IPP PROJECT DESCRIPTION
Thrust II - Industrial Project Proposal

Date Entered: 08/16/2001
Document Author: Glen Dahlbacka
More Authors:
Last Modified: 01/09/2002 02:57:05 PM
Modified By: Andrei Gakh

This Project has been approved for Dissemination to USIC Members.

Project Information

Project ID:	LBNL-T2-0203-RU
Title:	Low-Maintenance Wind Power System
Status:	Draft
Cycle Status:	Received at DOE
Technical Committee:	
Academy	
Technical Area:	Energy
Status Comment:	
Nonproliferation Area:	Delivery Systems
Is this a joint project?	No

Did this Project Evolve from a Thrust I? No **If Yes, Thrust I Project Number(s):**

Thrust 2 Flow Process- Steps and Responsibilities

Status	Change Information	Comments
Draft Proposal	Glen Dahlbacka - 08/16/2001 10:26:31 AM	Initial Condition
USIC Improvement Process	Glen Dahlbacka - 11/07/2001 02:02:43 PM	clicked to eval in parallel
Proposal Meets Requirements	Glen Dahlbacka - 11/07/2001 02:03:12 PM	clicked to eval in parallel
Address Deficiencies		
Proposal Available for Review	Glen Dahlbacka - 11/07/2001 02:03:21 PM	clicked to eval in parallel
Mature Proposal	Glen Dahlbacka - 11/07/2001 02:03:33 PM	clicked to eval in parallel
		This proposal is ready for review, comments on the business component will be addressed and additional information will be added during the approval process. Gary Tydings
ILAB Comments	Glen Dahlbacka - 11/29/2001 08:48:18 AM	no comments from ilab
ILAB Concurrence Action	Glen Dahlbacka - 11/29/2001 08:50:15 AM	
Technical Committee Action	Upendra Rohatgi - 12/18/2001 08:43:23 AM	Technical Comm has reviewed the proposal and comments have been send. Proposal is good.
Preliminary Review for Dual-Use by the Technical Committee	Upendra Rohatgi - 12/18/2001 08:44:21 AM	No dual use issues
Ready for DOE Review	David Ehst - 12/21/2001 10:47:47 AM	
Received at DOE	Andrei Gakh - 01/09/2002 02:56:38 PM	Received; 29-04
Hold at DOE		
Incorporate Changes		
Approved by DOE		
DOE Approval Letter		
Available for Funding		
Allocate Funding		
Notification of Intent to Proceed		
Notification of Principals		
Statement of Work		
CRADA		
Contract Negotiations with Institute(s)		
Contract(s) Placed		
Institute(s) Engaged		
Project Completed		
Project Canceled		
Project Disapproved		
Project Inactive/Withdrawn		

CRDF Information:

General Project Cycle Comments:
USIC Review and response attached

Technical review responses:

Reviewer: The overhead proposed for the project is greater than 10%.

The overhead is 90k/945k or 9.5%. This includes rental/use of the hudodynamic test facility, which at the discretion of the DOE could be carried as a separate rental/use fee since this is an extraordinary expense item collected in the general institutional support line for SRC. The reviewer may have seen the task breakdown by LBNL which is in the same text area as the NIS costs. Alas the LBNL overhead is considerably greater than 10% but is not constrained by DOE NIS policies.

Reviewer: What is the role of Uralmet?

Uralmet is the Russian industrial partner who will commercialize the windmills in Russia in collaboration with the US industrial partner. We are very fortunate to have an industrial partner lined up in Russia who has been working on a business plan for Russian sales and this increases the probability for a good commercial outcome. Uralmet will work side by side with SRC and hire the scientists and manufacturing staff as the project matures.

Reviewer: We need more people identified for the size of the project than the ~15 listed.

The list has been updated to 30 scientists and technicians. LBNL has a list of over 100 who may participate in the project including many support individuals.

Reviewer: This is good project and deserves funding.

We concur.

Project Schedule

Date Subcontract Placed:
Date Project Completed:

Summary Description (Non-Proprietary)

Lawrence Berkeley National Laboratory (LBNL), the State Rocket Center (SRC) Makeyev Design Bureau, Chelyabinsk, Russia, and Empire Magnetics, Inc propose to collaborate on the development of an improved design of a Vertical Axis Wind Turbine (VAWT). We propose that scientist and engineers at the SRC facility be employed to design, prototype and test versions of the rotor and design an integrated wind turbine system for the production of electricity. Mechanical and magnetic bearings, a high efficiency alternator, as well as additional electronics will be provided by Empire Magnetics, and its partner companies in the U.S. The industrial partner will provide matching funds with both in-kind effort and $100k cash to LBNL.

We believe that specific configurations of the VAWT have been overlooked because, on first review, they appear less efficient than alternatives. For decades companies have flirted with VAWT designs incorporating the Darrieus, H-Darrieus, and Savonious rotors. The wind power industry, over the course of its evolution, has largely abandoned these rotor designs in favor of larger, higher efficiency, Horizontal Axis Wind Turbine (HAWT) rotors. In recent years these high-efficiency rotors, together with improvements in the technology and organization of modern wind farms, have helped wind power to become the fastest growing energy source and a multi-billion-dollar global industry. In most areas of the world, however, highly efficient wind farms are still not economically competitive with fossil-fuel-fired and nuclear power plants.

The cost of maintaining the complex HAWT machinery, used to capture the abundant kinetic energy of the wind, has limited the industry's economic success.

New market opportunities are emerging around the world for inexpensive, small-scale power stations. In many locations a modern wind farm or single HAWT capable of generating hundreds of kilowatts is no more appropriate than would be a coal or natural gas-fired power plant. In Russia, India, China and numerous remote locations in the developed and developing world, the expense of fossil fuel based power makes renewable energy sources and, specifically, wind power an extremely attractive alternative. In, so called, Off-Grid and End-of-Grid markets, the technology of the modern HAWT has not proven scalable and can't compete successfully with diesel generators. This proposal targets the considerable market opportunity for small-scale, highly reliable and durable wind power systems.

It is our premise that the vertical axis rotor designs have not been fully exploited and have some distinct benefits at the system level that make them worthy of additional development. The inherent advantage of the VAWT, with most wearing components located close to the ground, for easy maintenance, has long been recognized. However, designers have generally made the mistake of pairing vertical axis rotors, which are usually less efficient, with the same compliment of transmission and electronic components that bound the operational costs of most modern HAWT's. Our design concept represents a departure from typical designs in that it contains far fewer mechanical components that generally necessitate maintenance, add cost, and reduce efficiency. Many wind turbine designs are limited by the goal of controlling the rotor to maintain a constant frequency at the output of the alternator, greatly restricting the total output power. Our system will overcome this limit with electronics that will allow variable frequency, variable voltage power from the alternator to be matched to the grid frequency and voltage. Most turbines are subject to damage in high winds, requiring that they be shut down when the most wind power is available. Our system will be inherently self-limiting, avoiding the need to stop generating power in higher wind conditions. We contend that improvements of the vertical axis rotor design are feasible and that, when this rotor is integrated into a system design that takes advantage of its features, the overall system can be more economic than alternatives and highly successful in fulfilling the current need for Off-Grid and End-of-Grid power.

The proposed design effort emphasizes durability and reliability of the overall system, rather than efficiency alone. Companies designing wind turbines typically have technical expertise in one or two areas and lack the resources to obtain a high level of expertise in other areas. We have identified individuals at SRC who have the requisite backgrounds to undertake the rotor and mechanical system design tasks. In addition, the center has wind tunnels and other test facilities that can be employed in development and testing, as the design matures. We believe that the SRC team can provide technical expertise at a cost that is competitive in the world market and can leverage their access to sophisticated test facilities, developed for the space program, to offer better results.

We propose a collaborative effort that draws on these Russian capabilities, adds U.S. industry expertise in bearing technology and electronics, and utilizes the expertise of the LBNL Engineering Division in the integration, optimization, and delivery of systems containing diverse technologies.

LBNL is a multimillion-dollar national research facility of the U.S. Department of Energy. The laboratory has an excellent track record of participation in DOE's Initiatives for Proliferation Prevention (IPP) Program. The work proposed for funding would take advantage of capabilities in the Engineering Division (http://engineering.lbl.gov/engdiv.htm) in the areas of project management, systems engineering, mechanical design, structural analysis, magnetic analysis, and fluid mechanics. The Engineering Division at LBNL has extensive experience in the management of and participation in similarly sized R&D and construction projects involving diverse technologies and international collaborations.

LBNL Engineering Division involvement in the planned three-way collaboration with SRC will include but be not limited to:

- overall management of the three-way collaborative project with SRC and Empire Magnetics
- system level engineering support to coordinate the technical work completed by SRC and Empire Magnetics
- evaluating the accuracy of analytic and experimental results obtained by SRC

assisting the collaboration in the definition of and specification of interfaces between subsystems
scheduling of and participation in project reviews

Makeyev Design Bureau SRC (http://www.fas.org/spp/civil/russia/makeyev.htm) is a leading developer of strategic submarine-launched ballistic missile (SLBM) systems. Several generations of SLBM's developed by SRC constitute the core of the Russian naval nuclear strategic force, as they did during the Cold War. At present SRC is pursuing a conversion program. Since the end of the Cold War, SRC has begun to experiment with wind turbine technology and has targeted wind power stations as one area for diversification. In addition to considerable engineering and manufacturing expertise, SRC possess unique experimental facilities for complex aeronautical and space flight simulations. The work proposed will take advantage of the analytic, design, and experimental capabilities as well as the considerable fabrication and assembly infrastructure of SRC.

Empire Magnetics, Inc. (http://www.empiremagnetics.com/) is in the business of making and selling specialty electrical motors. The company has expertise in the design and production of electro-mechanical systems that are durable in extreme climatic conditions, has extensive industry contacts that have helped to bring the team together, and has the sales channels to bring this product to market when it is ready. This team's capabilities include a wide range of technical skills related to motion control and project management. Empire Magnetics Inc. has developed a business relationship with Uralmet, a Russian company. Over a period of three years, this relationship has enabled the successful completion of a number of engineering projects. As a result of this experience, Uralmet management personnel are prepared to provide direct lines of communication and local oversight to the wind turbine project at SRC. After the R&D phase, Uralmet is prepared to commit resources to the successful commercialization of products emerging from the proposed project.

In addition to Uralmet, other members of the partnership represented by Empire Magnetics in this proposal include:
Lynx Motion Technology, XZEL LLC, and The ElectriHydraulic Company.

Year 1

A. Tasks to be completed by SRC

Task 1. In collaboration with LBNL and Empire Magnetics, create a document summarizing the system requirements and constraints.
Task 2. Perform a conceptual design study and analysis to identify the critical parameters affecting efficiency, durability, and manufacturability of the vertical axis rotor.
Task 3 Create a preliminary mechanical design of the rotor, taking into consideration the constraints of the overall system design of the wind turbine.
Task 4. Build and test a scaled, prototype version of the rotor and correlate performance with a numerical or analytic model.
Task 5. Create a detailed design of the rotor and a preliminary mechanical design of the integrated wind turbine system. In collaboration with LBNL and Empire Magnetics, define mechanical interfaces with the mechanical bearings and electrical systems provided by U.S. companies.
Task 6. Submit monthly progress reports to Empire Magnetics and LBNL.

Proposed Support Breakdown:

Senior Staff	$30/day	1,500 man-day	$45k
Technical Staff	$20/day	3,500 man-day	$70k
Support Staff	$10/day	5,000 man-day	$50k
M&S			$148k
Travel			$60k
Institutional Support			$40k

B. Tasks to be completed by LBNL

Task 1. Provide overall project management oversight of the planned three-way collaborative project with SRC and Empire Magnetics.

Task 2. Provide system level engineering oversight to the collaboration, including collection and tracking of goals and requirements, identification of areas of technical risk, identification of design options, and functional modeling and simulation of the integrated system.

Task 3. Assist the collaboration in the definition and specification of interfaces between subsystems.

Task 4. In collaboration with Empire Magnetics, provide engineering expertise, in the areas of mechanical, electrical, and magnetic design, to evaluate the accuracy and completeness of analytic, design, and experimental work performed by SRC.

Task 5. Schedule quarterly and annual project reviews to evaluate and track progress and costs.

Task 6. Evaluate monthly progress reports from Empire Magnetics and SRC.

Proposed Support Breakdown:

Labor	$117k
M&S	$10k
Travel	$15k
Indirect	$85k

C. Tasks to be completed by Empire Magnetics

Task 1. Provide day-to-day project management, including coordination between SRC, LBNL and subcontractors and detailed cost and schedule planning and tracking

Task 2. Collaborate with SRC and LBNL in establishing goals and requirements for the wind turbine system including output power, efficiency budgets, maintenance intervals, operational limits, manufacturing and assembly constraints, and acceptable costs.

Task 3. Design, or manage partner companies and subcontractors in the design of, the electrical systems for control and conversion of the wind power to electricity

Task 4. Design, or manage partner companies and subcontractors in the design of, the mechanical bearings supporting the rotor.

Task 5. Provide SRC with mechanical and electrical interface descriptions for each subsystem interfacing with the rotor and support structure.

Task 6. Perform market research and ongoing cost analysis to maintain the commercial viability of the design and establish sales and distribution contacts to enable commercialization of the system after the R&D phase.

Task 7. Submit monthly progress reports to LBNL, including cost and schedule updates.

<u>Year 2</u>

A. Tasks to be completed by SRC

Task 1. Build and test a full-scale prototype of the rotor and support structure to verify performance and test fabrication techniques.

Task 2. Optimize the design for mass production and create the final mechanical design for the rotor and tooling required for manufacturing.

Task 3. Create a detailed mechanical design of the integrated wind turbine system with complete interface specifications for components provided by Empire Magnetics. Document all analytic work and design information in the form of engineering notes, drawings, and specifications.

Task 4. Submit monthly progress reports to Empire Magnetics and LBNL.

Proposed Support Breakdown:

Senior Staff	$30/day	1,500 man-day	$45k
Technical Staff	$20/day	3,500 man-day	$70k
Support Staff	$10/day	5,000 man-day	$50k
M&S			$257k

Travel	$60k
Institutional Support	$50k

B. Tasks to be completed by LBNL

Task 1. Provide overall project management oversight to the collaboration.
Task 2. Continue providing system level engineering oversight, including tracking and refining goals and requirements and verifying compliance with specifications.
Task 3. Continue to collaborate with Empire Magnetics, in providing engineering expertise to evaluate the accuracy and completeness of analytic, design, and experimental work performed by SRC.
Task 4. Schedule quarterly and annual project reviews to evaluate and track progress and costs.
Task 5. Evaluate the potential of technology developed by the collaboration for further development and implementation in areas of interest to LBNL.
Task 6. Evaluate monthly progress reports from Empire Magnetics and SRC.

Proposed Support Breakdown:

Labor	$142k
M&S	$6k
Travel	$15k
Indirect	$115k

C. Tasks to be completed by Empire Magnetics

Task 1. Provide day-to-day project management, including overall coordination between SRC, LBNL and subcontractors and detailed cost and schedule planning and tracking.
Task 2. Collaborate with SRC and LBNL in monitoring compliance of the design and prototype hardware with the system requirements.
Task 3. Produce, or manage partner companies and subcontractors in the production of the electrical systems appropriate for incorporation into the full-scale prototype and deliver this hardware to SRC.
Task 4. Produce, or manage partner companies and subcontractors in the production of the mechanical bearings, to support the full-scale prototype rotor, and deliver this hardware to SRC.
Task 5. Provide SRC with finalized mechanical and electrical interface descriptions for each subsystem interfacing with the rotor and support structure.
Task 6. Continue market research to maintain the commercial viability of the design and establish sales and distribution contacts to enable commercialization of the system after the R&D phase.
Task 7. Submit monthly progress reports to LBNL, including cost and schedule updates.

Nonproliferation Impact

During the Cold War Makeyev Design Bureau SRC was at the center of the development of the missile technology constituting the core of the Russian naval nuclear strategic force. Among SRC's achievements since its inception in 1947 are the first nuclear-armed SLBM (R-13 / SS-N-4 Sark) in the Soviet arsenal, the first intercontinental SLBM (R-29 / SS-N-8 Sawfly), and a third generation SLBM with MIRV's (RSM-50 / SS-N-18 Stingray). There is little doubt that expertise in missile technology for use in weapons systems has been, and will continue to be, in high demand in some parts of the world. Similarities between the SS-N-4 and the No-Dong missile suggests North Korea received considerable assistance from the Makeyev design bureau in the past. Indeed in October 1992, more than 60 Russian missile technicians from the Makeyev bureau were detained at an airport in Moscow as they were about to board a flight to North Korea. It has been suggested that the number of personnel traveling in this group strongly indicates that contact between Makeyev and North Korea had been going on for some time, and that

some missile development work had already been completed. This site is an important location to engage IPP in development of commercial opportunities and develop the ability of Uralmet to hire SRC employees and provide more secure jobs.

Since the end of the Cold War SRC has increased efforts to convert its available systems and technologies for space projects. It has proposed commercial applications for all SLBM's, which are currently in operation. Three simple sub-orbital launchers have been demonstrated, but more sophisticated upgrades to achieve orbital insertion capability await financial support for actual development and construction. The limited success of efforts to convert missile systems to civilian launch vehicles has inspired broader efforts at diversification. The proposed project will achieve the intended objectives of the IPP program by re-directing NIS scientific and engineering expertise towards peaceful technologies. The project will have a stabilizing effect by providing seed funding for a commercial effort in a rapidly growing industry. Efforts at SRC can be directed towards income producing endeavors, thus benefiting the local economy, providing an international source of capital, and enabling redirection of critical staff and capabilities that might otherwise be drawn away to proliferant states.

WMD Bona Fide

If your computer is unable to open the attached document, please follow these steps:

1. **right click on the document**
2. **select the view option**
3. **this will launch the document in a read/print mode**

Participants in the SRC creative team have almost no publications because publishing was not permitted in the high-security environment in which they have worked. However, each participant typically posses thirty to fifty inventor's certificates (Russian internal patents). SRC management is willing to disclose more specific information about the staff, including providing CV's, once contact is made directly with IPP management. The following NIS staff will participate in the planned project. Other support staff involved in WMD will work on the project in various stages. There may be some minor support from noninvolved persons.

Name	Involved in WMD research, manufacturing, or testing	Involved in R&D of underlying WMD technology	No WMC involvement
Aljohin, Alexander Alexandrovich	Specialist in structures and strength of materials		
Balikina, Tamara Alekseevna	Durability calculations, experiment, testing		
Bushman, Grigorij Anatoljevich	Loading calcs, results representation		
Danilkin, Vjacheslav Andreevich	Expert of durability of rocket design		
Demchenko, Alexander Antonovich	Specialist in structures and strength of materials		
Druchenko, Vladimir Anatoljevich	Technological process expert		
Grahov, Jurij Vasiljevich	Specialist in aerodynamics		
Hanov, Valentin Suerbaevich	Materials expert		
Jurjev, Valerij Viktorovich	Specialist in control and energy		

	engineering
Kabanov, Jurij Pavlovich	Specialist in aero and gas dynamics
Korobejnikov, Jurij Alexandrovich	Coordinator
Kravchenko, Elena Vladimirovna	Specialist in design of rocket and wind power technologies
Krechka, Sergey Alekseevich	Composite expert
Krivcov, Vladidmir Ivanovich	Specialist in design of rocket and wind power technologies
Krivospickij, Vladimir Pavlovich	Specialist in design of rocket and wind power technologies
Maximov, Vasilij Filippovich	Specialist in technology
Moiseenko, Pavel Vasiljevich	Specialist in control and energy engineering
Mukminov, Ramil Raviljevich	Specialist in control systems
Murashev, Vladimir Iljich	Specialist in structures and strength of materials
Ovcharenko, Nikolaj Jakovlevich	Specialist in aerodynamics
Podgornova N.V.	Chemistry expert
Shamsutdiniv, Rafael Nurgaleevich	Specialist in design of rocket and wind power technologies
Sharashov, Oleg Ivanovich	Metal specialist
Sharij, Anatolij Ivanovich	Specialist in dynamics experiments
Sleta, Alexandr Vasiljevich	Rocket design and development
Telicin, Jurij Sergeevich	Specialist in rocket energy systems
Tomilov, Alexander Georgievich	Specialist in design of rocket and wind power technologies
Troshin, Vladimir Viktorovich	Welding expert
Ushakov, Jurij Vasiljevich	Specialist in dynamics experiments
Vojnov, Jurij Jevgenjevich	Specialist in structures and strength of materials

Benefit To NIS

The current projections for population growth, and associated increase in electricity demand, indicate an enormous long-term market for affordable wind power. Stimulated largely by the goal of reducing CO2 emissions, the alternative energy market is growing rapidly in Europe and the U.S. with wind power leading the way. In the developing world, where many countries lack adequate indigenous supplies of fossil fuels, wind power stations are solving the common problem of increased electricity demand in areas with minimal or nonexistent distribution

networks. Because of the rapid growth in the developed and developing world, even a small portion of the wind power market could employ large numbers of Russian engineers and scientist, in a peaceful and globally beneficial enterprise.

The success of the proposed project could also have a humanitarian benefit to Russia. In many parts of the country, factory closures and crumbling infrastructure are leaving many without reliable electricity. In some cases, entire towns are dependent upon the coal or nuclear-fired steam turbines of local factories for power. During the winter months, especially in northern latitudes, factory closures, brought on by recent economic hard times, have translated into a life threatening loss of heat in homes. The development of wind power technologies would help to provide a reliable and clean source of energy in areas where the electrical infrastructure has ceased to function or fallen into disrepair. The guiding principle of the proposed design effort is to create a simple and durable small-scale wind power system. If this equipment could provide a reliable supply of electricity under the harshest climatic conditions, such as during the driving wind and cold of the Siberian winter, the technology developed in the course of this project could have a beneficial affect on the quality of life in Russia.

Benefit To DOE

DOE would benefit by direct support of its mission to limit proliferation of weapons of mass destruction. The funding of this project would support the efforts of the NIS weapons facility to diversify into an area in which it has already expressed interest. In addition, the project would further DOE's research mission in the area of alternative energy. While many alternative energy technologies hold great promise for the future, wind power is now the world's fastest growing energy source. Steady and sustained policy incentives have helped European companies gain dominance over the wind power industry. The group of U.S. companies in this proposed collaboration believes that the majority of wind power equipment producers are not optimizing according to the proper goals to fulfill an emerging demand in the area of small-scale power generation. The proposed funding would sponsor an R&D effort to explore a new strategy for turbine design and operation.

Industrial Applications

How does the sponsor plan to market the proposed product, or incorporate process improvements in manufacturing operations?

The increasing global commitment to the reduction of CO2 emissions coupled with a large and steadily growing demand for electricity has created a potentially large market for wind power generation equipment. The willingness of Empire Magnetics and the partners in the Wind-Sail group to invest in this project demonstrates their belief in the profitability of developing and selling wind power generation equipment.

Interested US Companies

The research work proposed for sponsorship is part of a larger program with several participants bringing their strengths to the project in partnership with Empire Magnetics Inc as the lead company with those listed below as subcontractors.

Lynx Motion Technology brings the patented Axial Gap alternator that we propose to drive directly from the rotor. This will result in a variable voltage, variable frequency output. The efficiency of the alternator itself is on the order of 95 to 98 percent. Lynx also brings expertise in magnetic design and other aspects of rotating machines.

XZEL, LLC designs and manufactures power supplies and brings specific expertise in the design and manufacture of inverters.

The ElectriHydraulic Company has performed market research that has justified the formation of the Wind-Sail group as well as the proposal of this project. This research has resulted in verbal agreements with some customers to support the product implementation once field units are ready. Several ranchers are willing to allow test units on their property, and have indicated a willingness to purchase units if they are

economically viable. In addition, Excel Energy has given verbal indications that they are willing to fund as many wind power projects as we can muster, if we can demonstrate economic viability.

(Pending NDA which is in process) another company brings a patented circuit that converts AC, of variable frequency and variable voltage, to DC voltage with efficiency in the range of 97 percent.

Empire Magnetics is assembling additional groups with capabilities in related areas, such as flywheel energy storage, magnetic bearings, tower and support structure, and venture capital.

Additional Project Information Comments:

DOE Laboratory, NIS Institute and Company Information

DOE Lead Lab: LBNL
DOE Supporting Labs: None
Universities Involved:

DOE (PSO) Interface (OPTIONAL)
Office Name:
Contact Name:
Phone Number:

Project's Relation To National Lab Program:

PI Information

Name:
Oshatz, Daryl
Title: Mechanical Engineer
Phone: +1 510-486-6679
Fax: +1 510-486-4544
Email: daryl_oshatz@lbl.gov

Support Contact Information

Name: Rasson, Joseph
Title: Mechanical Engineering Dept. Head
Phone: +1 510-486-6450
Fax: +1 510-486-4711
Email: jerasson@lbl.gov

ILAB Contact

Contact: Glen Dahlbacka
Title: Program Manager
Phone: +1 510-486-5358
Fax: +1 510-495-2111
Email: GHDahlbacka@lbl.gov

DOE Laboratory Information Comments:

Daryl Oshatz is a Mechanical Engineer in the Engineering Division at the E. O. Lawrence Berkeley National Laboratory. Daryl received a BS in Mechanical Engineering from the University of California, Berkeley. He has published several papers at national and international conferences on particle accelerator technology. His areas of expertise include: providing project management and technical leadership on accelerator and high-energy physics construction projects; analytic and finite element analysis of structural, thermal, and electro-magnetic systems; and mechanical systems integration. His current assignment is Lead Mechanical Engineer in the design and construction of the Front End Systems Medium Energy Beam Transport that will be installed at Oakridge National Laboratory in 2002 as part of the linear accelerator for a neutron scattering user facility called the Spallation Neutron Source. Previously, Daryl worked as the Lead Mechanical Engineer on the DIRC Support Structure for the BaBar Detector, a high-energy physics detector installed at the Stanford Linear Accelerator Center in 1997.

Joseph E. Rasson, Ph.D.

Dr. Joseph Rasson is the Head of the Mechanical Engineering Department at the Lawrence Berkeley National Laboratory. He received his Ph.D. in Mechanical Engineering from the University of California at Berkeley in 1979. He has published several papers at national and international conferences on energy conversion devices and particle accelerator technology. As head of the department, he provides technical and administrative leadership to about 90 mechanical engineers matrixed to projects around the Laboratory and, very importantly, leadership and strategic planning to the Engineering Division. His areas of expertise include: Absorption heat pumps, particle detector design and large project system integration and management.

Lead NIS Institute

Institute: State Rocket Center, Makeyev Design Bureau

Street: Turgoyak Road, 1
City: Miass
Zip/Postal Code: 456300
Country: Russia
Affiliation: Ministry of Defense (MOD)

NIS PI Information

Name: Krivospickij, Vladimir Pavlovich
Title: Rocket Designer

Phone: +7-351-352-6217
Fax: +7-351-356-6191
Email: vladimir@mmz.miass.chel.su

NIS Institute Information Comments:

Vladimir Degtyar, Head and General Designer, Makeyev Design Bureau SRC
Tel: (7-35135) 2-63-33 or 2-39-70
Fax: (7-35135) 5-22-91
Telex: 124858 ROSA SU
Email: vladimir@mmz.miass.chel.su

Partner Company / Contact

Company:	Empire Magnetics Inc.	**Phone:**	+1 707-584-2801
USIC Contact:	Richard Halstead	**Fax:**	+1 707-584-3418
Mailing Address:	5780-B Labath Avenue, Rohnert Park, CA 94928	**E-Mail:**	rick@empiremagnetics.com
Fed. Ex. Address:	5780-B Labath Avenue, Rohnert Park, CA 94928		

Additional Contact Information:

Business Plan Summary:

A short summary of the principal elements of the sponsor's plan to commercialize the proposed project, please include:

Market Analysis -
Describe the current markets in the U.S., NIS, and other countries to be addressed by this project, and discuss the expected growth in other markets. Indicate current market size and how it will be impacted by the project in terms of volume and dollar growth.
Explain other competitive efforts in the same field and how this project can compete effectively. Present the analysis in terms of both U.S. and NIS opportunities.

Cost/Benefit Analysis -
Develop a cost/benefit analysis to show how the proposed project will meet the industry partner's investment criteria, considering required investments and expected returns over the product life-cycle. The level of detail presented should be appropriate to the stage of development of the projects. An analysis that is adequate to justify commitment of company cost-share funds is required.

Finance Plan -
Include a plan showing development, engineering, and production cost estimates, planned sources of finance, and expected revenues.

Risk Analysis -
Indicate the probability of success of the project within schedule and budget constraints. Include potential obstacles to on-time and successful project completion as well as an indication of how to avoid or overcome the obstacles.

The group of U.S. businesses, herein referred to as the Wind-Sail group, intend to design, produce, market, install and service a series of wind-powered products for profit. Such products will be sold nationally and internationally via beneficial partnerships as appropriate. The Wind-Sail group proposes a partnership with the Makeyev State Rocket Center (SRC) wherein SRC will design and produce wind driven rotors. The Wind-Sail group will design and produce axial gap alternators, magnetic bearing systems, and the electronics for these products. The Wind-Sail group will market the complete systems in the West. Uralmet, a Russian company, will market the same systems.

Target Markets:

Grid Connected Commercial Energy Producers:	investor owned utilities, cooperatives, large power users
Distributed grid support:	utilities
Remote users:	ranchers, farmers
International:	villages, off-grid users
Work sites:	construction, mining
Farming:	irrigation, livestock watering, aqua-culture
Villages:	deep-well survival

Product Overview:

Small wind power units of 3 kW to 30 kW capacity will be designed to be extremely durable. These units are intended to produce some power as long as the minimum wind speed is available. The primary design focus will be on a “build and forget theme.” The design goal for the life of the unit is 30 years. Many of the prospective users will be isolated, in remote and off grid situations. For these users survival may depend on the ability to obtain some power in all conditions, as opposed to getting efficient power in optimum conditions. The Russian engineering community has a long history of successfully design and manufacture of equipment that is exceptionally durable. The phrase, “built like a Russian tank.” is based on this success. As envisioned, the rotor and support structure will be designed and tested in Russia. Early production will likely be done there, as well. Since wind power can be sold on a global basis, there will be many pathways of development. It appears that a positive two-way trade arrangement is possible, with parts such as the rotor coming from Russia, and components like the axial gap generators and electronics coming from USA.

Market Size:

The estimated world market for wind power devices is in excess of $4 billion annually, growing at approximately 25 percent per year. Wind-Sail believes it can capture a 5 to 10 percent share of the marginal growth by delivering exceptionally durable and reliable products.

Larger units will be based on Russian developed wind power designs incorporating features from helicopter technology. These large units will be marketed to commercial power producers who are seeking maximum revenue from their investments. The estimated world market for such devices is in excess of $1 billion annually. Due to the improved reliability and greater efficiency as compared to current devices, Wind-sail believes it can capture a 10 percent share of the marginal growth.

Risk:

The design task is primarily an optimization of several known components into a functional system. All of the components can be calculated, modeled and tested before production begins, starting from this basis, technical risk is relatively low. The greater risk factor is economic. The cost justification for commercial wind power is based on electrical rates from competitive sources. Market conditions can change, however current trends indicate the changes are likely to be favorable for wind power. The cost of mass-producing Russian designed wind rotors is an unknown factor. The assumption that such rotors can be made in Russia at competitive costs is untested. It appears that customers will be willing to pay a premium for off grid wind power units, if those units are exceptionally reliable. This assumption has not been tested in the marketplace.

Funding:
Members of the Wind-Sail group will provide the initial funding. Currently this group includes: Empire Magnetics Inc. Uralmet, Lynx, ElectriHydraulics, and XZEL. Discussions are under way with other potential companies. As the product development moves forward, additional funding from customers and venture groups will be sought. The Emergent Power Group has expressed a willingness to review our plans, and Excel Energy has stated that they are in a position to fund economically viable wind power projects. Some international customers with insufficient electrical generation resources have also expressed an interest.

Sales and Marketing:
Empire Magnetics Inc. currently markets electric motors and other motion control products internationally, via an established distribution network. Since wind power generation is a form of motion control, we believe the same network will form the basis of a sales network to sell Wind-Sail products. In Russia, the Uralmet Company, in cooperation with SRC, claims to have some prospective customers for wind power in places where there is insufficient or unreliable electrical power. Uralmet intends to expand sales activities as products and revenue are realized.

CRADA #: **Date Signed:**

Company Comments:

USIC 0203 Proposal eval and response

USIC 0203 Proposal eval and respons

Funding Information

3-5 Year Spending Plan ($K): (must be non-blank and a number >0 and <10,000 K)

Fiscal Year	US Labs ($K)	NIS Institutes ($K)	Total ($K)
First FY	$177.000	$413.000	$590.000
Second FY	$228.000	$532.000	$760.000
Third FY	$0.000	$0.000	$0.000
Forth FY	$0.000	$0.000	$0.000
Fifth FY	$0.000	$0.000	$0.000
Totals	$405.000	$945.000	**$1350.000**

Proposed Partner Company Contributions ($K): (must be non-blank and a number >0 and <10,000 K)

Fiscal Year	Partner Company Contribution ($K)
First FY	$525.000
Second FY	$825.000
Third FY	$0.000
Forth FY	$0.000
Fifth FY	$0.000
Total	$1350.000

Proposed Funding Comments:

$100k of the partner contributions will be cash into LBNL - more detailed budget information is on file with LBNL ILAB representative

(All Amounts must be non-blank and a number >0 and <10,000 K)

Funding Year	Source and Amount ($K)	Lab Code	Comments
$0.000			
$0.000			
FY	$0.000		
$0.000			
$0.000			
FY	$0.000		
$0.000			
$0.000			
FY	$0.000		
$0.000			
$0.000			
FY	$0.000		
$0.000			
$0.000			
FY	$0.000		
Totals	$0.000		

Total Amount Allocated: $0.0 **($K)**

Allocated Funding Comments:

(All Amounts must be non-blank and a number >0 and <10,000 K)

Funding Year	Source	Costed US ($K)	Costed NIS ($K)	Costed Both ($K)	Lab Code	Comments
FY						
FY						
FY						
FY						
FY						
Totals						

$0.000
$0.000
$0.000

*** For those funded with DOD Funding, how much funding (in $ K) went to:**

Salaries paid to Students:	$0.00 (K)
Equipment Costs:	$0.00 (K)
Funds Paid to US Companies:	$0.00 (K)

Disbursed Funding Comments:

Deliverables by Fiscal Year Funding

Funding Year 1

Deliverable	Date Complete
Documentation summarizing the system requirements and constraints	
Documentation of the conceptual design study and analysis of rotor performance	
Scaled prototype of rotor and documentation of experimental test results	
Documentation of the preliminary mechanical design of the rotor and integrated wind turbine system	

Funding Year 2

Deliverable	Date Complete
Full-scale prototype of the rotor and support structure and documentation of experimental test results	
Documentation of the detailed mechanical design of the rotor and support structure with all interfaces fully specified	
Documentation in the form of engineering notes and specifications describing the proposed manufacturing process, performance specifications, and	

engineering calculations utilized in the determination of operational limits and safety factors.

Funding Year 3

Deliverable	**Date Complete**

Funding Year 4

Deliverable	**Date Complete**

Funding Year 5

Deliverable	**Date Complete**

Deliverables Comments:

Contract Placed:

FTE Invoiced: person years

Total FTE weapons scientists, engineers and technicians funded: 40.0

Estimated NIS FTEs: 175.0
(Based on the following formula: Total Proposed to NIS Institutes / $5,400)

General (OLD) Funding Comments:

OLD Comments: