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Soldier Systems Technology Roadmap (TRM)

Projects and Participants Identified at the Power/Energy/Sustainability Workshop

Vancouver, September 21-23, 2009

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The Strategic Review Group Inc.
Le groupe des examens stratégiques

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About This Document

Why have I received this document?

You've received this document because:

1. You attended the Soldier Systems Technology Roadmap (TRM) Power/Energy/Sustainability Workshop in Vancouver, BC, September 21-23, 2009, and
2. Following the breakout session on Collaboration Opportunities, you signed a sheet indicating your interest in one or more power-related Soldier Systems projects

What is in the document?

This is a record of the projects outlined on flip charts at each of six tables following the Soldier Systems Technology Roadmap Power/Energy/Sustainability workshop.

The project areas, which are described in this document, are:

1. Standards
2. Connectors
3. Storage
4. Integrating Power Sources
5. Fuel Cells
6. Electro Textiles

Each description includes the list of workshop participants who signed the sheet indicating their interest in the project area.

Help us to improve the project descriptions

By necessity, the project descriptions on the flip charts were brief and, sometimes, cryptic. Before sending you this document, we asked NRC and DRDC professionals in the area of energy technology to review the descriptions and clarify them where possible.

Now we are asking you take a few minutes to do the same for the projects for which you indicated an interest. Your comments will be incorporated into the document and forwarded to the Soldier Systems TRM Power/Energy/Sustainability Sub-committee for further action.

Please send your comments to Geoff Nimmo at Industry Canada:

nimmo.geoffrey@ic.gc.ca

Thank you.

1. Standards

Project Description

Interoperability with allies and integration of soldier-level systems will require the adoption of common standards in the design process for all aspects of power, energy and sustainability systems and subsystems.

Working groups on the issue of standards have been implemented within NATO efforts. However, the current efforts do not include large portions of soldier systems. Therefore, there remain many opportunities to develop open standards for design and integration for the critical area of power and energy within soldier systems.

A project to develop these standards could consider the following components. Some of these are later identified as discrete projects.

- Voltage: The standardisation of input voltage would bring more benefits at the sub-systems and systems levels. If each sub-system has a common input voltage, then exchange or replacement of a sub-system by another would not pose problems at least from a voltage point of view. A common power source voltage would be a first step in a common infrastructure on the soldier.

- Form Factor: Form factor is an important factor in every aspect of soldier systems for the dismounted soldier. Standards could be established related to form factors affecting power and energy capabilities.

- Protocols: Standards need to be developed to enable communication between components at all levels. The current multiplicity of protocols creates problems in the design, implementation and the integration of power and energy components.

- Interfaces: Electrical and mechanical interfaces need to be standardized to minimize the number of different interfaces. The chosen system voltages will influence choices in interfaces. A second aspect of interfaces is the bi-directionality of power and energy on the soldier.

- Connectors: Connectors are important because, even with an integrated system, there are separate devices and sub-systems on the dismounted soldier. Connectors will also be important if the soldier system is modular. The connector domain is a good candidate for standardization.

Project Participants

The list of workshop participants who signed the form indicating interest in this project area:

Name	Organization	Email
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2. Connectors

Project Description

Common power/energy connectors are an essential element for soldier systems, and no universal 'soldier system connector' exists. This project would involve developing a device that allows transfer of power/data across all standard devices and subsystems on the soldier. Interfaces and physical characteristics must reflect the user's environment, as well as mechanical, electrical, and data requirements.

Efforts have been made under NATO in relation with soldier interoperability, but these do not cover a generic Soldier System connector. A "universal soldier system connector" would be low cost, soldier adapted and compatible with different transport media (e.g. wires, e-textile, flat cabling to the soldier system manufacturers or integrators).

There is a strong relationship between this project and the one on Standards but this project more directly focuses on connectors:

Elements of this project would include:

- Understanding various transmission technologies (wired, wireless etc) and requirements of soldier system:
  - Mechanical side (e.g. look at pin and socket vs. spring loaded contact vs. close proximity induction),
  - "Thin" form factors (e.g. oval, flat, square, even round)
  - Soldier to vehicle/base (for charge and data exchange)
  - Universal, Non "gender-specific" (i.e. a common connector for all devices)
  - Power rating: voltage and current rating including safety requirements.
  - Current and future EMI/EMC environment,
  - Environmental condition, ruggedization, mating cycles, safety features (e.g. breakaway or kick disconnect)
  - Protocols (e.g. suitable for USB, Ethernet, Firewire, RS232, CANbus),
  - Usability (e.g. keying, cleaning, maintenance, handling in winter gears, etc.).

Project Participants

The list of workshop participants who signed the form indicating interest in this project area:

Name	Organization	Email
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3. Storage (Batteries)

Project Description

All soldier systems have a common need to efficiently store electrical energy to be used later when needed by various devices. The demands of the soldier power system may vary considerably from nominal power to peak power. Storage requirements are affected by a very demanding soldier environment, which can vary in temperature, humidity, etc.

This project would include several related areas:

- Storage components: Cell material (positive and negative electrode, high specific capacity, electrolyte, self-discharge rate improvement, internal resistivity)
- Re-Charging components: Recharging batteries of different chemistries requires changes in methodology (more efficient or versatile algorithms)
- System integration: voltages, standards, state of health vs. state of charge

Elements of this project would include:

- Understanding the range of needs
- Optimizing form, fit and function of energy storage
- Addressing components optimization needed to fit soldier power demand mission profiles.
- Developing as hybrid power source system for optimal run-time (energy production, harvesting, etc.)

Project Participants

The list of workshop participants who signed the form indicating interest in this project area:

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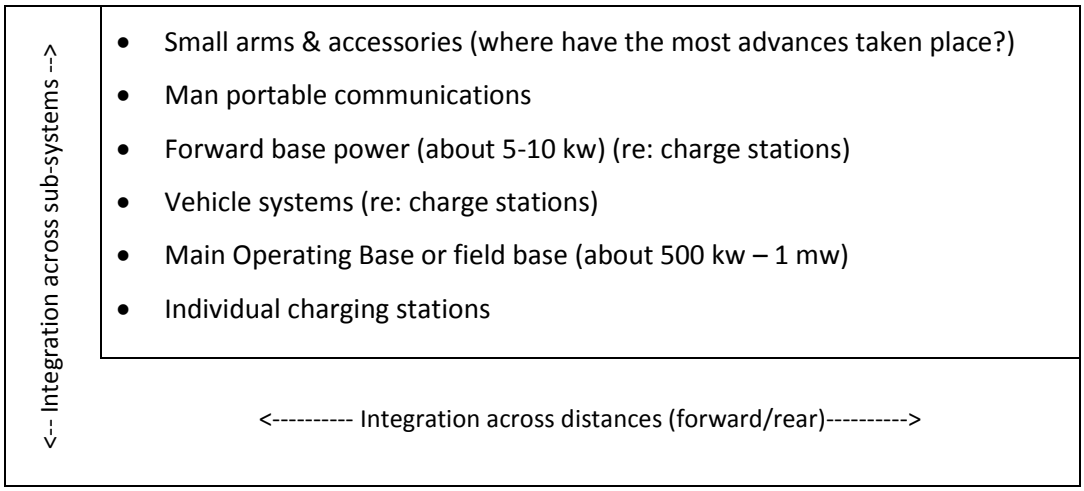
4. Integrating Power Sources

Project Description

An important challenge is to take energy from diverse power sources and 'move energy' to various devices (capabilities) on the soldier to meet a mission requirement. The "integration" of these requirements is related to all soldier systems and sub-systems, including weapons, communications, forward operating base requirements, etc.

The following graphic represents the various aspects of integration that must be considered.



Project Participants

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5. Fuel Cells

Project Description

Fuel cells have been identified as one promising power source for soldier systems. They represent an alternative to standard "s" energy storage technologies (battery etc), and they are efficient with high energy density based on fuel used. Areas that require further development are:

- Developing a rugged and inexpensive individual micro-fuel cell that is portable
- Developing fuel options: H2 (H2 production, sources) -liquid fuel -> JP-8 (sofc) (long term) alkaline fuel cell
- Improving system level performance: start up time, cold weather conditions, military conditions (contamination), safety.

This project requires:

- Understanding power demand requirements based on mission profiles, to enable fuel cell system optimization.
- Developing a hybrid power source system for optimal run-time with electrical energy production and storage to deliver an optimized peak & nominal load to soldier system.

Project Participants

The list of workshop participants who signed the form indicating interest in this project area:

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6. Electro Textiles

Project Description

Electro textiles can be used to make clothing that conducts electricity. Electricity will enable virtually every aspect of the soldier system. Therefore, enabling and improving transmission of electrical energy around the soldier is an essential ingredient in the design of the soldier system. Electro textiles can be part of the transmission solution since they cover the soldier.

The project on electro-textiles would be integrated with developments in the areas of connectors, integration, storage, and sources.

An electro-textile project would consider primarily

- How to use textiles as a grid for the distribution of power/energy
- How to use textiles for storage, energy management, and harvesting ex. solar harvesting

The project would likely involve understanding power demand requirements for transmission and utilization; understanding wearability and durability parameters; and developing a transmission system on a 'soldier grid'.

Project Participants

The list of workshop participants who signed the form indicating interest in this project area:

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