

FINAL REPORT – EXECUTIVE SUMMARY



Project Number: R-040-051

Recipient: Packet Digital

Award Amount: \$500,000

Total Project Costs: \$1,022,659.24

Goal of Project:

To significantly improve the performance of military grade battery charging solutions targeting the following improvements:

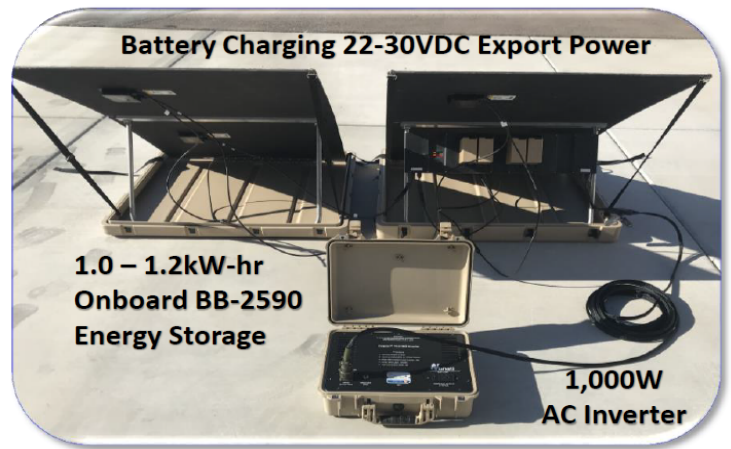
- Reduced the number and complexity of printed circuit boards and wiring harnesses.
- Reduce the cost and complexity of enclosure.
- Reduce overall weight.
- Pass Environmental testing standards.
- Reduce manufacturing complexity.

Packet Digital LLC, Nishati, and the U.S. Naval Research Laboratory (NRL) developed and are currently commercializing a 570W transportable solar power generation system, the PD 570-Watt Rapid Solar Kit, with extended capability of delivering up to 1kW of power when set up in parallel, for remote military installations, emergency shelters, and camps. The PD 570-Watt Rapid Solar Kit product will eliminate fuel requirement and noise and will reduce the life cycle cost of standard electromechanical power generations. Packet Digital delivered a MIL-STD tested solar kit with a fast set-up time of 2 minutes, a fully integrated power system, and the highest energy density footprint available.

Significant Findings:

While there are commercially available systems in the power range of the PD 570-Watt Rapid Solar Kit with competitive pricing; however, they are not comparable to the PD 570-Watt Rapid Solar Kit for the following reasons:

- Constructed with heavy, rigid glass cover sheets and aluminum frames which are bulky and can trap sand and other debris around the edges. Low performance in certain environmental conditions and not ideal for a portable application.
- Do not easily fold up into a compact, rugged enclosure.
- Sold as kits of components that must be connected, resulting in a complex, fragile system.
- Setup and teardown is not fast and simple.
- Not tested to military specifications for operating environments and transportation.



The PD 570-Watt Rapid Solar Kit is optimized, flexible, and scalable from the ground up that takes advantage of the state of the art in generators, PV, electronics, and energy storage. The system consolidates components to reduce complexity and cost and takes advantage of innovative designs to reduce the deployed footprint; all while improving PV performance and maintaining the required ruggedization and robustness.

Differentiating features of the Packet Digital/Nishati system include:

- The energy density exceeds anything that is on the market in this space and will be one of the only MIL-STD 810G survivable solar systems.
- Reducing the deployed footprint and increasing the power capability increases the number of missions and scenarios that can apply a renewable energy solution.
- Consolidating components eases the transportation, configuration management, and sustainment burden of current systems.
- With the advent of trailer-mounted hybrid power systems, the PD 570-Watt Rapid Solar Kit will provide its own protected modular stowage on trailers and easy deployment from trailers.

During Phase II Packet Digital, with NRL and Nishati:

- Optimized the PD 570-Watt Rapid Solar Kit for manufacturing with a >30% reduction in printed circuit boards and wiring harnesses.
- Build a low-cost enclosure, designed to be machined in production.
- Reduced the weight from 30 to 22lbs.
- Passed MIL-STD 810D environmental testing:
 - Low Temperature, MIL-STD-810G Method 502.6

- High Temperature, MIL-STD-810G Method 501.6
- Humidity, MIL-STD-810G Method 507.6
- Rain, MIL-STD-810G Method 506.6
- Vibration, MIL-STD-810G Method 514.7
- Shock, MIL-STD-810G Method 516.7
- Blowing Dust, MIL-STD-810G Method 510.6
- Blowing Sand, MIL-STD-810G Method 510.6



- Sold two systems to the US Marine Corps
- Demonstration scheduled in February 2021 for the United States Special Operations Forces
- Multiple tests have been conducted with the following additional features added:
 - Battery state of charge (SOC) threshold met indicator.
 - Charging indicator on all batteries to avoid ambiguity.
 - Parallel operation load sharing optimization.

Next Steps:

Packet Digital and Nishati have been and will continue reaching out to our military network to advertise the product. Activities that broaden the marketing opportunities such as participating in military expos, product demonstrations, and product release announcements will be pursued. Packet Digital has developed is executing on a marketing plan for further engagement with military customers to promote sales of this product.

The US Marine Corps is demonstrating the product across the Marine Corps to define future purchasing requirements for this next generation of products.

A demonstration has been scheduled with US Special Operations Forces 75th Ranger Regiment in February of 2021 at Fort Benning GA to support evaluation of the product.

A commercial version of the product is being pursued for specialty use.

Benefits of the Project to ND:

This project will result in a new solar technology product from North Dakota, creating high skilled jobs and increased manufacturing in the state. This product could be the beginning of a line of portable solar solutions that would help solidify North Dakota's reputation as one of the countries energy leaders, not just for fossil fuels production, but as an advocate of a diverse energy portfolio, including polar solar power, leading the way to energy independence.

Our discussions continue with Chiptronics, Inc., a certified small HUBZone Business in Dunseith, ND, adjacent to the Turtle Mountain Indian Reservation and this product development effort could employ and promote highly technical job skills in one of the state disadvantaged areas.

Mutual collaboration with local colleges and universities is possible for the testing, analysis, research and fabrication design of this and future projects.