

# TRANSFORMING FIRST TO LAST MILE OF BLOOD TRANSPORT FOR ARMED SERVICES BLOOD PROGRAM

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## TECHNICAL BRIEF



## Executive Summary

The Blood Armor Global, developed by MaxQ, is a cutting-edge, AABB standards driven, modular blood transport system designed to meet the stringent demands of military operations. This military-grade solution sets a new standard in global blood logistics by providing up to 13 days of continuous cold chain protection for 18–22 units of whole blood, all while maintaining a critical temperature range of 1–10°C. Capable of reliable performance in both arctic winters and desert summers, the Blood Armor Global eliminates the logistical challenges of blood cold chain and far surpasses existing solutions such as the Collins box. This white paper highlights the key advantages of the Blood Armor Global for military stakeholders, reinforced by rigorous lab testing and field trials. These tests confirm its reliability, durability, and efficiency even under the most extreme operational conditions.

## Key Challenges in Military Blood Transport

The timely availability of whole blood or blood components at the point of injury is crucial for saving lives during military operations. However, transporting blood products from collection sites to blood donor centers, to maintaining blood inventories at far-forward bases presents

significant challenges. These products require strict cold chain maintenance and must be transported in qualified containers, that are standards compliant, and robust enough to endure long, rugged journeys through austere environments.

Current solutions, such as the Collins box, struggle to meet these demands, especially in extreme hot or cold ambients, due to their limited thermal performance and lack of flexibility. For example, the Collins box can hold 18 units of whole blood but is only pre-qualified to maintain the required temperature range for 48 hours in most domestic shipping ambient conditions. This may fall short in addressing the diverse and evolving needs of military missions, including:

- **Overseas Shipments:** Blood Donor Centers (BDCs) or Armed Services Whole Blood Processing Laboratories (ASWBPLs) may need to transport whole blood units to regions like the Indo-Pacific where transit times can extend to 5–7 days due to customs delays.
- **Arctic Conditions:** Far-forward bases in arctic environments may require the transport of 18 or more units of whole blood within the region over durations exceeding 24 hours.

The complexity of military operations necessitates a next-generation blood transport solution that offers greater modularity and flexibility. Such a

system must be capable of supporting diverse mission profiles while ensuring that whole blood is transported safely and efficiently across varied and often extreme conditions.

## Blood Armor Global: A Next-Generation Blood Transport System

The Blood Armor Global system directly addresses the key challenges of military blood transport by incorporating cutting-edge insulation technologies, customizable configurations, and rugged military-grade materials. With dimensions of 20" x 20" x 20", it is optimized for both domestic and international transport, making it ideal for Blood Donor Centers (BDCs), Armed Services Whole Blood Processing Laboratories (ASWBPLs), and most upper roles of care.

- 1. Thermal Performance:** The system leverages proven Vacuum Insulation Panels (VIPs) and Phase Change Materials (PCMs) to ensure consistent and reliable temperature control. Lab tests conducted under ISTA 7D summer and winter profiles demonstrated that Blood Armor Global consistently maintains blood at the required 1–10°C for up to 7 days depending on the mission profile. The system’s modular pack-out configurations are as follows:

**Table 1.** Modular pack-out variation for Blood Armor Global.

Pack-out	Capacity / Qualification
Long Range	18 – 22 WB units, 7-13 days*
Medium Range	>18 WB Units, 5-days
Short Range	>18 WB Units, 3-days
Arctic	18 WB Units, 2-days
Wet Ice	18 WB Units, 3-days

\*7-days against ISTA 7D, 13 days at moderate ambient

This robust thermal design and modularity make Blood Armor Global adaptable to different mission requirements, ensuring reliable performance in diverse conditions, whether in deserts, arctic regions, or during long-distance transport.

- 2. Durability:** Constructed from rugged expanded polypropylene (EPP), the Blood Armor Global system has been rigorously tested under the ISTA 3A distribution cycle. These tests ensure the container can withstand the harsh realities of military transport and handling while protecting the integrity of its precious contents.
- 3. Ease of Use:** The system’s versatile design accommodates both phase change coolants and wet ice, depending on available resources in different military settings. Additionally, the medium-range configuration maintains temperature control

for at least 5 days, while the short-range pack-out sustains it for a minimum of 3 days. This flexibility provides critical temperature management for varying mission durations and payload sizes, offering unmatched reliability across different geographical conditions. A dry ice and non-dry ice pack-out for Blood Armor Global to transport frozen products is currently under development.

## Comparative Advantages: Blood Armor Global vs. Collins Box

The Blood Armor Global system offers several key advantages over existing blood transport containers like the Collins Box:

The Blood Armor Global’s adaptability to diverse mission profiles—whether for extended durations or extreme climates—makes it a far more versatile and efficient solution compared to the Collins Box, which lacks the same level of customization and thermal performance.

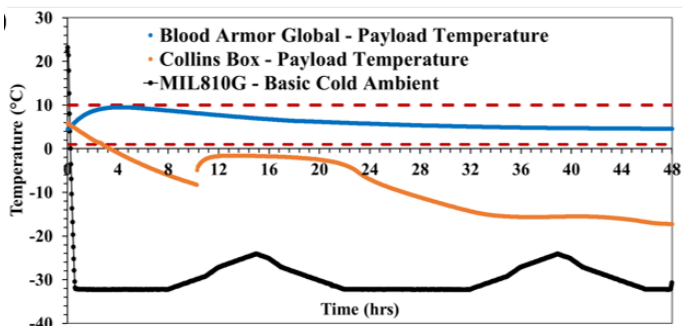
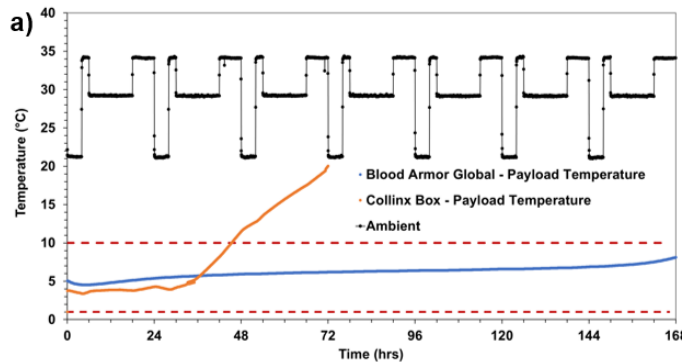
Feature	Blood Armor Global	Collins Box
<b>Capacity</b>	18 – 22 units (Variable)	18 Units
<b>Thermal Performance</b>		
<b>Global Summer*</b>	7 – days	2 – days
<b>Global Winter*</b>	7 – days	13 hours
<b>MIL 810G Basic Hot (Desert)</b>	2 – days	44 hours
<b>MIL 810G Basic Cold (Arctic)</b>	2 – days	3 hours
<b>Coolants</b>	Phase change or wet ice based on availability and mission needs	Wet ice only
<b>Modularity</b>	3 configurations based on mission	1 configuration

\*ISTA 7D Standards



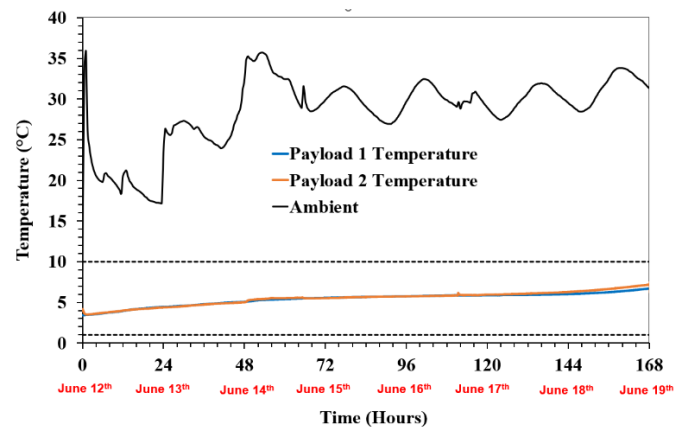
## Lab Testing: Data-backed Performance

MaxQ Research conducted rigorous laboratory tests to validate the Blood Armor Global's thermal performance. Under the ISTA 7D summer ambient profile, the Blood Armor Global maintained the 1–10°C range for 168 hours, a 250% improvement over the Collins box, which lasted only 48 hours under the same conditions. The Blood Armor Global also excelled in arctic conditions, demonstrating resilience in temperatures as low as -31°C and maintaining stability for 48 hours, compared to the Collins box's 3 hours. These results confirm the system's superior ability to protect blood supplies in various climates and mission durations.



## Field Testing: Proving Robustness in Real-World Scenario

To validate the performance of the Blood Armor Global container in operational settings, field testing was conducted by shipping the container from Joint Base Lewis-McChord (JBLM) to the University of Texas Health Science Center at San Antonio (UTHSCSA). The team collaborated with the Blood Donor Center at JBLM – MAJ Joshua Martinez (Chief, ASBBC-PNW) and Dr. James Bynum (Vice Chair, Surgical Research, UTHSA) to conduct the field testing. The goal was to simulate a realistic shipping scenario and assess the container's ability to maintain the required temperature range throughout the transport. During the shipment, ambient temperatures peaked at 36°C with an average of 32°C. Despite these challenging conditions, the Blood Armor Global maintained the payload temperature between 1–10°C for the entire 7-day period. Upon arrival, the blood unit was confirmed to be fully viable, meeting all clinical acceptance criteria.



## Operational Considerations for Military Stakeholders

The Blood Armor Global is engineered for ease of use, long-term durability, and extended transport durations, making it a highly effective solution for military blood logistics. Key operational advantages include:

- **Extended Endurance for Shipments:** Pre-qualified with modular pack-out configurations, the Blood Armor Global ensures reliable transport of blood products under extreme ambient conditions, maintaining precise temperature control for up to 7 days whether in high heat or freezing environments. Making it a truly global transport solution.
- **Low Maintenance Requirements:** The container requires only routine visual inspections, significantly reducing the maintenance burden.
- **Five-Year Shelf Life:** With a five-year shelf life, the Blood Armor Global offers long-term storage and readiness. This longevity allows military stakeholders to maintain an operational inventory for both training exercises and mission-critical deployments.

## Conclusion

The Blood Armor Global container represents a major advancement in military blood transport, addressing critical gaps in the current logistics system. By integrating cutting-edge thermal insulation technologies, modular pack-out configurations, and rugged military-grade materials, MaxQ Research has developed a solution capable of maintaining the cold chain for up to 7 days under the harshest operational conditions. Rigorous laboratory and field testing has validated the container's ability to preserve the integrity and viability of blood supplies over long distances and through extreme environments. With its versatility, extended transport duration, and ease of use, the Blood Armor Global sets a new standard for military blood transport, improving mission success rates and ultimately saving lives on the battlefield.

### About MaxQ

MaxQ is Temperature Controlled Packaging Re-Imagined! Trusted by over 1,500 global hospital blood banks and blood centers, MaxQ is revolutionizing the shipping of temperature-sensitive blood products and other biologics with advanced breakthroughs in thermal insulation sciences and transparency. Its patented technologies enable a new category of payload-specific, advanced packaging solutions with unprecedented features, thermal performance, and cost efficiency.

Thermal Control  
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