**Nuclear Explosion Monitoring Research and Engineering (NEMR&E) Program
Quarterly Report - BAA06-36; DE-FC52-06NA27322**

Research Title: A Multi-Layer Phoswich Radioxenon Detection System

Name: David M. Hamby, PhD

Institution: Oregon State University

Reporting Period: 11/01/06 – 01/31/07

Technical Progress:

Description of Activities Conducted this Reporting Period:

During the third quarter of our research we continued development of our two-channel digital pulse processor, and finalized/optimized our XEPHWICH design. We have completed a number of simulations (using MCNP) on potential design features of a two-channel phoswich detector, and have come to agreement on the most efficient design for the ARSA framework. This design will encompass two planar, triple-layer phoswich detectors positioned parallel to each other such that the gas-counting volume is a very thin disk. This approach creates a counting geometry that is very close to 4π , while simplifying the manufacturing process. For the DPP2, a two-channel fast preamplifier is being designed. The preamplifier will have DC-offset and gain adjustments. As described in the proposal, valid signal pulses from two PMTs are identified and captured in the FPGA and then digitally processed in a dedicated Digital Signal Processor (DSP). The MicroBlaze processor from Xilinx is intended to be replaced with the DSP. The processor is a soft core, meaning that it is implemented using general logic primitives rather than a hard core such as DSP.

Progress/Deliverables Required by this Reporting Period per Contract:

The proposed schedule shows that, by the end of the third quarter, the ZEPHWICH prototype design and construction would be complete (Phase 1, Task b), the design and construction of DPP2 is continuing (Phase 2, Task a), and the MCNP modeling/optimization of the saddle geometry would be complete (Phase 3, Task b).

Reason for Differences in Cooperative Agreement Statement of Objectives/Deliverables and Actual Progress/Deliverables, Corrective Actions:

As noted above, Task 1b is complete and the ZEPHWICH design has been finalized. The planar detector is on order with St. Gobain and a design for the ARSA framework has been analyzed. Task 2a is progressing as anticipated. Task 3b is complete, however, the saddle design has been replaced with a parallel planar configuration. This design will have near-equal efficiency, with an ease in manufacture that is seen as greatly outweighing small losses of efficiency.