1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to seek basic and applied research for the development of agile manufacturing techniques that take advantage of recycled and reclaimed materials. The proposed research can focus on either of two waste streams generated at forward operating bases (FOBs): metals and plastics. Re-claimed and re-purposed metals or plastics salvaged from the battlefield also could be included. Proposed efforts should be scoped to offer a safe and environmentally responsible way to reduce disposal requirements and to turn a specific waste-stream into value-added products for use by the warfighter. Automation, modest energy and utility impacts, labor minimization, and compatibility with existing and established military distribution systems are key attributes; therefore, systems requiring manual operations and large logistical foot prints would be undesirable. Proposed equipment capability would need to be transportable via an International Standards Organization (ISO) container or interface with multi-modal transportation methods used in the Department of Defense (DoD). FOB infrastructure and related resources vary widely based on the Service, the site’s operational role, mission, environment and proximity to the front. Potential projects funded under this SON must adhere to current requirements for power, water and other resources on FOBs as shown in Table 1. Manufacturing processes that minimize the resources required for operation are of particular interest.

Table 1. FOB Resource Requirements

<table>
<thead>
<tr>
<th>Power</th>
<th>Water</th>
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</thead>
<tbody>
<tr>
<td>Army Force Provider</td>
<td>Typically link generators to loads; occasionally may form small microgrids</td>
</tr>
<tr>
<td>U.S. Air Force</td>
<td>Single or linked generators to develop encampment microgrid</td>
</tr>
</tbody>
</table>

The definition of manufacturing within this SON includes traditional manufacturing processes (i.e., melting, casting, heat treatment), or 3D printing/additive manufacturing.
2. Expected Benefits of Proposed Work

The benefits of this SON would be improved self-sustainability of the warfighter in-theater, increased operational readiness, a reduction of our logistics tail, and the ability of the warfighter to manufacture on-demand at the point of use. Successful results of this work will show that FOB plastic and metallic waste streams and battlefield scrap can be reused, with field-capable manufacturing processes allowing the warfighter to potentially fabricate replacement parts or perform repair operations, while keeping subject waste streams out of open burn pits, or incinerators currently used on many FOBs. Reducing open burning would benefit not only the environment, but the health of the personnel performing the burn.

3. Background

At some point in the future, we can expect to see additive manufacturing on the battlefield. Currently, the Army’s Rapid Equipping Force (REF) has supplied a Stratasys Fortus 250 3D printer to the battlefield in the Expeditionary Laboratory (ExLab), but this equipment is limited to only ABS plastic, whose feedstock is provided by the OEM. Metal additive manufacturing has many challenges currently keeping the technology from the battlefield such as equipment cost, footprint, weight, power needs, transport and storage of metal powders, build volume limitations, and process control. This practice uses jet fuel to ignite and incinerate plastic, paper, and wood materials, and has led to respiratory problems of the warfighters undertaking this effort.1

The concept of manufacturing with recycled and reclaimed materials in-theater at an FOB has gained traction within the DoD. This idea could revolutionize the way we wage war, in that it could potentially reduce the huge logistics tail needed to conduct wars on foreign soil, saving valuable resources and lives. This research aligns with one of the Army’s “Next Five” S&T (science and technology) Challenges: sustainability/logistics: transport, distribute and dispose”.2,3 It is also consistent with the Army technical gap of having the capability to fabricate needed repair parts from any material at or near the point of need”.

Shrinking the logistics tail is an important benefit of utilizing recycled and reclaimed materials in-theater.4 The 2012 Army Sustainability Report, released 31 October 2012, outlines the Army’s desire to reduce the number of convoys required to resupply troops on the battlefield.5 In addition, the U.S. Air Force Energy Strategic Plan, dated 2013, and the U.S. Navy’s Energy Vision for the 21st Century, dated 2010, both cite goals reducing operational vulnerability and improve effectiveness while reducing its logistical tail. Reducing vulnerable convoys not only saves materiel and lives, but troops assigned to guard these convoys can actually be utilized for their intended purpose—engaging the enemy. The charter to reduce the logistical tail in the combat zone is deemed critical to the success of the overall Army transformation, with relevance to Army future missions.6 All US Military services and their sustainment communities should consider the reduction in the logistics footprint a principal goal. As stated in Ransom’s paper, “Technology will be one of the primary enablers to reduce the logistics footprint, and the reduction of the logistics footprint is clearly a key element of the future battlefield.”7 NASA has also expressed interest in this area.

Missions in-theater often encounter unexpected threat challenges such as the need for replacement parts, modifications to existing equipment, or emergency safety equipment. Solutions are often
required in a time-sensitive manner. While the DoD uses various methodologies to determine the most important parts to carry, when a unit needs an unavailable part, equipment can sit for weeks waiting for a replacement part. Worse yet, the part may not be available at all, triggering a potentially lengthy acquisition process, resulting in a substantial logistics tail. Further, few manufacturers are interested in producing small batches of specialized military items. The ability to fabricate such items in theater would greatly reduce logistical burdens, cost and time delays.

4. Cost and Duration of Proposed Work

The cost and time to meet the requirements of this SON are at the discretion of the proposer. Although two options are available (Standard Proposals and Limited Scope Proposals), it is expected that one or more standard proposals will be most beneficial for realizing the goals of this SON.

Standard Proposals: These proposals describe a complete research effort or substantial, well-defined subset of the research effort. The proposer would incorporate the appropriate time, schedule and cost requirements to accomplish the scope of work proposed, and the work would be tied to one or more of the major SON goals. SERDP projects normally run from two to five years in length and vary considerably in cost consistent with the scope of the effort. It is expected that most proposals will fall into this category.

Limited Scope Proposals: Proposers with innovative approaches to the SON that entail high technical risk or have minimal supporting data may submit a Limited Scope Proposal for funding up to $200,000 and approximately one year in duration. It is expected that for this group of needs, there will be less value associated with Limited Scope Proposals. If these are funded, they may be eligible for follow-on funding if they result in a successful initial project. The objective of these proposals should be to acquire the data necessary to demonstrate proof-of-concept or reduction of risk that will lead to development of a future Standard Proposal. Proposers should submit Limited Scope Proposals in accordance with the SERDP Core Solicitation instructions and deadlines.

Coordination of the technical work by a central technical lead will be beneficial.

5. Point of Contact

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For Core Proposal submission due dates, instructions, and addition solicitation information, visit the SERDP website.
6. References

5. Dellarocco GJ. Force projection research and development: the key enabler for Army transformation [strategy research project]. [Carlisle Barracks (PA)]: Army War College (US); 2001 Apr 10.
6. Jameson LW. Shrinking the logistics tail in the combat zone [strategy research project]. [Carlisle Barracks (PA)]: Army War College (US); 2002 Apr 9.
7. Ransom DS. Logistics transformation – reducing the logistics footprint. [Research paper]. [Carlisle Barracks (PA)]: Army War College (US); 2002 Apr 5.