Opportunities in Personnel Survivability

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Capability through collaboration
DMTC Vision & Mission

• **Vision:**
  
  Provide technology solutions enabling industry to enhance Australian Defence capability.

• **Mission:**
  
  DMTC will lead, facilitate and manage cooperative research in the defence sector in materials, manufacturing & related themes, with the Defence customer, industry and research sector as key stakeholders.

• **Strategic Intent:**
  
  CAPABILITY THROUGH COLLABoration
Background

- Defence Materials Technology Centre – DMTC Ltd.
  - 1st Defence Future Capability Technology Centre (DFCTC) est. by Defence
  - Business model based on the successful CRC program
  - Funded for an initial period of 7 years from June, 2008
    - Core: $90M program ($30M - Defence, $8M - States, $52M – Participants)
    - Additional $20M program in Personnel Survivability - activity through 2016
  - Staff level ~75 FTE (10 HQ) around 130 headcount (with Program 7 at full rate)
  - Major activities across NSW, QLD, SA & Victoria (HQ in Melbourne)
R&D - The Capability Case

Modified from UK Defence Industrial Strategy, December 2005 pg 39
Personnel Survivability Goals

Also known as Program 7 – Personnel Survivability works to:

• Improve level of personnel protection for armed and support personnel
  • ↓ weight, bulk, cost etc.
  • ↑ multi-insult capability (blast/ballistic, agent protection)
  • ↓ signature (visible/IR/radar), adaptive/broadband materials
  • ↑ utility & fit (design integration, power management, anthropometry, load carriage, thermal management, etc.)

• Provide a path to field consistent with ADF acquisition requirements
  • Address utilisation “valley of death”
  • Practical enhancement of protection and/or performance of soldier/personnel
Where Program 7 Fits
Partners leverage Commonwealth & outside investment against partner S&T capability through collaborative, integrated supply chain model.

Formal program management structure in place.

Industry/End User-Led Project Focus:
- Industry treated as “first amongst equals” for purposes of project development, utilisation/commercialisation pathway.
- Projects without strong path to utilisation (end-user involvement) are “at-risk”.

Operational Model
Benefits to stakeholder groups

- DMTC provides an efficient, cost-effective mechanism of engagement to each Stakeholder Group:
  - Secures co-investment in capability development
  - Lasting access to improved industry capability
  - Strategic industry capability development initiative

- Co-investment in capability development
  - Achieve improved capability
  - Receive Defence guidance on relevance/applicability of industry capability development

- Provides co-investment in capability development
  - Receive access to research funds, industry partnerships, defence partnerships and a strongly applied context
Program 7 Participants

Industry / End User (7)

Universities (4)

Research Orgs. (3)
## Technology Areas

<table>
<thead>
<tr>
<th>Technology Areas</th>
<th>Outcomes</th>
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</thead>
<tbody>
<tr>
<td>1 Hard Armour Systems</td>
<td>Manufacturing of ceramic plate inserts and semi-rigid panels for torso and head protection</td>
</tr>
<tr>
<td>2 Soft Armour Systems</td>
<td>Fabrics with reduced weight and improved ballistic performance for body armour</td>
</tr>
<tr>
<td>3 Advanced Fabric Technologies</td>
<td>Fabric and garment technologies to improve strength, comfort and service life of combat clothing.</td>
</tr>
<tr>
<td>4 Power Generation and Management</td>
<td>Soldier-borne power generation, storage, distribution and management systems</td>
</tr>
<tr>
<td>5 New Concepts</td>
<td>Future integration planning and concept development</td>
</tr>
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Program 7 Case Study - HCAS

7.1.2 High Curvature Armour Systems (HCAS) focuses on:

“Ongoing development of a suite of Next Generation manufacturing, materials and process technologies to deliver improved personnel armour to the contemporary Australian combatant.”

Divided into Four key technology areas:

Double Diaphragm Deep Drawing (D4)

Semi-Rigid Soft Armour
- Quasi-rigid soft armour for improved impact response and protection of female combatants.

Polymer-Ceramic Strike Face Materials
- Low-cost formable strike faces with extreme multi-hit performance.

Life of Type (LOT)
- Improved capability in armour QA and recertification.
High Curvature Shell Tech

Double Diaphragm Deep Drawing (D4)

Protecting a Soldier’s Extremities:

- Established capability in article design and manufacture.
- Adoption of new ballistic materials incl UHMWPE.
- Unique ‘D4’ manufacturing route; splice-less morphology.
- Shell weight of < 800g / ballistic limit > 700 m/s. (Traditional 1.2 kg)
- Dynamic and static structural and manufacture modelling by PacificESI.
Evolution of a national capability

Initial Phase:
ADA and VCAMM carried out initial R&D under Land 149, a CTD project back in 2005-2007, plus other follow-on studies (2008-2010)

Current Project:
DMTC Project 7.1.2, within Personnel Survivability program; 2011-13

Commercialisation Program:
ADA to develop production capability under a DMO PIC project; 2013-2015
Unique manufacturing capability
Collaborative team work
Fit, Form and Function

Ballistic threat spectrum:

- Blast loads
- Blunt trauma
- HV fragments (1.1g FSPs)
- HG rounds (9mm HG)
- HV rifle rounds (7.62mm)

Structural requirement:

- Overall stiffness criteria
- Impact resistance
- Environmental resistance
## Comparison of material options

<table>
<thead>
<tr>
<th></th>
<th>Traditional Armour Laminate</th>
<th>NG Laminates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reinforcing fibre</strong></td>
<td>Aramid (Kevlar)</td>
<td>UHMWPE (Spectra)</td>
</tr>
<tr>
<td><strong>Matrix material</strong></td>
<td>Thermosetting resin</td>
<td>Thermoplastic</td>
</tr>
<tr>
<td><strong>Bulk density of laminates</strong></td>
<td>1.35</td>
<td>0.95</td>
</tr>
<tr>
<td><strong>Fabric preparation</strong></td>
<td>Cutting and splicing</td>
<td>None</td>
</tr>
<tr>
<td><strong>Manufacturing method</strong></td>
<td>High Pressure hot stacking</td>
<td>PA Vacuum forming</td>
</tr>
<tr>
<td><strong>Ballistic merit rating v FSPs</strong></td>
<td>Very high</td>
<td>Excellent</td>
</tr>
<tr>
<td><strong>Curved v. flat performance</strong></td>
<td>-10%</td>
<td>+20%</td>
</tr>
<tr>
<td><strong>Comparable weights</strong></td>
<td>N/A</td>
<td>-25%</td>
</tr>
<tr>
<td><strong>Structural performance</strong></td>
<td>Excellent</td>
<td>Acceptable</td>
</tr>
</tbody>
</table>
Armour shells structural testing
Current capability

• Final design of dedicated manufacturing equipment

• Pilot Plant in Knoxfield by Aug 2013

• Broad-based capability

• ~24 articles per day

• A DMTC technology demonstration facility
SME Engagement Opportunities

Opportunity to integrate SMEs into core programs

Existing Programs

e.g. Supporting Participants

Strategically build expertise in SMEs to feed into new programs

New Programs

e.g. light-weighting, fabrication technologies

Build capability in SMEs through strategic one off projects

Build capability in SMEs through strategic one off projects

DMTC Best Practice Program

e.g. UST, RIAS, Exel, Ventou

e.g. Technical benchmarking

Supply chain productivity projects
Future program planning

Eg. Land 400, Land 125 follow-on
Elements of a DMTC Program

- Requirement in Aust. industry context.
- Potential funding source identified.
- Desire to develop local capability
- Desire to collaborate (e.g., supply chain)
- Willingness to partner and invest
- Technical capability to support research
- Relevance to existing DMTC research
Questions and Contacts

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