

SpaceGuard Blanket Initiative

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Objective

This experiment focuses on designing a blanket to help minimize the effects of x-rays on the human body.

Background

One theorized solution to protecting against space radiation is having the spacecraft produce its own electromagnetic field. This should be able to deflect the ionized particles found in cosmic radiation. While blocking the ionized particles, it still allows X-rays and gamma rays to pass through. Another theoretical solution is to encase the spacecraft with a significant layer of water, since hydrogen is known to be a very effective resource to shield from radiation.

Currently NASA has developed a vest to help protect astronauts from radiation due to solar particles. Though a lot of information about this vest is classified it seems mainly focused on shielding from gamma radiation with the use of hydrogen-rich polymers. Its main purpose is to reduce the likelihood of radiation-induced cancer.

Research

In this experiment I set out to find easily accessible materials that may have useful properties in shielding from harmful cosmic radiation. I then tested my materials with an x-ray machine.

Faraday fabric is an electromagnetic shielding material made of multiple layers that create a faraday cage. It is known to have anti-static, antifungal, and antibacterial properties.



Carbon fiber fabric offers stable performance with high carbon content and resilience to harsh environments. This material in many layers is known to protect against electromagnetic radiation.

Mylar emergency blankets are made up of Polyethylene terephthalate. This material is very compact and lightweight, and a great insulating material. Being able to reflect up to 90% of body heat.



Research Continuation

Cotton fabric is known to be hypoallergenic and biodegradable. It is a very durable fabric and quite versatile. While cotton's moisture absorption and relatively low antibacterial properties pose challenges, it can be treated to enhance its resistance against bacteria, thereby improving its overall protective qualities.



Polyester fabric is durable and easy to care for, having the ability to be machine washed, and is not prone to wrinkle. Polyester fibers do not retain moisture as much as cotton does, and this material can also be treated to have more antibacterial and antimicrobial qualities.



Woven Stripe Linen is a natural fiber making it very eco-friendly, it is also a hypoallergenic fabric. This material is an ideal choice for temperature regulation, being able to keep the body warm in colder temperatures and very breathable for hotter temperatures. This material does absorb moisture, but it dries quickly. Its moisture-wicking abilities can create an environment that is less favorable for bacterial growth compared to synthetic fibers.

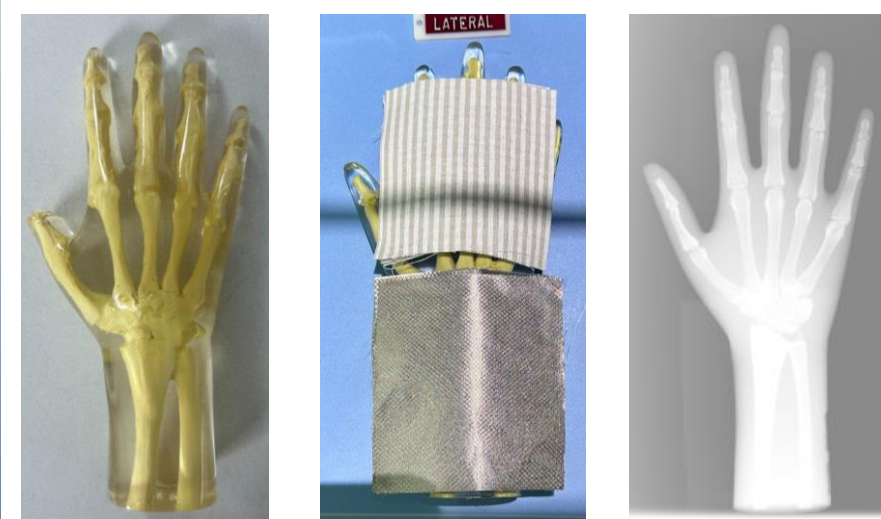


Liquid Stitch is a convenient, versatile fabric glue for quick projects, offering a strong bond on various fabrics. For my project this was used as bonding between the materials.

Implementation and Testing



I was able to utilize an x-ray machine in the Radiology Department to see if the materials I have selected have any qualities that could block out some of the x-rays. Highlighted in red you can see the three layers of faraday fabric showing the highest signs of having the ability to block out minimal x-rays. Using a phantom, I placed three layers of faraday fabric and Woven Stripe Linen to further test against x-ray penetration.



A phantom is an object designed to have characteristics of human tissue or anatomy.



Once the prototype was completed, I intended to test it again for x-rays using Personal Radiation Detector. Unfortunately, this dosimeter requires a significant amount of radiation, and the x-ray machine does not produce enough for this dosimeter to react.

Prototype

- Using three layers of faraday fabric attached to mylar sheets, I slid that into an outer-layer casing made of polyester faille and woven stripe linen.
- In my prototype, two square elements are joined together to capture the essence of a quilt-inspired blanket design. Additional pieces will be attached at the edges to avoid puncturing the Faraday fabric and Mylar.



Conclusions and Future Work

Using the x-ray machine in the radiology department I was able to expose my material to roughly 0.03% of the radiation that astronauts are exposed to in deep space. Visual inspection clearly showed evidence that the material provided some shielding from the x-rays. However, I was unable to measure the amount of shielding as the radiation levels were too low for my dosimeter to pick up. To further this work, I would need access to an x-ray machine that produces higher levels of radiation, and I would need a dosimeter that is able to take finer measurements of radiation.

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