

DHS National Technical Nuclear Forensics Program FY 10 Summary Report: Graduate Mentoring Assistance Program (GMAP)

Martha A. Finck

October 2011



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Approved by:

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Date

EXECUTIVE SUMMARY

Several DHS NTNFC Graduate Fellows worked with INL professional staff mentors in nuclear forensics research programs for the practicum portion of the program. This summary report details the graduate Fellow practicum experience, as well as a proposed seminar/interview process for placement of future Fellows at the INL.

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ACRONYMS

CAES	Center for Advanced Energy Studies (INL)
DOE	Department of Energy
GMAP	Graduate Mentoring Assistance Program
INL	Idaho National Laboratory
INMM	International Nuclear Materials Management
NF	Nuclear Forensics
TRISO	Tristructural-isotropic (TRISO) fuel is a type of micro fuel particle

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INTRODUCTION

This program provides practical training to DHS graduate fellows in the DOE laboratory complex. It involves coordinating students, their thesis advisors, and their laboratory project mentors in establishing a meaningful program of research which contributes to the graduate student's formation as a member of the nuclear forensics community. This final written report includes information concerning the overall mentoring experience, including benefits (to the lab, the mentors, and the students), challenges, student research contributions, and lab mentor interactions with students' home universities.

Idaho National Laboratory hosted two DHS Nuclear Forensics graduate Fellows (nuclear engineering) in summer 2011. Two more Fellows (radiochemistry) are expected to conduct research at the INL under this program starting in 2012. An undergraduate Fellow (nuclear engineering) who worked in summer 2011 at the laboratory is keenly interested in applying for the NF Graduate Fellowship this winter with the aim of returning to INL.

Jennifer Dolan returned this year from a previous summer internship at INL and is a nuclear engineering student from University of Michigan who worked with INL mentor Dr. David Chichester. Dr. David Chichester holds a Sc.D in Nuclear Engineering from Massachusetts Institute of Technology and his research focus lies in the areas of neutron generator design and operation, nondestructive analysis of special nuclear material, radiation transport modeling, and neutron detection. The DHS research practicum included simulation, modeling, and experimentation related to nuclear safeguards/detection, dealing primarily with fast neutron detection and characterization in energy and time. Determination of the research topic for the summer research practicum and placement of the Fellow were facilitated since Jennifer had spent previous summer internships at the INL working with Dr. Chichester.

Ms. Dolan presented her research at the INMM (International Nuclear Materials Management Annual Meeting) in California in July 2011 (abstract attached). This conference is a good experience for students to discuss their research with a professional audience and is an important part of the INL summer internship program for graduate as well as undergraduate interns.

Jenny Martos is a nuclear engineering student at UC Berkeley (faculty advisor Dr. Peter Hosemann) who worked with INL mentor Dr. Maria Okuniewski. The arranged research program is a continuation of the work included in her master's thesis, "Ultra Small Scale Advanced Fuel Form Characterization to Evaluate Fission," which involved applying nanoscale mechanical testing and microscopy characterization on advanced fuel forms, such as TRISO particles, in order to evaluate how they fail and if their failure can lead to fission product release. Her practicum work will involve nano-indentation testing on both irradiated and non-irradiated TRISO particles using the INL Materials Facilities at CAES. Dr. Maria Okuniewski holds a Ph.D. in Nuclear Engineering from University of Illinois and is a research and development scientist and engineer whose work focuses on basic fuel properties and modeling. The placement and research program determination of this Fellow was also based on previous contacts and collaboration between the INL mentor and the academic advisor.

Ms. Martos presented her research at the 2nd Annual U.S. Department of Energy Nuclear Energy Programs Materials Science and Engineering Materials Cross-cut Workshop and The 5th Annual Asia-Pacific Nuclear Energy Forum on Materials for Nuclear Applications which took place at the Berkeley Nuclear Research Center at UC California in June 2011.

A third student is scheduled to start the DHS NF practicum in summer 2012. Erin Gantz is a graduate student at UC Berkeley in radiochemistry research. Her thesis research involves radiochemical separations of americium and uranium under the supervision of her faculty advisor Heino Nitsche. Her INL mentor will be Dr. Terry Todd. Erin had previously worked as an undergraduate summer student with Dr. David Chichester at the INL. Placement of this Fellow is planned with a member of Terry Todd's radiochemistry group. Dr. Terry Todd is a nationally recognized expert in radiochemical separations and is an INL laboratory fellow. Dr. Todd is a talented and energetic radiochemical engineer who has worked primarily in separation of radioactive materials from spent nuclear fuel and nuclear waste.

A fourth NF Graduate Fellow, Mathew Snow, is interested in conducting his practicum at the INL starting in 2012 in the area of radiochemistry as it applies to nuclear/radiological forensics. Matthew is a second year graduate student of Prof. Sue Clark at Washington State University. He spent summer 2011 conducting research with INL staff member Dr. Dean Peterman in the characterization of a novel actinide chelator. Mathew expressed an interest in working on a proposed project (INL LDRD) which involves collaboration with Dr. Clark at WSU. The placement of this fellow is pending, provided funding is approved for this program of research. The possibility of placing this student with the Radiochemistry group is currently under discussion.

An undergraduate Fellow, Sabrina Ireland, has expressed an interest in applying for the Graduate Fellowship. Sabrina spent a challenging summer internship at the INL in 2011 and would be open to working in nuclear forensics programs with a mentor from the nuclear engineering directorate at the laboratory.

For future placement of DHS graduate fellows where the student is not necessarily familiar with the laboratory's potential mentors and their research programs, it is proposed that the fellow visit the laboratory (January prior to the practicum period) and meet various staff as well as present his/her research interests/experience. Once a laboratory mentor and fellow have been assigned, it is further proposed that the INL researcher make an initial visit to the host university to discuss the student's thesis research and the corresponding laboratory practicum with the academic advisor and student. Student and mentor travel costs would be reimbursed by DHS. Additional funding will be requested for this placement process. In this manner, solid commitments and expectations will be set well in advance of the actual summer research experience.

Idaho National Laboratory has the mentoring expertise and the laboratory capabilities that provide an ideal training opportunity for graduate students in nuclear forensics. INL is the premier DOE laboratory in nuclear energy research where the traditional areas of nuclear fuel characterization and radiochemical separations, in which INL has many years of research experience, can be applied to nuclear forensics. INL expertise in neutron detection within the National & Homeland Security domain is also widely recognized. Indeed, active recruitment for individuals into this program was not a major factor since all candidates contacted the laboratory first seeking to work with professional staff within various areas of INL. INL research staff members are dynamic and very active in their fields and welcome these highly qualified graduate students into nuclear forensics research programs.

CHALLENGES AND SUCCESSES OF THE NF PRACTICUM

The involvement of DHS NF fellows in laboratory research makes a positive impact on both their careers and the programs to which they contribute. The long-term effect has yet to be measured, however, past experience indicates that even in informal internship programs, the best students are attracted and return to the DOE laboratory system to establish their careers. The summer school program operating under the auspices of the DHS NTNFC program also has been effective in drawing talented students to the field of nuclear forensics. Graduate Fellows have on several occasions mentioned that it was a factor in their decision to apply for the Fellowship, and seems to be an effective way to raise awareness of the field. The ability of the INL to attract and retain such talent is a credit to the effective mentoring in INL Homeland Security and the strength of the technical programs and staff.

Many students will maintain an apartment near their home university for the summer while they are in Idaho for the practicum and will make double payments in rent. The DHS housing stipend appears not to be sufficient to cover these costs. This minor issue should be addressed in order not to discourage students from accepting the scholarship as it seems to be a problem with several graduate Fellows. The Graduate Fellows were reimbursed by their respective INL mentors for supplementary housing costs this summer 2011 using check requests from the mentor research budget.

The issue of security clearances for the Fellows that will allow them to access necessary INL restricted laboratories is a possible issue. Although some students will have already been through the process and will have obtained DOE clearance before their arrival at INL, this is usually not the case. An efficient mechanism is needed to take care of this often lengthy process before the students arrive ready to conduct research at the host laboratory. Discussions are underway to find a path forward at INL to start the DOE clearance process well in advance of the student's practicum.

The generous DHS mentor stipend that compensates these dedicated professional staff for the time they spend with the students is quite welcome. This funding has been put to good use by current mentors, Dr. Chichester and Dr. Okuniewski. This allows them to actually give more time and attention to the Fellow and enhances the practicum experience during the relatively short time the student will spend at the laboratory. Presentation of results at conferences with the student and face to face interaction with university thesis advisor are some of the applications of this stipend. Further funding will be requested for current Fellows to make a trip to INL to present their research interests and interview with potential mentors. This approach was suggested by Dr. Chichester in order to make the best match possible.

The recruitment/selection/placement process for these graduate Fellows is a competitive one as it takes place within the DOE laboratory system. These highly qualified students benefit from being sought after by various laboratories where the research practicum experience can sometimes eventually lead to a permanent professional posting. While the best and brightest merit such a scholarship, politics may sometimes influence the selection process. The transparency of the application evaluation process in particular is critical to maintaining the integrity of the merit scholarship and of the quality of professionals being trained to enter the field of nuclear forensics.

In summary, this program appears to have great potential for success in supporting graduate level students who pursue careers in nuclear forensics. This relatively specialized field may not have been an obvious choice for some who have already shown talent in the traditional areas of chemistry or nuclear engineering. The active recruiting for this scholarship program for candidates at universities across the U.S. brings needed visibility to this field. Not only does this program offer critical practical training to these students, it brings attention to a very attractive field of work where young professionals are urgently required in order for the future. The effectiveness of retaining such talent remains to be seen and may be primarily controlled by the availability of DOE laboratory research funding in this field in the years to come.