Trinity Section
American Nuclear Society
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DINNER MEETING ANNOUNCEMENT

"Design and Testing of Small Nuclear Reactors for Defense and Space Applications"

Speaker: Patrick McClure, Los Alamos National Laboratory

Abstract: *please see page 2. Note: part of the work described in this presentation received one of the 2013 R&D 100 awards.*

Biography: *Patrick McClure has twice been a group leader at LANL. He is currently managing two small reactor design projects in NEN-5, the Nuclear System Design and Analysis Group. He has been at LANL for 19 years performing nuclear design and safety analysis for the NRC and DOE with an emphasis on severe nuclear accidents. Mr. McClure has a B.S. from the University of Oklahoma and a M.S. from the University of New Mexico.*

Place: **Courtyard by Marriott, Santa Fe**
3347 Cerrillos Road, Santa Fe, NM (505-473-2800)

Directions: From Albuquerque, take 1-25 North approximately 55 miles to Exit 278 (Cerrillos Road). Hotel is located 3 miles on the left-hand side of Cerrillos Road, just before Richards Avenue.

Date: **September 20, 2013**

Time: **6:00** Social Hour with Cash Bar
7:00 Buffet Dinner (with filet of sole and beef Bourguignon)
7:45 Speaker

Cost: *$30 per person, ½ price for students and children*

We strongly encourage you to sign up and pay for this event using our PayPal payment account. Visit the "Calendar" page of our web site (http://local.ans.org/trinity/calendar.html) and select the appropriate payment button. You may use your own credit card and do NOT need to have a PayPal account to make the payment.

RSVP: If you do not use PayPal payment, please RSVP no later than Sep 16th to:
Markku Koskelo: mkoskelo@aquilagroup.com (505-338-8083) or
CJ Solomon: clell.solomon@gmail.com (505-695-8820)

RSVP must be received by 16 Sep in order to give final numbers to the caterers. While we strongly encourage everyone to use online payment to sign up and prepay, an RSVP is a commitment to attend/pay at the door. We cannot afford "no shows" after the final count is given to the caterers, as the Section is partially subsidizing the cost of this event. If you cancel after 16 Sep, you will still be responsible for paying.

Design and Testing of Small Nuclear Reactors for Defense and Space Applications

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NASA uses deep space science missions to explore the underlying fabric of the universe. Deep space mission have relied on radioisotope power systems for energy. Los Alamos National Laboratory and NASA Glenn Research Center are proposing a very small uranium-based reactor that produces one kW of electricity as an alternative to radioisotope power systems for some deep space missions. This small reactor uses heat pipes as a means of heat removal from the reactor core and Stirling engines as the means of power conversion. A heat pipe is a sealed tube with an internal fluid that can efficiently transfer heat produced by the reactor. A Stirling engine is a thermodynamic heat engine that converts thermal power into mechanical work using a linear piston and displacer.

A proof of concept experiment was performed in September 2012 at the Nevada Test Site Device Assembly Facility. The experiment demonstrated the first use of a heat pipe for reactor cooling, as well as the first use of a Stirling engine to produce electricity using heat from a fission reactor—the electric power produced was 24 watts. The experiment, DUFF (Demonstration Using Flattop Fissions), team consisted of engineers from LANL, the NASA Glenn Research Center (GRC) and National Security Technologies LLC (NSTec). The team configured an existing nuclear experiment, known as Flattop, to allow for a water-based heat pipe to extract fission heat from the uranium core. The heat was transferred to a pair of free-piston Stirling engines. The nuclear system configuration is a demonstration of the basic reactor physics and heat transfer of a simple and reliable space reactor power system.

A follow-on program to perform another proof of concept test at the Nevada Test Site in the next two years is being seriously considered by NASA. If this test is successful, a follow-on prototype program is expected. Once developed, this reactor would serve as the model for follow-on reactors at higher power levels. These reactors would have applications in both the defense community and NASA. The U.S. Air Force and Navy are looking for nuclear power in the 10 to 100 kW electric range for space and undersea applications. NASA has desired nuclear power in the 100 kW range for applications involving space propulsion and planetary surface power.

This talk will focus on the design of the small 1 kW reactor, the proof of concept test and the potential follow-on program.

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