AIR FORCE RESEARCH LABORATORY RESIDENT ASSOCIATESHIP PROGRAM Continuation

Robert Day
NATIONAL ACADEMY OF SCIENCES

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Final Report

DISTRIBUTION A: Distribution approved for public release.
# Abstract

The promotional schedule to advertise the National Research Council (NRC) Research Associateship Programs included the following: 1) attendance at meetings of major scientific and engineering professional societies; 2) advertising in programs and career centers for these and other professional society meetings; 3) direct mailing and emailing of announcements and program materials to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States; 4) posting announcements on internet job sites, electronic newsletters and professional society websites; 5) print advertising in high profile publications (e.g., Science magazine, the Chronicle of Higher Education); and, 6) maintaining a presence on social media sites such as Facebook. The NRC attended a number of minority focused events in which we maintained exhibit booths, participated in workshops and advertised in meeting literature, newsletters and websites or submitted materials for distribution. In addition, ads were placed in a variety of minority publications (e.g., Affirmative Action, Black Collegian).

# Subject Terms

Post-Doctoral research
During the reporting period, the NRC conducted the following activities in support of the subject contract:

**Outreach and Promotion**

The promotional schedule to advertise the National Research Council (NRC) Research Associateship Programs included the following: 1) attendance at meetings of major scientific and engineering professional societies; 2) advertising in programs and career centers for these and other professional society meetings; 3) direct mailing and emailing of announcements and program materials to presidents, graduate deans, and heads of appropriate science and engineering departments and minority-affairs offices of all academic degree-granting institutions in the United States; 4) posting announcements on internet job sites, electronic newsletters and professional society websites; 5) print advertising in high profile publications (e.g., Science magazine, the Chronicle of Higher Education); and, 6) maintaining a presence on social media sites such as Facebook.

The NRC attended a number of minority focused events in which we maintained exhibit booths, participated in workshops and advertised in meeting literature, newsletters and websites or submitted materials for distribution. In addition, ads were placed in a variety of minority publications (e.g., Affirmative Action, Black Collegian).

In advertising the Research Opportunities available to prospective applicants, the NRC maintained an up-to-date listing of all active Research Advisers, current Adviser contact information and details of each Research Opportunity.

**Processing and Review of Applications**

Applications to the Research Associateship Program were submitted via a web-based application system. Each of the four application cycles opened two months prior to the application deadline. NRC staff provided support to prospective applicants including providing application instructions, technical support and additional information as requested.

A summary of applications for the reporting period is shown in Table 1.

For each applicant, the NRC received and processed an application form, a research proposal, transcripts, a statement of previous and current research, and confidential reference reports. An application file check was made prior to the review and each applicant was notified if required documents were missing.

The NRC convened panels in five broad discipline areas for the competitive review of applications in the Research Associateship Programs. Results of the review were made available to Laboratory Program Representatives immediately following the conclusion of the each review.

A summary of the outcome of the review of applications for the reporting period is shown in Table 1.

**Administration of Awards**

The NRC made awards to applicants based on sponsor authorization. A summary of awards authorized and the acceptance or declination by the applicant during the current reporting period is shown in Table 1.

For Associates beginning or continuing tenure, the NRC provided the administrative functions described in the contract Statement of Work. These functions included stipend payments, management of a major medical benefits insurance program, and reimbursement for relocation and travel to professional meetings.
A summary of NRC Research Associates on tenure during the reporting period is shown in Table 2.

**Outcomes Reporting**

All NRC Associates who completed tenure were required to submit a final report that described the outcome of their Associateship award. Final reports received by the NRC during the current reporting period are attached to this technical report.

The activities of Associates submitting final reports during this reporting period, including publications, presentations and patents, as well as an assessment of their experience in the program, are summarized in Table 3. Specific research accomplishments of Associates completing tenure during the reporting period are summarized in Table 4.

**Table 1.** Applications and Awards

**Table 2.** Associates on Tenure

**Table 3.** Associates Activity

**Table 4.** Summary of Associate Research

**Attachments:** Associate Final Reports
## Table 1: Applications and Awards

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</tr>
<tr>
<td>DeMars, Kyle Jordan</td>
<td>Jah, Moriba K.</td>
<td>5/2/2011</td>
<td>12/31/2012</td>
<td>United States</td>
</tr>
<tr>
<td>Dennison, John Robert</td>
<td>Ferguson, Dale C</td>
<td>1/17/2012</td>
<td>1/16/2013</td>
<td>United States</td>
</tr>
<tr>
<td>Frueh, Carolin</td>
<td>Jah, Moriba K.</td>
<td>11/1/2011</td>
<td>10/31/2013</td>
<td>Germany</td>
</tr>
<tr>
<td>Heinrich, Jonathon Robert</td>
<td>Cooke, David L.</td>
<td>3/16/2012</td>
<td>3/15/2013</td>
<td>United States</td>
</tr>
<tr>
<td>Hock, Rachel Allison</td>
<td>Balasubramaniam, Karatholuva S.</td>
<td>5/1/2012</td>
<td>4/30/2013</td>
<td>United States</td>
</tr>
<tr>
<td>Lee, Christina On-Yee</td>
<td>Mozer, Joel B.</td>
<td>10/4/2010</td>
<td>10/3/2012</td>
<td>United States</td>
</tr>
<tr>
<td>Melko, Joshua Jennings</td>
<td>Viggiano, Albert A.</td>
<td>10/24/2011</td>
<td>10/23/2013</td>
<td>United States</td>
</tr>
<tr>
<td>Seletskiy, Denis V.</td>
<td>LeVan, Paul D.</td>
<td>10/1/2010</td>
<td>7/26/2012</td>
<td>United States</td>
</tr>
<tr>
<td>Shi, Yong</td>
<td>Su, Yi-Jiun Caton</td>
<td>1/16/2012</td>
<td>1/15/2014</td>
<td>China</td>
</tr>
<tr>
<td><strong>US Air Force Academy, Colorado Springs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ayachitula, Rajani</td>
<td>Knize, Randall J.</td>
<td>8/3/2012</td>
<td>8/2/2013</td>
<td>United States</td>
</tr>
<tr>
<td>Ghoreyshi, Mehdi</td>
<td>Cummings, Russell Mark</td>
<td>8/11/2010</td>
<td>8/10/2013</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Porter, Christopher Odell</td>
<td>McLaughlin, Thomas E.</td>
<td>11/1/2011</td>
<td>10/31/2013</td>
<td>United States</td>
</tr>
</tbody>
</table>
**Table 3: Associates’ Activities**

28 Associates ended tenure during the report period
22 months was the average tenure length
36 months was the longest
10 months was the shortest
22 submitted final reports

In the final reports, Associates indicated the following scholarly activity while on tenure.

- 33 Articles published in refereed journals
- 1 Patent applications
- 14 International presentations
- 131 Domestic presentations
- 4 Awards

After ending their tenure, Associates indicated their future plans as follows:

- 1 Permanent position at the NRC host agency
- 6 Contract or temporary position at the NRC host agency
- 0 Research/administrative position with another U.S. government agency
- 0 Research/administrative position with foreign government agency
- 10 Research/teaching at US college/university
- 1 Research/teaching position at a foreign college or university
- 1 Research/administrative position in private industry in the U.S.
- 0 Research/administrative position in private industry outside of the U.S.
- 0 Research/administrative position with a non-profit
- 0 Self-employed/consulting
- 2 Postdoctoral Research
- 0 Other
- 1 No information provided

In their final reports, Associates were asked to evaluate certain aspects of their experiences on a scale of 1 (low) to 10 (high). The average rating for each item follows:

- **9.0** Short-term value (lab)-Development of knowledge, skills, and research productivity at lab
- **8.9** Long-term value (career)-How your Research Associateship affected your career to date
- **8.9** Laboratory Support-Equipment, funding, orientation, safety & health training, etc.
- **9.1** Adviser Mentoring-Quality of mentoring from the Research Adviser
- **9.0** LPR Support-Quality of administrative support from the LPR
- **8.9** NRC Support-Quality of administrative support from the NRC
### Table 4: Summary of Associate Research

<table>
<thead>
<tr>
<th>Associate</th>
<th>Tenure Dates</th>
<th>Projects</th>
</tr>
</thead>
</table>
2. Initiated research on diagnostics and health management using hierarchical framework.  
3. Created modeling software to analyze Vapor Cycle Systems as part of TMS's. Enables the study of transient thermal phenomena. |
2. Constructed and tested rotary ball valve for Pulsed Detonation Engine use, with substantial improvements in volumetric efficiency.  
3. Developed computational code to compute heat transfer rates to pulsed detonation engine tube walls, found thermal barrier coating increased detonation tube wall temperatures.  
4. Demonstrated prechamber as knock mitigation technique, enabling full load operation down with a 60 octane PRF blend in a spark ignition engine.  
5. Demonstrated intercooler, optimized ignition timing, direct injection, and to reduce the octane requirement of the Rotax 914 from 100 to 87. |
| Beier, Hope     | 1/4/2010-11/16/2012   | 1. Developed a multiplex stimulated Raman scattering imaging system.  
2. Improved the spectral resolution of multiplex coherent Raman scattering spectra.  
3. Used coherent Raman scattering to measure the temperature of aqueous solutions with submicron resolution.  
4. Monitored the kinetics of ion influx into biological cells using a high-speed imaging system.  
5. Developed a system to acquire low-frequency Raman scattering spectra of biological molecules and compare to THz resonances. |
| Chakravarty, Uttam | 10/1/2010-8/13/2012 | 1. Biologically inspired wings of micro munition vehicles (MMVs) were constructed with membrane, attached to the metallic/composite reinforced structures.  
2. Finite element models were developed for the modal characteristics of the flexible wings of MMVs and validated by experimental and analytical results.  
3. The effects of added mass, damping, and aerodynamic loads on the modal characteristics (natural frequencies and mode shapes) of the wings were investigated.  
4. The wings were vibrated in vacuum and in air for investigating the effects of added mass and damping on their modal characteristics.  
5. Aerodynamic loads were estimated from the wind-tunnel test data, where the angle of attack of the wings and freestream velocity of air are varied. |
| Comfort, Kristen| 8/2/2010-8/1/2012     | 1. Identified a disruption in EGF dependent signal transduction by silver, gold, and iron oxide nanoparticles.  
2. Elucidated combinatorial bioeffects on a cellular, protein, and genomic level following concurrent exposure to nanoparticles and a static magnetic field.  
3. Evaluated the photothermal capability of gold nanorods during NIR laser irradiation and correlated the resultant heat production to nanorod aspect ratio.  
4. Discovered the impact of biologically relevant fluids on the photothermal efficiency of gold nanorods and successfully linked the diminution of thermal production to a solution-induced nanorod agglomeration phenomenon.  
5. Developed and implemented a new nano-bioeffect paradigm targeting lower, occupational exposure levels of nanomaterials. |
| Fillery, Scott  | 1/5/2009-1/4/2012     | 1. Dielectric breakdown strength in insulating materials in heavily dependent on the population of defects. Hence, control over the size, shape and orientation of inclusion fillers can significantly impact the high electric field behavior.  
2. Introduction of inorganic inclusions, in the form of low permitivity platelets, aligned to frustrate propagation of a failure path, show significant improvements in dielectric breakdown strength.  
3. Attachment of polymeric structures to the nanoparticle surface, while positively promoting an improved nanocomposite dispersion, does not provide an enhancement to dielectric breakdown strength. |
4. Improvements to capacitor energy density, when utilizing nanocomposite motifs, requires a delicate balance, increasing material polarizability while staunching deleterious defects that result in premature breakdown under applied fields.

5. Biomaterials, such as silk, show significant versatility, stemming from the large phase space of chain conformation. Highly crystalline chain conformations show improvements to dielectric breakdown strength of 150%.

Kane, Sushil 8/2/2010-8/1/2012
1. Synthesized nanomaterials (NMs) such as silver nanoparticles (AgNPs) and nanoscale zerovalent iron (nZVI) and Ni and Pd coated nZVI.
2. Remediation of carbon tetrachloride (CT) by nZVI and bimetallic (Ni and Pd) nZVI is investigated and found that nZVI and Bimetallic nZVI has fast kinetics to react CT. We found the highest efficiency ever reported in literature.
3. Fate and transport of AgNP was studied and found that AgNP transport differently at different pHs through porous media.
4. AgNPs and Ag ion showed different transport pattern through porous media.

Martin, Jennifer 11/1/2010-10/31/2012
1. Designed and utilized an aptamer selection for cortisol with a tunable stringency component integrated into the method. Found that more stringent conditions evolved the pool toward a single sequence dominating 45% of the final sequenced pool.
2. Developed equilibrium dialysis protocols for testing dissociation constants of aptamer/small molecule target binding. Confirmed a low micromolar Kd of a cortisol sequence.
3. Modified conditions to enable a ~30 nM limit of detection for cortisol the identified cortisol aptamer with a gold nanoparticle assay (serum cortisol ~200-450 nM).
4. Developed a method for testing aptamer/target interactions with custom DNA microarrays. Studied structural properties of aptamer/target binding (buffer conditions, purity, fluorescence reporting scheme, distance from chip surface).
5. Identified potential thrombin binding aptamers, each of which contained a sequence motif similar to the known 15-mer thrombin binding aptamer.

McClong, Amber 7/1/2009-2/13/2012
1. Established and validated the appropriate digital image correlation system, laser extensometer, high temperature grips, and environmental chamber for thermomechanical evaluation of shape memory polymers.
2. Thermal stability of shape memory polymers determined with thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC).
3. Appropriate post-cure cycles established for multiple shape memory polymers based on the preliminary TGA and DSC results.
4. The path-dependent axial behavior of both Veriflex-E and a BMI-based SMP were evaluated using dynamic mechanical analysis (DMA) and axial tensile tests.
5. The shape memory response of Veriflex-E was evaluated using DMA and axial tensile tests.
6. The strain rate dependence of Veriflex-E was evaluated using axial tensile tests.
7. Shape memory hybrids combining SMPs and SMAs were created and evaluated.

McConney, Michael 9/1/2009-8/17/2012
1. Developed a new fabrication technique to create polymer stabilized cholesteric liquid crystals that enables high contrast optical filters to be made.
2. Made an cholesteric optical filter that induces high contrast (hyper-reflectivity) when exposed to heat or to light.
3. Made an cholesteric optical filter that which is high contrast and the wavelength of the filter changes when exposed to heat or light.
4. Developed an electrically tunable cholesteric liquid crystal.
5. Developed a novel CW laser from a polymer stabilized cholesteric liquid crystal.

McDonald, Jonathan 1/18/2011-6/29/2012
1. Derived discrete representation of the Ricci tensor for Piecewise-flat manifolds.
2. Used our discrete Ricci tensor to provide a geometric discretization of Richard Hamilton’s Ricci flow equations on piecewise-flat manifolds.
3. Used discrete exterior calculus (DEC) to develop an inherently discrete analysis of curvature on simplicial geometries.
4. Applied techniques from Persistent Homology and quantum theory to demonstrate how quantum computations can be viewed as foliations of hypersurfaces whose geometry is determined by the correlation information between qubits.
5. Demonstrated the geometric view of quantum computation for 1D quantum cellular automata.

O’Connor, Alan 9/12/2011-7/31/2012
1. Demonstrated convergence of a distributed multi-agent system for agreeing on a collective sensing action when
there is uncertainty about the target dynamical model.

2 Computed an analytical formula for the Cramer-Rao Lower Bound on range and velocity estimation variance and its dependence on the emitted radar pulse-train length. This result was confirmed for a stationary target using an S-band radar.

3 Quantified the benefit of feedback control of radar pulse-train length. Showed that the actively controlled approach achieved a 14% reduction in tracking error and dwell-time cost for constant velocity targets compared to the best constant policy.

4 Developed detector/tracker for asteroids moving in image sequences. This was an application of cognitive-based data-association algorithms developed by my advisor. Demonstrated improved performance for data with occlusions of objects of interest.

**Rider, Keith** 7/18/2011-7/17/2012
- Measured particle deposition rates from helium droplet beam to compare with calculations.
- Designed and build magnesium and perfluoropolyether sources.
- Performed TPD/TPR experiments on magnesium and perfluoropolyether thin films.
- Performed DSC/TGA experiments on magnesium and perfluoropolyether bulk materials.
- Assisted with other experiments (XRD, SEM) of these and other materials.

**Sanders, Nathaniel** 8/1/2011-6/30/2012
- Developed a heating reactor for gas-phase molecules to be interfaced with molecular beam, mass spectrometer.
- Developed models for the pyrolysis of endothermic fuel simulant n-hexane under deoxygenated, low pressure conditions.
- Introduced a novel class of Boron Nitride-based nanomaterials as catalysts to modify distribution of reaction intermediates.
- Was able to differentiate classes of catalytic activity, and identify commonalities in catalytic behavior.
- Developed a supercritical sample reaction chamber to be safely integrated to instrument for future work.

**Seletskiy, Denis** 10/1/2010-7/26/2012
- High sensitivity spectroscopic methods developed.
- Using methods above, local cooling to 110 K has been measured, in agreement with the model.
- Bulk cooling to 119 K has been demonstrated.
- Laser cooling model has been extended to include effects of saturation.
- Cooling by 80 degrees has been demonstrated inside of a optically-pumped semiconductor laser cavity.

**Smith, Matthew** 6/1/2010-6/30/2012
- Created novel self-oscillating (BZ) gels based on the biomacromolecule gelatin and synthetic polymer p(AAm-co-APMA).
- Developed chemistries for effectively postfunctionalizing these gels with a Ru metal catalyst.
- Characterized chemical and mechanical behavior of BZ gelatin as a function of reactant concentration, gel size.
- Demonstrated gel printing and ink stamping techniques for effective patterning of catalyst, made first heterogeneous gels.
- Demonstrated conditions for synchronized, coupled oscillations between active patches, laid foundation for modular design.

**Voccola, Kaitlyn** 9/15/2011-9/14/2012
- For a polarimetric SAR system consisting of orthogonally polarized dipoles, we found a way to circumvent the standard assumption/approximation that the polarization properties of the transmitted waves remain constant throughout the flight trajectory.
- Completed numerical experiments comparing current polarimetric SAR imaging with our coupled polarimetric imaging approach for extended targets in clutter and found that it improved image signal-to-clutter ratio and mean-squared error.
- Developed forward model and imaging operator for a correlation based SAR imaging technique for targets and volume scattering clutter. Developed resolution analysis for the imaging scheme and found improvements over standard imaging.
- Created a clutter minimization technique based on avoiding certain pairs of correlated data which requires no knowledge of the clutter present in the scene of interest.
- Developed MATLAB code to simulate correlated SAR data and implement the correlation imaging scheme. It was found that clutter mitigation was successful for a variety of targets and for a variety of antenna trajectories.

**Wang, Peng** 10/1/2009-8/3/2012
- Capacity Optimization of MIMO Links with Interference: Derives the approximate theoretical capacity formula for MIMO links with interference through SVD. An Integer Programming algorithm is proposed to solve the capacity
### Resource Allocation in MIMO-based Ad Hoc Networks
Solves the problem of joint routing, scheduling, power control and bit rate selection with the goal of maximizing the system throughput that satisfies the given end-to-end traffic demands.

### Throughput Optimization of Cognitive Radio Networks
The optimal solution provides a theoretical upper bound of throughput for cognitive radio networks. Also, derives a theoretical upper bound when greedy solution is used to solve the MWIS problem.

### Throughput Optimization for Cognitive Radio Network with Slowly Varying Channels
Study the effect of aggregate delay; compare the optimal solution and the approximation solution, the centralized solution and distributed solution.

<table>
<thead>
<tr>
<th>Wu, Thomas</th>
<th>9/1/2010-8/14/2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Investigated design methodologies for aircraft synchronous generator, including main machine, exciter and pilot exciter.</td>
<td></td>
</tr>
<tr>
<td>2 Developed linear and nonlinear electrical models for aircraft synchronous generator.</td>
<td></td>
</tr>
<tr>
<td>3 Developed lumped element thermal and mechanical models for aircraft synchronous generator.</td>
<td></td>
</tr>
<tr>
<td>4 Updated nonlinear electromechanical actuator model.</td>
<td></td>
</tr>
<tr>
<td>5 Started to work on generator testing.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yang, Chi</th>
<th>6/22/2010-6/21/2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Developed optically pumped mid-infrared in-plane DBR semiconductor lasers, reached the record power of 3 W in a 7 nm spectral range.</td>
<td></td>
</tr>
<tr>
<td>2 Realized the first unstable resonator diode laser at 2 µm wavelength as precursor to unstable resonator quantum cascade lasers.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Introducing Gold Nanoparticles into PEDOT:PSS Layer.</td>
<td></td>
</tr>
<tr>
<td>2 Introducing Gold Nanoparticles into Active Layer.</td>
<td></td>
</tr>
<tr>
<td>3 Modifying the metallic electrode/active layer interface through nano-imprint patterning.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zunoubi, Mohammad</th>
<th>8/1/2011-7/31/2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Designed a Graphic Precessing Unit (GPU) high-performance computing system with a compute power of 15 Teratlops/s.</td>
<td></td>
</tr>
<tr>
<td>2 Implemented the first multiple computational tools for the analysis of coupled propagation equations for the Ultra-Short Laser Pulse (USPL) propagation.</td>
<td></td>
</tr>
<tr>
<td>3 Implemented the first multiple computational tools for the propagation of USPL in atmosphere and its interaction with matters.</td>
<td></td>
</tr>
<tr>
<td>4 Developed the massively parallel version of the above tool on GPUs to help speeding up the computation times by a factor of 70 over the convetional CPU tools.</td>
<td></td>
</tr>
</tbody>
</table>
1) Associate Last or Family Name
Alleyne

2) FORWARDING Address (to which your tax statement will be mailed)
Residence or Institution
Street
City, State, Zip
Urbana, IL, 61801

3) Today's Date
May 16, 2012

4) Host Agency
AFRL (e.g., AFRL)
Laboratory or Center
WPAFB (e.g., Wright Patterson AFB)
Division / Directorate / Department
RZP (e.g., High-Speed Propulsion)

5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)
Kirk Yerkes

6) TITLE OF RESEARCH PROPOSAL
Distributed Hybrid Thermal Management Systems for High Performance Aircraft Cooling Systems

7) SUMMARY OF RESEARCH DURING TENURE
Itemize significant findings in concise form, utilizing key concepts/words.

1) Developed a hierarchical approach to controlling Thermal Management Systems (TMS's) within complex air vehicles. Hierarchical approach is preferred method for handling distributed loads and storage.

2) Initiated research on diagnostics and health management using hierarchical framework.

3) Created modeling software to analyze Vapor Cycle Systems as part of TMS's. Enables the study of transient thermal phenomena.

4)

5) (USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) RESEARCH IN PROGRESS
Describe in no more than 100 words.

Merging the modeling framework with the control framework. Create an actual system model with realistic components to design hierarchical controller and test in simulation.

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals

b) Books, book chapters, other publications

c) Manuscripts in preparation, manuscripts submitted


10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide titles, inventors, and dates of applications.

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International
Domestic

Experimental Load Emulation for Multi-Evaporator Air Conditioning and Refrigeration Systems, 14th International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, IN, July 16-19, 2012

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES  Include dates, names and locations of seminars.

- Transient Thermal Systems Modeling and Control, University of Cincinnati, ME Dept, Jan 27, 2012
- Transient Thermal Systems Modeling and Control, University of California, Irvine, ME Dept, March 9, 2012
- Transient Thermal Systems Modeling and Control, University of Michigan, Controls Systems Seminar, March 30, 2012
- Transient Thermal Systems Modeling and Control, University of California, San Diego, ME Dept, April 6, 2012
- Transient Thermal Systems Modeling and Control, Rutgers University, MAE Dept, April 11, 2012

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE

Professor

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION

Mechanical Science and Engineering, University of Illinois at Urbana-Champaign

16) POST-TENURE POSITION STATUS / CATEGORY  Please indicate only one.

- Permanent position at the NRC host agency
- Contract or temporary position at the NRC host Agency
- Research/Administrative position with another U.S.-government agency
- Research/Administrative position with a foreign-government agency
- Research/teaching position at a U.S. college or university
- Research/teaching position at a foreign college or university
- Research/administration position in private industry in the U.S.
- Research/administration position in private industry outside of the U.S.
- Research/administration position with a non profit
- Self-employed/consulting
- Postdoctoral research
- Other (Please specify, possible)
- No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor – excellent), please rate the following:

SHORT TERM VALUE

- Development of knowledge, skills, and research productivity
  Comments
  It was good to know more specifics of the people and problems here at the lab. I did not pick up new skills but I did get to see how they may be applicable in various domains.

LONG TERM VALUE

- How the NRC Associateship award affected your career to date
  Comments
  The NRC Associateship award has had a neutral effect on my career to date. It will be more interesting to see how it affects my career in the future.

LAB SUPPORT

- Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
  Comments
  I have had everything that I’ve needed.

ADVISER/MENTOR SUPPORT

- Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
  Comments
  There was little contact between the mentor and myself on research related topics over the course of the year.

LPR SUPPORT

- Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
  Comments
  I think the admin support was very good. Things were turned around in a timely fashion. The LPR even came up with some admin solutions that were out of the box for the Educational Partnership Agreement we created.

NRC SUPPORT
Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

Comments
Very good.

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator
No handwritten signature required; but you may upload a scanned signature file below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asha Davis</td>
<td><a href="mailto:adavis@nas.edu">adavis@nas.edu</a></td>
</tr>
<tr>
<td>Linda Sligh</td>
<td><a href="mailto:lsligh@nas.edu">lsligh@nas.edu</a></td>
</tr>
<tr>
<td>Jason Thornhill</td>
<td><a href="mailto:jthornhill@nas.edu">jthornhill@nas.edu</a></td>
</tr>
<tr>
<td>Peggy Wilson</td>
<td><a href="mailto:pwilson@nas.edu">pwilson@nas.edu</a></td>
</tr>
<tr>
<td>Suzanne White</td>
<td><a href="mailto:swhite@nas.edu">swhite@nas.edu</a></td>
</tr>
</tbody>
</table>

Id#          Rev. July 2011  Proj/Act ID#
# Final Report

**Associate Last or Family Name:** Anderson

**First Name:** Eric

**M.I.:** K

**FORWARDING Address (to which your tax statement will be mailed):**

- **Residence or Institution:** residence
- **Street:**
- **City, State Zip:** Centerville, OH 45459

**FORWARDING Phone(s) and E-Mail (if known):**

- **Home Phone:**
- **Alt. Phone:**
- **Preferred E-mail:** eric.anderson.ctr@wpafb.af.mil

**Today's Date:** April 30, 2012

**Dates of Tenure:**

- from November 2, 2009
- to May 2, 2012

**Host Agency:** AFRL

**Laboratory or Center:** Wright Patterson AFB

**Division / Directorate / Department:** Turbine Engine Division, Combustion Branch

**Name of Laboratory NRC Adviser (and USMA Mentor, if applicable):** Dr. Joseph Zelina

## Title of Research Proposal

Knock Mitigation Techniques to Enable SI Engine Operation on Low Octane Fuels

## Summary of Research During Tenure

Itemize significant findings in concise form, utilizing key concepts/words.

1. Assisted in establishment of the Small Engine Research Laboratory (SERL) at AFRL to develop IC engine technology.

2. Constructed and tested rotary ball valve for Pulsed Detonation Engine use, with substantial improvements in volumetric efficiency.

3. Developed computational code to compute heat transfer rates to pulsed detonation engine tube walls, found thermal barrier coating increased detonation tube wall temperatures.

4. Demonstrated prechamber as knock mitigation technique, enabling full load operation down with a 60 octane PRF blend in a spark ignition engine.

5. Demonstrated intercooler, optimized ignition timing, direct injection, and to reduce the octane requirement of the Rotax 914 from 100 to 87.

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

## Research in Progress

Describe in no more than 100 words.

Continuing research includes development of a prechamber optimized for the Rotax 914 combustion chamber geometry. We are also an optically accessible single cylinder engine for studying direct injection and prechamber ignition in the Rotax 914. This engine will enable visualization of fuel sprays in a firing or motored engine with high speed video, laser induced fluorescence, or particle imaging velocimetry techniques. Flame development with the prechamber can be observed by recording natural flame luminosity and chemiluminescence.

## Publications and Papers Resulting from NRC Associateship Research

Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals


b) Books, book chapters, other publications

N/A

c) Manuscripts in preparation, manuscripts submitted

N/A

## Patent or Copyright Applications Resulting from NRC Associateship Research
Provide titles, inventors, and dates of applications.

N/A

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

Domestic


12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES Include dates, names and locations of seminars.
N/A

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE
N/A

14) POST-TENURE POSITION / JOB TITLE
Research Engineer

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
Innovative Scientific Solutions Inc., AFRL Contractor, my physical address: Building 71 Room 5, 7th St, WPAFB, OH 45433

16) POST-TENURE POSITION STATUS / CATEGORY Please indicate only one.

☐ Permanent position at the NRC host agency
☒ Contract or temporary position at the NRC host Agency
Abbreviate Host Laboratory/Center WPAFB
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
☐ Research/teaching position at a U.S. college or university
☐ Research/teaching position at a foreign college or university
☐ Research/administration position in private industry in the U.S.
☐ Research/administration position in private industry outside of the U.S.
☐ Research/administration position with a non profit
☐ Self-employed/consulting
☐ Postdoctoral research
☐ Other (Please specify, possible) ___
☐ No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
☐ Development of knowledge, skills, and research productivity
Comments
Working at AFRL/RZTC/SERL provided me with the opportunity to spend most of my time doing hands-on experimental research. I would have ranked this a full 10 with some additional guidance as to the overall goals of the laboratory would have been.

LONG TERM VALUE
☐ How the NRC Associateship award affected your career to date
Comments
The associateship allowed me to learn new skills in the Detonation Engine Research Facility as well as continue to learn IC engine testing and development. It also provided me the opportunity to teach at nearby universities. I would have ranked this a full 10 had I been able to publish/present more frequently.

LAB SUPPORT
☐ Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
Comments
Since SERL was a new laboratory, funding and equipment for our laboratory has improved dramatically since I began my fellowship. I feel that we now have funding and equipment which enables us to produce quality data. I have had no problems with the safety and health guidelines followed here.

**ADVISER/MENTOR SUPPORT**

I feel I could have used more interaction from my mentor. Most of my interaction on a day-to-day basis were with the non-NRC laboratory researchers. Additional input as to the expectations of the NRC would have been helpful.

**LPR SUPPORT**

All of my needs from the LPR were met quickly.

**NRC SUPPORT**

All of my needs in this area were met quickly. One area that is always tricky is figuring out income tax with the lack of official tax forms from NRC, but I understand that there are good reasons for NRC avoid providing 1099 or W-2 forms.

18) **PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.**

As stated above, more mentor input and the income tax issue could be areas for improvement.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator.

No handwritten signature required; but you may upload a scanned signature file below:

- Asha Davis: adavis@nas.edu
- Linda Sligh: lsligh@nas.edu
- Jason Thornhill: jthornhill@nas.edu
- Peggy Wilson: pwilson@nas.edu
- Suzanne White: swhite@nas.edu

Id# Rev. July 2011 Proj/Act ID#
# FINAL REPORT

1) **Associate Last or Family Name**  
   Beier

2) **FORWARDING Address (to which your tax statement will be mailed)**  
   Residence or Institution (Residence)  
   Street  
   City, State Zip  
   San Antonio, TX 78258

3) **Today's Date**  
   November 15, 2012

4) **Dates of Tenure**  
   from January 4, 2010  
   to November 16, 2012

5) **Host Agency**  
   AFRL  
   (e.g., AFRL)

6) **Laboratory or Center**  
   Joint Base San Antonio  
   (e.g., Wright Patterson AFB)

7) **Division / Directorate / Department**  
   711 HPW/RHDO  
   (e.g., High-Speed Propulsion)

8) **Name of Laboratory NRC Adviser**  
   (and USMA Mentor, if applicable)  
   Dr. Benjamin Rockwell

9) **TITLE OF RESEARCH PROPOSAL**  
   Stimulated Raman Scattering Imaging of Laser Induced Protein Denaturation

10) **SUMMARY OF RESEARCH DURING TENURE**  
    Itemize significant findings in concise form, utilizing key concepts/words.

   1) Developed a multiplex stimulated Raman scattering imaging system.
   2) Improved the spectral resolution of multiplex coherent Raman scattering spectra.
   3) Used coherent Raman scattering to measure the temperature of aqueous solutions with submicron resolution.
   4) Monitored the kinetics of ion influx into biological cells using a high-speed imaging system.
   5) Developed a system to acquire low-frequency Raman scattering spectra of biological molecules and compare to THz resonances.

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

11) **RESEARCH IN PROGRESS**  
    Describe in no more than 100 words.

   My current research is focused on using techniques such as spontaneous and coherent Raman scattering, high-speed imaging, and confocal and multi-photon microscopy for the investigation of biological response to electromagnetic exposure. Of particular interest is exploration of effects or specific information that can be gained from low-frequency Raman techniques and using this technique as an indirect comparison to direct terahertz exposure.

12) **PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**  
    Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

   a) Publications in peer-reviewed journals

   1. Beier HT, Roth CC, Tolstykh GP, Ibey BL, Resolving the spatial kinetics of electric pulse-induced ion release, Biochemical and Biophysical Research Communications (2012), 423(4), 863-866.

   b) Books, book chapters, other publications

   c) Manuscripts in preparation, manuscripts submitted

   2. Tolstykh GP, Beier HT, Roth CC, Thompson GT, Payne JA, Kuipers MA and Ibey BL. Activation of Intracellular Phosphoinositide Signaling after a Single 600 Nanosecond Electric Pulse, Biochemical and Biophysical Research Communications (2012), in internal review.
10) **PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**  
Provide titles, inventors, and dates of applications.

11) **PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES**  
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

**International**

1. Beier HT, Roth CC, Tolstykh GP, Ibey BL “Resolving the spatial kinetics of nanosecond pulse-induced calcium release” Bioelectrics, Kumamoto, Japan, 2012

**Domestic**


12) **SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES**  
Include dates, names and locations of seminars.

1. Beier , HT “Optical Approaches for Chemical and Biological Sensing: Whispering Gallery Modes and Stimulated Raman Scattering” Seminar for UT-San Antonio Physics Department, February 2012 (Invited)

13) **PROFESSIONAL AWARDS RECEIVED DURING TENURE**

1. AF Section 219 Venture Funds: “Investigation of Directed-Energy-Induced Membrane Dynamics using Stimulated Emission Depletion Nanoscopy “, Role: PI. (September 2012)

14) **POST-TENURE POSITION / JOB TITLE**

Research Biomedical Engineer

15) **NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION**

Air Force Research Laboratory  
711 Human Performance Wing  
Bioeffects Division  
4141 Petroleum Road  
Fort Sam Houston, TX 78234

16) **POST-TENURE POSITION STATUS / CATEGORY**  
Please indicate only one.

- Permanent position at the NRC host agency
- Contract or temporary position at the NRC host Agency  
  Abbreviate Host Laboratory/Center _____
- Research/Administrative position with another U.S.-government agency
- Research/Administrative position with a foreign-government agency
- Research/teaching position at a U.S. college or university
- Research/teaching position at a foreign college or university
- Research/administration position in private industry in the U.S.
- Research/administration position in private industry outside of the U.S.
- Research/administration position with a non profit
- Self-employed/consulting
- Postdoctoral research
- Other (Please specify, possible) _____
- No information provided
17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM

On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE

10 Development of knowledge, skills, and research productivity

Comments

The NRC program gave me the opportunity to work in a laboratory with equipment and resources not typically available in an academic setting, with free reign to work on projects of my own choosing. I was able to work directly with and learn from other scientists and technicians with many years of true laboratory experience. I do not believe I could have gained experience of this magnitude in an university setting.

LONG TERM VALUE

10 How the NRC Associateship award affected your career to date

Comments

The NRC program gave me the opportunity to establish a research program and apply for and be awarded research grants as a principal investigator that I will continue to work on as a federal civilian employee. It gave me the opportunity to prove my capabilities to my mentors and led directly to an offer of employment.

LAB SUPPORT

10 Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.

Comments

Support from the laboratory was outstanding. I was given unparalleled access to any equipment necessary for any experiment of my choosing, substantial start-up type funds to purchase any need supplies, my own laboratory space which I was subsequently allowed to upgrade as my space requirements increased, and access to technician support to help me meet my objectives. I was also given the opportunity to apply for additional research grants to expand my research program.

ADVISER/MENTOR SUPPORT

10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

Comments

I could not have asked for a more supportive mentor. He is always there to make sure I had everything I needed for my research program and as a member of the laboratory. He is always more than willing to go out of his way to solve any problem that I may have, whether with research, professionally, or personally.

LPR SUPPORT

10 Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)

Comments

Support from the LPR was outstanding. He always made sure we had everything we needed in the laboratory. He was also extremely supportive in ensuring I was well-taken care of in terms of my research program and future career.

NRC SUPPORT

9 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

Comments

Administrative support was typically excellent. I never had any issues with insurance, payroll, etc. Everyone in the NRC office was courteous and seemed willing to help. Travel reimbursement was a bit slow at times (up to two months) and sometimes required an over-abundance of justification; however, all issues were eventually resolved.

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required;
but you may upload a scanned signature file below:

Hope Beier

Id# Rev. July 2011 Proj/Act ID#

Asha Davis: adavis@nas.edu
Linda Sligh: bsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu
1) Associate Last or Family Name  
Chakravarty

2) FORWARDING Address (to which your tax statement will be mailed)  
Residence or Institution: University of New Orleans  
Street: Department of Mechanical Eng., 2000 Lakeshore Dr  
City, State Zip: New Orleans, LA 70148

3) Today's Date  
July 18, 2012

4) Host Agency  
AFRL
(e.g., AFRL)

5) Laboratory or Center  
Eglin AFB  
(e.g., Wright Patterson AFB)

6) Division / Directorate / Department  
Munitions Directorate  
(e.g., High-Speed Propulsion)

7) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)  
Jess Willard Curtis

8) TITLE OF RESEARCH PROPOSAL  
Experimental and Finite Element Modal Analysis of the Flexible Wings of Micro Munition Vehicles

9) SUMMARY OF RESEARCH DURING TENURE  
Itemize significant findings in concise form, utilizing key concepts/words.

1) Biologically inspired wings of micro munition vehicles (MMVs) were constructed with membrane, attached to the metallic/composite reinforced structures.
2) Finite element models were developed for the modal characteristics of the flexible wings of MMVs and validated by experimental and analytical results.
3) The effects of added mass, damping, and aerodynamic loads on the modal characteristics (natural frequencies and mode shapes) of the wings were investigated.
4) The wings were vibrated in vacuum and in air for investigating the effects of added mass and damping on their modal characteristics.
5) Aerodynamic loads were estimated from the wind-tunnel test data, where the angle of attack of the wings and freestream velocity of air are varied. (USMA Davies Fellow: please add summary of teaching, including classes taught.)

10) RESEARCH IN PROGRESS  
Describe in no more than 100 words.

Biologically inspired hair receptors are designed for detecting the surrounding air flow characteristics of micro munition vehicles. Finite element model is developed for investigating the deformation, shear force, and bending moment distributions of the hair receptors at different fluid flow velocities, considering both steady and unsteady aerodynamics. Dynamic characteristics (natural frequencies and mode shapes) of the hair receptors are also investigated at the steady and unsteady air flow regimes.

11) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH  
Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals

b) Books, book chapters, other publications

c) Manuscripts in preparation, manuscripts submitted

10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide titles, inventors, and dates of applications.

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International
1) Uttam Kumar Chakravarty, “Modal Analysis of Micro Air Vehicle Wings,” 9th International Conference on Mechanical Engineering (published only the abstract); Dhaka, Bangladesh: December 18–20, 2011.

Domestic

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES
Include dates, names and locations of seminars.
2) Uttam Kumar Chakravarty, “Mechanics of Composite Structures for Aerospace Applications,” Department of Aerospace Engineering, Embry-Riddle Aeronautical University, 600 S. Clyde Morris Blvd., Daytona Beach, FL 32114: March 26, 2012.

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE
Assistant Professor

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
Department of Mechanical Engineering, University of New Orleans, 2000 Lakeshore Dr, New Orleans, LA 70148

16) POST-TENURE POSITION STATUS / CATEGORY
Please indicate only one.
[ ] Permanent position at the NRC host agency
[ ] Contract or temporary position at the NRC host Agency
[ ] Research/Administrative position with another U.S.-government agency
[ ] Research/Administrative position with a foreign-government agency
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[ ] Research/teaching position at a foreign college or university
[ ] Research/administration position in private industry in the U.S.
[ ] Research/administration position in private industry outside of the U.S.
[ ] Research/administration position with a non profit
[ ] Self-employed/consulting
[ ] Postdoctoral research
[ ] Other (Please specify, possible)
17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM

On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
- Development of knowledge, skills, and research productivity
  Comments
  10

LONG TERM VALUE
- How the NRC Associateship award affected your career to date
  Comments
  10

LAB SUPPORT
- Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
  Comments
  10

ADVISER/MENTOR SUPPORT
- Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
  Comments
  10

LPR SUPPORT
- Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
  Comments
  10

NRC SUPPORT
- Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
  Comments
  10

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required; but you may upload a scanned signature file below:

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Asha Davis</td>
<td><a href="mailto:adavis@nas.edu">adavis@nas.edu</a></td>
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<tr>
<td>Suzanne White</td>
<td><a href="mailto:swhite@nas.edu">swhite@nas.edu</a></td>
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Id# Rev. July 2011 Proj/Act ID#
Remote Actuation of Epidermal Growth Factor (EGF) Signal Transduction through a Nano-based Mechanism

7) SUMMARY OF RESEARCH DURING TENURE  Itemize significant findings in concise form, utilizing key concepts/words.

1) Identified a disruption in EGF dependent signal transduction by silver, gold, and iron oxide nanoparticles.
2) Elucidated combinatorial bioeffects on a cellular, protein, and genomic level following concurrent exposure to nanoparticles and a static magnetic field.
3) Evaluated the photothermal capability of gold nanorods during NIR laser irradiation and correlated the resultant heat production to nanorod aspect ratio.
4) Discovered the impact of biologically relevant fluids on the photothermal efficiency of gold nanorods and successfully linked the diminution of thermal production to a solution-induced nanorod agglomeration phenomenon.
5) Developed and implemented a new nano-bioeffect paradigm targeting lower, occupational exposure levels of nanomaterials.

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) RESEARCH IN PROGRESS  Describe in no more than 100 words.

Currently, a NIR dependent, remote release of EGF is being developed which utilizes gold nanorods of various aspect ratio as a platform. Gold nanorods are functionalized with carboxylated PEG and EGF molecules are conjugated to via a well documented EDC/NHS reaction. Successful creation of these EGF-nanorod conjugates will be verified by dynamic light scattering, UV-VIS, and SEM. These conjugates will then undergo NIR laser irradiation with the released EGF being collected, quantified, and correlated to the nanorod aspect ratio and the degree of solution heating. Following optimization, this release mechanism will be used to induce EGF signaling in vitro.

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH  Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals


b) Books, book chapters, other publications


c) Manuscripts in preparation, manuscripts submitted


10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH

Provide titles, inventors, and dates of applications.

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

Comfort, K.K.; Maurer, E.I.; Braydich-Stolle, L.K.; Hussain, S.M. Inhibition of EGF-Induced Signal Transduction by Low Levels of Silver, Gold, and Iron Oxide Nanoparticles Presentation given at Materials Research Society (MRS), November 29, 2011, Boston, MA (Oral Presentation)

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES

Include dates, names and locations of seminars.


13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE

Postdoctoral Researcher

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION

Oak Ridge Institute for Science and Education, AFRL, Wright Patterson AFB, Dayton, OH

16) POST-TENURE POSITION STATUS / CATEGORY

Please indicate only one.

☐ Permanent position at the NRC host agency
☒ Contract or temporary position at the NRC host Agency
Abbreviate Host Laboratory/Center AFRL
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
☐ Research/teaching position at a U.S. college or university
☐ Research/teaching position at a foreign college or university
☐ Research/administration position in private industry in the U.S.
☐ Research/administration position in private industry outside of the U.S.
☐ Research/administration position with a non profit
☐ Self-employed/consulting
☐ Postdoctoral research
☐ Other (Please specify, possible) ______
☐ No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM

On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE

☒ Development of knowledge, skills, and research productivity

Comments

This was an excellent opportunity to expand my core knowledge base and skill set. Additionally, through the support I was provided, my NRC postdoctoral period was very productive, both professionally and research-based.

LONG TERM VALUE

☒ How the NRC Associateship award affected your career to date

Comments
I feel that the prestige associated with an NRC post-doctoral fellow will significantly strengthen my prospects for my future career. Furthermore, the skills I acquired through this fellowship will be incorporated into and strengthen my highlighted qualifications for future employment opportunities.

**LAB SUPPORT**
- Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.

**Comments**
The support I received from Dr. Hussain's laboratory was phenomenal. The equipment is state of the art and I was always provided with the materials and proper safety information that I needed to effectively perform my research. The multi-disciplinary approach Dr. Hussain has taken to his group was of a significant benefit to expanding my research capabilities and learning new laboratory skills.

**ADVISER/MENTOR SUPPORT**
- Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

**Comments**
I received nothing but the utmost level of support and encouragement from Dr. Hussain. He helped me grow as a scientist and a professional, while simultaneously introducing me to the Air Force environment. Furthermore, I always received the necessary funding for project completion and travel. Dr. Hussain has helped to direct me and provide advise for my future career path and what I have learned from him, I believe, will be invaluable in my future endeavors.

**LPR SUPPORT**
- Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)

**Comments**
Whenever I required assistance from Dr. Stone, such as travel authorization or fellowship renewals, these were always handled rapidly and in a very professional manner. Furthermore, he made himself very available at the beginning of my tenure to discuss my project and personally welcome me, which to me demonstrated his extreme investment in NRC fellows.

**NRC SUPPORT**
- Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

**Comments**
On the whole, I perceived the NRC support to be very good and Ms. Linda Sligh was more than willing to help me or to put me in contact with the appropriate person. The reimbursement for travel process was fairly straightforward and I received my reimbursement quickly. However, one concern I have is that I or my advisor were not informed that NRC changed their policy and no longer allowed for a 3rd year renewal, not allowing for adequate time to search for a new position.

18) **PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.**

1) Clearly outline if the renewal policies change to allow fellows adequate time line up another position.
2) Transition to per diem for meals instead of individual entry as this was a very time consuming process.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

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</tr>
<tr>
<td>Kristen K Comfort: Suzanne White: <a href="mailto:swhite@nas.edu">swhite@nas.edu</a></td>
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</tbody>
</table>

Kristen K Comfort

Rev. July 2011

Proj/Act ID#
1) Associate Last or Family Name | Fillery
---|---
2) FORWARDING Address (to which your tax statement will be mailed) | 
Residence or Institution | Residence
Street | 
City, State, Zip | Beavercreek OH 45431
3) Today’s Date | 
Dates of Tenure | from January 5, 2009 to January 4, 2012
4) Host Agency | AFRL
Laboratory or Center | Wright Patterson AFB
Division / Directorate / Department | Materials and Manufacturing
5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable) | Michael Durstock
6) TITLE OF RESEARCH PROPOSAL | Next Generation Polymer Nanocomposites: Implications to Capacitor Dielectrics and Energy Density
7) SUMMARY OF RESEARCH DURING TENURE | Itemize significant findings in concise form, utilizing key concepts/words.
1) Dielectric breakdown strength in insulating materials in heavily dependent on the population of defects. Hence, control over the size, shape and orientation of inclusion fillers can significantly impact the high electric field behavior.
2) Introduction of inorganic inclusions, in the form of low permittivity platelets, aligned to frustrate propagation of a failure path, show significant improvements in dielectric breakdown strength.
3) Attachment of polymeric structures to the nanoparticle surface, while positively promoting an improved nanocomposite dispersion, does not provide an enhancement to dielectric breakdown strength.
4) Improvements to capacitor energy density, when utilizing nanocomposite motifs, requires a delicate balance, increasing material polarizability while staunching deleterious defects that result in premature breakdown under applied fields.
5) Biomaterials, such as silk, show significant versatility, stemming from the large phase space of chain conformation. Highly crystalline chain conformations show improvements to dielectric breakdown strength of 150%.
8) RESEARCH IN PROGRESS | Describe in no more than 100 words.
1. Investigation into the potential of SiO2 nanoparticles, functionalized with a polystyrene surface coverage, to provide an enhancement in dielectric breakdown strength. SiO2 nanoparticles provide an ideal platform, due to the low dielectric constant, thereby providing no significant field enhancement to the polymeric phase, as well as the large breadth of synthesis routes.
2. Completion of research into the silk films as potential dielectric materials. Final characterization of silk phase and electrical properties.
9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH | Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.
a) Publications in peer-reviewed journals
b) Books, book chapters, other publications

0) **PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**
Provide titles, inventors, and dates of applications.

11) **PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES**
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

   International

   Domestic

12) **SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES** Include dates, names and locations of seminars.


13) **PROFESSIONAL AWARDS RECEIVED DURING TENURE**
Arthur K. Doolittle Award, Most Outstanding Paper, Polymeric Materials Science and Engineering Division, American Chemical Society, Spring 2009.

14) **POST-TENURE POSITION / JOB TITLE**
Technologist - Electronic Product Division

15) **NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION**
WL Gore and Associates, 555 Paper Mill Rd., Newark, DE, 19711

16) **POST-TENURE POSITION STATUS / CATEGORY** Please indicate only one.
- Permanent position at the NRC host agency
- Contract or temporary position at the NRC host Agency
- Research/Administrative position with another U.S.-government agency
- Research/Administrative position with a foreign-
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<td>Postdoctoral research</td>
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</tbody>
</table>

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM

On a scale of 1 – 10 (poor - excellent), please rate the following:

<table>
<thead>
<tr>
<th>SHORT TERM VALUE</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of knowledge, skills, and research productivity</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The associateship program, in combination with the post doctoral position at AFRL/RX provided in-valuable support towards developing new skills and knowledge. Allowing me to broaden my knowledge and skills base, becoming a more productive research scientist. The opportunity presented a entirely new research area from which I have developed skills that are intrinsic to my future position, as well as offering a new prespective of soft skills in proposal writing and communication skills.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LONG TERM VALUE</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>How the NRC Associateship award affected your career to date</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In examining my productivity and maturity, the NRC associateship has a broader and complete effect on my research career, than my graduate studies. The NRC associateship and AFRL post doctoral position will provide a far greater influence in communication, experimental design and writing than any other opportunity to this date.</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAB SUPPORT</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The support for equipment and funding at AFRL/RXBN was outstanding. I found the level of bureaucracy to be understandable for a military organization, but at times did stunt productivity and prevent full investigation into particular research areas. Health and safety was a primary concern at the laboratory, handled well at both orientation and periodically throughout my tenure.</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ADVISER/MENTOR SUPPORT</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The quality of mentoring at AFRL/RXBN was excellent. The door was always open, allowing for discussions of research and overarching projects direction. At the same time, there was space and support to pursuing differing ideas and concepts, not linearly related to the core mission.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LPR SUPPORT</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I only interfaced with the NRC Program Representative on official occasions, relating to travel requests and tenure extensions. As such, I can't reliably comment or rate the quality of support.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NRC SUPPORT</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The quality of support from the associateship administration was prompt and efficient. Questions relating to insurance, travel and changes to stipend were handled without delay.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required; but you may upload a scanned signature file below:

- Asha Davis: adavis@nas.edu
- Linda Slight: lslight@nas.edu
- Jason Thornhill: jthornhill@nas.edu
- Peggy Wilson: pwilson@nas.edu
- Suzanne White: swhite@nas.edu

Id# | Rev. July 2011 | Proj/Act ID# |
Kanel

2) **FORWARDING Address** (to which your tax statement will be mailed)

Residence or Institution
Street 2950 Hobson Way
City, State Zip Beavercreek, OH, 45433

3) **Today's Date**

July 31, 2012

4) **Host Agency**

AFIT/ENV
(e.g., AFRL)

**Laboratory or Center**
Wright Patterson AFB
(e.g., Wright Patterson AFB)

Division / Directorate / Department
AFIT
(e.g., High-Speed Propulsion)

5) **Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)**

Mark Goltz

6) **TITLE OF RESEARCH PROPOSAL**

Fate and Transport of Nano Materials in the Subsurface Environment and their Application to Groundwater Remediation

7) **SUMMARY OF RESEARCH DURING TENURE**

Itemize significant findings in concise form, utilizing key concepts/words.

1) Synthesized nanomaterials (NMs) such as silver nanoparticles (AgNPs) and nanoscale zerovalent iron (nZVI) and Ni and Pd coated nZVI.

2) Remediation of carbontetrachloride (CT) by nZVI and bimetallic (Ni and Pd) nZVI is investigated and found that nZVI and Bimetallic nZVI has fast Kinetics to react CT. We found the highest efficiency ever reported in literature.

3) Fate and transport of AgNP was studied and found that AgNP transport differently at different pHs through porous media.

4) AgNPs and Ag ion showed different transport pattern through porous media.

5) (USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) **RESEARCH IN PROGRESS**

Describe in no more than 100 words.

I was trying to use the study in column experiment, which resemles the real filed condition.

9) **PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**

Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals


b) Books, book chapters, other publications


c) Manuscripts in preparation, manuscripts submitted


10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH

Provide titles, inventors, and dates of applications.

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International


Domestic

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES  Include dates, names and locations of seminars.


13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE

Research Scientist

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION

2950 Hobson Way, Beavercreek Oh 45433, AFIT-Wright Patterson AFB

16) POST-TENURE POSITION STATUS / CATEGORY  Please indicate only one.

☐ Permanent position at the NRC host agency
☒ Contract or temporary position at the NRC host Agency
☐ Abbreviate Host Laboratory/Center ______
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
☐ Research/teaching position at a U.S. college or university
☐ Research/teaching position at a foreign college or university
☐ Research/administration position in private industry in the U.S.
☐ Research/administration position in private industry outside of the U.S.
☐ Research/administration position with a non profit
☐ Self-employed/consulting
☐ Postdoctoral research
☐ Other (Please specify, possible) ______
☐ No information provided
17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM

On a scale of 1 – 10 (poor - excellent), please rate the following:

**SHORT TERM VALUE**
- Development of knowledge, skills, and research productivity
  Comments
  10

**LONG TERM VALUE**
- How the NRC Associateship award affected your career to date
  Comments
  10

**LAB SUPPORT**
- Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
  Comments
  10

**ADVISER/MENTOR SUPPORT**
- Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
  Comments
  10

**LPR SUPPORT**
- Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
  Comments
  10

**NRC SUPPORT**
- Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
  Comments
  10

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

It would be nice to let the fellow to complete the three year tenure once hired.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator.

No handwritten signature required; but you may upload a scanned signature file below:

- Asha Davis: adavis@nas.edu
- Linda Sligh: bsligh@nas.edu
- Jason Thornhill: jthornhill@nas.edu
- Peggy Wilson: pwilson@nas.edu
- Sushi Kanel: swkane@nas.edu
- Suzanne White: swhite@nas.edu

Id#           Rev. July 2011           Proj/Act ID#
DNA MICROARRAYS TO IMPROVE THE APTAMER SELECTION PROCESS FOR ON-CHIP APPLICATIONS

7) SUMMARY OF RESEARCH DURING TENURE
   Itemize significant findings in concise form, utilizing key concepts/words.

   1) Designed and utilized an aptamer selection for cortisol with a tunable stringency component integrated into the method. Found that more stringent conditions evolved the pool toward a single sequence dominating 45% of the final sequenced pool.
   2) Developed equilibrium dialysis protocols for testing dissociation constants of aptamer/small molecule target binding. Confirmed a low micromolar K_d of a cortisol sequence.
   3) Modified conditions to enable a ~30 nM limit of detection for cortisol the identified cortisol aptamer with a gold nanoparticle assay (serum cortisol ~200-450 nM).
   4) Developed a method for testing aptamer/target interactions with custom DNA microarrays. Studied structural properties of aptamer/target binding (buffer conditions, purity, fluorescence reporting scheme, distance from chip surface).
   5) Identified potential thrombin binding aptamers, each of which contained a sequence motif similar to the known 15-mer thrombin binding aptamer.

   (USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) RESEARCH IN PROGRESS
   Describe in no more than 100 words.

   We are looking at testing the binding of several more cortisol aptamer candidates, and further decreasing the LOD of the AuNP detection assay to enable saliva-based detection (~10-25 nM). We are also working on confirming binding of the microarray potential thrombin aptamers by capillary electrophoresis and surface plasmon resonance methods.

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
   Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

   a) Publications in peer-reviewed journals

   b) Books, book chapters, other publications

   c) Manuscripts in preparation, manuscripts submitted

      • Martin, J., Chushak, Y., Chavez, J., Hagen, J., Kelley-Loughnane, N., "DNA Microarrays for Aptamer Identification and Structural Characterization" (2012) Technical Note, internal review

10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
    Provide titles, inventors, and dates of applications.
11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

Domestic
- Chemical and Biological Defense Science and Technology Conference (Las Vegas) 2011- “Combination of In Silico Oligonucleotide Library Design and Microarray Screening for High Throughput Selection of Aptamers” Yaroslav Chushak, Jennifer A. Martin, Jorge L. Chávez, Morley O. Stone, and Nancy Kelley-Loughnanie

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES Include dates, names and locations of seminars.

- RH Biotronics Update (Dayton, OH) 2011- Presented “Human Effectiveness Directorate: Bio-X Biotronics Review” (with J. Hagen)
- RX Biotechnology Review (Dayton, OH) 2012- Presented “In silico and High-throughput Microarray Selection of Biological Recognition Elements” (with Y. Chushak)
- RH Biotronics Update (Dayton, OH) 2012- Presented “Human Effectiveness Directorate: Bio-X Biotronics Review” (with J. Hagen)

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE
Research Associate, Henry Jackson Foundation

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION

711 HPW/RHXBC
2510 Fifth St.
Area B Bldg. 840
WPAFB, OH  45433-7913

16) POST-TENURE POSITION STATUS / CATEGORY Please indicate only one.
- Permanent position at the NRC host agency
- Contract or temporary position at the NRC host Agency Abbreviate Host Laboratory/Center RHXBC
- Research/Administrative position with another U.S.-government agency
- Research/Administrative position with a foreign-government agency
- Research/teaching position at a U.S. college or university
- Research/teaching position at a foreign college or university
- Research/administration position in private industry in the U.S.
- Research/administration position in private industry outside of the U.S.
- Research/administration position with a non profit
- Self-employed/consulting
- Postdoctoral research
- Other (Please specify, possible)
- No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
- Development of knowledge, skills, and research productivity
  Comments

LONG TERM VALUE
- How the NRC Associateship award affected your career to date
  Comments

LAB SUPPORT
- Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.
  Comments
ADVISER/MENTOR SUPPORT
Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
Comments

LPR SUPPORT
Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
Comments

NRC SUPPORT
Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
Comments
It was difficult to receive feedback or any response related to moving expenses. Responses for payroll, travel, etc. were efficient.

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.
It would be nice to have an orientation at the beginning of the program for all related aspects of the program. If I hadn't met current/former NRC researchers, I wouldn't have known anything about estimated taxes. Otherwise, I think it is a fantastic opportunity and I really appreciated and enjoyed the experience.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator
No handwritten signature required; but you may upload a scanned signature file below:
Asha Davis: adavis@nas.edu
Linda Sligh: bsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

Id# Rev. July 2011 Proj/Act ID#
Characterization of the Path-Dependent Behavior of Reinforced Shape Memory Polymers for Adaptive (Morphing) Skins

7) SUMMARY OF RESEARCH DURING TENURE  Itemize significant findings in concise form, utilizing key concepts/words.
   1) Established and validated the appropriate digital image correlation system, laser extensometer, high temperature grips, and environmental chamber for theromechanical evaluation of shape memory polymers.
   2) Thermal stability of shape memory polymers determined with thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC).
   3) Appropriate post-cure cycles established for multiple shape memory polymers based on the preliminary TGA and DSC results.
   4) The path-dependent axial behavior of both Veriflex-E and a BMI-based SMP were evaluated using dynamic mechanical analysis (DMA) and axial tensile tests.
   5) The shape memory response of Veriflex-E was evaluated using DMA and axial tensile tests.
   6) The strain rate dependence of Veriflex-E was evaluated using axial tensile tests.
   7) Shape memory hybrids combining SMPs and SMAs were created and evaluated.

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) RESEARCH IN PROGRESS  Describe in no more than 100 words.
   1) Constitutive models are under development and will be validated with both Matlab and with Abaqus finite element software.
   2) Expanded manufacturing and evaluation of shape memory hybrids is in the planning stages.
   3) Novel shape memory polymers that have the potential for higher transition temperatures and are processable into composites are being synthesized and evaluated.

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
   Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.
   a) Publications in peer-reviewed journals
b) Books, book chapters, other publications

c) Manuscripts in preparation, manuscripts submitted


10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide titles, inventors, and dates of applications.


11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

Domestic


12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES  Include dates, names and locations of seminars.

“Shape Memory Polymers for Aerospace Structural Applications.” St. Mary’s University, San Antonio, Texas, November 28, 2011

“Adaptive and Multifunctional Materials.” Mound Laser and Photonics Center, Dayton, Ohio, June 21, 2011

“Shape Memory Polymers for Morphing Aircraft Structures.” 3rd Annual Society for the Advancement of Material and Process Engineering Dinner, University of Dayton, Dayton, Ohio, March 16, 2011

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE

Assistant Professor of Mechanical Engineering

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION

St. Mary’s University, San Antonio, TX

16) POST-TENURE POSITION STATUS / CATEGORY  Please indicate only one.

☐ Permanent position at the NRC host agency
☐ Contract or temporary position at the NRC host Agency
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
☒ Research/teaching position at a U.S. college or university
☐ Research/teaching position at a foreign college or university

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM

On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE

☐  Development of knowledge, skills, and research productivity
  Comments
  I was exposed to many new areas of technical expertise.

LONG TERM VALUE

☐  How the NRC Associateship award affected your career to date
  Comments
  This is difficult to judge. An answer might be easier to give if looking back in several years than it is right now.

LAB SUPPORT

☐  Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.
  Comments

ADVISER/MENTOR SUPPORT

☐  Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
  Comments
  Time is an issue with the successful Advisers. In my opinion NRC should do something to provide supplemental mentoring/career broadening assistance.

LPR SUPPORT

☐  Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
  Comments
NRC SUPPORT

Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

Comments
Travel started off rough, but was a 10 by the end of tenure.

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Some sort of support needs to be in place for career development. This was a great opportunity to do research but it seems to lead to a bit of a dead end as far as the next career step. The top candidates already know how to do research, what we need even more is development of other skills and connections to create a pathway forward.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required; but you may upload a scanned signature file below:
Asha Davis: adavis@nas.edu
Linda Sligh: bsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

Id# | Rev. July 2011 | Proj/Act ID#
## National Research Council

### FINAL REPORT

<table>
<thead>
<tr>
<th>1) Associate Last or Family Name</th>
<th>First Name</th>
<th>M.I.</th>
<th>2) FORWARDING Address (to which your tax statement will be mailed)</th>
<th>FORWARDING Phone(s) and E-Mail (if known)</th>
</tr>
</thead>
<tbody>
<tr>
<td>McConney</td>
<td>Michael</td>
<td></td>
<td>Res. or Inst. Res.</td>
<td>Home Phone:</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Street</td>
<td>Alt. Phone: 515-231-4059</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>City, State Zip</td>
<td>E-mail: <a href="mailto:mcconney@gmail.com">mcconney@gmail.com</a></td>
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<td></td>
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<td></td>
<td>Beavercreek, Oh, 45434</td>
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<tr>
<td>3) Today's Date</td>
<td></td>
<td></td>
<td>August 22, 2011</td>
<td>Dates of Tenure</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>from September 1, 2009 to August 17, 2012</td>
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<tr>
<td>4) Host Agency</td>
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<td>AFRL (e.g., AFRL)</td>
<td>Laboratory or Center</td>
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<td>Wright Patterson AFB (e.g., Wright Patterson AFB)</td>
<td>Division / Directorate / Department</td>
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<td>Materials and Manufacturing (e.g., High-Speed Propulsion)</td>
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<tr>
<td>5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)</td>
<td>Timothy J. Bunning</td>
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<tr>
<td>6) TITLE OF RESEARCH PROPOSAL</td>
<td></td>
<td></td>
<td>&quot;Advanced Light Responsive Liquid Crystal Elastomers&quot;</td>
<td></td>
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<tr>
<td>7) SUMMARY OF RESEARCH DURING TENURE</td>
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<td></td>
<td>Itemize significant findings in concise form, utilizing key concepts/words.</td>
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<tr>
<td></td>
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<td></td>
<td>1) Developed a new fabrication technique to create polymer stabilized cholesteric liquid crystals that enables high contrast optical filters to be made</td>
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<td>2) Made an cholesteric optical filter that induces high contrast (hyper-reflectivity) when exposed to heat or to light</td>
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<td>3) Made an cholesteric optical filter that which is high contrast and the wavelength of the filter changes when exposed to heat or light</td>
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<td>4) Developed an electrically tunable cholesteric liquid crystal</td>
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<td>5) Developed a novel CW laser from a polymer stabilized cholesteric liquid crystal</td>
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<td>(USMA Davies Fellow: please add summary of teaching, including classes taught.)</td>
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<tr>
<td>8) RESEARCH IN PROGRESS</td>
<td></td>
<td></td>
<td>Describe in no more than 100 words.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Currently working on photo-responsive liquid crystalline polymers. More specifically this includes designing and patterning the mesogenic monomers before polymerization to create a material with the desired photo-induced actuation.</td>
<td></td>
</tr>
<tr>
<td>9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH</td>
<td></td>
<td></td>
<td>Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.</td>
<td></td>
</tr>
<tr>
<td>a) Publications in peer-reviewed journals</td>
<td></td>
<td></td>
<td>ME McConney, MM Duning, LV Natarajan, AA Voevodin, VP Tondiglia, TJ White, TJ Bunning, Molecular Crystals and Liquid Crystals 559: 115-126 (2012)</td>
<td></td>
</tr>
</tbody>
</table>
b) Books, book chapters, other publications

c) Manuscripts in preparation, manuscripts submitted

ME McConney, VP Tondiglia, LV Natarajan, TJ White, TJ Bunning. "Electrically Induced Reflective Color Changes in Polymer Stabilized Cholesterics" (In Preparation)

10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH

Provide titles, inventors, and dates of applications.

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International


Domestic


ME McConney, TJ White, J Hurtubise, VP Tondiglia, LV Natarajan, TJ Bunning. Tunable Hyper-reflective Filters. Central Regional Meeting of American Chemical Society (CeRMACS), 2010.

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES Include dates, names and locations of seminars.

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE
Contractor at AFRL-RX/ Scientist III

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
3005 Hobson Way, Bldng 654, RM 70
Materials and Manufacturing Directorate AFRL
WPAFB, OH, 45434
16) POST-TENURE POSITION STATUS / CATEGORY  Please indicate only one.
- Permanent position at the NRC host agency
- Contract or temporary position at the NRC host Agency
- Research/Administrative position with another U.S.-government agency
- Research/Administrative position with a foreign-government agency
- Research/teaching position at a U.S. college or university
- Research/teaching position at a foreign college or university
- Research/administration position in private industry in the U.S.
- Research/administration position in private industry outside of the U.S.
- Research/administration position with a non profit
- Self-employed/consulting
- Postdoctoral research
- Other (Please specify, possible) 
- No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
- Development of knowledge, skills, and research productivity
  Comments

LONG TERM VALUE
- How the NRC Associateship award affected your career to date
  Comments

LAB SUPPORT
- Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.
  Comments

ADVISER/MENTOR SUPPORT
- Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
  Comments

LPR SUPPORT
- Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
  Comments

NRC SUPPORT
- Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
  Comments

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator
No handwritten signature required; but you may upload a scanned signature file below:
- Asha Davis: adavis@nas.edu
- Linda Sligh: lsligh@nas.edu
- Jason Thornhill: jthornhill@nas.edu
- Peggy Wilson: pwilson@nas.edu
- Suzanne White: swhite@nas.edu

Id# Rev. July 2011 Proj/Act ID#
1) Associate Last or Family Name  McDonald
   First Name  Jonathan
   M.I.  R

2) FORWARDING Address (to which your tax statement will be mailed)
   Residence or Institution  Residence
   Street
   City, State Zip  Belmont, MA  02478
   FORWARDING Phone(s) and E-Mail (if known)
   Home Phone:
   Alt. Phone:
   Preferred E-mail: jmcdnld@gmail.com

3) Today's Date  June 21, 2012
   Dates of Tenure  from January 18, 2011 to June 29, 2012

4) Host Agency  AFRL
   (e.g., AFRL)
   Laboratory or Center  Rome Res. Site
   (e.g., Wright Patterson AFB)
   Division / Directorate / Department  RITA
   (e.g., High-Speed Propulsion)

5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)
   Paul M Alsing

6) TITLE OF RESEARCH PROPOSAL
   A Discrete Geometric Approach to Characterizing Quantum Computations

7) SUMMARY OF RESEARCH DURING TENURE
   Itemize significant findings in concise form, utilizing key concepts/words.
   1) Derived discrete representation of the Ricci tensor for Piecewise-flat manifolds
   2) Used our discrete Ricci tensor to provide a geometric discretization of Richard Hamilton's Ricci flow equations on piecewise-flat manifolds
   3) Used discrete exterior calculus (DEC) to develop an inherently discrete analysis of curvature on simplicial geometries
   4) Applied techniques from Persistent Homology and quantum theory to demonstrate how quantum computations can be viewed as foliations of hypersurfaces whose geometry is determined by the correlation information between qubits.
   5) Demonstrated the geometric view of quantum computation for 1D quantum cellular automata.
   (USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) RESEARCH IN PROGRESS
   Describe in no more than 100 words.
   We are currently studying the numeric behavior of simplicial Ricci flow and the role of diffeomorphisms. We are also investigating the geometric foundations of multi-partite entanglement (through measures such as information area).

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
   Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.
   a) Publications in peer-reviewed journals
      P M Alsing, J R McDonald, W A Miller, "The simplicial Ricci tensor," Class. Quantum Gra.v. 28 (2011) 155007
   b) Books, book chapters, other publications
   c) Manuscripts in preparation, manuscripts submitted
      P M Alsing, J R McDonald, W A Miller, X Wang, "Simplicial Ricci Flow"
      J R McDonald, W A Miller, X Wang, "On exterior calculus and curvature in piecewise-flat manifolds"
      S Ray, C Tison, M A Corne, J R McDonald, W A Miller, "Simplicial Ricci Flow on Discretizations of the 2- and 3-spheres"
10) **PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**
   
   Provide titles, inventors, and dates of applications.

   N/A

11) **PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES**

   Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.
   
   **International**

   Domestic

   J R McDonald, "Hybrid Measures and Discrete Exterior Calculus," 6th Gulf Coast Gravity Meeting, Florida Atlantic University, Boca Raton, FL, 16 May 2011

   J R McDonald, "The Simplicial Ricci Tensor," East Coast Gravity Meeting, Syracuse University, Syracuse, NY, 22 April 2012


12) **SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES**

   Include dates, names and locations of seminars.

   "Geometric Discretizations and Piecewise-flat manifolds," Naval Research Laboratory, Washington, DC, 28 Mar 2011

13) **PROFESSIONAL AWARDS RECEIVED DURING TENURE**

14) **POST-TENURE POSITION / JOB TITLE**

   Postdoctoral Researcher

15) **NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION**

   Department of Mathematics, Harvard University, One Oxford St, Cambridge, MA

16) **POST-TENURE POSITION STATUS / CATEGORY**

   Please indicate only one.

   - ☐ Permanent position at the NRC host agency
   - ☐ Contract or temporary position at the NRC host Agency
   - ☐ Research/Administrative position with another U.S.-government agency
   - ☐ Research/Administrative position with a foreign-government agency
   - ☐ Research/teaching position at a U.S. college or university
   - ☐ Research/teaching position at a foreign college or university
   - ☐ Research/administration position in private industry in the U.S.
   - ☐ Research/administration position in private industry outside of the U.S.
   - ☐ Research/administration position with a non profit
   - ☐ Self-employed/consulting
   - ☒ Postdoctoral research
   - ☐ Other (Please specify, possible)
   - ☐ No information provided

17) **APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM**

   On a scale of 1 – 10 (poor - excellent), please rate the following:

   **SHORT TERM VALUE**

   ☐ Development of knowledge, skills, and research productivity
   
   Comments

   **LONG TERM VALUE**

   ☐ How the NRC Associateship award affected your career to date
   
   Comments

   **LAB SUPPORT**

   ☐ Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
   
   Comments

   Obtaining proper equipment/computers to perform research adequately could sometimes be slow and stall some aspects of the research.
ADVISER/MENTOR SUPPORT

10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

Comments

LPR SUPPORT

8 Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)

Comments

There was very little interaction between NRC associates and the LPR. However, they were always helpful when needed and getting forms signed/approved was quick and effortless.

NRC SUPPORT

9 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

Comments

Very helpful and always knowledgeable about processes and requirements.

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required; but you may upload a scanned signature file below:
Asha Davis: adavis@nas.edu
Linda Sligh: lsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

Id# Rev. July 2011 Proj/Act ID#
National Research Council

1) **Associate Last or Family Name**
   O’Connor

2) **FORWARDING Address** (to which your tax statement will be mailed)
   Residence: Arlington, MA 02474

3) **Today’s Date**
   from September 12, 2011
   to July 31, 2012

4) **Host Agency**
   AFRL
   (e.g., AFRL)

5) **Name of Laboratory NRC Adviser**
   Leonid Perlovsky

6) **TITLE OF RESEARCH PROPOSAL**
   Integrating Prior Knowledge and Sensor Data for Active Sensing

7) **SUMMARY OF RESEARCH DURING TENURE**
   Itemize significant findings in concise form, utilizing key concepts/words.

   1) Demonstrated convergence of a distributed multi-agent system for agreeing on a collective sensing action when there is uncertainty about the target dynamical model.
   2) Computed an analytical formula for the Cramer-Rao Lower Bound on range and velocity estimation variance and its dependence on the emitted radar pulse-train length. This result was confirmed for a stationary target using an S-band radar.
   3) Quantified the benefit of feedback control of radar pulse-train length. Showed that the actively controlled approach achieved a 14% reduction in tracking error and dwell-time cost for constant velocity targets compared to the best constant policy.
   4) Developed detector/tracker for asteroids moving in image sequences. This was an application of cognitive-based data-association algorithms developed by my advisor. Demonstrated improved performance for data with occlusions of objects of interest.

5) (USMA Davies Fellow: please add summary of teaching, including classes taught.)
   N/A

8) **RESEARCH IN PROGRESS**
   Describe in no more than 100 words.
   Am currently investigating the use of multipath propagation information in passive location of RF emitters. The active sensing aspect of this project has to do with the fact that the quality of information depends on the position and velocity of the mobile sensor. Having some prior knowledge of the position of the emitter permits an optimization sensor trajectory and thus of future measurements.

9) **PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**
   Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

   a) Publications in peer-reviewed journals
      None completed yet.

   b) Books, book chapters, other publications

   c) Manuscripts in preparation, manuscripts submitted

10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide titles, inventors, and dates of applications.
N/A

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

Domestic

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES
Include dates, names and locations of seminars.

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE
N/A

14) POST-TENURE POSITION / JOB TITLE
Technical Staff

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
Lincoln Laboratory
Massachusetts Institute of Technology
244 Wood Street
Lexington, MA 02420-9108

16) POST-TENURE POSITION STATUS / CATEGORY
Please indicate only one.
☐ Permanent position at the NRC host agency
☐ Contract or temporary position at the NRC host Agency
☐ Abbreviate Host Laboratory/Center
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
☒ Research/teaching position at a U.S. college or university
☐ Research/teaching position at a foreign college or university
☐ Research/administration position in private industry in the U.S.
☐ Research/administration position in private industry outside of the U.S.
☐ Research/administration position with a non profit
☐ Self-employed/consulting
☐ Postdoctoral research
☐ Other (Please specify, possible) ______
☐ No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
☐ Development of knowledge, skills, and research productivity
Comments
7

LONG TERM VALUE
How the NRC Associateship award affected your career to date
Comments
9

LAB SUPPORT
Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.
Comments
5

ADVISER/MENTOR SUPPORT
Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
Comments
7

LPR SUPPORT
Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
Comments
6

NRC SUPPORT
Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
Comments
10

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator
No handwritten signature required; but you may upload a scanned signature file below:

Asha Davis: adavis@nas.edu
Linda Sligh: lsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

Id# Rev. July 2011 Proj/Act ID#
1) Associate Last or Family Name  Rider

2) FORWARDING Address (to which your tax statement will be mailed)
   Residence or Institution Residence
   Street
   City, State Zip Prospect, VA 23960

3) Today's Date
   July 17, 2012

4) Host Agency
   AFRL
   (e.g., AFRL)

5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)
   C. Michael Lindsay

6) TITLE OF RESEARCH PROPOSAL
   Energetic Nanocluster Thin Films

7) SUMMARY OF RESEARCH DURING TENURE
   Itemize significant findings in concise form, utilizing key concepts/words.
   1) Measured particle deposition rates from helium droplet beam to compare with calculations
   2) Designed and build magnesium and perfluoropolyether sources
   3) Performed TPD/TPR experiments on magnesium and perfluoropolyether thin films
   4) Performed DSC/TGA experiments on magnesium and perfluoropolyether bulk materials
   5) Assisted with other experiments (XRD, SEM) of these and other materials

   (USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) RESEARCH IN PROGRESS
   Describe in no more than 100 words.
   The next phase of this research project will be characterizing materials made with the helium droplet method using the baseline chemistry that was established with the thin film studies. Knowing the TPD behavior of the thin films should make it much easier to understand the behavior of the more complex core-shell particles made with the helium droplet beam.

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
   Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.
   a) Publications in peer-reviewed journals
      none
   b) Books, book chapters, other publications
      none
   c) Manuscripts in preparation, manuscripts submitted
      Physical and Chemical Properties of Iodine (V) Oxide Films
      B.K. Little,* M.B. Bogle, J.C. Nittinger, R.C. Fantasia, S.B. Emery, K.B. Rider, and C.M. Lindsay
      J. Mat. Chem.
      Superfluid Helium Droplet Assembled Nanocluster Films: Cluster Formation and Deposition Rates
      S.B. Emery, K.B. Rider, B.K. Little, and C.M. Lindsay
      J. Phys. Chem. C
      Magnesium Cluster Films Grown by Superfluid Helium Nanodroplets
      S.B. Emery, K.B. Rider, B.K. Little, and C.M. Lindsay
      Thermochemical Measurements of a Magnesium-Perfluoropolyether Pyrolant
10) **PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**

Provide titles, inventors, and dates of applications.

none

11) **PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES**

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

**International**

none

**Domestic**

Keith B. Rider, Samuel B. Emery, Brian K. Little, and C. Michael Lindsay, Magnesium-Perfluoropolyether Reactions Studied by TPD/TPR, AFOSR Contractor's Meeting, Arlington, VA, 5/21 to 5/24/2012

12) **SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES**

Include dates, names and locations of seminars.

none

13) **PROFESSIONAL AWARDS RECEIVED DURING TENURE**

none

14) **POST-TENURE POSITION / JOB TITLE**

Associate professor of Chemistry

15) **NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION**

Longwood University, 201 High St., Farmville, VA 23909

16) **POST-TENURE POSITION STATUS / CATEGORY**

Please indicate only one.

- Permanent position at the NRC host agency
- Contract or temporary position at the NRC host Agency
- Research/Administrative position with another U.S.-government agency
- Research/Administrative position with a foreign-government agency
- Research/teaching position at a U.S. college or university
- Research/teaching position at a foreign college or university
- Research/administration position in private industry in the U.S.
- Research/administration position in private industry outside of the U.S.
- Research/administration position with a non profit
- Self-employed/consulting
- Postdoctoral research
- Other (Please specify, possible) _____
- No information provided

17) **APPRaisal OF RESEARCH ASSOCIATESHIP PROGRAM**

On a scale of 1 – 10 (poor - excellent), please rate the following:

**SHORT TERM VALUE**

- Development of knowledge, skills, and research productivity

  Comments

  I got a lot of work done in a very short time. It was a very intense year.

**LONG TERM VALUE**

- How the NRC Associateship award affected your career to date

  Comments

  My associateship will probably win me my promotion to full professor.

**LAB SUPPORT**

- Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.

  Comments

**ADVISER/MENTOR SUPPORT**

- Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

  Comments

**LPR SUPPORT**
Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)

Comments

NRC SUPPORT

Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

Comments

We had very good experiences with Azar Storage, Omega Travel, and the NRC payroll office

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required; but you may upload a scanned signature file below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asha Davis</td>
<td><a href="mailto:adavis@nas.edu">adavis@nas.edu</a></td>
</tr>
<tr>
<td>Linda Sligh</td>
<td><a href="mailto:lsligh@nas.edu">lsligh@nas.edu</a></td>
</tr>
<tr>
<td>Jason Thornhill</td>
<td><a href="mailto:jthornhill@nas.edu">jthornhill@nas.edu</a></td>
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<tr>
<td>Peggy Wilson</td>
<td><a href="mailto:pwilson@nas.edu">pwilson@nas.edu</a></td>
</tr>
<tr>
<td>Suzanne White</td>
<td><a href="mailto:swhite@nas.edu">swhite@nas.edu</a></td>
</tr>
</tbody>
</table>

Id#                          Rev. July 2011                          Proj/Act ID#
1) Associate Last or Family Name
Sanders

2) FORWARDING Address (to which your tax statement will be mailed)
Residence or Institution Residence
Street
City, State Zip Sunnyvale, CA 94087

3) Today's Date
June 26, 2012

4) Host Agency
AFRL (e.g., AFRL)

5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)
Christopher Bunker

6) TITLE OF RESEARCH PROPOSAL
In-situ Detection of Pyrolysis Intermediates in Supercritical Hydrocarbon

7) SUMMARY OF RESEARCH DURING TENURE
Itemize significant findings in concise form, utilizing key concepts/words.

1) Developed a heating reactor for gas-phase molecules to be interfaced with molecular beam, mass spectrometer.
2) Developed models for the pyrolysis of endothermic fuel simulant n-hexane under deoxygenated, low pressure conditions.
3) Introduced a novel class of Boron Nitride-based nanomaterials as catalysts to modify distribution of reaction intermediates.
4) Was able to differentiate classes of catalytic activity, and identify commonalities in catalytic behavior.
5) Developed a supercritical sample reaction chamber to be safely integrated to instrument for future work.
(USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) RESEARCH IN PROGRESS
Describe in no more than 100 words.

Currently, we are preparing multiple manuscripts for publication, the first of which thoroughly describes the foundational characterization of pyrolysis reaction intermediates in the gas-phase which we found to produce reaction mechanisms which produced unique intermediates of potential importance. The second manuscript describes work investigating the behavior of a new class of BN-based nanomaterials which display unique, low-temperature catalytic activity in driving the intermediate, and product ion distribution towards useful, endothermic fuel products of potential use in the AFRL. Now, having layed the groundwork and characterized a novel catalysts, a supercritical source will be integrated for the second phase of work.

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals

b) Books, book chapters, other publications

c) Manuscripts in preparation, manuscripts submitted


10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide titles, inventors, and dates of applications.
11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

Nathaniel L. Sanders, William K. Lewis, Christopher E. Bunker, Kevin Kuchta, Sean Pawlowski, Yi Lin, and John Connell

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES Include dates, names and locations of seminars.

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE
Research and Development Scientist / R & D Researcher

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
Agilent Technologies, Inc. Santa Clara, CA 95051

16) POST-TENURE POSITION STATUS / CATEGORY Please indicate only one.
- Permanent position at the NRC host agency
- Contract or temporary position at the NRC host Agency
- Research/Administrative position with another U.S.-government agency
- Research/Administrative position with a foreign-government agency
- Research/teaching position at a U.S. college or university
- Research/teaching position at a foreign college or university

- Research/administration position in private industry in the U.S.
- Research/administration position in private industry outside of the U.S.
- Research/administration position with a non profit
- Self-employed/consulting
- Postdoctoral research
- Other (Please specify, possible)
- No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
- Development of knowledge, skills, and research productivity
  Comments
  The position allowed me to broaden and stretch my research skills, by allowing me to approach the research from a new perspective (physical chemistry as opposed to analytical chemistry). Also, by taking full responsibility for the direction and progress of the project it was necessary that I work more efficiently and evaluate potential project directions more critically than in the past.

LONG TERM VALUE
- How the NRC Associateship award affected your career to date
  Comments
  The award was definitely a positive contribution to my resume. The job has allowed me to network with and develop new research connections which I would like to take advantage of in the future. It has given me an appreciation for the program in developing the careers of young scientists, and introducing them to the research environment in which close interactions occur between university and government laboratories.

LAB SUPPORT
- Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
  Comments
  The host lab provided for every possible need on a timely basis. I couldn't speak more highly of the manner in which they helped to facilitate my associateship.

ADVISER/MENTOR SUPPORT
- Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
  Comments
My adviser did an excellent job in his role as a mentor. Our discussions regarding the work was challenging and insightful, often giving me the opportunity to think of new approaches to perform studies and present results. I believe any young scientist would benefit tremendously from working in Dr. Bunker’s lab.

LPR SUPPORT

Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)

Comments

Dr. Rivir was extremely helpful in accommodating my administrative needs, as well as enthusiastic in support of my, and my host laboratory research goals and accomplishments.

NRC SUPPORT

Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

Comments

The support I received from the NRC was very helpful and always communicated back to me in a timely manner. I felt that they were extremely reliable, and I’m grateful for my time there. I would highly recommend the experience to anyone considering the opportunity.

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required; but you may upload a scanned signature file below:

Asha Davis: adavis@nas.edu
Linda Sligh: lsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

Id# Rev. July 2011 Proj/Act ID#
# FINAL REPORT

## 1) Associate Last or Family Name

Seletskiy

## 2) FORWARDING Address (to which your tax statement will be mailed)

<table>
<thead>
<tr>
<th>Residence or Institution</th>
<th>Street</th>
<th>City, State, Zip</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Albuquerque, NM 87123</td>
</tr>
</tbody>
</table>

## 3) Today's Date

August 1, 2012

## 4) Host Agency | Laboratory or Center | Division / Directorate / Department
--- | --- | ---
AFRL | Kirtland AFB | Space Vehicles
(e.g., AFRL) | (e.g., Wright Patterson AFB) | (e.g., High-Speed Propulsion)

## 5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)

Dr. Paul LeVan

## 6) TITLE OF RESEARCH PROPOSAL

Laser Refrigeration

## 7) SUMMARY OF RESEARCH DURING TENURE

- High sensitivity spectroscopic methods developed
- Using methods above, local cooling to 110 K has been measured, in agreement with the model
- Bulk cooling to 119 K has been demonstrated
- Laser cooling model has been extended to include effects of saturation
- Cooling by 80 degrees has been demonstrated inside of a optically-pumped semiconductor laser cavity.

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

## 8) RESEARCH IN PROGRESS

Understanding of parasitic heating effects that limit cooling; cooling below 100 K; improving intra laser cavity cooling to reach sub-100 K regime.

## 9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH

- **Publications in peer-reviewed journals**

- **Books, book chapters, other publications**

## 10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH

Provide titles, inventors, and dates of applications.
11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

2) C-Y Li, Denis V. Seletskiy, Jeffrey G. Cederberg, Mansoor Sheik-Bahae, “Detection of ultrafast THz pulses via electro-absorption in coupled asymmetric quantum wells”, Proc. SPIE, 8260, 826021 (2012);
4) D.V. Seletskiy, S. D. Melgaard and M. Sheik-Bahae, "Thermal imaging with high spatial and temperature resolution", Proc. SPIE 8275, 82750H (2012);

Domestic

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES Include dates, names and locations of seminars.

“Optical Refrigeration: From Laboratory Curiosity to Efficient Cryocoolers”, AFRL, Kirtland AFB, NM (Jul. 2012)

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

National Science Foundation International Research Fellowship

14) POST-TENURE POSITION / JOB TITLE

Junior Group Leader

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION

Universität Konstanz, Fachbereich Physik/LS Leitenstorfer, Fach M 696, 78457 Konstanz, Deutschland

16) POST-TENURE POSITION STATUS / CATEGORY Please indicate only one.

☐ Permanent position at the NRC host agency
☐ Contract or temporary position at the NRC host Agency
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
☐ Research/teaching position at a U.S. college or university
☒ Research/teaching position at a foreign college or university

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM

On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE

10 Development of knowledge, skills, and research productivity
Comments

LONG TERM VALUE

10 How the NRC Associateship award affected your career to date
Comments

LAB SUPPORT

10 Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
Comments

It would be great if NRC could allocate some of the small equipment/lab supplies/ money for the researchers

ADVISER/MENTOR SUPPORT

10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
Comments

It was a pleasure working with Dr. Paul Le Van, he showed the right amount of guidance as well as given freedom to pursue my own research ambitions.

LPR SUPPORT

10 Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
Comments

Great support

NRC SUPPORT

10 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
Comments
Great support by all the staff members, especially Linda Sligh

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator. No handwritten signature required; but you may upload a scanned signature file below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
</tr>
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<tbody>
<tr>
<td>Asha Davis</td>
<td><a href="mailto:adavis@nas.edu">adavis@nas.edu</a></td>
</tr>
<tr>
<td>Linda Sligh</td>
<td><a href="mailto:lsligh@nas.edu">lsligh@nas.edu</a></td>
</tr>
<tr>
<td>Jason Thornhill</td>
<td><a href="mailto:jthornhill@nas.edu">jthornhill@nas.edu</a></td>
</tr>
<tr>
<td>Peggy Wilson</td>
<td><a href="mailto:pwilson@nas.edu">pwilson@nas.edu</a></td>
</tr>
<tr>
<td>Suzanne White</td>
<td><a href="mailto:swhite@nas.edu">swhite@nas.edu</a></td>
</tr>
</tbody>
</table>

Id# Rev. July 2011 Proj/Act ID#
1) **Associate Last or Family Name**: Smith

2) **FORWARDING Address** (to which your tax statement will be mailed):
   Residence or Institution:
   Street:
   City, State Zip: Holland, MI 49423

3) **Today's Date**: July 3, 2012

4) **Host Agency**: AFRL
   **Laboratory or Center**: Wright Patterson AFB
   **Division / Directorate / Department**: Materials and Manufacturing Directorate

5) **Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)**: Richard A. Vaia

6) **TITLE OF RESEARCH PROPOSAL**: Mechanical quantification of model parameters during oscillation in catalytically active hydrogels

7) **SUMMARY OF RESEARCH DURING TENURE**: Itemize significant findings in concise form, utilizing key concepts/words.

   1) Created novel self-oscillating (BZ) gels based on the biomacromolecule gelatin and synthetic polymer p(AAm-co-APMA)
   2) Developed chemistries for effectively postfunctionalizing these gels with a Ru metal catalyst
   3) Charcterized chemical and mechanical behavior of BZ gelatin as a function of reactant concentration, gel size
   4) Demonstrated gel printing and ink stamping techniques for effective patterning of catalyst, made first heterogeneous gels
   5) Demonstrated conditions for synchronized, coupled oscillations between active patches, laid foundation for modular design

   (USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) **RESEARCH IN PROGRESS**: Describe in no more than 100 words.

   Demonstrating effective stamping in p(AAm-co-APMA) gels. Will use mechanical design principles to demonstrate amplified nonlinear motion driven by autonomous coupled oscillations.

9) **PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**: Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

   a) Publications in peer-reviewed journals


   b) Books, book chapters, other publications


   c) Manuscripts in preparation, manuscripts submitted

10) **PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**

Provide titles, inventors, and dates of applications.

11) **PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES**

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

**International**

**Domestic**


12) **SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES**

Include dates, names and locations of seminars.


13) **PROFESSIONAL AWARDS RECEIVED DURING TENURE**

14) **POST-TENURE POSITION / JOB TITLE**

Assistant Professor of Engineering

15) **NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION**

Hope College, 27 Graves Place, Holland, MI 49423

16) **POST-TENURE POSITION STATUS / CATEGORY**

Please indicate only one.

- [ ] Permanent position at the NRC host agency
- [ ] Contract or temporary position at the NRC host Agency
- [ ] Research/Administrative position with another U.S.-government agency
- [ ] Research/Administrative position with a foreign-government agency
- [x] Research/teaching position at a U.S. college or university
- [ ] Research/teaching position at a foreign college or university
- [ ] Research/administration position in private industry in the U.S.
- [ ] Research/administration position in private industry outside of the U.S.
- [ ] Research/administration position with a non profit
- [ ] Self-employed/consulting
- [ ] Postdoctoral research
- [ ] Other (Please specify, possible)
- [ ] No information provided

17) **APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM**

On a scale of 1 – 10 (poor - excellent), please rate the following:

**SHORT TERM VALUE**

[10] Development of knowledge, skills, and research productivity

Comments

**LONG TERM VALUE**

[10] How the NRC Associateship award affected your career to date

Comments

**LAB SUPPORT**

[10] Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
Comments

ADVISER/MENTOR SUPPORT
10 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
Comments

LPR SUPPORT
10 Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
Comments

NRC SUPPORT
10 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
Comments

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

I was extremely satisfied with my time as an NRC Associate, this has been an exceptional opportunity for me for career growth. Overall I think the program is in a good position.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator.

No handwritten signature required; but you may upload a scanned signature file below:

Asha Davis: adavis@nas.edu
Linda Slighe: bligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

Id# Rev. July 2011 Proj/Act ID#
1) Associate Last or Family Name
Voccola

2) FORWARDING Address (to which your tax statement will be mailed)
Residence or Institution
City, State Zip Fort Collins, CO 80525

3) Today's Date
September 14, 2012

4) Host Agency
AFRL (e.g., AFRL)

5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)
Muralidhar Rangaswamy

6) TITLE OF RESEARCH PROPOSAL
Polarimetric Synthetic-Aperture Radar Correlation Imaging

7) SUMMARY OF RESEARCH DURING TENURE
Itemize significant findings in concise form, utilizing key concepts/words.

1) For a polarimetric SAR system consisting of orthogonally polarized dipoles, we found a way to circumvent the standard assumption/approximation that the polarization properties of the transmitted waves remain constant throughout the flight trajectory.

2) Completed numerical experiments comparing current polarimetric SAR imaging with our coupled polarimetric imaging approach for extended targets in clutter and found that it improved image signal-to-clutter ratio and mean-squared error.

3) Developed forward model and imaging operator for a correlation based SAR imaging technique for targets and volume scattering clutter. Developed resolution analysis for the imaging scheme and found improvements over standard imaging.

4) Created a clutter minimization technique based on avoiding certain pairs of correlated data which requires no knowledge of the clutter present in the scene of interest.

5) Developed MATLAB code to simulate correlated SAR data and implement the correlation imaging scheme. It was found that clutter mitigation was successful for a variety of targets and for a variety of antenna trajectories.

In addition I mentored two summer students in the lab on two separate research projects. One on extending my polarimetric imaging scheme for more complicated targets and a second on developing Cramer-Rao type bounds for bounded estimators.

8) RESEARCH IN PROGRESS
Describe in no more than 100 words.

Currently I am finishing the proof to analytically show why my imaging technique minimizes clutter effects on the image. I am preparing a manuscript to submit to SIAM Journal on Imaging Sciences for the end of the month. After the proof is finished for standard SAR imaging I am working on generalizing the result for polarimetric SAR imaging. In addition during my tenure I developed a second technique for estimating the correlation or covariance matrix of a scene of interest using reproducing kernel Hilbert space techniques. I will compare this technique with the first method developed during my tenure at the lab.

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals

b) Books, book chapters, other publications

c) Manuscripts in preparation, manuscripts submitted

10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide titles, inventors, and dates of applications.

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International

Domestic

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES
Include dates, names and locations of seminars.


13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE
Postdoctoral Research Fellow

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
Department of Mathematics, Colorado State University, 101 Weber Building, CSU, Fort Collins, CO 80523-1874

16) POST-TENURE POSITION STATUS / CATEGORY
Please indicate only one.
- Permanent position at the NRC host agency
- Contract or temporary position at the NRC host Agency
- Research/Administrative position with another U.S.-government agency
- Research/Administrative position with a foreign-government agency
- Research/teaching position at a U.S. college or university
- Research/teaching position at a foreign college or university
- Research/administration position in private industry in the U.S.
- Research/administration position in private industry outside of the U.S.
- Research/administration position with a non profit
- Self-employed/consulting
- Postdoctoral research
- Other (Please specify, possible) ______
- No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
10 Development of knowledge, skills, and research productivity
Comments
The associateship gave me the opportunity to spend focused time on gaining knowledge in my research area and allowed me to get my thesis work published quickly. It is so helpful for a young scientist to have this time post grad school to get settled as a researcher without other responsibilities to distract from our intellectual development.

LONG TERM VALUE
10 How the NRC Associateship award affected your career to date
Comments
The Associateship gave me a chance to travel to many conferences and network with many in my field. It also gave me the ability to consider and see first hand certain career possibilities. In addition I was able to try my hand at mentoring at the lab during the summer which helped me to decide to continue in academia and work with students.

LAB SUPPORT
10 Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.
Comments
The lab has a lack of MATLAB licenses which affected my ability to start my numerical experiments in a timely manner, this is a general lab issue though, not specific to myself and my situation.

ADVISER/MENTOR SUPPORT
9 Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
Comments
Dr. Rangaswamy was very helpful in sharing his knowledge of radar and general career development advice. There was a mismatch between our interests but this was expected as he was not the original mentor I applied to work with.

LPR SUPPORT
10 Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
Comments
Also Sam Rosengarten and Joanne Maurice at AFRL were very helpful.

NRC SUPPORT
10 Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
Comments
Linda was great at answering my questions quickly and in a helpful manner. Everything was easy to figure out and it made the move very simple.

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator
No handwritten signature required; but you may upload a scanned signature file below:

Asha Davis: adavis@nas.edu
Linda Sligh: lsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

Id#     Rev. July 2011     Proj/Act ID#
## FINAL REPORT

### 1) Associate Last or Family Name

WANG

### 2) FORWARDING Address (to which your tax statement will be mailed)

Residence or Institution:
Street:
City, State Zip: Wilmington, DE 19809

### 3) Today's Date

July 25, 2012

### 4) Host Agency

AFRL
(e.g., AFRL)

### 5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)

Michael Medley

### 6) TITLE OF RESEARCH PROPOSAL

Joint Spectrum Allocation and Scheduling in Multi-Radio Multi-Channel Cognitive Radio Wireless Networks; Throughput Optimization for Cognitive Radio Network with Slowly Varying Channels

### 7) SUMMARY OF RESEARCH DURING TENURE

1) **Throughput Optimization for Cognitive Radio Networks with Multi-Radio Multi-Channel:** Extends the optimal scheduling algorithm developed in my PhD thesis to solve the joint spectrum allocation and scheduling problem and obtains the optimal solution.

2) **Capacity Optimization of MIMO Links with Interference:** Derives the approximate theoretical capacity formula for MIMO links with interference through SVD. An Integer Programming algorithm is proposed to solve the capacity problem.

3) **Resource Allocation in MIMO-based Ad Hoc Networks:** Solves the problem of joint routing, scheduling, power control and bit rate selection with the goal of maximizing the system throughput that satisfies the given end-to-end traffic demands.

4) **Throughput Optimization of Cognitive Radio Networks:** The optimal solution provides a theoretical upper bound of throughput for cognitive radio networks. Also, derives a theoretical upper bound when greedy solution is used to solve the MWIS problem.

5) **Throughput Optimization for Cognitive Radio Network with Slowly Varying Channels:** Study the effect of aggregate delay; compare the optimal solution and the approximation solution, the centralized solution and distributed solution.

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

### 8) RESEARCH IN PROGRESS

The proposed projects have been finished. Now we are working on the test bed development of cognitive radio network. We are interested in implementing a Frequency Hopping system (i.e. Bluetooth) with GNU Radio and USRP. We modify the hardware through FPGA programming to achieve two goals. One is the frequency hopping mechanism which has been finished. The second one is to implement a time slot transmit protocol where each packet is transmitted at the beginning of each time slot. Currently we are working on the second part which can be done soon.

### 9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH

- **Publications in peer-reviewed journals**

c) Manuscripts in preparation, manuscripts submitted

10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
Provide titles, inventors, and dates of applications.

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

   International

   Domestic

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES Include dates, names and locations of seminars.

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE
Research Associate

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
Army Research Lab, Aberdeen Proving Ground, MD

16) POST-TENURE POSITION STATUS / CATEGORY Please indicate only one.
☐ Permanent position at the NRC host agency
☐ Contract or temporary position at the NRC host Agency
Abbreviate Host Laboratory/Center
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
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☐ Research/teaching position at a foreign college or university
☐ Research/administration position in private industry in the U.S.
☐ Research/administration position in private industry outside of the U.S.
☐ Research/administration position with a non profit
☐ Self-employed/consulting
☐ Postdoctoral research
☐ Other (Please specify, possible) ______
☐ No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
☐ Development of knowledge, skills, and research productivity
Comments
Cooperate with senior researchers to publish and present papers in conferences, and do projects to improve the skills of software and hardware.

LONG TERM VALUE
☐ How the NRC Associateship award affected your career to date
Comments
Research experiences provided by NRC program are helpful in finding a position in DOD industry.

LAB SUPPORT
Quality of support from the Laboratory—equipment, funding, orientation, safety and health guidelines, etc.

Comments
Lab provides the required equipments, safe and comfortable working environment, and a pretty good library.

ADVISER/MENTOR SUPPORT
Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)

Comments
Adviser provides helpful suggestions, and discuss the research with me frequently.

LPR SUPPORT
Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)

Comments
LPR signs the documents in time.

NRC SUPPORT
Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

Comments
NRC processes my travel authorization form and travel reimburse request in time, and answers my questions patiently.

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required; but you may upload a scanned signature file below:

Asha Davis: adavis@nas.edu
Linda Sligh: lsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

Id#  Rev. July 2011  Proj/Act ID#
**FINAL REPORT**

1) **Associate Last or Family Name**

Wu

2) **FORWARDING Address** (to which your tax statement will be mailed)

FORWARDING Address: Oviedo, FL 32765

3) **Today's Date**

August 14, 2012

4) **Host Agency**

AFRL

**Laboratory or Center**

WPAFB

**Division / Directorate / Department**

Aerospace Systems

5) **Name of Laboratory NRC Adviser**

Dr. Kerk Yerkes

**Dr. Mitch Wolff**

6) **TITLE OF RESEARCH PROPOSAL**

Advanced Modeling of Aircraft Synchronous Generator System

7) **SUMMARY OF RESEARCH DURING TENURE**

Itemize significant findings in concise form, utilizing key concepts/words.

1) Investigated design methodologies for aircraft synchronous generator, including main machine, exciter and pilot exciter;

2) Developed linear and nonlinear electrical models for aircraft synchronous generator;

3) Developed lumped element thermal and mechanical models for aircraft synchronous generator;

4) Updated nonlinear electromechanical actuator model;

5) Started to work on generator testing.

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

8) **RESEARCH IN PROGRESS**

Describe in no more than 100 words.

The design and modeling methodologies for the three-stack aircraft synchronous generator have been developed. The design for the main machine and exciter uses the expansion of the inverse air-gap function to tailor the salient-pole rotor appropriately. Both linear and nonlinear electric modeling techniques have been introduced. The nonlinear modeling incorporates finite-element method and neural networks to provide a more realistic depiction of machine performance. Using these design and modeling methodologies, we have developed a preliminary electrical model for a F-16 generator, which is a three-stack, 40 kVA, 12 krpm design. Initial test plans for validation of the models was introduced. Design of experiment and statistical model development as a cross-validation will be incorporated into future efforts to develop a functional, accurate electrical, thermal and mechanical models of the F-16 generator.

9) **PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**

Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals

b) Books, book chapters, other publications

c) Manuscripts in preparation, manuscripts submitted


10) **PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH**

Provide titles, inventors, and dates of applications.
11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.

International


Domestic

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES Include dates, names and locations of seminars.
From June 15 to Aug. 14, I was invited to teach a 40 hour summer course on Advanced Electric Machinery at Wright State University arranged by AFRL. The course materials are highly related to my NRC research work.

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE
Professor

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
Department of Electrical Engineering and Computer Science, University of Central Florida

16) POST-TENURE POSITION STATUS / CATEGORY Please indicate only one.

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Abbreviate Host Laboratory/Center
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☐ Research/administration position in private industry outside of the U.S.
☐ Research/administration position with a non profit
☐ Self-employed/consulting
☐ Postdoctoral research
☐ Other (Please specify, possible)
☐ No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
☐ Development of knowledge, skills, and research productivity
Comments

LONG TERM VALUE
☐ How the NRC Associateship award affected your career to date
Comments

LAB SUPPORT
☐ Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.
Comments

ADVISER/MENTOR SUPPORT
☐ Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
Comments

LPR SUPPORT
☐ Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
Comments
NRC SUPPORT

10

Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)

Comments

18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

I am glad to be reviewer for future NRC programs.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator.

No handwritten signature required; but you may upload a scanned signature file below:

<table>
<thead>
<tr>
<th>Asha Davis</th>
<th><a href="mailto:adavis@nas.edu">adavis@nas.edu</a></th>
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<td><a href="mailto:swhite@nas.edu">swhite@nas.edu</a></td>
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Id#                          Rev. July 2011                          Proj/Act ID#
# Final Report

## 1) Associate Last or Family Name

<table>
<thead>
<tr>
<th>Yang</th>
<th>First Name</th>
<th>M.I.</th>
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</table>

## 2) FORWARDING Address (to which your tax statement will be mailed)

| Residence or Institution | Residence
<table>
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<tr>
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<tbody>
<tr>
<td>Street 6952 Carmelito Loop NE</td>
<td>Albuquerque, NM 87113</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CITY, STATE, ZIP</th>
<th>Home Phone</th>
<th>Alt. Phone</th>
<th>Preferred E-mail</th>
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<tr>
<td></td>
<td>505-363-6474</td>
<td></td>
<td><a href="mailto:chiyang@chtm.unm.edu">chiyang@chtm.unm.edu</a></td>
</tr>
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</table>

## 3) Today’s Date

<table>
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<tr>
<th>Date</th>
<th>Dates of Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 20, 2012</td>
<td>from June 22, 2010 to June 21, 2012</td>
</tr>
</tbody>
</table>

## 4) Host Agency | Laboratory or Center | Division / Directorate / Department

| AFRL (e.g., AFRL) | Kirtland AFB (e.g., Wright Patterson AFB) | RDLAS (e.g., High-Speed Propulsion) |

## 5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)

| Ron Kaspi |

## 6) TITLE OF RESEARCH PROPOSAL

Improved Hole Confinement in GaSb-Based Type-I Multi Quantum Well (MQW) Diode Lasers for >3 um Emission

## 7) SUMMARY OF RESEARCH DURING TENURE

Itemize significant findings in concise form, utilizing key concepts/words.

1) Developed optically pumped mid-infrared in-plane DBR semiconductor lasers, reached the record power of 3 W in a 7 nm spectral range.

2) Realized the first unstable resonator diode laser at 2 µm wavelength as precursor to unstable resonator quantum cascade lasers.

3)

4)

5)

(USMA Davies Fellow: please add summary of teaching, including classes taught.)

## 8) RESEARCH IN PROGRESS

Describe in no more than 100 words.

We are developing strategies to extract high brightness from broad-area interband diodes and quantum cascade lasers (QCLs) emitting in the mid-infrared. The method is to use Focused Ion Beam (FIB) milling to generate fabricate cylindrical mirrors to form on-chip unstable resonator cavity geometries.

## 9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH

Provide complete citations: author(s), title, full name of journal, volume number, page number(s), and year of publication.

a) Publications in peer-reviewed journals


b) Books, book chapters, other publications

c) Manuscripts in preparation, manuscripts submitted

## 10) PATENT OR COPYRIGHT APPLICATIONS RESULTING FROM NRC ASSOCIATESHIP RESEARCH

Provide titles, inventors, and dates of applications.

## 11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES

Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.
International

Domestic

12) SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES  Include dates, names and locations of seminars.

13) PROFESSIONAL AWARDS RECEIVED DURING TENURE

14) POST-TENURE POSITION / JOB TITLE
Research Assistant Professor

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION
University of New Mexico

16) POST-TENURE POSITION STATUS / CATEGORY  Please indicate only one.

☐ Permanent position at the NRC host agency
☐ Contract or temporary position at the NRC host Agency
☐ Research/Administrative position with another U.S.-government agency
☐ Research/Administrative position with a foreign-government agency
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☐ Research/teaching position at a foreign college or university
☐ Research/administration position in private industry in the U.S.
☐ Research/administration position in private industry outside of the U.S.
☐ Research/administration position with a non profit
☐ Self-employed/consulting
☐ Postdoctoral research
☐ Other (Please specify, possible)  
☐ No information provided

17) APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM
On a scale of 1 – 10 (poor - excellent), please rate the following:

SHORT TERM VALUE
☐ Development of knowledge, skills, and research productivity
Comments

LONG TERM VALUE
☐ How the NRC Associateship award affected your career to date
Comments

LAB SUPPORT
☐ Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.
Comments

ADVISER/MENTOR SUPPORT
☒ Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
Comments

LPR SUPPORT
☐ Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
Comments

NRC SUPPORT
☐ Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
18) PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.

Please do NOT scan to PDF. Send the Final Report as MSWord document via e-mail to your NRC Program Coordinator

No handwritten signature required; but you may upload a scanned signature file below:

Asha Davis: adavis@nas.edu
Linda Sligh: lsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

| Id# | Rev. July 2011 | Proj/Act ID# |
1) Associate Last or Family Name
Yen

2) FORWARDING Address (to which your tax statement will be mailed)
Residence or Institution: Residence
City, State Zip: Cambridge, MA 02138

3) Today’s Date
September 11, 2012

4) Host Agency
AFRL
Laboratory or Center: Wright Patterson AFB
Division / Directorate / Department: Materials and Manufacturing
(e.g., High-Speed Propulsion)

5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)
Dr. Michael Durstock

6) TITLE OF RESEARCH PROPOSAL
Plasmonic Enhancement of Organic Photovoltaics

7) SUMMARY OF RESEARCH DURING TENURE
Itemize significant findings in concise form, utilizing key concepts/words.
1) Introducing Gold Nanoparticles into PEDOT:PSS Layer
2) Introducing Gold Nanoparticles into Active Layer
3) Modifying the metallic electrode/active layer interface through nano-imprint patterning
4) 
5) 

USMA Davies Fellow: please add summary of teaching, including classes taught.

8) RESEARCH IN PROGRESS
Describe in no more than 100 words.
Polymer-based organic photovoltaic systems hold promise for a low-cost, light-weight alternative renewable energy. To
date, organic bulk heterojunction solar cells show power conversion efficiencies up to 8.6%. Recently, the exploitation of
surface plasmon resonance effects, based on advantageous optical properties such as light concentration and scattering, has
attracted much attention for increasing the photocurrent generation of organic solar cells. Surface plasmon is localized by
noble metallic nanoparticles, such as Au, Ag, and Cu, resulting in highly localized and intense fields. We are seeking methods
to incorporate gold nanoparticles into organic solar cells and then improve its light-to-electric conversion efficiency. We have
been successfully transferred metallic nanoparticles into organic device (proven by TEM) and monitored a 30% efficiency
enhancement.

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH
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a) Publications in peer-reviewed journals

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Provide titles, inventors, and dates of applications.

11) PRESENTATIONS AT SCIENTIFIC MEETINGS OR CONFERENCES
Provide complete references: author(s), title, abstract/proceeding citation, meeting name and location.
12) **SEMINARS OR LECTURES DELIVERED AT UNIVERSITIES AND/OR INSTITUTES**  Include dates, names and locations of seminars.

13) **PROFESSIONAL AWARDS RECEIVED DURING TENURE**

Best Ph.D Thesis Award, Sigma Xi Society

14) **POST-TENURE POSITION / JOB TITLE**

15) **NAME AND ADDRESS OF POST-TENURE POSITION / JOB 0RGANIZATION**

16) **POST-TENURE POSITION STATUS / CATEGORY**  Please indicate only one.

- Permanent position at the NRC host agency
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- Research/administration position in private industry outside of the U.S.
- Research/administration position with a non profit
- Self-employed/consulting
- Postdoctoral research
- Other (Please specify, possible) ______
- No information provided

17) **APPRAISAL OF RESEARCH ASSOCIATESHIP PROGRAM**

On a scale of 1 – 10 (poor - excellent), please rate the following:

**SHORT TERM VALUE**

- Development of knowledge, skills, and research productivity
  Comments

**LONG TERM VALUE**

- How the NRC Associateship award affected your career to date
  Comments

**LAB SUPPORT**

- Quality of support from the Laboratory--equipment, funding, orientation, safety and health guidelines, etc.
  Comments

**ADVISER/MENTOR SUPPORT**

- Quality of mentoring from the Laboratory NRC Adviser (USMA Mentor, if applicable)
  Comments

**LPR SUPPORT**

- Quality of administrative support from the Laboratory (e.g., NIST, NRL, IWR, FHWA) NRC Program Representative (LPR)
  Comments

**NRC SUPPORT**

- Quality of administrative support. Please assess respective NRC aspects (e.g., moving company, insurance, Omega, payroll, coordinator, travel, etc.)
  Comments

18) **PLEASE PROVIDE ANY SUGGESTIONS FOR PROGRAM IMPROVEMENT.**
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No handwritten signature required; but you may upload a scanned signature file below:

Asha Davis: adavis@nas.edu
Linda Sligh: lsligh@nas.edu
Jason Thornhill: jthornhill@nas.edu
Peggy Wilson: pwilson@nas.edu
Suzanne White: swhite@nas.edu

| Id# | Rev. July 2011 | Proj/Act ID# |
1) Associate Last or Family Name  
Zunoubi  

2) FORWARDING Address (to which your tax statement will be mailed)  
Residence or Institution SUNY  
Street 1 Hawk Dr.  
City, State Zip New Paltz, NY 12561  

2) FORWARDING Phone(s) and E-Mail (if known)  
Home Phone:  
Alt. Phone:  
Preferred E-mail: zunoubm@engr.newpaltz.edu  

3) Today's Date  
August 28, 2012  

4) Host Agency  
AFRL  
(e.g., AFRL)  

4) Laboratory or Center  
Kirtland AFB  
(e.g., Wright Patterson AFB)  

4) Division / Directorate / Department  
Advanced Electric Laser Branch  
(e.g., High-Speed Propulsion)  

5) Name of Laboratory NRC Adviser (and USMA Mentor, if applicable)  
Dr. William P. Roach  

6) TITLE OF RESEARCH PROPOSAL  
Massively-Parallel Modeling of High Peak Ultrafast Laser Pulse Propagation and Nonlinear Matter Interaction on Multi-GPU Systems  

7) SUMMARY OF RESEARCH DURING TENURE  
Itemize significant findings in concise form, utilizing key concepts/words.  
1) Designed a Graphic Precessing Unit (GPU) high-performance computing system with a compute power of 15 Teraflops/s.  
2) Implemented the first multiple computational tools for the analysis of coupled propagation equations for the Ultra-Short Laser Pulse (USPL) propagation.  
3) Implemented the first multiple computational tools for the propagation of USPL in atmosphere and its interaction with matters.  
4) Developed the massively parallel version of the above tool on GPUs to help speeding up the computation times by a factor of 70 over the convetional CPU tools.  
5) (USMA Davies Fellow: please add summary of teaching, including classes taught.)  

8) RESEARCH IN PROGRESS  
Describe in no more than 100 words.  
Currently, there exists ongoing research activities to develop the multi-GPU version of the tool described above in item 4 to make the analysis of extremely large compute scenarios and kilometer-long propagation of USPLs possible.  

9) PUBLICATIONS AND PAPERS RESULTING FROM NRC ASSOCIATESHIP RESEARCH  
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a) Publications in peer-reviewed journals  
b) Books, book chapters, other publications  
c) Manuscripts in preparation, manuscripts submitted  
A CUDA-Accelerated nonlinear Schrodinger solver for the propagation of Ultra-Short Laser Pulse and its interaction with matters  

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14) POST-TENURE POSITION / JOB TITLE

Associate Professor, ECE Department

15) NAME AND ADDRESS OF POST-TENURE POSITION / JOB ORGANIZATION

State University of New York

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<thead>
<tr>
<th>Name</th>
<th>Email</th>
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<tbody>
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<td>M.R. Zunoubi</td>
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