

DEFENCE DÉFENSE

Smart Textile Applications for the Soldier of the Future A Vision from R&D

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Soldier Systems Technological Roadmap

17 juin 2009



Recherche et développement
pour la défense Canada

Defence Research and
Development Canada

Canada



The Soldier – Conerstone of the Force...

- Without him, nothing is possible.....
- Capable of adapting to various situations.....
- Has specific needs in order to be efficient in most operational conditions...
- 70% of what a soldier touch or use is under the form of flexible or textile materials.....
- Smart Textile technologies can increase the operational efficiency.....
- But how ?????





Smart Textile -Vision from R&D.....

- Various Project on Soldier system at DRDC Atlantic, Suffield, Toronto and Valcartier.....
- No conducting trends between projects projets....
- Positioning study on Smart Textiles initiated by DRDC Valcartier in the spring of 2007...
- R&D Capability Evaluation in Soldier System is currently under way.....
- New R&D projects are under definition phase.....

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History – The First Smart Textile

- Textile for the tent of the Bedouin of the Jordanian desert – Hair of Goats with specific properties....
- Intelligent Fuses for Underwater Grenades during the Second World War.....
- G-suits –40's.....



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Key to Success: Convergence.....

- Current Technological Progress is at the limit of Traditional Ways of Doing....
- The « Netting » of different Technologies is critical to futures Applications.....
- Human Factors must be seriously considered....
- The Human is usually the weak link in the use or efficient deployment of new technologies.....



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Positioning Study – Smart Textile

- Environmental Protection
 - Protection againsts the weather
 - Protection NBC
 - Comfort (heating and cooling)
- Ballistic Protection
- Situation Awareness
 - Integrated Sensors
 - Physiological Conditions
 - Position
- Signature Management (Camouflage)
- Sustain
 - Génération and Storage of Energy
 - Information Exchange



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Convergence : Utopic Combat Uniform

- Intégration is problématique....
- Weight and Energy.....
- But we have to start somewhere....
- Work started in CARDE in Québec City in 1954.....



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Environmental Protection

- Incorporation of dynamic textiles that could adapt to different environmental conditions.....
- Heating and cooling at the torso level is a priority.....
- Intermittent Systems that can be linked to another platform.....
- Incorporation physiological sensors....



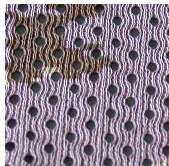
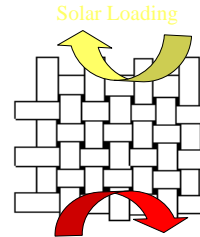
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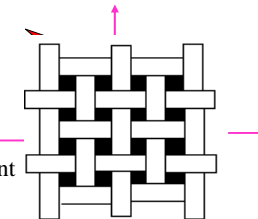


Temporaire



Contraintes mécaniques

Permanent



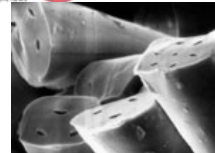
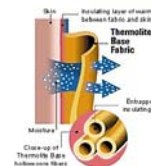
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Environnemental Protection

- Biological and/or chemical protection for low intensity conflict.....
- Fiber Treatments and Use of hollow « reactives » fibers....
- Réaction againts the threat - configurability & adaptability....
- Incorporation of a short duration respirator....
- Gas generator to create a position pressure



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Balistic Protection

- Developpement of new lightweight comfortable materials againsts blast and projectiles....
- Dynamic Response adapted to the situation...
- Incorporation of Medecine againsts pain or antiseptique to reduce the effect of Impact...
- Damage Report.....

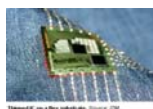
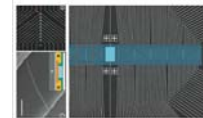


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Situation Awareness

- Integration of sensors to increase situation awareness – Internally and Externally.....
- Hypothermia & dehydration.....
- Avoid encapsulating the soldier in a bubble.....
- Intelligent Response againsts different NBC threats....
- Sensor Network at different level..
- Durabilité et long term reliability.....



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Signature Management - Camouflage

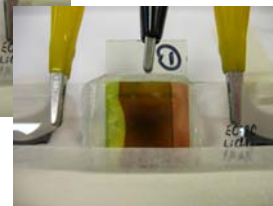
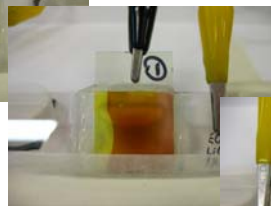
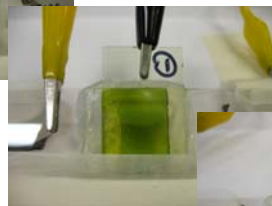
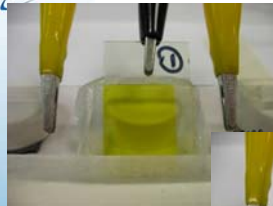
- Adaptive multispectral materials capable of adapting to different environment.....
- Low-snagging and lightweight....
- Use reflection and not the emission of light in the visible band.....
- Change its convective and emissive properties in the thermal.....
- Modify its conductivity permeability and properties againts the radar.....
- A compromise in performance againts the threat level shall be performed....



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Electrochromic multi-layers Pixel



Developpement d'un pixel adaptatif de « 4 couleurs »

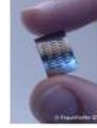


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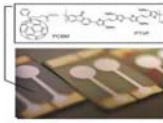


Sustain – Energy Generation

- Integrated Solar Cells....
- Heat Scavenging.....
- Use of Mouvement.....
- Fuel Cells.....
- Management and Dispatching of energy consumption is part of the solution.....



Micro Fuel Cells. Source:Wias Berlin



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Sustain – Information Exchange

- Development of an Information Exchange Infrastructure in the Textile....
- Man-Machine Interface
- Reliability and et durability is critical
- Maintenance and Updates.....
- Low electro-magnetic signature.....

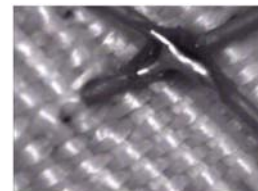
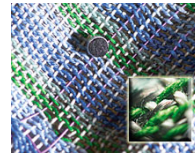


Figure 2: Solder interconnect

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Essentials Points – Smart Textiles

- Acceptability (Human Factor.....)
- Adaptability to different situations.....
- Durability (Wash cycles and maintenance)
- Integration & Convergence
- Energy Source and interconnections are actually problematic.....
- Costs - \$\$\$\$\$\$



Questions ?????



