

From the Printer to Post: Evaluating the Feasibility of 3D-Printed Modular Barracks for Deployed Environments



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Abstract

A vital element of an expeditious military is the ability to quickly deploy troops to austere and dynamic environments. Living quarters are an essential component of deployment. Currently, Department of Defense branches rely on traditional solutions, such as temporary forward deployed barracks huts (B-Huts), containerized living units (CLUs), or Tent Extendable Modular Personnel (TEMPER), a modular, soft-walled, aluminum-framed tent. While practical, these frameworks fail to meet the demands of survivability and durability, force protection, and livability. Additionally, these options impose a significant logistical burden that requires shipment of construction material, engineer and transportation workforce, and associated time costs that strain operational and sustainment processes. This research conducts a qualitative comparative evaluation which will analyze the speed, cost, durability, efficiency, and logistical footprint of conventional housing types. This research will analyze the cost of survivability, logistics, and habitability of Additive Manufacturing construction in comparison to current conventional options.

Methods



- Qualitative Analysis of four housing types: TEMPER tents, B-Huts, Container Living Unit (CLUs), and Additive Manufacturing (AM)
- Multi-Criteria Decision Analysis (MCDA) in four criteria: survivability, logistical efficiency, equipment lifespan, and habitability
- Peer-review survey in two realistic environments
- Case studies (Engineer Research and Development Center – Construction Engineering Research Laboratory

Results & Impact

- The result led to subject-matter experts (SMEs), peer survey, to determine the most important criteria for living quarters in deployment environments is survivability and logistical efficiency. See Figure 1.
- The best rated perceived housing type to provide these criteria is CLUs. See Figure 2.

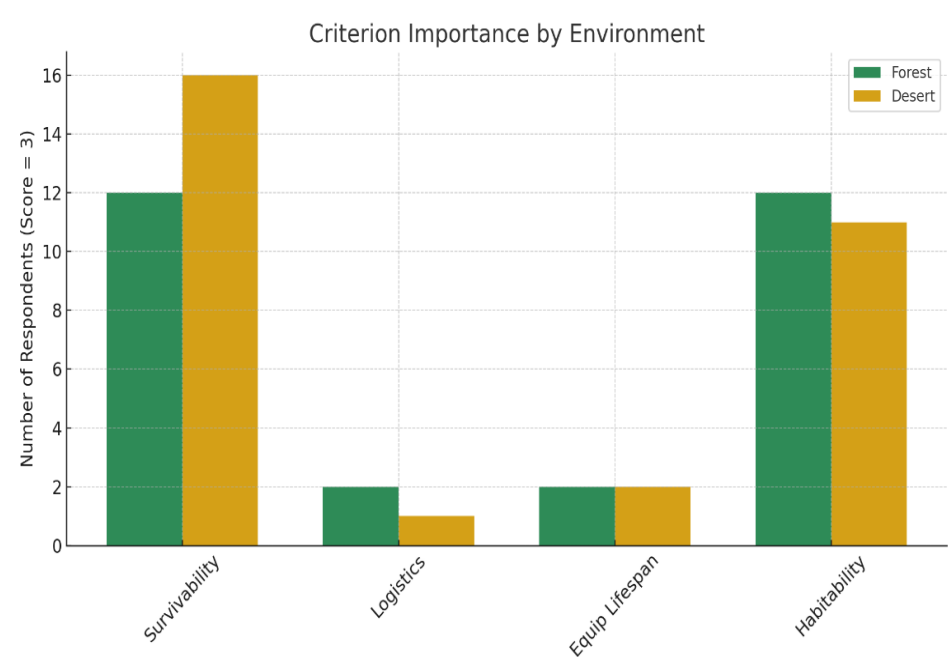


Figure. 1

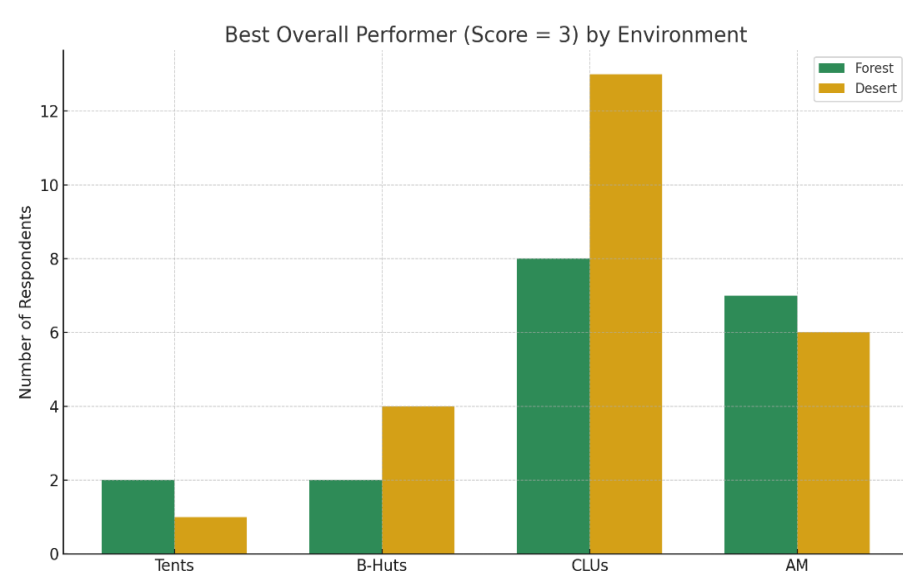


Figure. 2

Future Research

- Full-scale field trials in operational environments. ERDC is conducting studies but are focused on controlled environments but consistently pushing the envelope to continue maturing the technology.
- Documentation of AM long-term durability assessment and material degradation studies.



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