

2010 REVIEW FORM FOR SBIR/STTR PHASE I GRANT APPLICATIONS

GRANT APPLICATION NO.: 94832S10-I **TOPIC NO.:** 59 b
APPLICATION TITLE: High Speed Data Acquisition Module for Radiation Pulses
PROPOSING FIRM NAME: Esensors Inc.
PRINCIPAL INVESTIGATOR: Dr. Darold Wobschall

REVIEWER NAME: Kenneth Johns
AFFILIATION OF REVIEWER: University of Arizona
TELEPHONE NO. OF REVIEWER: 520 621 6791

I HAVE READ THE INSTRUCTIONS IN THE FORWARDING LETTER. MY REVIEWING COMMENTS FOLLOW.

Kenneth Johns
Signature of Reviewer

01/23/2010
Date

1. Scientific/Technical Approach

Please comment on the strength and innovativeness of the idea and the technical approach. The following optional questions are suggested to guide your review: To what extent does the proposed work build upon or move beyond the current state-of-the-art? How new or unique is the idea? How significant is the scientific and/or technical challenge? Is a breakthrough possible? Has the applicant demonstrated knowledge of the subject? How thoroughly have the concepts been presented?

Esensors, Inc. proposes to deliver a high speed data acquisition module for radiation pulses. The design will take advantage of commercial off-the-shelf (COTS) electronics to produce a very compact, high precision pulse shape data acquisition module. The target application is the output from photomultiplier tubes (PMT's) though semiconductor detectors were also mentioned in the proposal introduction. The main idea is that presently there are very few, if any, all-in-one solutions for detector signal processing. Typically one must integrate front-end electronics with digitization and signal processing electronics with readout electronics. The idea presented here is to combine all of these functions into a miniaturized package. While the idea is not new, the proposed solution is reasonable. In terms of technology, the proposal is not moving beyond current state-of-the art. Rather it uses COTS devices (ADC's, FPGA's) to solve a common problem in high energy physics detector development. And that is how to efficiently and inexpensively perform digital signal processing and readout with modest speeds for a small number of channels (1-64). As detailed in the proposal, the technical solution is relatively straightforward. Sufficient detail was provided in the proposal for the front-end and digitization blocks. The reviewer would have liked more detail on the digital signal processing (DSP) and data readout implementation in the FPGA. Phase 1 sidesteps the data readout choice and uses an RS485 output for hardware design simplification. Esensors does have experience implementing a variety of serial interfaces however it would have been interesting to see details of the USB or Ethernet implementation (in the FPGA I assume). The company successfully developed and tested a pulse data acquisition system with similar performance capabilities lending confidence to a successful outcome for this proposal.

Overall summary of the scientific/technical approach (please check one):

1. For the reasons cited above, I strongly endorse the scientific and/or technical approach of the proposed work.

2. My sentiments are somewhere between 1 and 3.

[] 3. Because of the problem(s) identified above, I have reservations regarding the scientific and/or technical approach.

2. Ability to Carry Out the Project in a Cost Effective Manner

Please comment on the qualifications of the Principal Investigator (PI), other key staff, and consultants, if any, and on the level of adequacy of equipment and facilities.

The qualifications of the PI and the engineering staff are adequate for the needs of this proposal. The company has produced a variety of environmental sensor units. It has also previously developed an optical pulse analyzer and data acquisition module for a private customer as well as a low-noise preamplifier for a PMT.

Please comment on the soundness and level of adequacy of the Phase I work plan to show progress toward proving the feasibility of the concept.

The six month schedule seems tight but presumably the work on different sections of the data acquisition module will proceed in parallel. Additionally, they are presumably building on an existing prototype developed for other applications which reduces development time. The details given in the performance schedule were somewhat thin. However for Phase 1, the hardware design is simplified by using an RS485 output and external USB converter.

In your opinion, is the proposed R&D effort sufficient to justify the total cost (line I of the budget page, not including the fee)? E.g., is the cost consistent with that charged for comparable levels of effort by other R&D performers? Are the labor hours, for the PI and others, sufficient to accomplish the tasks and justify the total cost? Please comment.

The cost estimate is reasonable and primarily covers the electrical and computer engineering costs.

Overall summary of ability to carry out the project (please check one):

1. For the reasons cited above, I strongly endorse the applicant's ability to carry out the project.

2. My sentiments are somewhere between 1 and 3.

3. Because of the problem(s) identified above, I have reservations regarding the applicant's ability to carry out the project.

3. Impact

Please comment on the significance of the technical and/or economic benefits of the proposed work, if successful.

The technical significance of the proposed work is modest. It does fill a need to integrate front-end, DSP, and readout functionality into one low cost electronics module. The proposal does not clearly and specifically indicate its relevance to present or future HEP programmatic activities. Such a module might be more relevant to HEP activities by making it multichannel, externally triggered, and more easily connected to a wider and more modern variety of particle detectors. On the other hand, the module may find application in detector development for medical physics or in other sub-fields such as condensed matter physics, chemistry, and biology that make use of signal processing of PMT signals in their experiments.

Please comment on the likelihood that the proposed work could lead to a marketable product or process, and on the size of the potential market.

I could imagine several niche markets for this device, especially in medical physics, but not on large scale (less than a thousand).

Please comment on the likelihood that the project will attract further development funding (from private sector sources or from Federal, non-SBIR/STTR sources) after the SBIR/STTR project expires.

I have no expertise in venture capital. Funding outside DOE might be possible if defense or homeland security applications could be identified. From the outline given for their Phase II goals, Phase II funding from SBIR would result in a data acquisition module that would be close to a product ready for market.

Overall summary of impact (please check one):

1. For the reasons cited above, I strongly believe that the proposed work, if successful, will have significant impact.

2. My sentiments are somewhere between 1 and 3.

3. Because of the problem(s) identified above, I have reservations regarding the impact of the proposed work