July 17, 2014

Karlene Fine, Executive Director
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Ave Dept 405
Bismarck, ND 58505-0840

Dear Ms. Fine,

Packet Digital is submitting the enclosed grant application to request funding in support of the Renewable Energy Project, “Solar Soaring Power Manager” in the amount of $500,000. This funding will be used as a match for the nine month project which will run from September 1, 2014 to June 1, 2015 and has a total budget of $1 million. Other partners in this project include the Naval Research Lab, ComDel Innovation in Wahpeton, ND, the Northern Plains Unmanned Systems Test Site, NDSU and UND.

The development of a reliable UAS powered by clean, renewable energy will have a very significant impact on North Dakota and the world over. The applications for this technology are nearly limitless, from agriculture to water management to pipeline monitoring.

If you have questions I can be reached at 701-365-4421 or terri.zimmerman@packetdigital.com.

This letter sets forth a binding commitment on behalf of Packet Digital to complete the project as described in the application. Thank you for our consideration.

Sincerely,

Terri F. Zimmerman
CEO
Packet Digital, LLC
201 N 5th St, Suite 1500
Fargo, ND 58102

enc

Renewable Energy Program

North Dakota Industrial Commission

Application

Project Title:

Solar Soaring Power Manager

Applicant:

Packet Digital, LLC

Principal Investigator:

Andrew Paulsen

Date of Application:

July 18, 2014

Amount of Request:

$500,000

Total Amount of Proposed Project:

$1,010,000

Duration of Project:

9 months - September 1, 2014 to June 1, 2015

Point of Contact (POC):

Terri Zimmerman

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701-232-0661

POC Email:

terri.zimmerman@packetdigital.com

POC Address: 201 N 5th St. Ste 1500 Fargo ND

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ABSTRACT

Objective: Create a solar soaring power management system for Unmanned Aerial Systems to initially double fly times and ultimately provide unlimited endurance powered by solar energy. This will be achieved by harnessing solar energy with high efficiency, flexible photovoltaics and auto-soaring technology to enable the UAV to autonomously gain lift from rising hot air along with advanced power management algorithms. Packet Digital will create an advanced solar power management integrated circuit (PMIC) combining flexible, high efficiency power conversion circuitry with a microprocessor to make the first PMIC targeted for dramatically extended flight times in unmanned aircraft.

Expected Results: This project will develop the most efficient solar cells, auto soaring, and power management algorithms to initially demonstrate double fly times and ultimately unlimited endurance unmanned aircraft. Project expected results include:

- Develop the techniques for a UAV to autonomously seek, acquire, and exploit thermal updrafts
- Develop a 40% efficient solar cell in a flexible solar array, optimized for a UAV wing
- Develop a solar soaring power management integrated circuit
- Demonstrate extended flight time on a UAS constituting the basis for an “eternal” aircraft

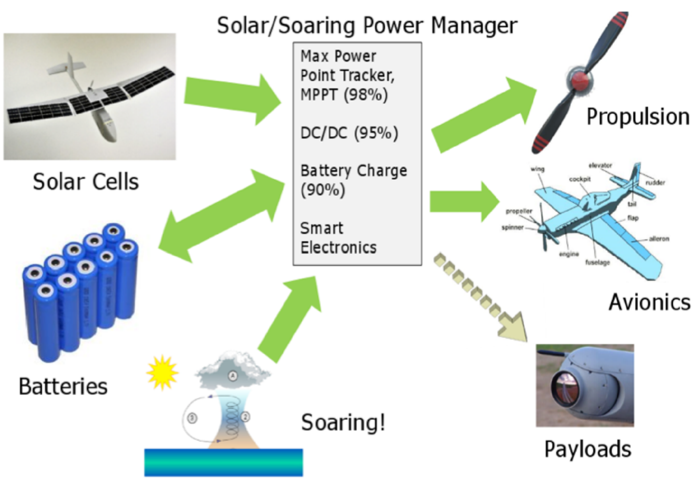
Duration: Three-phase project: Phase I of 9 months, Phase II of 9 months, and Phase III of 6 months.

Total Project Cost: $1,010,000 Phase I ($500k REC, $260k Naval Research Lab, $250k Private Investor), $1M Phase II ($303k REC, $447k NRL, $250k PI), and $1M Phase III ($375k REC, $375k NRL, $250k PI).

Participants: Packet Digital LLC, Naval Research Lab (NRL), ComDel Innovation in Wahpeton, ND, the Northern Plains Unmanned Systems Test Site, NDSU and UND.

PROJECT DESCRIPTION

Objective: This research and development project will create a solar soaring power management system for Unmanned Aerial Systems to initially double fly times and ultimately provide unlimited endurance powered by solar energy. This will be achieved by harnessing solar energy with high efficiency, flexible photovoltaics and auto-soaring technology to enable the UAV to autonomously gain lift from rising hot air and advanced power management algorithms.



This product will optimize the power conversion from the solar array to the batteries, from the batteries to the electronics, and from the batteries to the propulsion motor. The power conversion circuitry will provide state-of-the-art high efficiency power while the microprocessor will run advanced algorithms for maximum power point tracking, auto-soaring, and Packet Digital's patented On-Demand Power for optimizing power delivery.

Methodology: This project will incorporate classical systems engineering and rapid application development. Modeling of a UAV indicates that a 40% efficient solar cell, combined with efficient soaring would enable continuous flight. This project will be divided into three main efforts: solar cell, soaring algorithms, and power management. The following is the work plan for the Phase I portion of these efforts:

Objective 1: Solar Cell Development - Confidential (See Appendix)

Objective 2: Soaring Algorithm Development

Task 1 - Select appropriate microprocessor to use for soaring algorithms. For Phase I this will be a high performance, low power discrete component on a circuit board that will interface with the power conversion circuitry. This microprocessor will be integrated into an ASIC in Phase II.

Task 2 - Develop techniques for a UAV to autonomously seek, acquire, and exploit thermal updrafts. NRL has developed an algorithm called Autonomous Locator of Thermals (ALOFT). Algorithms will be optimized for thermal updraft discovery using nonlinear least squares to find center of updraft for maximum lift utilization. Using modeling and simulation, NRL's preliminary work in this field will be leveraged, refined, and optimized for the target solar powered North Dakota UAS applications and inclusion in the Phase II ASIC.

Task 3 – Design and build electronic circuit to implement auto-soaring algorithm. The algorithm will be implemented by creating a dedicated circuit that interfaces with the autopilot. This effort will include developing communication protocol that allows the algorithms to communicate with the autopilot. For Phase I this will be a high performance, low power discrete component on a circuit board that will interface with the power conversion circuitry. This microprocessor will be integrated into an ASIC in Phase II.

Task 4 - Integrate the algorithm circuit into the UAV and flight test. This will include designing and implementing a mounting system and electrical interface. Discrete components will be utilized and in Phase II ASICs will be created to replace them. An existing airframe will be selected, integration completed, and a test flight that will validate new algorithms.

Objective 3: Power Management Development

Task 1 - Select appropriate microprocessor to use for power management algorithms. This microprocessor core must be the same as that chosen for Objective 2 above; however, the peripherals, such as timers, analog-to-digital converters, etc., may be different. Phase II integration will combine the microprocessor core with all of the required peripherals to support all anticipated functions of the ASIC.

Task 2 - Develop MPPT algorithm to locate and track global maximum power point across solar array(s). The algorithm must optimize for expected conditions encountered during extreme endurance flights, such as contamination on solar cell, inclimate weather, cloud shadowing, etc.

Task 3 - Develop flexible, high efficiency power conversion circuitry using discrete components that match, as closely as possible, the function of the planned custom silicon to be implemented in Phase II. This circuitry will support efficient battery charging, MPPT solar conversion, propulsion motor control, and DC power for onboard electronics and payloads.

Task 4 - Develop battery charging algorithms optimized for *Objective 1* solar cells. These charging algorithms shall be tested using the prototype solar cells from NRL whenever possible. This task requires the actual batteries to be used in the UAS so the battery selection must be done early in Phase I.

Task 5 - Test power solution for desired performance and efficiency using prototype solar cells, actual battery pack to be used in UAS and the discrete power conversion circuitry.

Phase I Completion: Once all of the above tasks are complete the separate solutions will be integrated together into a prototype airframe and tested at the Northern Plains Unmanned Systems Test Site.

Anticipated Results: Phase I will result in an early prototype of an extended flight UAS modeled in a lab environment. The solar array will be integrated into the wings of the UAS and will extend the flight time by at least 100%. The soaring algorithms will be functional and, though not fully optimized, will be able to add significant flight time to the UAS. The power management and battery charging solution will be fully functional with close to the same potential as the final design. It is expected that a flight time of several hours will be possible at the end of Phase I of this project using nothing more than clean renewable solar power and the innovative solutions developed for solar cells, auto-soaring, and power management.

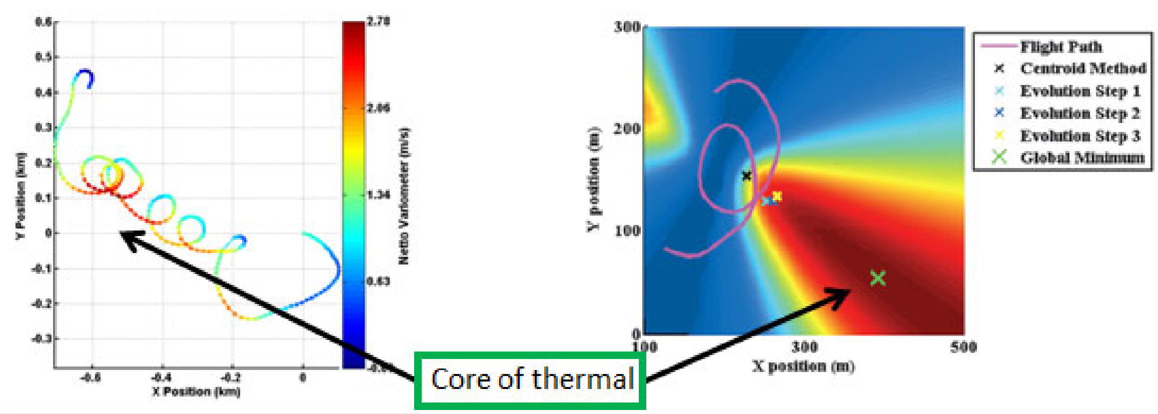
Phase I Deliverables:

- Produce a solar cell covering the desired spectrum with 30-35% efficiency, with a target of 40%
- Develop an algorithm for achieving MPPT for the prototype solar cell
- Create a prototype power management solution with greater than 90% efficiency, with a target of 95%
- Define the architecture for the power electronics solution to be implemented in custom silicon
- Develop improved soaring algorithms based on the mathematical model for thermal updrafts
- Test all prototyped solutions integrated in a lab environment

Facilities: Development activities will occur at Packet Digital's facility in Fargo, North Dakota. Packet Digital is fully equipped for the design and development of the prototype circuitry defined herein. A full tool suite of computer aided design software and laboratory equipment is in place for conceptual design, debug, and integration. For photovoltaic research, NRL has expertise in optoelectronic device modeling, design, growth, fabrication, and characterization. NRL maintains a III-V semiconductor growth and processing facility with three MBE reactors as well as a state-of-the-art solar cell material and device characterization laboratory including solar simulators providing high spectral fidelity. NRL also maintains an extensive capability in the design, fabrication and flight testing of UAVs. Additionally, facilities providing test equipment at North Dakota State University are available through a professional relationship. Manufacturing facilities are available through ComDel Innovations (CDI) in Wahpeton. The Northern Plains UAS Test Site is headquartered in Grand Forks, ND and uses several UAS Test Ranges.

Resources: Packet Digital, with power management expertise and mixed signal ASIC design experience, will develop the battery charging and high efficiency power management solutions. NRL, with extensive UAV expertise, will provide the soaring algorithms and high efficiency solar arrays with durable film coatings to be placed on the UAV wings. ComDel Innovation in Wahpeton, ND is our partner for manufacture of the airframe and any mechanical sub-components, as well as final assembly of the aircraft. Packet Digital will partner with NDSU and UND on testing and analysis of the aircraft flight performance. The Northern Plains Unmanned Systems Test Site will be utilized for flight-testing and evaluation.

Techniques to Be Used, Their Availability and Capability: The solar cell development will require new techniques to achieve the project goals. New materials will be used for the cell fabrication in order to achieve the 40% efficiency believed to be required for unlimited flight. These materials will also be fabricated using new techniques to insure the flexibility required. Although these aspects of the solar cell development will be new, NRL and Packet Digital engineering teams believe, based on their experience, that a solution is possible. The Packet Digital team will develop specialized power algorithms to optimize the solar energy. The techniques to be used for the power management portion of the project will be well understood and familiar to Packet Digital. The primary focus of Packet Digital in this area will be to optimize the implementation of these techniques for the specific tasks necessary to achieve the extended flight times of the unmanned aircraft. The key techniques for soaring algorithm development will be nonlinear least squares to find center based on a specific mathematical model of the updraft cross-section.



Environmental and Economic Impacts while Project is Underway: This project is focused on using clean renewable solar energy so the environmental impact should be positive since the aircraft will be flown for testing without using any fossil fuels. The economic impact will be significant with twenty to twenty five persons being employed for the duration of the project.

Ultimate Technological and Economic Impacts: One result of this project will be the expanded applicability of unmanned aircraft. Unlimited flight time and clean renewable power source will mean that these aircraft can be deployed to provide continuous surveillance for pipeline monitoring and environmentally sensitive areas. There is also great interest in utilizing UASs for precision agriculture for monitoring crop health and weed and moisture management. Also, unmanned aircraft can provide services such as Internet access to areas that lack the necessary infrastructure. This Internet access can be used for medical services, education, commerce and many other positive social and economic benefits.

NRL expects many benefits from this project including reduction in forces, increased troop safety, increased effectiveness of military operations, and others. These same benefits could help in the private sector as well, particularly where safety is a concern such as the oil and gas industry.

The solar cell and power management technology also has potential to improve any application that currently uses solar technology. The 40% efficient solar cell being developed is a great improvement over the most efficient solar cells today, which are around 30% efficient. The increased efficiency that is being proposed for this project could be used for homes, remote warning systems, traffic signals or any number of applications where a battery needs to be charged using solar energy.

Why the Project is Needed: Battery life on commercial UASs is extremely short, approximately 20 minutes, limiting applicability and uses. Significantly extending battery life and, ultimately, creating an eternal aircraft changes the entire industry, creating many new applications. A primary use for unmanned aircraft systems is surveillance; e.g. commercial monitoring of gas pipelines or agricultural crops or military surveillance over the ocean or remote areas, reducing risks for our soldiers. In any surveillance application, unlimited flight times are a huge benefit, realized in cost reductions and increased effectiveness. Time consumed returning for refueling is time taken away from doing assigned tasks. In many cases, where the task must not be interrupted, multiple aircraft are deployed in order to insure constant surveillance. Not only will this project reduce the number of unmanned aircraft needed for a particular task but the aircraft will use clean renewable energy rather than the fuels that are used today in extended flight applications.

STANDARDS OF SUCCESS

The goal of the project is to initially double fly times on a small UAS with and ultimately create unlimited endurance with a UAS.

Project Deliverables:

- Deliver a 20% improvement in the efficiency of solar cell power, from 33% currently to 40% in order to provide enough solar battery power to enable unlimited flight
- Achieve power management with greater than 90% efficiency for typical loads, with a target of 95%, to extend battery life sufficiently to survive nighttime flight
- Innovative MPPT algorithm for extracting maximum charging capacity from the solar cells
- Soaring algorithms optimized for both daytime and nighttime flight to achieve unlimited endurance

The value to North Dakota: Current commercial fly times of UASs are approximately 20 minutes, making it impractical to utilize UASs for many types of application. By developing this solar soaring power management to extend fly times and removing this limiting factor, UASs become more practical and applicable to many markets and users in North Dakota and globally including:

AGRICULTURE

- Crop monitoring (eg. disease, irrigation)
- Water absorption of soil
- Spraying to manage weeds and other pests

PIPELINE MANAGEMENT

- Leak detection

INDUSTRIAL

- Spill tracking
- Power line and infrastructure monitoring
- Runway inspection

COMMUNICATIONS

ENVIRONMENTAL

- Air quality management/control
- Wildlife monitoring and behavioral research
- Prairie and erosion monitoring

EMERGENCY RESPONSE, LAW

- SWAT missions and Narcotics sensors
- Law enforcement and border monitoring
- Monitoring surveillance of establishments

CLIMATE MONITORING

WATER MANAGEMENT

- News and sports broadcasting
- Monitoring water levels, flood alerts
- Satellite augmentation systems

Packet Digital is already in discussion with a number of commercial partners including Google (Titan Aerospace), Singapore Aerospace and Fourth Wing. Packet Digital's management team brings over 40 years of experience in developing, incubating and commercializing new technologies. Packet Digital's CEO and CTO have extensive experience launching new products and services in global markets.

This research and development effort will bring the manufacture of solar soaring UASs with the longest flight time to ComDel Innovations in Wahpeton North Dakota. The local universities will assist in fabrication design, testing and analysis. Testing of the Solar Soaring UASs at the Northern Plains Unmanned Aircraft Test Site will create more visibility for the test site and North Dakota and this cutting edge solar technology will attract collaborating companies to the test site. This effort will preserve jobs and create new jobs in the research and development with twenty to twenty five persons being employed for the duration of the project and more during the manufacture of the UASs, testing and analysis at the universities and the North Plains Unmanned Aircraft Test Site.

This North Dakota project will enhance the research and education in the area of solar cells utilizing new techniques to develop the most efficient solar cells in the market. Achievement of persistent, solar powered light will require advanced power management and peak power tracking electronics. Within this Renewable Energy Council project the usage of a differential evolution or mutation methodology will be studied and researched. During the project, Packet Digital will work with both NDSU and UND.

BACKGROUND/QUALIFICATIONS

Packet Digital has developed power management integrated circuits and technology to extend battery life or reduce power consumption in a number of applications. Our patented On-Demand Power technology addresses the shortcomings of software based power management by moving the control out of the microprocessor and placing the intelligence inside the power management integrated circuits (PMICs). One of the key differentiators of our technology is that it offers *active* power savings, meaning the circuitry does not have to be put into a sleep mode in order to save power. This active mode power savings will be critical in the UAS application because of the importance of maintaining full functionality while in flight. With our technology we have extended battery life 400% in wireless sensors, 40% in a radio, and reduced power consumption by 20% in data center servers. We will bring our expertise and knowledge in building power efficient systems and intelligent power management algorithms to develop the most power efficient UAV.

Modeling of a UAV indicates that a 40% efficient solar cell, combined with efficient soaring would enable continuous flight. The NRL has developed the most advanced solar cells demonstrating 33% efficiency. We propose to achieve the required the 40% efficiency by layering semiconductor materials with varying band-gaps in an attempt to most efficiently convert the broad solar photon spectrum.

Achievement of persistent, solar powered flight will require advanced power management and maximum power point tracking (MPPT) electronics. The role of an MPPT is to adjust the load voltage of the solar array to maximize the power that can be extracted. This is a dynamic process that must respond to changes in the environment such as changes in solar insolation and array temperature. Packet Digital has also developed novel methods for achieving MPPT.

This project will be completed in three phases. The first phase will be nine months in duration and will involve the architecture and prototype of the power management circuitry, fabrication of flexible solar cells, and development of the soaring algorithms. Power conversion, solar MPPT conversion, and battery charging algorithms will implemented using discrete parts. Following the proven implementation the development of an ASIC will begin. The ASIC development for Phase I will consist of a feasibility study and the architecture of the digital and analog portions of the design. Phase I will conclude with integration of the discrete power management solution, solar cells and soaring algorithms into a test fixture to be tested.

Phase II of the project will be nine months in duration and will cover the design and fabrication of a custom ASIC which will miniaturize the discrete solution developed in Phase I as well as the second iteration of the solar cells and soaring algorithms. The first portion of Phase II power management development will be the completion of the ASIC design with the fabrication, packaging, and testing of the ASIC consuming the remainder. The solar cell work will consist of improving on the efficiency and flexibility of the cells by optimizing the materials and the substrate using the test results of Phase I. The soaring algorithm work will concentrate on nighttime flight. Phase II will conclude with the integration of the solar, soaring, and power solutions into a prototype UAS which will be used to demonstrate extended flight times.

Phase III will be six months in duration and will complete the project. All of the pieces of the project will come together to produce the complete unmanned aircraft system solution. The solar charging, soaring, and power management solutions will be integrated into the airframe. This completed UAS will undergo extensive testing at the test site in North Dakota. The test flights will be used to refine the design to achieve the stated goal of unlimited endurance flights. The solar cell and soaring algorithm work will continue for the NRL team as they work on further enhancements to the design.

Management Team: Andrew Paulsen, Director of Advanced Technology for Packet Digital, a key leader in the initial development of PowerSage technology. He leads the Advanced Power Management Team, developing new products and technology. Andrew has extensive research, testing, and product development expertise in the power field. He has significant experience in solar powered vehicles, battery charging, and motor controls from many years leading the electrical group of the NDSU solar racing team.

Terri Zimmerman, Packet Digital CEO, has over 20 years of experience developing, incubating, and commercializing new technologies. She has raised over $500 million in capital to launch new products and services in global markets. She has grown companies to significant revenues resulting in successful exits. She has been appointed to a state economic development board by the Governor of North Dakota.

Rob Nance, Packet Digital CTO, has over 20 years experience in the architecture and design of computers. He has served in senior technical roles at DELL and NCR where he designed ASICs, motherboards, and systems for multi-processor designs. He led the development of Intel's first blade server and helped create the SSI blade standard. He developed Intel's specification for the Open Compute Project.

Naval Research Lab: Dr. Edwards has been PI on two prior autonomous soaring efforts and wrote his PhD thesis on the topic. He has participated as an autonomous soaring subject matter expert for Office of Naval Research, Army Research Lab, and industry partners. He has extensive experience with long-duration UAVs acting as a key player for the 48hr Ion Tiger Liquid Hydrogen fuel cell program.

Dr. Walters has over 20 years of photovoltaic experience and is currently managing three solar cell development efforts and has a recent patent on novel multi-junction solar cell design. He also has extensive experience and expertise in fielding solar cell experiments, including 5 space experiments and an underwater solar experiment. He is executing a flexible solar array development project under DOD funding.

MANAGEMENT

Management Plan: Packet Digital will lead the effort with significant collaboration of NRL and support from ComDel Innovations, the universities, and the Test Site. Teams will work in parallel and interact directly as needed. Weekly status meetings will be held via teleconference, however, face to face meetings will be scheduled quarterly to ensure team cohesiveness. The development schedule and financial reports will be updated on a monthly basis. Major schedule items will include systems requirements definition, design and development activities, prototype development, integration and test, and final delivery.

Quality Assurance & Systems Engineering: Existing validated software and hardware will be leveraged as much as possible. A tailored systems engineering approach will be utilized for this development effort to efficiently execute the development while ensuring proper due-diligence is maintained. A risk management approach will be utilized including a matrix to track requirements that are deemed to have high risk.

TIMETABLE

The following table shows the project schedule for this phase. The timeline includes developing and testing discrete prototypes of the system as well as initial ASIC design work to study the feasibility of creating a custom integrated circuit for commercialization.

Task	September	October	November	December	January	February	March	April	May
Project Start: September 1, 2014	■□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Materials Acquisition	■■■■	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Power Conversion Circuitry Design	□□■■	■■■■	■■■■	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Prototype Power Conversion Circuitry	□□□□	□□□□	□□□■	■■■■	■■■■	■■■■	■■■■	□□□□	□□□□
Develop Solar MPPT Conversion	□□□□	□□□□	□□■■	■■■■	■■■■	■■■■	■■■■	□□□□	□□□□
Develop Battery Charging Algorithm	□□□□	□□□□	□□□□	■■■■	■■■■	■■■■	■■■■	□□□□	□□□□
Soaring Algorithm Development	□□□□	■■■■	■■■■	■■■■	■■■■	■■■■	■■■□	□□□□	□□□□
Solar Cell Material Selection	□□□□	■■■■	■■■■	■■■□	□□□□	□□□□	□□□□	□□□□	□□□□
Solar Cell Fabrication	□□□□	□□□□	□□□■	■■■■	■■■■	■■■■	■■□□	□□□□	□□□□
ASIC Feasibility	□□□□	■■■■	■■■■	■■■□	□□□□	□□□□	□□□□	□□□□	□□□□
Preliminary Digital ASIC Design	□□□□	□□□□	□□□■	■■■■	■■■■	■■■■	■■■■	■■■■	■■■□
Preliminary Analog ASIC Design	□□□□	□□□□	□□□□	□□■■	■■■■	■■□□	□■■■	■■■■	■■■□
Intergrated Solutions Testing in Lab	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	■■■■	■■■□
Test and Documentation	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□■■	■■■□
Interim Report	□□□□	□□□□	□□□□	□□□□	□□■□	□□□□	□□□□	□□□□	□□□□
Final Report: March 1, 2015	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□■

BUDGET

Project Associated Expense	NDIC's Share	Private Sponsor Share	Naval Research Lab Share	Total
Direct Personnel Costs	$215,000	$122,000		

Indirect OH and G&A (65%)	$139,500	$79,000		
Total Personnel Costs	$354,500	$201,000	$222,000	$767,500
Software Costs	$86,000	$49,000		$135,000
Materials	$59,500		$38,000	$97,500
Total	$500,000	$250,000	$260,000	$1,010,000

The $1,010,000 budget is based on estimates for the time, material and software for the tasks detailed above in the timeline. If less funding is available, the ASIC feasibility portion of the proposal could be shifted to later phase, leaving the discrete component prototypes for this phase. This will reduce the labor by approximately six engineer months. Above labor, material and software costs of $500,000 are estimated for the Renewable Energy Council Grant. Other partners have committed to fund 50.5% of the budgeted costs. NRL has committed matching funds of $260,000 for the nine month period. Springfield Angel Investors have also committed an additional $250,000 for the nine month period.

Personnel Detail: The CEO and CTO are budgeted for 1 month each for project management, partner and customer collaboration and technology review. The technical managers are budgeted 5 engineer-months for project oversight and will be involved with architectural design, reviews, documentation, and design verification. The software team is budgeted 3 engineer-months for algorithm and software design. The analog and digital ASIC engineering teams are each budgeted 6 engineer-months for ASIC feasibility and preliminary design. The hardware team is budgeted 6 engineer-months for power conversion prototype boards, schematic design, layout, building and testing boards and airframe integration and testing.

CONFIDENTIAL INFORMATION

Information regarding improving the efficiency of the solar cells is considered confidential.

PATENTS/RIGHTS TO TECHNICAL DATA

Packet Digital reserves the right to file patents related to the intellectual property generated from this proposal and will work with legal counsel to determine if additional patents could be filed. Our power management algorithms and methodology are protected by our patent portfolio. We also have copyrights and our registered trademarks include On-Demand Power®, PowerSage®, and Packet Digital®.