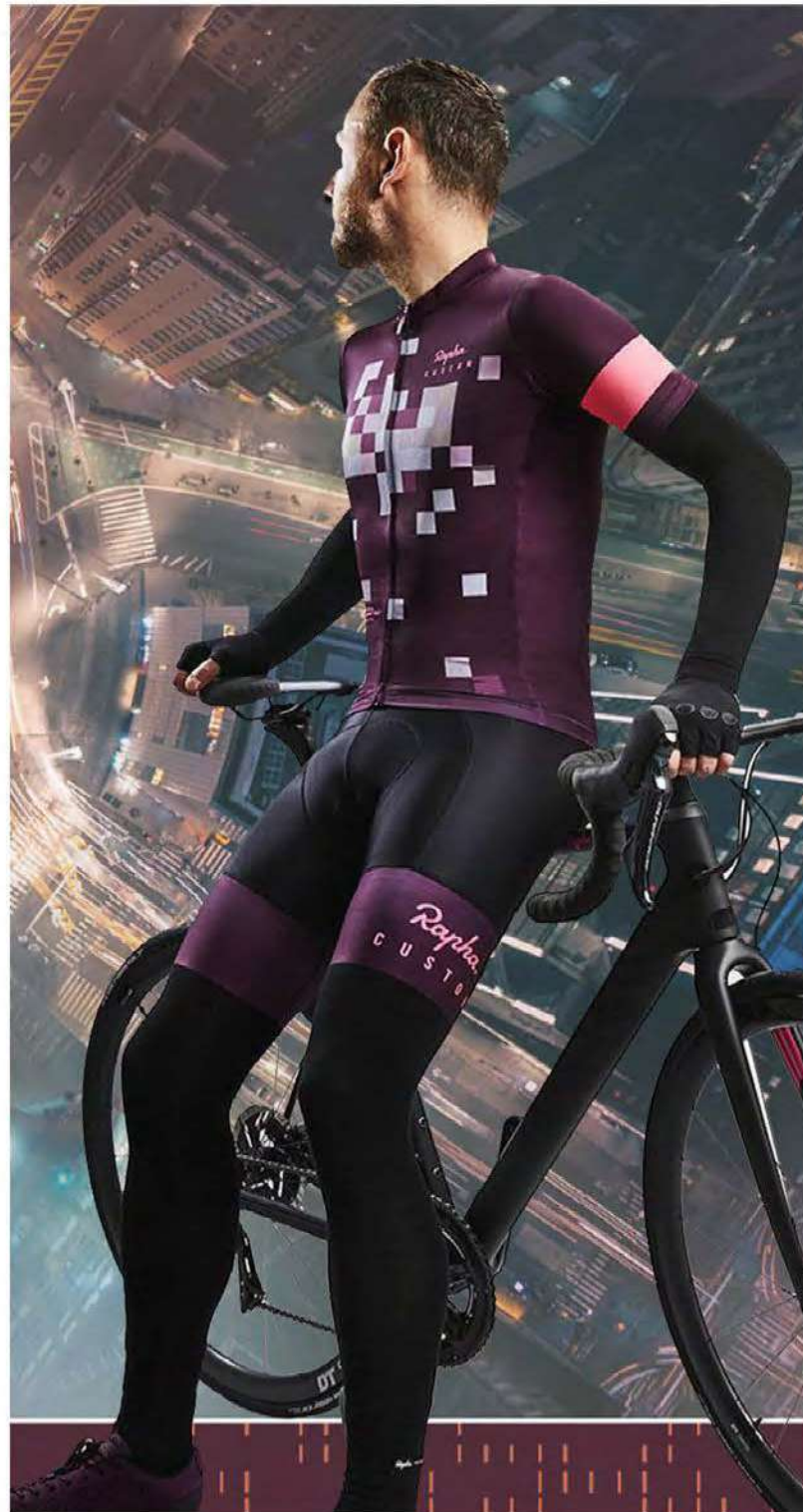
So pinning the excess material back, and then going back and trimming everything was the main task for the end of the week.

Week 13

**Final materials and start of final base layer
and jacket models.**

Other than the pattern being an original design I wanted an original textile as well.

Inspired by the 'Code Create' WGSN 2020 graphics, I made a pixel Lycra pattern through Spoonflower.





Doing the black base layer mock-up just the week before really helped me make the final model.

I finished the un-fitted final model in half the time I did the black mock-up.

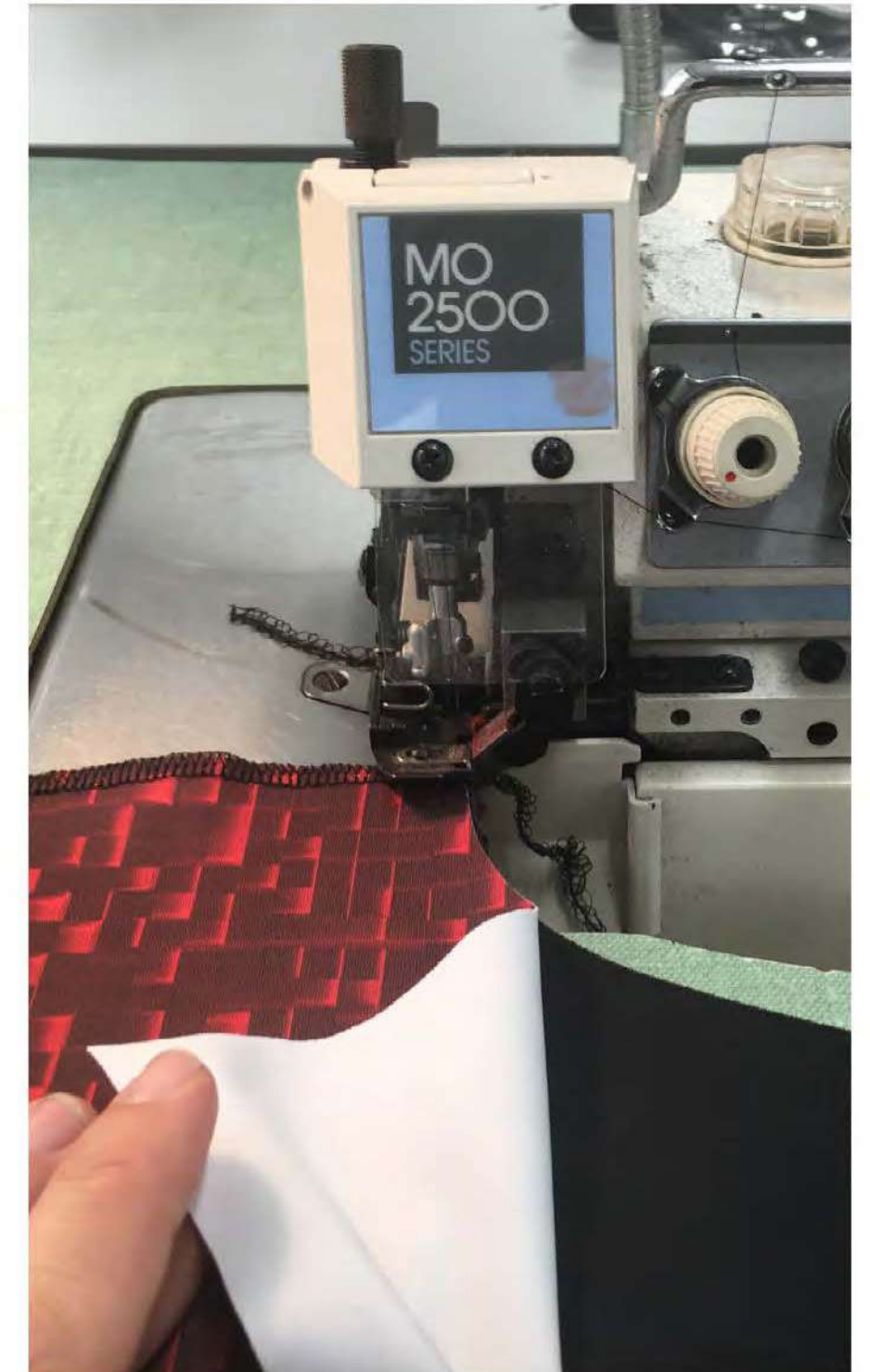
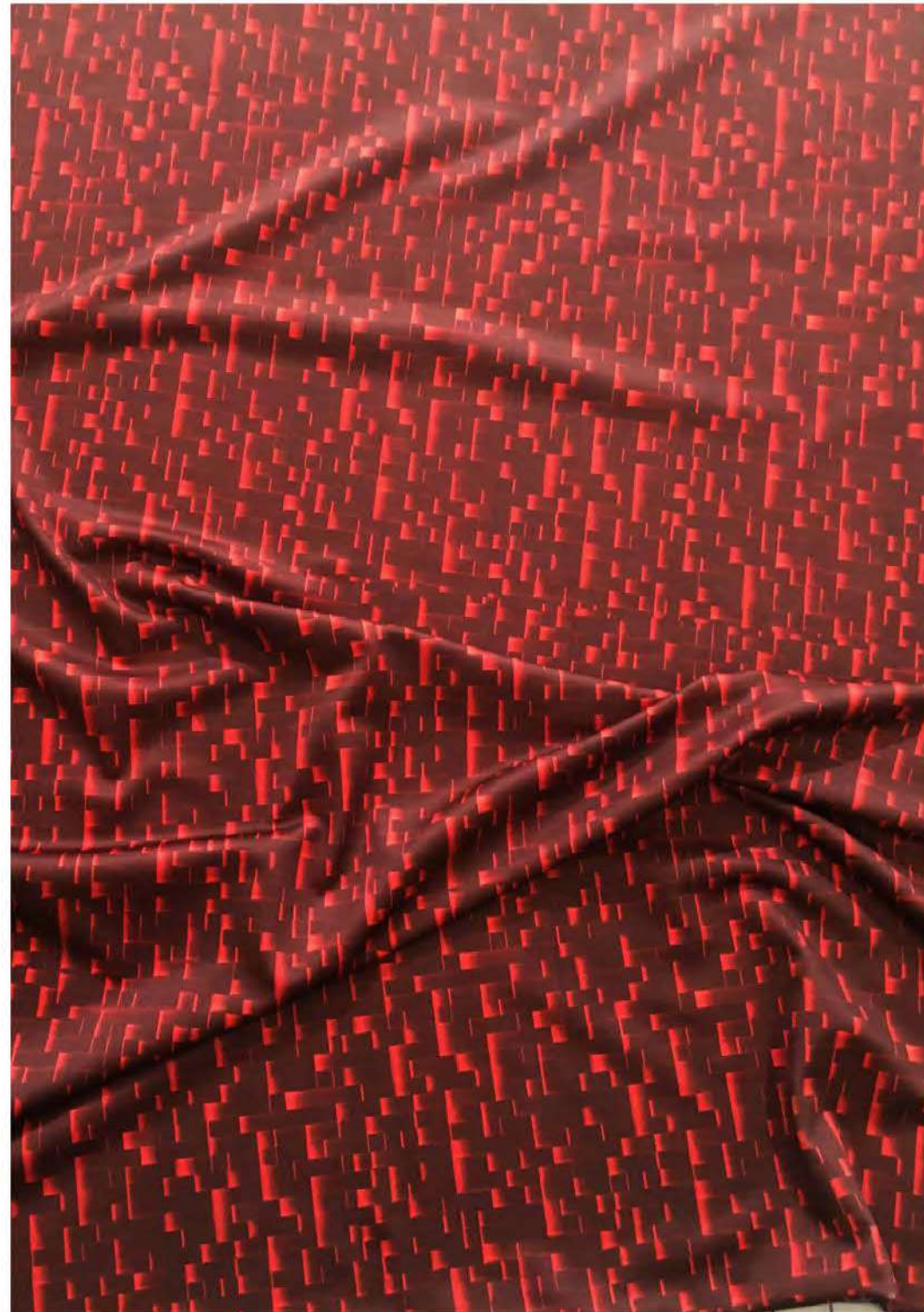


The final base layer looked good, but did not fit the way I wanted.

Many design decisions needed to be made about more seams, if there should be Omni-Heat silver dots inside, and what was to be done about the fit on the mannequin.

I started the jacket model the next day. I had done a jacket mock-up the term before, so I had a rough idea of how to do it.

Many things went wrong.



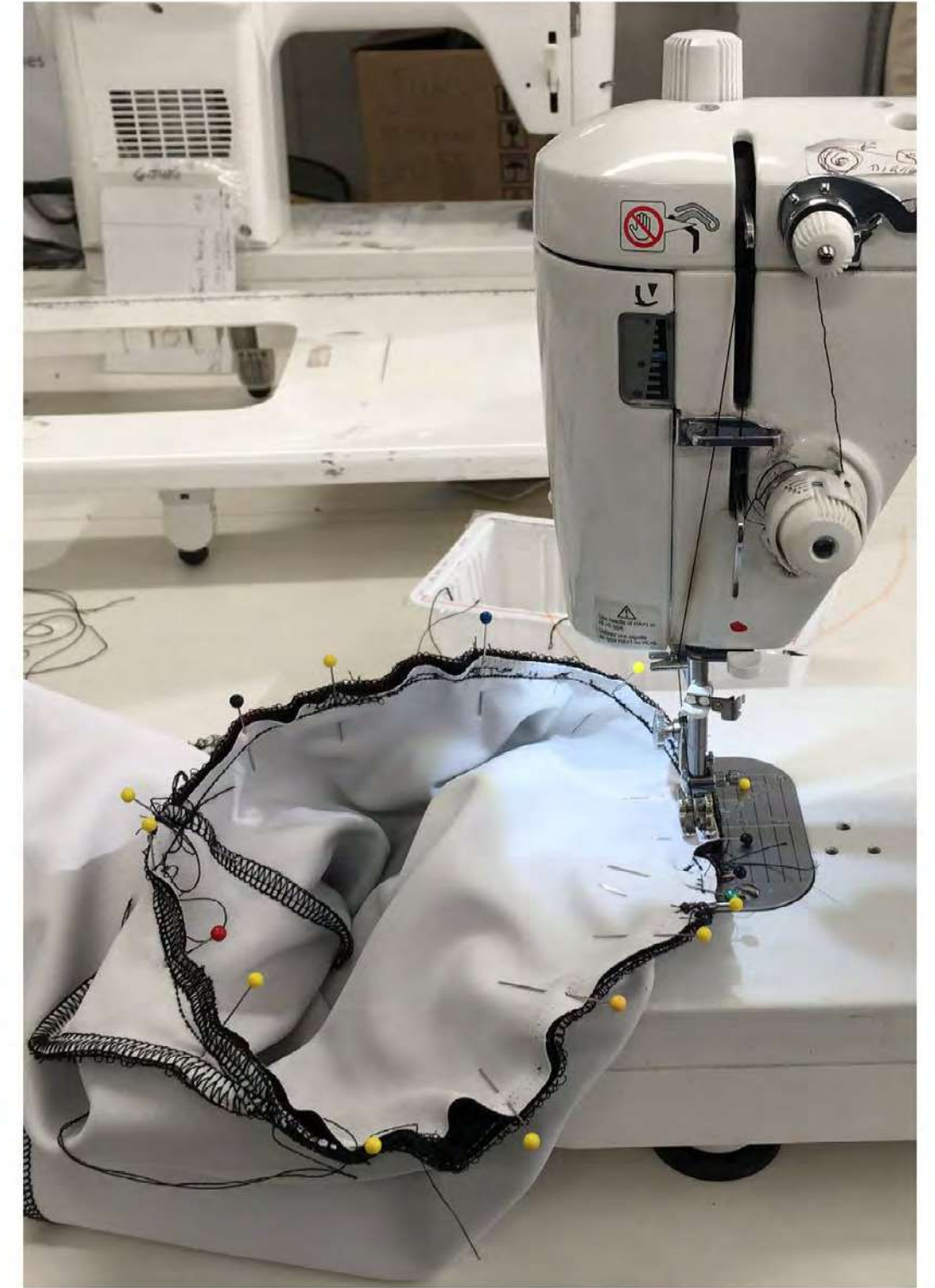
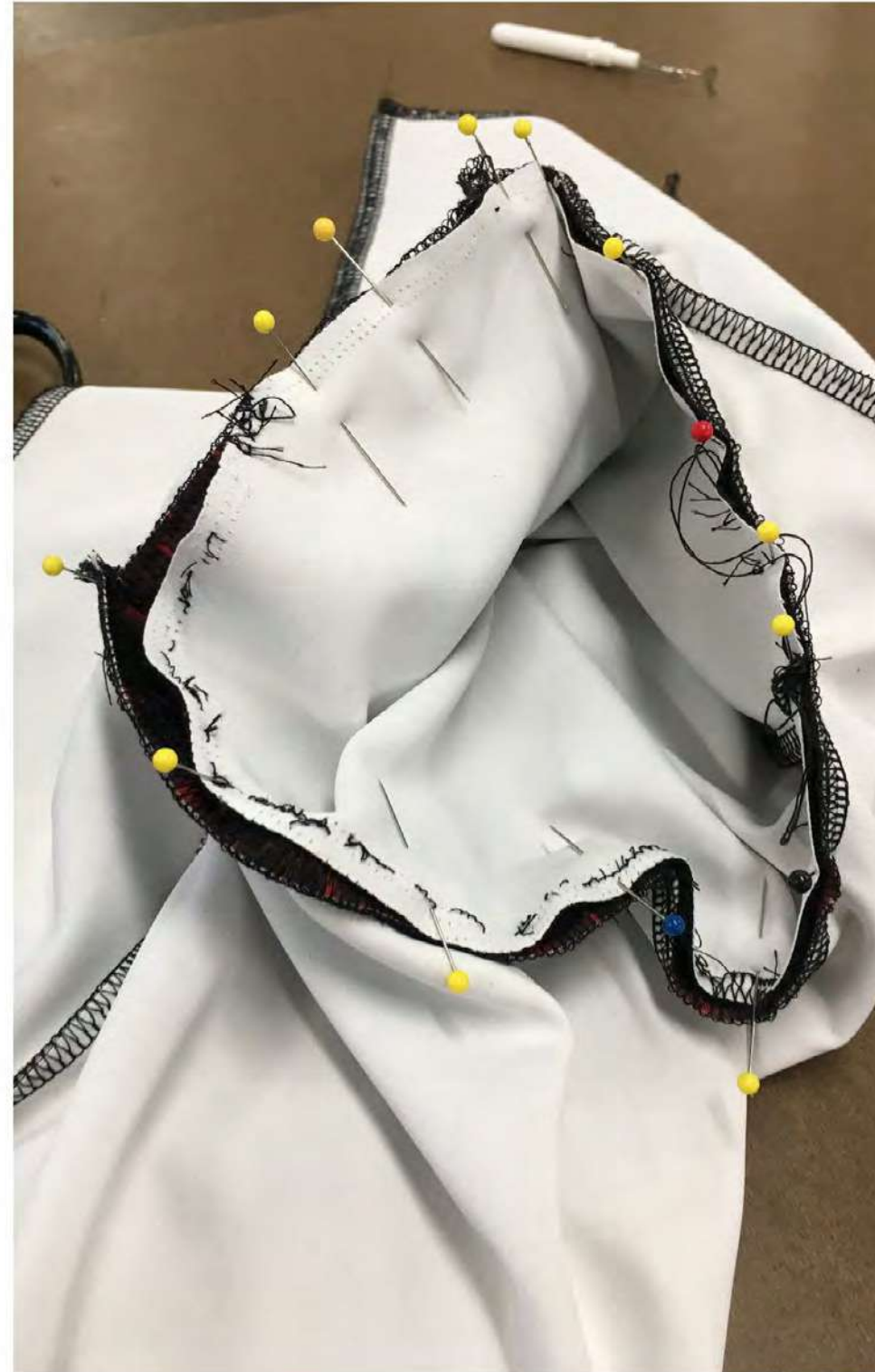


I attached the black and pixel lycra materials together then attached the pockets.

The sleeve pattern was cut, but I waited to attach them until I was more patient and rested.

The sleeves for the jacket tested my patience.

I tried to do it on the overlock machine, and you can see the excess thread on the sleeve that I had to pull out numerous times. I then took it to the Juki and sewed and pinned it properly.





Now, the sleeves were hard but I learned enough from the pinning and sewing of the sleeves that the cuffs weren't too hard.

There are two strips of elastic in the wrist as well to make sure that no heat escapes the sleeves while the athlete is running.

At the end of week 13 I had started both the final base layer and the final jacket.

Because the final was on a Monday, I had only two days to finish both the base layer and the jacket as well as the presentation.

Chaos ensued.



Week 14

Final model and presentation.



After finishing and fitting the hood, I used seam tape used to patch tents and outdoor equipment to finish the corners.

I attached velcro ovals to seal the hood.

True to the original design, I used the same seam tape to tape off all the seams on the base layer.

The idea was that because the athlete's body temperature is so high and so important to the product, that the tape would help seal the garment.

I was finally finished.





