

# Redistributed manufacturing to support field medical care

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## Aims

The aim of redistributed manufacturing (RDM) is to bring production closer to the point of clinical use thereby enhancing the capability to deliver immediate and optimised medical care. Additional benefits include reducing logistical burden and costs, and improving supply resilience.

The aim of our preliminary investigation was to scope potential RDM technology innovations with an emphasis on support to field medical care. Three key imperatives were selected:

- > increased freedom of movement, agility, flexibility and robustness
- > reduced resource utilisation and complexity, increased independence and potential modularisation
- > enhanced field care, sustainable, scalable and remote technologies.

## Methods

Our investigation followed a qualitative, narrative, mixed-methods approach. An academic working group was created with representation from health tech innovation teams, design, engineering, logistics, medical textiles, cell therapies and device manufacturing. Initial workshop discussion was focused upon a number of 'real-life' scenarios through which a process of analysis was carried out in the following domains:

- > existing capability gap
- > scientific and engineering feasibility
- > financial metrics
- > patient and end-user focused outcomes
- > regulatory considerations.

## Results

The following output clusters were identified:

- > personal protective requirements ('left-of-bang' concept)
- > manufacturing, infrastructure and logistic requirements
- > RDM products: bio-pharmaceutical, cell and tissue therapies, and additive layer manufacturing technology
- > training and skills, and governance.

These clusters were aggregated and refined against the initial requirements to establish a series of priority work packages as shown in Table 1.

**Table 1. Priority work packages**

Work package number	Research and development work package	Objective(s)
1	Requirements for field medical care	Develop reference guides with alignment to real world clinical needs. Guide design and efficacy of proposed technology and innovations.
2	Additive layer manufacture capability	Evaluate field deployable ALM processes for custom medical devices with lean design. Focus on wound care, surgical devices, immobilisation and protection.
3	Cell and tissue therapy manufacturing capability	Identify elements of PCP and supply chain where CaTT can have most benefit. Feasibility and therapeutic benefit for casualty stabilisation, tissue reconstruction and sustainability. Costs of integration into the PCP.
4	Clinical fluids manufacturing capability	Demonstrate capability to produce clinical fluids including intravenous solutions with supply at or near to point of injury/illness. Reduction of logistical burden and improving freedom of movement.
5	Bio-pharmaceutical manufacturing capability	Advance the development of miniaturised portable manufacturing device platforms and technologies capable of produce small-molecule active pharmaceutical ingredients and therapeutic proteins. Reduced stockpiling and logistical burden. Rapid treatment at or near to point of injury/illness.
6	Innovation, assessment and adoption for field medical care	To integrate learning from all research themes. Systematic evaluation and validation of medical innovation route maps. Business case and investment guidance for innovators and technology acquisition staff.

ALM = additive layer manufacture; CaTT = cell and tissue therapy; PCP = patient care pathway.

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## Conclusion

Our preliminary investigation and analysis has produced a clearer understanding of the role of RDM within field medical care and areas for further exploration and exploitation of relevant technologies. Our primary objective was achieved to produce a detailed description of the technology and innovation applications for field medical care in a range of clinical scenarios and situations.

The main learning from this process has been the appreciation of the incredible potential for RDM and related technologies to provide enhanced capability and improved resilience with reduced reliance on supply logistics. The potential academic and practical impact is significant and will have the ability to transform field medical care in the future. ■