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Power the Force: A Networked Information Technology Approach to Efficiently Powering the Brigade

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Problem/Issue: Current and future ground combat operations depend on the effective management of all resources available to the commander. Electrical Power consumers on the future battlefield include vehicle, sensor, shooter, communication, and decision making networks that rely on reliable mobile and portable sources of power and energy. Based on the need to reduce the Army logistics burden, “Shipping more batteries” is not a feasible option. To meet this demand, new technologies are required to provide the systems with adequate electrical power for systems while minimizing the logistics burden.

Relevance to C2: Nearly every C2 system requires electrical power. Addressing the challenge of reducing overall electrical requirements and/or more efficiently providing electrical power will enable all echelons of command and execution to operate more efficiently and effectively on the future battlespace (UA/UE).

Technical Approach to Problem: Power the Force is a concept that applies network centric management and integration of power and energy sources needed by the warfighter, resulting in less overall electrical requirements and improved methods of providing electrical power.

The brigade unit is the system boundary for this engineering concept and can be considered to be an element of a power grid similar to the commercial US power grid. Within the boundary identified, IT systems can monitor and manage power loads while providing information for sound decision making, just as domestic power producers monitor the power grid. Current logisitics requirements to the brigade area are over twenty battery power sources as well as the JP-8 (and in some cases DF2 and MOGAS) fuel that power platforms, vehicles and command posts. Application of these technologies will result in a force that manages/uses fuel more efficiently, and systems that provide electrical power more effectively.

At the basic level, two technical areas are being researched: managing power and more efficiently providing power. Managing power includes two type of systems; those that conserve energy and those that balance the demands for power. More efficiently providing power can be identified by those technologies for mobile power that can be moved on the battlefield like generators and portable power that can be carried by soldiers or employed on a portable sensor. Results of research in each of these areas will be discussed in the following section.

Results: The Intelligent Power Management System (IPMS), power management for Land Warrior Systems, and improved power distribution equipment are the first steps to manage the demands for Power the Force. These programs were designed to provide more efficient use of power to increase overall systems operation time or to extent the operation with the same logistics requirements. IPMS is a system to manage electrical power users within a single command and control shelter platform. The system monitors the power available from generator sets to the platform and in periods of power shortage or "brown outages" the system turns off the electronics in the shelter in a programmable priority that maintains the most critical systems.

IPMS originated as an idea involving management of electrical requirements through prioritization of power distribution to C4ISR equipment integrated on Army platforms. The idea became a CECOM Small Business Innovative Research (SBIR) (both Phase I (concept) and Phase II SBIR (product development)). This successful effort transitioned to PM Platforms for full-scale platform integration and qualification testing. The technology is being integrated on various Standard Integrated Command Post System platforms. At the end of this engineering program, the IPMS will be ready for integration into new or fielded SICPS platforms.

Improved power distribution management through IPMS is being extended from a single platform to the tactical command post complex. The concept is to manage and control multiple command and control shelters to include the electrical generator systems. Future power management

systems may extend the command post network and the generator network to provide a system of system that is aware of electrical loads required and match this to the generator capacity.

Power management is a technology to reduce electrical power required by the electronics of a system without sacrificing operation capability. One area begun by DARPA and executed by CERDEC, is a comprehensive analysis Land Warrior electronics and development of technologies to reduce these requirements. The program analyzed system electronics and software to identify improvements in power consumption by "turning off" capabilities when not required. Initial results showed the system, which originally consumed over 24 watts, could be reduced to less than 16 watts of consumption with electronic hardware changes alone. Analysis of software identified an additional 30-50% power savings was possible. These concepts can be extended to all systems that require portable power sources.

The benefits of engineering that power management and power distribution management will be continued at the platform level to improve the efficiency of fuel consumption in every platform and beyond the platform to the organization. As an example, the Stryker Brigade consumes over 300,000 gallons of fuel in 72 hours of operations. Even small percentage improvements in fuel consumption will result in increased operational capabilities and huge logistics cost savings.

Beyond efficient fuel consumption, Power the Force is a concept that provides the brigade with the most efficient method for providing soldier or portable power. By taking a system of systems approach, the brigade can manage the energy sources within the brigade boundary. Technologies are being researched that convert fuel sources to hydrogen that produces electrical energy in future fuel cell systems. The introduction of improved rechargeable batteries and rechargers on current vehicles could greatly reduce the logistics demand on thousands of batteries. Electronics on batteries or smart batteries can provide the system and decision maker with information concerning the run-time remaining.

In current power supply systems, the conversion of fuel to electrical power is accomplished through generator sets into electro-mechanical or in vehicles, the fuel is converted to mechanical energy for mobility and heat as a by product. Future technologies may convert fuel into hydrogen for use in various hydrogen consuming systems like fuel cells or provide another conversion of chemical energy directly into electrical energy. The electrical energy produced by future systems will power the electronic vehicle, sensor, shooter, communication, and decision making systems required to realize the network centric vision of the battlefield.

The system of systems approach in Power the Force will allow the Army to make better decisions about the usefulness of solar energy and other energy harvesting techniques. Each resource has requirements that must be carried and maintained in order to capture, convert, save, store or harvest power. The Army has a strategic position to move toward hybrid-electric (HE) platforms. HE platforms could provide an advantage in the future by reducing or eliminating the need for generator sets that normally require trailers and may improve fuel efficiency. The deployability advantage alone might provide justification for the move to HE. Power the Force can provide the systems of systems engineering necessary for various trade-off analyses.

Power the Force is an effort to provide network centric management to the power sources within the brigade area, as a tactical power grid. The efforts is designed to provide an IT backbone within the brigade that allows the commander to make better management decisions with resources. Power the Force, as a comprehensive analysis of all energy consumers in the brigade area, will reduce the power required to sustain operations, reduce the cost of operations and allow the commander to manage the capability of his unit while engaged in Network Centric Warfare.