

Austere Location 3D Printing for Custom Medical Devices and Equipment Maintenance



Introduction-Who We Are

XO Armor emerged from a visionary quest to revolutionize athlete care, founded on the belief that injury reduction and post-injury care are paramount to athletic success. Born out of the lab of Dr. Michael Zabala of Auburn University, XO Armor stands as a beacon of innovation in the sports medicine industry. After demonstrating clear success with professional athletes, XO Armor's commitment to excellence and innovation propelled the capabilities into the realms of medical orthoses and military care. Recognizing the universal need for precision protection and personalized solutions, the company seamlessly transitioned the custom medical device expertise to serve diverse sectors. Today, XO Armor stands as a trusted partner in safeguarding individuals across sports, medicine, and military domains, uniting cutting-edge technology with unwavering dedication to enhance safety and performance. The full-service solution provides all necessary tools for both online or offline locations to create custom-fit care for all individuals.

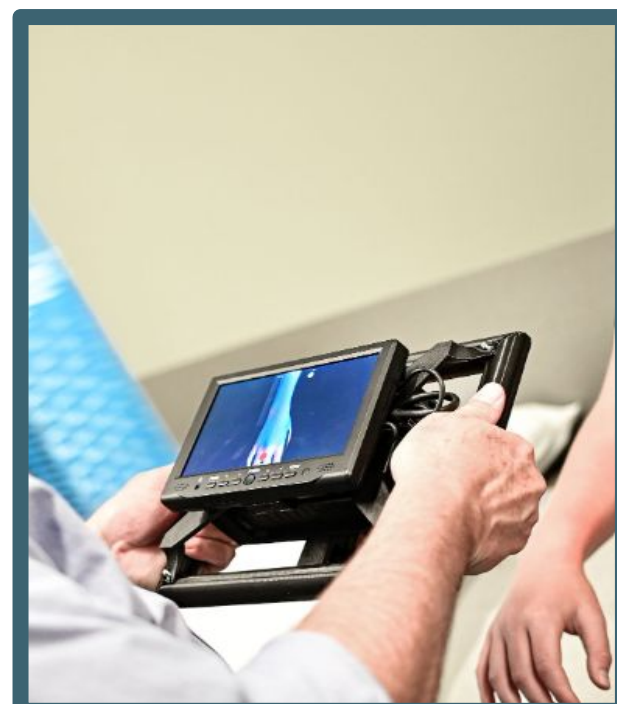
Custom Medical Devices

XO Armor's on-site solution elevates injury care for military personnel, bridging gaps in access to traditional clinics, particularly during deployments and in forward-operating environments. With our portable and self-contained system, medical personnel can swiftly provide customized care directly in the field, regardless of location. This accessible approach, designed specifically for our XO Service division, ensures that military personnel receive timely and tailored treatment, even in remote or challenging environments, maximizing readiness and minimizing downtime for our armed forces. With three simple steps, a custom device can be created and provided to the patient.

Process:

1. Scan the patient using XO Armor's provided scanner
2. Adjust scan using XO Armor's offline software
3. Print, add padding if desired, and provide to the patient

Step 1: Scan



Step 2: Adjust/Alter



Step 3: Print & Provide



Unique Expertise and Capabilities for DoD

At XO Armor, our mission is to safeguard the lives of military personnel by pioneering on-demand medical solutions and mission-critical maintenance components designed for the most challenging and austere environments. Through innovation, rigorous testing, and an understanding of the demands faced by our armed forces, we strive to be the trusted partner in enhancing safety, survival, and mission success by offering expertise in the below factors:

- Customized additive manufacturing design and deployment
- Materials testing and high-impact testing
- Contested logistics domain knowledge
- Offline software capabilities for remote environments
- Extensive biomechanical engineering with access to state of the art biomechanical lab and testing facilities
- Utilizing commercial off-the-shelf hardware as a cost-effective, reliable solution
- Tailored solutions for ease of use with no specialized training

Portable Printer in Each Facility or Remote Location



Current Efforts in DoD

Current efforts and accomplishments within the XO Armor capabilities designed for support of the Department of Defense:

Mobile Offline Manufacturing for Supply Chain Sustainment

- Adapting current custom-fit medical device hardware/software solution to operate offline in an austere environment
- Adding capability to our system that includes a vast library of printable devices to the benefit of deployed military personnel
- Creating premade, standard tools, utility items, and medical devices in various sizes to be printed in forward operating environments
- Evaluate ease of use through user interface and user experience testing, targeting 15 minutes or less of training time to teach any non-technical user how to operate scan to print process
- Characterize multiple filaments to address durability, functionality, and categorized use case



A. Several custom-fit devices previously manufactured by XO Armor. From left to right: (back row) Shoulder pad, rib pad, ulnar gutter splint, thigh contusion pad, shin guard, wrist brace (middle row) AC pad with raised area, wrist/forearm brace, distal forearm brace, metacarpal pad (front row) thumb spica, buddy splint. B. Several standard devices previously manufactured by XO Armor. From left to right: (back row) 90° angle bracket, hose adapter, J-hook, male and female clips (front row) adjustable crescent wrench, assorted bolts, assorted fasteners, metric socket adapters.

Test Results for Strength and Durability



Various shoulder models after impact testing. The top row of guards were manufactured with resins via SLA, while the bottom row of guards were manufactured with PLA via FDM. Impact testing results from the multiple trials with various designs and materials presented below.

Guard	Avg Force (lb)	Avg Velocity (mph)	Avg Momentum (kg m/s)	Break Status
Formlabs® Durable, solid	1564.06	12.09	48.54	NO BREAK
Formlabs® Durable, holed	1609.97	12.01	48.20	NO BREAK
Formlabs® Tough, solid	1400.86	11.99	48.15	NO BREAK
Formlabs® Tough, holed	1458.51	12.09	48.53	3rd Trial
Hatchbox® PLA, solid	1512.82	12.09	48.55	NO BREAK
Hatchbox® PLA, holed	1495.34	12.08	48.51	5th Trial
Raise3D® PLA, solid	1788.80	12.12	48.65	2nd Trial



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