North Dakota Renewable Energy Program
Status Report

Recipient: Packet Digital LLC
Contract Number: R-040-051
Report for time period of: March 16, 2020 - June 30, 2020

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Description of Project
Packet Digital LLC, Nishati, and the U.S. Naval Research Laboratory (NRL) are collaborating to develop and commercialize transportable solar power generation modules capable of delivering up to 1kW, when set up in parallel, for remote military installations, emergency shelters and camps. The end product will eliminate the fuel requirement and noise and will reduce the life cycle cost of standard electromechanical power generation.

Project Tasks
Please describe the progress on all project tasks achieved during the reporting period:

Objective 1: Refine PSG1 electronic design to simplify manufacturing and assembly process -- **Progress was already reported in interim 2 report.**

- Task 1 – Refine the electronic board designs to reduce the amount of wiring and interconnect needed.
- Task 2 – Assemble the electronics and perform laboratory tests to verify functionality.

Objective 2: Refine PSG1 custom enclosure -- **Some of the progress was already reported in interim 4.** Below are additional updates:

- Task 1 – Refine overall enclosure design to make the assembly process easier and less expensive.
    - Enclosures with the latest design improvement were received from our vendor on March 30th. The design improvements have been verified to allow easier wiring installation and overall assembly process.

- Task 2 – Add more protection features to better withstand the MIL-STD tests -- **Progress was already reported in interim 4 report.**
- Task 3 – Survey and evaluate plastic injection mold options for the front panel -- **Progress was already reported in interim 2 report.**

Objective 3: Design modification of PSG-C1000 to make it lighter -- **Progress was already reported in interim 2 report.**

- Task 1 – Survey and evaluate economical options for lighter energy storage that will work for PSG-C1000.
- Task 2 – Modify current PSG-C1000 electronic design to support the selected new energy storage.

Objective 4: System integration and field test -- **Some of the progress was already reported in interim 4.** ***Below are additional updates:***

- Task 1 – Electronic assembly into the custom enclosure and integration with solar panel -- **Progress was already reported in interim 4 report.**
- Task 2 – Conduct field test.
    - ***Subsequent field test after fixing the minor technical issue (reported in interim 4) was done successfully, all functions worked as intended.***

Objective 5: FCC compliance testing -- **Some of the progress was already reported in interim 4.**
Below are additional updates:

- Task 1 – Identify FCC accredited testing laboratory to work with and proceed with the testing -- **Progress was already reported in interim 2 report.**
- Task 2 – Contingency plan, in the event that FCC test fails, Packet Digital will perform design refinement and re-test
    - Electronic design modification was completed and functionally verified.
    - Using the spectrum analyzer and near field probe, the level of radio frequency emission was measured and compared with the original design. The result showed a reduced level of EMI.
    - RF shield fabrics have been ordered and evaluated with varying results. One particular fabric offers better flexibility than the others but with comparable RF attenuation. It will be selected as the optional shield fabric.
    - FCC retesting will be scheduled after the completion of MIL-STD tests.

Objective 6: MIL-STD testing and certification

- Task 1 – Identify MIL-STD accredited testing laboratory to work with -- **Progress was already reported in interim 4 report.**
- Task 2 – Build four identical systems and proceed with the testing.
    - The progress of assembling four systems was slowed down substantially due to the coronavirus outbreak, resources had to be reallocated temporarily to fulfill military customer order of two PSG1s.
    - Assembly process is currently in back progress.
    - MIL-STD tests that have been coordinated with the Element Materials Technology test laboratory and were already scheduled for late April had to be postponed due to the Covid 19 outbreak, currently planned for late July or early August.
- Task 3 – Contingency plan, in the event that any of the MIL-STD tests fail, Packet Digital will perform the necessary design reinforcement and re-test.

Objective 7: Looking into potential new design to support further hybridization with gasoline/diesel power generator

- Task 1 – Perform market survey to investigate the potential market demand for such a hybrid system.
    - Market survey for hybrid solar and diesel power generators is ongoing with Nishati.
- Task 2 – Perform initial design architecture, capturing general functionalities of the hybrid system.
    - Will be started after the market survey is complete.

Deliverables

Please describe the progress on project deliverables, as stated in your contract, achieved during the reporting period:

- Report on the improvement in electronic design to simplify manufacturing and assembly process -- **Already reported in interim 2 report.**

- Report on the improvement in custom enclosure to simplify manufacturing and assembly process -- **Already reported in interim 3 report.**

- Report on the weight reduction of PSG-C1000 inverter module -- **Already reported in interim 2 report.**

- Report on the FCC and MIL-STD compliance of the product -- **Some of the progress was already reported in interim 4.** Below are additional updates:
    - Due to the coronavirus outbreak causing substantial delay in the progress, the schedule for MIL-STD compliance tests were pushed back and planned to be done in late July or early August.
    - FCC compliance retest is planned to be done after the MIL-STD test is completed.

Additional Information

- We received an order of two (2) PSG1s systems from our partner Nishati for our military customer, United States Marine Corp (USMC), to be demonstrated and evaluated. The order was processed and systems were manufactured and assembled during this report period. Two PSG1s were shipped on June 5. This is a big opportunity that allows PSG1 to be tested and evaluated by military end user customers in the field. The USMC will be taking the systems on a road show to demonstrate to military customers and will be evaluated to establish the requirements for the next orders from the USMC

Budget

Project Associated Expense	NDIC Share	NRL Share	Total
Total Personnel Cost	$389,898.60[1]	$500,000.00	$889,898.60
Software and Materials	$110,101.40[2]	$0.00	$110,101.40
Total	$500,000.00	$500,000.00	$1,000,000.00

[1] Direct personnel costs plus indirect overhead and G&A
[2] Direct materials costs plus G&A

Expenditures

Expenditures for the project to date are shown in the table below. Supporting documentation is provided as a separate attachment.

EXPENDITURES FOR INTERIM 5 REPORTING PERIOD ONLY			
Project Expense	**NDIC**	**NRL**	**Total**
Total Personnel Costs	$64,096.63	$129,548.38	$193,645.01
Software/Materials/Subs	$5,851.64	$52,914.30	$58,765.94
Total	$69,948.27	$182,462.68	$252,410.95

CUMULATIVE EXPENDITURES			
Project Expense	**NDIC**	**NRL**	**Total**
Total Personnel Costs	$302,770.92	$419,336.36	$722,107.28
Software/Materials/Subs	$26,666.93	$91,674.02	$118,340.95
Total	$329,437.85	$511.010.38	$840,448.23