

U.S. DEPARTMENT OF ENERGY



Rickover Fellowship Program In Nuclear Engineering

Student Deadline for Applications for 2013-2014
January 31, 2013

Awards Announced April 2013

PREPARED FOR
U.S. DEPARTMENT OF ENERGY, NAVAL REACTORS DIVISION
BY
KNOLLS ATOMIC POWER LABORATORY,
BETTIS ATOMIC POWER LABORATORY

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AN INTRODUCTION TO THE RICKOVER FELLOWSHIP PROGRAM IN NUCLEAR ENGINEERING

This program is designed to meet the needs of the Naval Reactors Division of the U.S. Department of Energy (DOE) for appropriately trained personnel for the maintenance and development of science and engineering technology as it pertains to naval nuclear propulsion. The program will assist in preparing students for roles in naval nuclear propulsion and will support the broader objective of advancing fission energy development through the research efforts of the fellows. The technical areas with greatest interest include reactor physics, nuclear materials science and engineering, radiation shielding technology, thermal hydraulics, and computational fluid dynamics. The principle emphasis is on students seeking Ph.D. degrees in nuclear engineering, or in closely related fields.

APPLICATION PROCEDURES

ELIGIBILITY

Students with undergraduate degrees in the physical sciences or engineering are eligible to apply for the Rickover Fellowship Program in Nuclear Engineering. The program is open to all individuals who will be starting graduate studies or graduate students who are currently enrolled in a qualified course of study (see Areas of Research below) but have not yet selected a thesis topic. The award is limited to 48 months maximum for doctoral candidates. Awards may be limited to less time than the maximum in some situations.

Applicants must be U.S. citizens. If any applicant is a dual citizen, they would be required to renounce their non-US citizenship in order to be interviewed as a finalist, and ultimately to accept the Fellowship award. Applicants must be capable of obtaining a security clearance from the DOE as discussed below. If a clearance is not granted in a timely manner, the fellow will not be allowed to continue in the program. Employees of the DOE Naval Reactor Programs and their contractors are not eligible for the Rickover Fellowship Program in Nuclear Engineering. Title VII of the Civil Rights Act of 1964, as amended, prohibits discrimination in hiring, promotion, discharge pay, fringe benefits, job training, classification, referral, and other aspects of employment, on the basis of race, color, religion, sex or national origin.

APPLICATION DEADLINE

Application forms (see page 9) will be available from approximately September through early January. Applications from previous years or from other fellowship programs may not be used. Completed applications will be accepted through January 31st for fellowships beginning the following September. An application consists of the following sections:

- Background Information including References (3 Required)
- Statement of the Applicant's Academic and Career Goals
- List of Current and Planned Courses
- Transcripts (Official Undergraduate and Graduate Transcripts Required.)
- GRE scores (ETS code is 5949. Scores must be sent directly from ETS.)
- Authorization for Release of Information Form

Please Note: All parts of the application must be received at the Medical University of South Carolina (MUSC), Office of Special Programs (OSP) by January 31st. GRE scores are required for a complete application. Late and/or incomplete applications will not be reviewed for awards.

Application materials can be submitted electronically, mailed to the address below, or emailed to Nicole Huchet at nhuchet@scuref.org. Electronic applications are available on the forms page of the SCUREF website at www.scuref.org under the "RFP" tab.

Medical University of South Carolina
Office of Special Programs, Rickover
19 Hagood Avenue, HOT 304-H4
MSC 851
Charleston, South Carolina 29425-8510
nhuchet@scuref.org, (843) 792-0832

FELLOWSHIP OBLIGATIONS

ENROLLMENT

During the fellowship period, fellows are expected to be registered and enrolled as full-time graduate students, and must perform study and research at their university within the objectives of the fellowship program. During the summer, fellows should be at their university involved in full-time research related to the completion of their degrees, be enrolled in classes, or be on practicum assignments. Refer to the Practicum section of this booklet for a description of these assignments.

TERMS OF APPOINTMENT

Each fellow must agree to the conditions contained in the letter of appointment including provisions for obtaining a security clearance. A fellow must agree that at the end of the appointment period to become employed by either the Knolls or Bettis Laboratory (the laboratory will be specified in the appointment letter). The required employment period will be one year for every two years of support. The practica will be performed at the same location as the agreed upon required employment. Knolls Laboratory is located near Schenectady, New York and Bettis Laboratory is located near Pittsburgh, Pennsylvania. Both Bettis and Knolls Laboratories are operated for the DOE by Bechtel Marine Propulsion Corporation (BMPC), a wholly owned subsidiary of the Bechtel Corporation.

ANNUAL RENEWAL OF FELLOWSHIP

Each fellowship appointment is renewed annually through a renewal application process. The renewal is based upon the fellow's academic performance and course of study. These forms along with current official transcripts must be submitted to MUSC by January 31st of each year. It is required that a DOE security clearance be obtained prior to renewal. Fellows must inform MUSC of their current addresses and must complete any evaluation/assessment questionnaires sent by MUSC for program information and/or evaluation.

SECURITY CLEARANCE

At the beginning of the fellowship appointment, all Rickover fellows will be required to complete applications for an "L" clearance with the DOE. This clearance will allow the Rickover fellow to interact more freely with Knolls and Bettis Laboratories engineering and scientific staff and to become a part of the Naval Reactors nuclear propulsion community. In most cases, it will take approximately six months for a Rickover fellow to receive clearance. If clearance is not granted within one year of submittal, or if the fellow is notified that clearance processing cannot be completed, support may be discontinued prior to the end of the current appointment year. No renewal appointments will be granted to Rickover fellows who are not able to obtain a security clearance. It is expected that fellows will maintain their security clearance for the duration of their appointment.

PRACTICUM

Rickover fellows are required to participate in at least two practica for at least three months each at a DOE Naval Reactor research laboratory to gain applied experience. As described above, a DOE security clearance must be obtained prior to the first practicum and maintained throughout the duration of the fellowship. The first practicum is normally held during the summer at the end of the first year of the fellowship. The practicum will be performed at the same location as the fellows agreed upon required employment (either Knolls or Bettis Laboratory as noted in the appointment letter). Individuals who should be contacted regarding practicum assignments are listed on page eight of this booklet. Prior internships or similar appointments to DOE facilities may NOT be substituted for the practicum requirement associated with this fellowship.

In addition, the Laboratories require a physical exam, including drug screening, conducted at the Laboratory where the practicum will be performed. Travel expenses for travel to complete the physical exam will be reimbursed.

QUALIFIED ACADEMIC AREAS

Rickover fellows must be enrolled in an academic course of study and pursue research applicable to the science and engineering programs for the Rickover Fellowship Program in Nuclear Engineering. A fellow's academic program must be structured so that it supports one of the following research areas:

AREAS OF RESEARCH

REACTOR PHYSICS

- Research on data for modeling nuclear phenomena including their improvement and assessment against worldwide experiments
- Development of advanced Monte Carlo techniques to solve the neutron transport equation for complex material arrangements in three-dimensional geometries using novel variance reduction procedures
- Improvements in methods using the diffusion approximation for calculating core neutronic behavior with burn up in the design of reactors
- Development and application of accurate and efficient deterministic methods for solution of the neutron transport equation for realistic, three-dimensional reactor core geometries.
- Investigation of procedures with improved accuracy and efficiency for evaluation of important reactor design parameters
- Development of advanced experimental techniques (e.g. measurement of sub-criticality, determination of fissile content in spent fuel)
- Development of advanced or innovative reactor design concepts

MATERIALS SCIENCE

- Performance prediction of nuclear fuels
- Advanced materials for use in neutron environments
- Corrosion in nuclear environments
- Fission product attack of materials
- Instrumentation for in-core measurements
- Fundamental studies of neutron and fission fragment damage to materials
- Computational material science studies

THERMAL HYDRAULICS AND COMPUTATIONAL FLUID DYNAMICS

- Measurements and modeling of the characteristics of thin liquid films in two-phase flow
- Measurements and modeling of void fraction, velocity and interfacial area in two- phase flow regimes under a wide range of conditions

- Mechanistic modeling of critical heat flux in the nucleate boiling and departure from nucleate boiling (DNB) regime
- Direct measurement and modeling of wall shear and pressure drop in two-phase flow
- Measurement and modeling of the size of liquid droplets and entrainment rates in annular two-phase flow
- Investigation of the calculational stability of various two-phase flow source terms
- Measurements and modeling of transient two-phase flow
- Development of a single-phase and/or two-phase Computational Fluid Dynamics (CFD) validation, uncertainty quantification and best-estimate plus uncertainty design methods
- Measurement of single-phase and/or two-phase flow field quantities required to validate CFD methods
- Development of new turbulence models for internal, anisotropic flows for application to CFD

SHIELDING

- Improved parallel efficiency in deterministic transport calculations
- Discontinuous mesh computations for large 3D problems
- Application of Monte Carlo to large scale shielding problems
- Hybrid Monte Carlo/deterministic shielding methods

THESIS RESEARCH

Rickover fellows must perform their PhD thesis research in one of the Areas of Research listed in the previous section, or in a related field with the approval of MUSC. A Knolls or Bettis Laboratory scientific staff member is generally assigned to the fellow's graduate committee by the fellow's university. All thesis topics must be unclassified. Thesis research assignment forms must be completed by the fellows and submitted to MUSC for approval. All forms are provided by MUSC.

EVALUATION OF APPLICATIONS

When an application is received, the staff at MUSC reviews the application to ensure that the applicant meets the basic criteria and has submitted all required application materials. If time permits, the staff will attempt to contact applicants who have submitted an incomplete application. However, it is the applicant's responsibility to check with MUSC to ensure that an application is complete.

After an application is checked and designated complete, it is submitted, along with all other complete applications, to a review panel. The review panel is composed of Naval Reactors Sites personnel, who are directly responsible for analysis and research in nuclear science and engineering areas applicable to the program. The panel reviews each application and selects finalists, which are then invited for in-person interviews. The review panel will subsequently select award recipients. Applications are reviewed on the basis of grades, GRE scores, career and goals statements, areas of research intent, and references. Professional personnel needs of the DOE Naval Reactors research program are also considered.

The number of awards given each year is dependent on the available funding and the qualifications of the candidates. Some applicants who do not receive awards are selected for "Honorable Mention" status. This status recognizes their achievements and places them on a list for a possible award should additional funding become available.

MUSC will notify applicants of their award status. Notification usually occurs in early April of each year. Once fellowships are awarded, MUSC handles the administration of the fellowship for the Naval Reactors Program. Questions about stipends, payment of tuition and fees, practicum assignments, travel, etc. should be referred to MUSC. Shortly after acceptance of the

appointment, an advisor from the Bettis or Knolls Laboratory will contact the fellowship recipient. This advisor is tasked to aid the recipient in selecting a research topic, and, as previously mentioned, will be assigned to the fellow's graduate committee.

PROGRAM BENEFITS

Fellows receive a monthly stipend in the amount of \$2,600. The fellow's basic stipend is augmented by an additional \$650 (prorated) dislocation allowance each month during the practicum. Stipends are mailed each month directly to the fellow or deposited directly into the fellow's bank account.

Naval Reactors attempts to provide adequate funding to fellows for meeting the costs of graduate school. No other student support that requires work or any other obligation such as teaching or research assistantship can be accepted. Other awards, prizes, and similar type payments (including veteran's benefits) that do not require a service may be accepted without a reduction in the stipend. Please contact MUSC if you have a question regarding accepting the Rickover Fellowship in conjunction with any other award, prize, or similar type payment.

TUITION AND FEES

The fellow's required tuition and fees are paid by MUSC directly to the participating university upon receipt of invoice. Optional, refundable, and penalty fees (such as late registration and duplication fees) are not payable by MUSC. Health insurance fees will be paid by MUSC only if they are certified to be required for all graduate students at the fellow's university. All tuition and fee charges must be certified to be consistent with those made to regular graduate students and necessary for enrollment into the graduate program.

In August of each year, MUSC notifies the bursar's office at each university regarding invoicing procedures for fellowship students. Students will receive a copy of this correspondence and should retain this copy for use in discussing any billing errors with their university's bursar office.

PRACTICUM

Travel expenses will be reimbursed for the fellow to travel to/from the practicum site providing that the distance is more than 50 miles one way from the fellow's university. Transportation expenses for travel actually performed will be paid. Travel by private automobile will be reimbursed at the current government rate per mile; travel by air will be reimbursed at the cost of the lowest commercial airfare. No expenses are paid for food or lodging at the practicum site. All travel must be authorized in advance by MUSC.

CONFERENCE TRAVEL

Fellows have the opportunity, dependent upon available funding, to attend national or international conferences. Reimbursement for conference travel is only approved when the student is presenting a paper or poster. Requests for travel funds should be made in writing to the fellowship office at MUSC at least two months before the anticipated travel dates.

STUDENT ASSISTANCE AWARDS

All Rickover fellows have the opportunity to apply for student assistance awards. These awards may be used for the purchase of laboratory equipment, instrumentation, software, computer hardware etc. They are restricted to one grant for a maximum of \$10,000 per Rickover fellow. All student assistance awards must receive a 100% cost share from the university. Applications for student assistance must be requested through MUSC. The approval of the awards is contingent on need and relevance to the research of the Rickover fellow.

APPOINTMENT OF LABORATORY ADVISOR TO THE RICKOVER FELLOW'S COMMITTEE

It is expected that every effort will be made to appoint the Rickover fellow's advisor from either the Knolls or Bettis Laboratory to the Rickover fellow's Graduate Committee. The fellow's host university will arrange this appointment and the fellowship program administrators will assist to ensure that this appointment is finalized. Opportunities may be provided to faculty advisors to interact with the fellow's sponsoring laboratory. This may include short-term visits to the sponsoring laboratory.

EXTERNAL RELEASE OF INFORMATION

REQUIRED APPROVALS OF RESEARCH INFORMATION

The abstract of the thesis research will be checked for consistency with one of the topical areas listed in the program description. Each fellow is required to keep a notebook describing accomplishments made while on a practicum assignment at one of the two Naval Reactors Laboratories. The notebooks will be reviewed at the laboratories for classified material and external release of information after the completion of each practicum. After the notebooks have been approved, material contained therein may be published, presented, displayed, or released, to anyone outside of the Rickover Fellowship Program in Nuclear Engineering (including the academic institution). A similar review will be performed on the final draft of the undefended thesis. Three weeks should be allowed for this final review. The Knolls or Bettis Laboratory advisor will assist the fellow in obtaining the required approvals.

PUBLICATION ACKNOWLEDGMENT

DOE and MUSC encourage fellows to publish reports and articles in scientific and engineering journals. The fellow must submit any articles, reports, or thesis to MUSC prior to submission for publication. All publications will show the joint affiliation of the fellow with the university and, if appropriate, with the laboratory in which the research was conducted, and should acknowledge fellowship support.

Fellowship support should be acknowledged in the following manner:

This research was performed under appointment to the Rickover Fellowship Program in Nuclear Engineering sponsored by Naval Reactors Division of the U.S. Department of Energy.

RICKOVER FELLOWSHIP PRACTICUM LABORATORIES AND FELLOWSHIP COORDINATORS

KNOLLS LABORATORY

www.knollslab.com

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P.O. Box 1072
Schenectady, NY 12301-1072
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E-MAIL: ray.gamino.contractor@unnpp.gov

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Technical Advisor, Reactor Thermal
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BETTIS LABORATORY

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U.S. DEPARTMENT OF ENERGY,
DIVISION OF NAVAL REACTORS
RICKOVER FELLOWSHIP PROGRAM IN NUCLEAR ENGINEERING
2013-2014

A complete application consists of:

1. Application Form (*Hand written applications will **not** be accepted*)
2. Current Official Transcript of Grades (all undergraduate and graduate transcripts required and must be sent directly to the Office of Special Programs from the Registrar)
3. Three (3) Reference Forms (enclosed)
4. Official GRE Scores (Must be sent directly from ETS. Our institution code is 5949)
5. Authorization for Release of Information Form (signed)

Please make sure that you have completed all parts of the application and have obtained the proper signatures for each section. Keep a copy of this application and supporting materials for your files.

All application materials must be submitted to MUSC, Office of Special Programs by January 31, 2013. It is the applicant's responsibility to check with MUSC regarding the completeness of the application file. Incomplete applications will not be reviewed.

Application materials can be submitted electronically, mailed to the address below, or emailed to Nicole Huchet at nhuchet@scuref.org. Electronic applications are available on the forms page of the SCUREF website at www.scuref.org under the "RFP" tab.

Medical University of South Carolina
Office of Special Programs, RFP
19 Hagood Avenue, HOT 304-H4
MSC 851
Charleston, South Carolina 29425-8510
nhuchet@scuref.org, (843) 792-0832

AUTHORIZATION FOR RELEASE OF INFORMATION

In connection with my application for the Rickover Fellowship Program in Nuclear Engineering, I understand that Knolls Laboratory, Bettis Laboratory, or BMPC (hereafter referred to as the Company) may now, or at any time while I am a fellow, conduct an investigative consumer report containing information on my character, general reputation, personal characteristics, or mode of living. I hereby release the Company, its officers, employees, and agents from any liability and responsibility arising from the preparation or use of said report or investigations relating thereto. Further, in connection with such application, I understand that the report, or portions thereof, may be disclosed by the Company to other parties, provided such disclosure is consistent with the purposes herein identified and I release all parties from any liability arising from such disclosure. I am aware I have the right to request from the investigative agency, the nature, and scope of the investigative report.

This authorization for release of information includes but is not limited to matters of opinion relating to my character, ability, reputation, and past conduct. I authorize and request all persons, schools, corporations, credit bureaus and law enforcement agencies to release such information without restriction or qualification.

I authorize the National Personnel Records Center, St. Louis, Missouri or other custodian of my military record to release to the investigative agency, information or photocopies from my military personnel and related records, or only the following information/records:

(This may include a Photostat of the DD Form 214, Report of Separation.)

In connection with the purposes described herein, I voluntarily waive all recourse and release all parties from liability for complying with or providing information under this authorization. I am willing to allow a Photostat of this authorization be considered as effective and valid as the original.

Print Name

Signature

Date of signature

Social Security Number

A COPY OF THIS AUTHORIZATION HAS BEEN PROVIDED TO THE ABOVE

Knolls or Bettis Laboratory Representative

Date

APPLICANTS NAME: _____

RICKOVER FELLOWSHIP

BACKGROUND INFORMATION

8. Address: () Home () School (check one)

Street or Box Number: _____

City: _____ State: _____ Zip: _____

Phone Number: _____ Cell Phone: _____ E-Mail: _____

9. Are you a U.S. Citizen? Yes () No ()

10. Are you a dual citizen? Yes () No ()

11. Have you ever applied for the Division of Naval Reactors, Rickover Fellowship Program in the past? Yes () No ()

If yes, when? _____

12. Have you ever applied for permanent employment or an internship at the Bettis or Knolls Laboratory? Yes () No ()

If yes, when and where? _____

QUALIFICATIONS

13. Extracurricular Activities

List all technical societies and service organizations. Include offices held.

14. Practical Experience

List significant work experience gained from time in a laboratory setting or federal agency.

APPLICANTS NAME: _____

RICKOVER FELLOWSHIP

15. Academic Awards and Honors

List significant pre-college and undergraduate honors and awards and give a brief description of each.

16. Employment Record

List current and/or most recent employment. Give organization name and job title. You may attach a resume instead of filling this section out.

17. References

Please have three persons familiar with your academic preparation and your technical capabilities, preferably three faculty members who are familiar with your current academic work, send the attached reference forms directly to MUSC. A reference may be returned with the student application packet if it is placed in a sealed envelope with the reference's signature across the seal. These reference forms can be found in electronic format on the forms page of www.scuref.org under the RFP tab.

18. Previous Courses

List all science, engineering and mathematics courses that you have completed at all undergraduate and graduate institutions listed in this application. Provide course title and number, hours attempted, and letter grade. An example is provided below. Use additional sheets, if necessary.

<u>Course Title and Number</u>	<u>Hours</u>	<u>Grade</u>
<i>Example: Engineering 101</i>	<i>4</i>	<i>A</i>

(If grades listed above are numeric, please indicate what scale they are based on such as 4 pt. or 5 pt.)

APPLICANTS NAME: _____

RICKOVER FELLOWSHIP

19. Current Courses

List all courses in which you are currently enrolled give title of course and number of hours.

<u>Course Title and Number</u>	<u>Hours</u>
<i>Example: Engineering 101</i>	<i>4</i>

20. Planned Courses

List all courses you plan to take prior to September 2013.

<u>Course Title and Number</u>	<u>Hours</u>
<i>Example: Engineering 101</i>	<i>4</i>

APPLICANTS NAME: _____

RICKOVER FELLOWSHIP

21. Statement on Career Goals and Objectives

Provide information on your plans. Include statements regarding what your education means to you and how this will influence your career plans. Please relate this to one or more of the areas of research listed on page four of the program description. This statement is critical to the overall evaluation of your application. Use additional sheets if necessary, but limit the statement to 500 words or two typed pages.

Signature: _____

Date: _____

(In providing this signature, the applicant recognizes that the Medical University of South Carolina and the program sponsor Knolls and Bettis Laboratories have the right to verify all information contained in this application. Any false or misleading statements made by the applicant may result in either the removal of the application or termination of a fellowship appointment.)

This program application was prepared under Grant Number DE-NE0000393 between The U.S. Department of Energy and the South Carolina Universities Research & Education Foundation.

