Nomination of Robert John Glass, Jr. for Senior Scientist, Sandia National Laboratories

Sandia National Laboratories and the rank of Senior Scientist

Since 1949, Sandia National Laboratories has developed science-based technologies that support our national security. Today, the 300+ million Americans depend on Sandia's technology solutions to solve national and global threats to peace and freedom.

Through science and technology, people, infrastructure, and partnerships, Sandia's mission is to meet national needs in five key areas: Nuclear Weapons, Defense Systems and Assessments, Energy, Climate & Infrastructure Security; International, Homeland & Nuclear Security; and Homeland Security & Defense. Sandia is a government-owned/contractor operated (GOCO) facility. Sandia Corporation, a Lockheed Martin company, manages Sandia for the U.S. Department of Energy's National Nuclear Security Administration. We seek collaborative partnerships on emerging technologies that support our mission.

"Senior Scientist" is the highest technical rank designated at Sandia National Laboratories; a special appointment for individuals whose contributions to the Laboratories' mission are deemed exceptional. This honor is given to fewer than 40 people in a population of over 10,000.

Breadth or Depth in Assignments

Describe what the nominee has done to demonstrate breadth and/or depth in abilities and efforts. Depth is demonstrated by an individual who is highly specialized, has unique responsibilities, or is a subject-matter expert. An individual demonstrates breadth with successful performance in multiple efforts.

Building on the single assignment given to him when first arriving at Sandia, Robert J Glass, Jr., (Bob) has created and led groundbreaking efforts for Sandia in Subsurface Science (1988-2003) and Complex Adaptive Systems of Systems (CASoS) Engineering (2004-present). Highly regarded internationally for his foundational scientific contributions, his vision, leadership skills, and technical acumen spanning many diverse fields, Bob has built highly effective teams and new Sandia programs focused on problems of critical importance for Sandia, the nation and the globe. The breadth and depth of his work has been profound.

Bob's design of research experiments and use of novel visualization techniques in the 1990s disproved the validity of many existing models for flow and transport through subsurface media, and led to his discovery of phenomena and the development of new theoretical and numerical modeling approaches that honored the underlying physics. Collaborating with staff from across Sandia, academia, and other national laboratories, he created the Flow Visualization and Processes Laboratory (FVPL) whose research formed

a foundational core for the Department of Energy's (DOE's) Subsurface Science Initiative in the 1990s. At that time, the FVPL was funded by DOE's two basic research funders, Basic Energy Sciences (BES) and the Environmental Management Science Program (EMSP), while supporting large applied projects at Sandia such as the Yucca Mountain Project (YMP), the Waste Isolation Pilot Plant (WIPP), the Environmental Restoration program at Sandia (ER), as well as many others across the DOE complex. The leadership and reputation of the FVPL underpinned the establishment of Sandia led initiatives in Water and methodologies developed at the FVPL are now utilized throughout the world. BES Geosciences program director Nick Woodward states, *"Bob's research…has fundamentally changed the way we approach an understanding of subsurface flow and transport problems…his research results have impacted a range of DOE-relevant technology programs at the most fundamental level."* Eric Webb, former Sandia Congressional Fellow, says, *"This truly pioneering work… propelled SNL into national and international prominence."*

Bringing his multi-disciplinary expertise and conceptual design skills to the arena of Critical Infrastructure and Complex Adaptive Systems of Systems (CASoS), Bob created a vision, a new approach that combined network theory and agent based modeling to engineer solutions within CASoS, and a team that has shaped the future of modeling and simulation at Sandia's National Infrastructure Simulation and Analysis Center (NISAC) for the Department of Homeland Security (DHS). Theresa Brown, Project Lead for NISAC says his *"vision…was ambitious, extremely well thought out and provided the scientific basis for this new area of study."* Applying his approach, Bob was instrumental in designing national policy for pandemic influenza preparedness in 2005-2007. Citing Bob's contributions as *"pivotal,"* Dr. Rajeev Venkayya, Senior Director for Biodefense, White House Homeland Security Council (WH-HSC), noted in a letter of appreciation to Tom Hunter, Sandia President and Laboratories Director, in 2007 that *"Dr. Glass's conceptual advances permeate the guidance, but his contributions were also practical,"* and praised Bob's *"illuminating presentation"* of his approach to council members representing five different federal agencies who owned the problem, that *"initiated an intense, iterative collaboration"* between Bob and council members as they forged the White House Pandemic Implementation Plan. Reviewed by the Institute of Medicine, Bob's community containment measures for pandemic influenza were corroborated by internationally preeminent researchers in the field such as Martin Cetron (Centers for Disease Control and Prevention [CDC]), Neil Ferguson (Imperial College, London), and Marc Lipsitch (Harvard University). With collaborators at the Department of Veterans Affairs and Stanford University, Bob's most recent work in this area has contributed to current national response countering the H1N1 pandemic in Fall 2009. Dr. Victoria Davey, Chief Officer of the VA's Office of Public Health and Environmental Hazards, says *"Dr. Glass has been instrumental in policy and practice development for the Nation with regard to pandemic influenza, and has assisted VA to plan and prepare for the current H1N1 pandemic."*

Bob's approach to engineering solutions in CASoS also served as the basis for his and Sandia colleague Walt Beyeler's groundbreaking work in large value payment systems (e.g., the US's Fedwire, through which trillions of dollars flow daily) with the Federal

Reserve Bank of New York, the European Central Bank, and the National Banks of France and Finland. James J. McAndrews, Senior Vice President of the Federal Reserve Bank of New York states that this work *"is recognized as a seminal and apposite application of physical and mathematical methods to a growing and vital area of economics."* This work was also held up as an example of the *"future of the field"* at a 2006 National Academy of Sciences review of Systemic Risk in Financial Systems and praised by Christine M. Cumming, First Vice President and Chief Operating Officer, Federal Reserve Bank of New York, by Charles Lucas, Member, Board of Mathematical Sciences, National Academy of Sciences, and by Donald L. Kohn, Governor, Board of Governors of the Federal Reserve System. Additionally, the project led to the team's participation in an international effort on Interdependency in Payment and Settlement Systems in 2007 supported by the G10 nations through the Bank of International Settlements (BIS) in Switzerland. James McAndrews states *"While many applications of network theory have been made to various social networks, there are few that are more apt, and have been as widely adopted, as Bob's application to the measurement and performance of large-value payment systems."*

Prompted by the success of Bob's integrative conceptual framework for CASoS modeling and analysis, his record of building and funding successful programs, and his skills at forging powerful collaborative teams, Sandia management asked Bob to lead a corporation-wide strategic initiative, the Roadmap for CASoS Engineering. Steven Roehrig, former Sandia Director of Energy, Resources & Systems Analysis, states, *"Bob led a group of top, senior staff in defining and documenting a roadmap for the research, development and application of CASoS… the structure and ideas in this roadmap drew heavily upon Bob's prior research and applications in a wide range of seemingly chaotic geophysical, infrastructure and social structures."* Combining this internal support with self-generated external funding, Bob is now actualizing the new and growing initiative through a pilot, "Phoenix," in which project-oriented teams are applying the problem definition and solution approaches of CASoS Engineering to high impact problems in complex socio-economic-technical systems. Of note, the Department of Veterans Affairs has funded a 5-year $3.75M proposal specifically to apply CASoS Engineering to the Veterans Health Administration. Dr. Victoria Davey states, *"Dr. Glass and his team's vision have enabled VA to newly see itself as a part of a complex set of adaptive systems… I have no doubt that he and his team will move VA to a new level of thinking about how we can mitigate threats and how we fit into the national arena in public health and healthcare policy."*

Bob's initiation of and sustained achievement in these diverse challenging areas of scientific and engineering research and application have contributed significantly to Sandia programs and Sandia's national and international reputation as an institution with vision and the talent to actualize it. In areas of both Subsurface Science and CASoS Engineering, he has built foundational thrusts at the Laboratory that have pushed beyond the originating program, establishing influential collaborative relationships and garnering substantial funding from varied sources to realize his vision. His work, and the work of subsequent investigators following his lead, has shaped wide-ranging fields of science and engineering and instigated new areas of critical research, methods, and ultimately

problem solutions. According to John Mitchiner, Sandia Senior Manager of Computational Science Research and Development, *"Bob exemplifies the characteristics of a Senior Scientist. He sees hard and important problems of national and global concern, approaches them with clarity and insight, and delivers novel, valuable results of great impact, bringing constructive attention to Sandia and its programs. I strongly recommend Bob's promotion to Senior Scientist. I believe that he has been working at the Senior Scientist level for many years."*

Demonstration of Criteria

Describe what the nominee has done to demonstrate that he/she meets the criteria listed below.

Major Laboratory Programs

List major Laboratory programs in which the nominee has been involved and describe how the nominee provided strategic vision and leadership to the programs.

Bob has provided strategic vision and leadership to many large established Laboratory programs such as the Yucca Mountain Project (YMP) and the National Infrastructure Simulation and Analysis Center (NISAC) and then transcended these programs to create new Sandia, national and international initiatives in Subsurface Science and the newly-emerging eclectic discipline of CASoS Engineering.

For the YMP, Bob's vision in model development and validation in the early 1990s went beyond the concepts within the YMP at the time. A gifted experimentalist schooled in applied mathematics and the use of dimensional analysis, Bob designed and led research programs to identify the active processes for flow and transport in unsaturated fractured rock. For the critical area of flow in fractures and fracture-matrix interaction he discovered new active processes and demonstrated that the multiphase flow models being used by the YMP at the time were invalid for many of their intended purposes. As documented in Bob's paper in *Geophysical Research Letters,*[1] the implications of these newly-discovered processes for flow and transport within fractured rock, such as the definition of effective properties and structural ramifications at large scale, were profound. Others in the YMP subsequently implemented numerical models incorporating some of these processes within effective properties and, with the help of Lawrence Livermore National Laboratory (LLNL) and the US Geological Survey (USGS) colleagues, Bob was able to design and conduct a field scale experiment at Yucca Mountain that demonstrated the large scale effects he had predicted.[2] Ray Finley, a Sandia manager who worked as a staff member on the YMP at this time says, *"I have personally witnessed him in high-level meetings (e.g. Yucca Mountain Project), identify*

[1] Glass, R.J., M.J. Nicholl and V.C. Tidwell, Challenging models for flow in unsaturated, fractured rock through exploration of small scale processes, ***Geophysical Research Letters***, 22:11:1457-1460, 1995.
[2] Glass, R.J., M.J. Nicholl, A.L. Ramirez, and W.D. Daily, Liquid phase structure within an unsaturated fracture network beneath a surface infiltration event: Field experiment, ***Water Resources Research,*** 38(10), 1199, 2002.

the fundamental problem, identify a solution path, and influence high-level funding decisions." In this way, Bob worked with colleagues across the YMP participants (LLNL, USGS and Los Alamos National Laboratory [LANL]), to influence the design of many tests and analyses conducted for YMP in the 1990s including LLNL's large block test, LANL's large caisson study, the USGS's property measurement program, and SNL's large scale capillary barrier test to name a few.

Through direct interaction with the then Vice President of Sandia's Energy, Security & Defense Technologies division Dan Hartley, Bob's strategic vision and leadership created the Sandia Flow and Visualization Processes Laboratory (FVPL). Constructed in 1993-1995, the 10,000 sq ft FVPL was based on Bob's approach to model development and validation as conceptualized for the YMP. This approach integrated state of the art laboratory and field methods (nearly all designed at the FVPL) to identify and understand active processes, and led to the development of new models with fundamentally new theoretical and numerical foundations to represent chosen systems of interest. The work at the FVPL was *"used to direct hundreds of millions of dollars of Federal investment in environmental restoration and forms a significant part of the basis for the Yucca Mountain license application"* states Eric Webb.

The FVPL championed Sandia's approach across the DOE complex, nationally, and internationally as part of DOE's expanding Subsurface Science Initiative with funding reaching several million dollars a year throughout the latter half of the 1990s and early 2000s. Bob wove these projects together to form a whole significantly greater than the sum of its parts, tackling the critical problem of process-generated structure in non-equilibrium subsurface systems. Eric Webb states, *"He completely coupled basic research funded by the Office of Science Basic Energy Sciences through all stages of development with direct application through work funded by the Environmental Management branch of DOE in ways that had never been done in these broad fields."*

- The Geosciences Program of Basic Energy Research (BES) funded projects on multi-phase flow in fractures and fractured rock, multi-component convection in porous media and hydraulic property scaling, research critical to all DOE sites.
- The Environmental Management Science Program (EMSP) funded projects on Dense Non Aqueous Phase Liquids (DNAPL, such as TCE and PCE) migration and remediation, the development of an in situ unsaturated flow permeameter, joint hydrologic and geophysical inversion methods for quantitative flow and transport measurement in the subsurface, and advanced models for unsaturated flow in fractured rock.
- The Yucca Mountain Project (YMP) and Waste Isolation Pilot Plant (WIPP) funded a number of laboratory and field experiments with associated modeling and analysis that focused on critical processes active in each, very different geologic repository settings.
- The International Program of the Office of Civilian Radioactive Waste Management (IP-OCRWM) funded international collaborations with Sweden, Germany, Switzerland, France and Spain on near drift two-phase flow processes

critical to the design and interpretation of their subsurface drift scale experiments at both the Hard Rock Laboratory in Sweden and at Grimsel in Switzerland.

- Sandia's Laboratory Directed Research and Development Program (LDRD) funded projects on enhanced vapor phase flow critical to YMP, and DNAPL migration which was then and remains one of the most devastating subsurface contaminant problems of the industrial age.
- Sandia's Environmental Restoration Program (ER) funded the development of the characterization plan for the Vadose Zone on Kirtland Air Force Base, and, as part of this effort, a large scale experiment designed and conducted to define meso-scale properties of the alluvial sediments underlying most of Kirtland.
- DOE's Uranium in Soils Integrated Demonstration Project (UID) funded field scale experiments that identified the active process by which uranium bypassed the vadose zone to reach the water table (burrowing crayfish living within the subsurface).
- DOE's Oil and Gas Partnership Program funded work with Halliburton to test enhanced recovery designs that made use of novel fluids and displacement protocols during hydro fracturing.
- The Idaho National Laboratory ESR Program (INL ESR) funded the application of complex systems theory to analysis of flow and transport in fractured rock: experiments and new models demonstrated that both field sampling methods and predictions of contaminant concentrations in such formations were fundamentally limited.

For NISAC, Bob focused his drive and technical expertise in complex non-equilibrium systems on critical infrastructures. In 2004, his vision and leadership created the Advanced Modeling and Techniques Investigations (AMTI) task to discover and develop theories, methods, and analytical tools useful for understanding the structure, function, and evolution of complex interdependent critical infrastructures. AMTI developed a conceptual approach that modeled systems as networks of nodes (e.g., agents) with node and link behavior given by a variety of mathematical forms. This extremely versatile and powerful approach could be applied to any infrastructure. The AMTI team developed the Loki Toolkit to instantiate the networked agent-based approach. Applying this approach to payment systems and pandemics, Bob *"developed differentiating insights and policy approaches that brought him and his team to national/international prominence…"* says John Mitchiner, then NISAC program manager. Each of these high impact applications, scrutinized by the National Academy of Sciences (NAS) and the Institute of Medicine (IOM) respectively, brought Sandia and NISAC great prestige and significantly increased respect from DHS, the U.S. Department of Health and Human Services (HHS), the National Institutes of Health (NIH), the Veterans Administration (VA), and the White House-Homeland Security Council. Bob's pandemic effort directly influenced the funding of a $5M project for NISAC-Critical Infrastructure Protection Decision Support System (CIPDSS) to evaluate the effects of pandemics on critical infrastructure. Additionally, AMTI applied Loki to the modeling and evaluation of chemical supply chains, the natural gas pipeline network, and the electric power grid, as well as a number

of abstract problems such as the spread of opinion on social networks, congestive failure in scale free networks, and self-organized extremist group formation. Through these efforts, Bob's vision and leadership have significantly influenced NISAC projects and fundamentally enhanced its capabilities.

Based on the accomplishments made in NISAC by applying the problem definition and solution methods of engineering to socio-economic-technical problems using the theory and tools of complex systems, Bob was asked to work with several others to create a Roadmap for CASoS funded by Les Shephard (Vice President of Sandia's Energy, Security & Defense Technologies Division) and championed by Steven Roehrig (then Director of Sandia's Energy, Resources, & Systems Analysis Center). Bob's vision for this effort gained him its leadership. His outreach efforts expanded the group of contributors to 12 staff members (including Senior Scientists and Distinguished Members of Technical Staff) spanning 9 Departments and 3 Divisions. The resulting Roadmap for the CASoS Engineering Initiative[3] created a sphere in which Sandia can lead the nation and globe. As defined in its Abstract:

> Complex Adaptive Systems of Systems, or CASoS, are vastly complex physical-socio-technical systems which we must understand to design a secure future for the nation. Defining Examples of CASoS encompass humanity's largest problems such as Global Climate Change and Conflict End Games. We argue that while the contexts for various CASoS differ widely, they are all deeply similar; that the theories, technologies, tools, and approaches to enable effective engineering efforts focused on the solution of CASoS problems are the same across all. … [T]he pull of applications [is critical]… As a national laboratory, Sandia has the mandate to solve very big problems of national/global impact. These problems are within CASoS. They will define our future.

Implementing the path articulated in the Roadmap, Bob created "Phoenix," a CASoS Engineering pilot, in the Fall of 2008. Within Phoenix, Bob is orchestrating 10+ projects, with over $4M/year funding, for DHS, the Department of Defense (DoD), the VA, Sandia Laboratory Directed Research and Development (LDRD), and the State of New Mexico, involving 20+ people on site from numerous organizational divisions and all staff levels from students to Senior Scientists, with multiple collaborators from academia, government, and industry. At the core of Phoenix are two LDRDs in two different business areas: Energy, Resources and Nonproliferation (ERN) support focuses on the Global Energy System, one of the most important CASoS with which we at Sandia must grapple; Homeland Security and Defense (HSD) supports analysis of multi-network cascading, the general problem of system-of-systems interdependency within actively adapting networks. Phoenix itself is being engineered as a CASoS; its team is developing a CASoS Engineering Framework, a CASoS Engineering Environment for applying the Framework principles, and an Application portfolio that is integrated to bring the process of Research, Development and Application together. John Mitchiner writes of Phoenix,

[3] Robert J. Glass, Arlo L. Ames, William A. Stubblefield, Stephen H. Conrad , S. Louise Maffitt, Leonard A. Malczynski, David G. Wilson, Jeffery J. Carlson, George A. Backus, Mark A. Ehlen, Keith B. Vanderveen, and Dennis Engi, Sandia National Laboratories: A Roadmap for the Complex Adaptive Systems of Systems CASoS) Engineering Initiative, Sandia National Laboratories SAND 2008-4651, September 2008.

"[Bob's] knowledge is now being shared across the laboratory to expand and deepen our collective knowledge in this area."

Personal Expertise and Reputation

Describe the expertise and reputation the nominee has obtained at the national or international level in his or her field or program.

Bob's expertise and reputation have risen to international levels in every field in which he has worked. This is truly remarkable as each of the "fields" of Subsurface Science and CASoS Engineering are actually "fields of fields," composed of subjects widely considered "independent" areas of study. Examples of Bob's expertise include hydrology, geology, unsaturated flow, multi-component convection, solute transport, fingering and wetting front instability, modified percolation modeling, complexity, computer science, complex adaptive systems, payment systems, infectious diseases, networks, and agent-based modeling. He has published extensively, authoring or coauthoring more than 75 journal articles; 15 book chapters / symposium series papers, and 50 reports / papers in conference proceedings. These publications have been highly cited (~2000 citations to date). He has been sought after to give invited talks (over 50) worldwide on subjects ranging from "The Structure of Subsurface Flow and Transport" to "Critical Infrastructure Protection" to "Wrangling with Uncertainty in CASoS Engineering." With colleagues, he has contributed over 125 presentations at national and international conferences. He has worked with 100s of colleagues from across the nation, Europe, the Middle East and Asia, and from national labs, governmental agencies, industry and academia.

Bob has presented his analyses to the White House Homeland Security Council (WH-HSC) and at two very high profile reviews (by the National Academy of Sciences [NAS] and the Institute of Medicine [IOM]). At the WH-HSC he convinced a cross-governmental team to shift the national focus from pharmaceutical to social-behavioral interventions to stop influenza pandemics. The NAS review held up his work as the direction for the future (systemic risk and payment systems). The IOM review of pandemic mitigation strategies was instigated by Centers for Disease Control and Prevention's (CDC's) consideration of Bob's discoveries for national policy.

Bob has served on advisory boards, editorial boards of journals, and many working groups (internal and external), as well as organizing Gordon and DOE Basic Energy Sciences (DOE-BES) conferences. He has received awards in Subsurface Science, in Payment Systems, for contributions to the design of a national competition for middle school students (Discovery Challenge), and a letter of thanks from the White House for his work in pandemic preparedness. Numerous national and international magazines have interviewed Bob and colleagues on the CASoS work; their analyses and graphics have been reproduced in Nature and New Scientist.

Letters of reference attesting to Bob's impact, reputation, and expertise have been received from leaders of influential national stature including: Rajeev Venkayya then of

the WH-HSC; James McAndrews, Senior Vice President of the Federal Reserve Bank of New York; Victoria Davey, the Chief Officer for Public Health and Environmental Hazards at the Department of Veterans Affairs; Nicholas Woodward, Director of the Geosciences Program for DOE-BES; and Erik Webb, former Congressional Fellow from Sandia, among others.

Bob lends his expertise and leadership to public sphere initiatives in which he believes he can make a difference. As a recent example, Bob has contributed many hours as Science Advisor, Chief Coordinator of the Upper Gila River Environmental Flows 2006 Science Forum, and panelist in the 2009 Science forum for the New Mexico Interstate Stream Commission on water development issues in the Gila Watershed in Southwest New Mexico (2006-2009). Craig Roepke, the Deputy Director for the Interstate Stream Commission for the State of New Mexico states, *"I can pay no greater compliment to Dr. Glass than to say he has repeatedly demonstrated the scientific brilliance, innovation, leadership, and collaborative ability that is desperately needed and which has proven hugely helpful to this agency."*

A strong believer that Sandia must support the education of our next generation of scientific leaders, Bob has held adjunct professor appointments at the University of Colorado, New Mexico Institute of Mining and Technology, the University of Nevada, the University of New Mexico (in both Departments of Civil and Environmental Engineering and Earth Sciences), and most recently at the Uniformed Services University of Health Sciences in Bethesda, Maryland. Bob created the first course in Vadose Zone Hydrology at the University of New Mexico Geology Department (graduate level) which he taught twice in his early years at Sandia. The results of a field experiment conduced by the class in 1992 were presented by students at a national conference and eventually resulted in a paper published in the then newly formed journal "Vadose Zone Hydrology" in 2005.

With a particular passion for educating students to do scientific research, Bob has sponsored students at all levels over his career at Sandia. Treating them as collaborators, Bob mentors students, giving them increasing responsibility over time which often reaches authorship or co-authorship of journal publications. Bob has worked with over 30 high school and undergraduate students and received a Sandia award for excellence in 1993 for his integration and mentoring of students in ongoing research. He has also served on the committees of more than 15 graduate students from over 10 universities, acting as research advisor for 12 of them. These students have become university professors and members of technical staff at national laboratories such as Sandia, Lawrence Livermore National Laboratory (LLNL), Idaho National Laboratory (INL), and Pacific Northwest National Laboratory (PNL). During Bob's nomination process for Senior Scientist, 8 of these students were contacted and all came forward with strong letters of support (included in the additional information section) detailing Bob's mentorship and the profound effect it has had on their personal and professional lives.

Bob develops those he works with as a matter of course. Internal to Sandia, he has worked with Senior Scientists to High School students, level one Managers to Vice

Presidents. Of principle note are Vince Tidwell (PMTS), Mehdi Eliassi (PMTS) (from whom letters of support are attached), Jim Brainard (SMTS) during his Subsurface Science years, and, more recently, Theresa Brown (DMTS), Walt Beyeler (PMTS) (from whom letters of support are attached), and Arlo Ames (DMTS) within his current center. In reference to Bob's early efforts within NISAC on using complex systems theory to understand the behavior of interdependent infrastructures, Walt Beyeler says, *"The ideas he introduced, and the discussions he shaped, were important foundations for much subsequent work in NISAC, not only mine but that of the others ... This experience was transformative and exciting for the reasons that I later came to realize are characteristic of Bob's work: he'd thought long and deeply about the problem, chosen the essential areas where new contributions would matter most, and approached the problem with infectious wholehearted dedication. It is this quality of thoroughgoing commitment to tackling important problems in imaginative ways that makes working with Bob such a valued part of my time at Sandia, and I know there are many others who would say the same thing."*

Speaking of Bob's last few years at the FVPL, Eric Webb states, *"Equally important [to all his accomplishments], Bob was able to transition leadership of the capabilities developed under this tutelage to other leaders who have carried on his work as he broadened his career and influence across the institution demonstrating his commitment to his science as well has his commitment to the institution."* These developing 'leaders' were both internal such as Vince Tidwell, Jim Brainard, Lucy Meigs and Susan Altman and, importantly for the Subsurface Science field, also external. Nick Woodward says *"I have to note that a large number of Bob's post-docs and younger collaborators have gone on from working in the Flow lab to outstanding careers on their own. Russ Detwiler, Hari Rajaram, Mike Nicholl, Scott Tyler, Bob Holt and Vince Tidwell are just some of the younger scientists who Bob has mentored. Bob's work and those of his collaborators have contributed in a major way to progress over the last decade in understanding subsurface flow and transport problems."*

Another measure of Bob's expertise and reputation in the world can be found by Googling his name ("RJ Glass") in combination with any number of critical words (instability, fingering, solute, flow, pandemic, payment system, network, etc.): this yields many cross references in each area. Of particular note, Bob's recent efforts with colleagues in payment systems and pandemic mitigation have already been cited many, many times.

Value to the Laboratory

Describe the value the nominee will bring to the Laboratory through this appointment.

Bob has the passion, commitment, and vision to address world problems and lead Sandia's expanding efforts tackling modern day national security threats. Terrorism, energy security, disease, climate change, and political instability are all global problems that require framing in the context of Complex Adaptive Systems of Systems (CASoS).

Bob's Roadmap for the CASoS Engineering Initiative defines the compelling nature of these multifaceted problems and presents the conceptual framework needed to provide a challenging future in which Sandia's technology, computing power, and modeling approaches are utilized, and its unparalleled staff inspired.

Today, problem solutions for socio-economic-technical systems are ad hoc, special purpose, and one-off efforts. Integrative effective solutions require development of new theory in science and engineering and the creation of a community of practice that applies that theory to important, high impact problems, accomplishments that Bob has demonstrated throughout his career. As a Senior Scientist, Bob will be empowered to build the broadly-based, cross-cutting teams needed to advance Sandia's leadership in this emerging field. Bob envisions a CASoS Engineering Institute with Sandia at the center of an outwardly growing international network of CASoS Engineers that government, private industry and international organizations will rely on to understand and solve their complex challenges. Theresa Brown states *"One of Bob's many strengths is his commitment to scientific exploration, not as an individual but through building a community of researchers that reaches across the globe."* Senior Scientist status will help Bob actualize this vision.

Former Sandia Director of Energy, Resources & Systems Analysis Steven Roehrig lauds Bob's vision and leadership saying, *"I found his insight into extremely difficult technical issues to be quite profound and was even more impressed with his ability to explain those issues well to others. Bob is a natural leader whose intellect and style draws other senior staff to his side for highly collaborative teams."* Bob can be counted upon to develop a shared vision for Sandia in the growing area of CASoS and CASoS Engineering and contribute to the Laboratories' strategic direction.

Curriculum Vitae

Bob' Curriculum Vitae may be downloaded from the CASoS Engineering Initiative website in either short or long forms.

References

List at least 3 professional references (internal or external) who can provide input on the nominee's qualifications for the Senior Scientist position.

Letter from Rajeev Venkayya (formally of the WH-HSC)

Letter of thanks to Tom Hunter, Sandia President and Laboratories Director on September 30, 2007, from Dr. Rajeev Venkayya, then the Special Assistant to the President and Senior Director for Biodefense, White House Homeland Security Council. Dr. Venkayya is currently the Director for Global Health Delivery at the Bill & Melinda Gates Foundation where he oversees late-stage development of health technologies and interventions as well as efforts to expand access to health solutions in the developing world.

External:

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Internal: (Colleagues/Mentees)

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Mehdi Eliassi, PMTS, Org 5417, Leathality, Threats, & Systems Analysis, meliass@sandia.gov

Additional Information

Include any special or extraordinary facts not cited above.

Additional letters of support from past graduate students

- Dr. Russ Detwiler, Assistant Professor, Civil and Environmental Engineering, University of California, Irvine, detwiler@uci.edu
- Dr. Robert Holt, Associate Professor, Geology and Geologic Engineering, University of Mississippi, rmholt@olemiss.edu
- Dr. Clay Cooper, Assistant Research Professor, Hydrologic Sciences, Desert Research Institute, Clay.Cooper@dri.edu
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- Kristine Baker, Deputy Operations Lead, Nuclear Science and Technology, Idaho National Laboratory, Kristine.Baker@inl.gov
- Dr. Lirong Zhong, Senior Research Scientist, Pacific Northwest National Laboratory, lirong.zhong@pnl.gov
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THE WHITE HOUSE

WASHINGTON

30 September 2007

Thomas O. Hunter, Ph.D.
President and Laboratories Director
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Dear Dr. Hunter,

I am writing to thank Sandia National Laboratories for its support of our efforts to improve national pandemic preparedness, and in particular to commend the pivotal contributions in this regard of Dr. Robert J. Glass.

On February 1, as you may know, the Centers for Disease Control and Prevention released its *Interim Pre-pandemic Planning Guidance: Community Strategy for Pandemic Influenza Mitigation in the United States – Early, Targeted, Layered Use of Nonpharmaceutical Interventions*, a document outlining community-level measures designed to mitigate the disease, suffering, and death that would be associated with a pandemic. This document was more than a year in the making, required a level of interagency cooperation and collaboration unprecedented in the realm of public health, and represents a great advance in our national preparedness. A critical overarching theme of the guidance is the application within communities of *targeted social distancing* to disrupt disease transmission networks, a concept developed and promoted by Dr. Glass.

Dr. Glass's conceptual advances permeate the guidance, but his contributions were also practical. In January of last year, in an illuminating presentation at the Eisenhower Executive Office Building, he outlined the approach he was advocating to the National Strategy for Pandemic Influenza Implementation Plan writing team. This presentation initiated an intense, iterative collaboration between Dr. Glass and several of the members of the writing team that laid the groundwork for the strategy now formalized in the CDC guidance document. Dr. Glass's willingness, during this formative period, to contribute his time, insights, and expertise was exemplary.

Since the guidance was released, we have seen widespread acceptance of the underlying principles, incorporation of the recommendations into State and local planning, and a shift in the public dialogue from a focus on the untoward consequences of the interventions to the practical steps necessary to deal with these consequences.

Harry S Truman said, "It is amazing what you can accomplish if you do not care who gets the credit," and those of us responsible for policy development certainly understand these wise words. It is the nature of policy documents that they don't carry anyone's name and don't apportion credit to the individuals who create them. In writing you now, now that the strategy Dr. Glass helped to formulate has become policy and is well into its implementation, I wanted to draw your attention to his real and substantial but largely unacknowledged contributions and to offer, again, our thanks and gratitude.

Regards,

Rajeev Venkayya, M.D.
Special Assistant to the President and Senior Director for Biodefense
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