

Joint Research and Project Development for Radiation Detectors, High Energy X-Ray and Gamma Rays Sources and Neutron Sources Focused at Homeland Security and with Applications to Fundamental Physics Research in Nuclear and Particle Physics.

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Introduction

A significant group of physicist and engineers has formed to study both science and engineering problems focused on the development of radiation detectors, laser driven charge particle acceleration, plasma physics, particle sources and novel particle accelerators, and the facilities at the Applied Physics Laboratory, with the goal of developing significant proposals in the area of homeland security and fundamental physics. The group intends to study both applied problems and fundamental problems in engineering and physics and form larger collaborative efforts outside Purdue with colleagues at Argonne National Laboratory, Lawrence Livermore National Laboratory, Oak Ridge National Laboratory as well as others. Targeted agencies will include, DARPA, DTRA, DOE, DOD, NSF and others having a strong interest in advanced technology development. In addition the laboratory is a well suited teaching environment to develop laboratory skill both in engineering and science students both at the graduate and undergraduate level. For example each of the past four years, a 5 day a week, 8 week long laboratory course has been taught by the laboratory for those student associated with the laboratory typically 6 student each session. This course will be opened up to all students on campus. Likewise the engineer faculty associated with the initiative will develop laboratory training focused on the unique resources presently available at APL and will become available at APL as the joint initiative progresses. A total funding request of \$125k will allow APL to remain open for a period from 12 to 18 months starting January 1, 2008 over which time the group will development research proposal that will allow the laboratory to become self sustaining. We are requesting funding for the initiative be shared by The Dean of the College of Science, The Dean of the College of Engineering and the Vice President of Research.

Opportunities for advanced plasma and materials research in national security

There are numerous opportunities for advanced plasma and materials research with applications to national security that can be collaboratively investigated at Purdue's Applied Physics Laboratory. Strategically, there are several university-guided calls that encourage collaborations between universities and national laboratories.

One particular opportunity is with the Office of National Security headed by Alan Foley at Argonne National Laboratory. Prof. J.P. Allain formerly headed research at Argonne in the area of compact, high-intensity plasma sources that would one day be capable of providing hybrid technologies such as combining compact high-intensity neutron and hard X-ray sources for through-barrier detection. He is still a visiting faculty staff at Argonne and envisions close collaboration with the national security detections group. This close collaboration with Argonne addresses the new vision by President Córdova for the Office of the Vice President for Research of establishing close ties with national laboratories, among other federal agencies and foundations. Allain served on the research board for “Through-Barrier Technologies” workshop headed by the Defense Intelligence Agency and will play a key role in establishing close ties with national security federal sponsors in collaboration with Argonne. The facilities at the Applied Physics Laboratory will be an invaluable asset to Purdue’s effort in seeking new strategic funding in national security.

Additional areas of research include advanced materials for detection. This is a focus area for agencies such as the NNSA. This will be an effort between the Schools of Nuclear Engineering and Materials Engineering with opportunities for testing protocols at the Applied Physics Laboratory.

Opportunities in Detector Development for Chemical and Biological Defense

Joint Program Executive Office for Chemical and Biological Defense has supported research at APL in detector development for Chemical Agents in sealed containers. Many opportunities for advanced detector development and for detector characterization exist in this important area for homeland defense and for protection of military personnel in theater. A major area of research is in the development of calibration standards for chemical detection system both in military and civilian applications. Because of the great need in the area of homeland defense for sensors in the area of Chemical, Biological, Radiological, Nuclear, Explosive detection (CBRNE) presently equipment is deployed whose sensitivity is not known accurately. The initiative in this area will be for the development of unique calibration solutions for instrumentation through innovative research and development based on real world needs. The resulting research ensures accurate, precise, reliable metrology and calibration with strong consideration for cost effectiveness and commercialization. This work will improve the false-negative alarm rate, and build confidence in the user community for the use of these advanced detection systems. Joint proposals will be developed through Naval Surface Warfare Centers, Crane and Corona.

Opportunities at the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory

The SNS is an important facility that allows for the study of materials as well as fundamental research in nuclear physics. The joint nuclear engineering and physics collaboration will give Purdue an advantage in developing unique proposals at the laboratory. Dr. Kim and Koltick presently have a proposal under consideration at NSF to do a fundamental physics experiment to search for power law fall-off in the momentum distribution of protons in metal hydrides at temperature up to 1000°K. The required sensitivity of the experiment is 1 part in 10^{10} . The experiment involves the development of a special target capable of storing hydrogen at high

temperatures, heated by convective heating with high temperature hydrogen gas. The formation of the a strong science and engineering at Purdue could assure the success of such a demanding experimental program.

Proposed Budget

This proposal requests funding so that APL remain open for 18 months, starting January 1, 2008 until June 30, 2009 for the purpose of developing proposals and joint programs between, Physics and Nuclear Engineering and collaborations outside.

The present lease agreement with Huston Electric ends October 13, 2008.

Budget Request for January 1, 2008 through June 30, 2009

Building

\$2000/month (January 1, 2008 – September 30, 2008)	\$ 20,000.00
\$6500/month (October 1, 2008 – June 30, 2009)	\$ 58,500.00

Supplies for 18 months	\$ 8,000.00
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Travel

In order to develop the proposals 2 trips per faculty member are required
Each trip \$2K.

5 Faculty x 2 trips	\$ 20,000.00
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Equipment repair

Minor equipment and supplies for proposal development	\$ 15,000.00
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Teaching

Physics/Engineering Course Development, minor equipment and materials	\$ 3,500.00
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Total Proposed 18 month Budget	\$125,000.00
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