2014 Truman Fellows promise to help advance Sandia's computational capabilities

By Bill Murphy

President Harry S. Truman Fellowship
in National Security Science and Engineering

Researchers Grey Ballard and John Gamble have been selected as Sandia's 2014 Truman Fellows. They join the ranks of 19 other Fellows who have been appointed since the President Harry S. Truman Fellowship in National Security Science and Engineering was established in 2004. Because the fellowships are three-year assignments, five Truman Fellows are still doing research at Sandia as part of their fellowship. Additionally, 10 other Truman Fellows subsequently joined the Labs' technical staff upon completion of their fellowship assignments, seven of whom are still researchers at Sandia.

Grey, who earned his doctorate in computer science from the University of California-Berkeley, will be working in Informatics and Systems Assessments Dept. 8966. His manager will be Susanna Gordon and his mentor is Tammy Kolda. John, who earned his doctorate in physics from the University of Wisconsin-Madison, will be working in Advanced Device Technologies Dept. 1425. His manager will be John Aidun and his mentor will be Rick Muller. Both Grey and John are scheduled to begin their Truman fellowships this month.

Sandia Chief Technology Officer (CTO) and Div. 7000 VP Julia Phillips says, "Again this year, Sandia received outstanding research proposals from numerous individuals competing for the prestigious Truman Fellowship. This year, we offered the most interviews of any other year, signifying that applications from outstanding candidates are on the rise.

"After a very challenging deliberation process, the Truman Selection Committee recommended two individuals for the Truman Fellowship. We look forward to great results from the game-changing research proposed by Grey Ballard and John Gamble. We are confident that their research will help us advance our work in areas of fundamental importance to our research foundations and mission areas."

Grey earned a B.S. in mathematics and computer science from Wake Forest University and an M.A. in mathematics from the same school. At UC-Berkeley, his doctoral thesis was titled, "Avoiding Communication in Dense Linear Algebra." He is the recipient of many awards for his academic achievements and was honored as the Edwin G. Wilson Male Student Athlete of the Year at Wake Forest for excellence in both academics and athletics. He is the lead author on a number of journal papers and his work has been highlighted in numerous conference proceedings. Among other professional work experience, Grey was a graduate student intern at Sandia between 2010 and 2012.

The Truman Fellowships are three-year appointments. Candidates are expected to have solved a major scientific or engineering problem in their thesis work or have provided a new approach or insight to a major problem, as evidenced by a recognized impact in their field. The program fosters creativity and stimulates exploration of forefront science and technology and high-risk, potentially high-value R&D. A panel of nine senior scientists and engineers reviews and ranks each application, interviews finalists, and makes a hiring recommendation to the CTO, 7000.

This year's panelists were: Dave Chandler (8300, chairman), Cynthia Phillips (1465), Joe Michael (1819), Philip Kegelmeyer (8900), Ed Cole (1000), Tan Thai (5630), Phil Dreike (5710), John Dec (8300), and Michael Desjarlais (1600).

Sandia's University Research Office (7911) and Human Resources (3554 and 3555) teamed more than eight years ago to create the Truman Fellowship Program and develop the processes necessary to implement the prestigious position.

Current Truman Fellows: Carlee Ashley, Matt Eichenfield, Kevin Carlberg, Paul Schmit, and Christina Ting.

John earned a B.A. is physics and mathematics from the College of Wooster in Ohio and an M.S. in physics from the University of Wisconsin-Madison. His doctoral thesis, also at UW-Madison, was titled "Quantum Effects in Semiconductor Nanostructures." John, who spent the summer of 2007 as a research assistant at Los Alamos National Laboratory, was the recipient of a National Science Foundation Graduate Research Fellowship and earned several awards for his academic achievements while at the College of Wooster. He was chosen as one of two commencement speakers for his graduating class in 2008. John is lead author or co-author on numerous published technical papers and has presented his work at conferences both in the US and overseas.

The Truman Fellowship selection committee found much to praise in the research proposals by Grey and John.

Regarding Grey's work, the committee wrote, "Grey proposes to develop a computer-aided search for a tensor decomposition that will provide better scaling (exponent less than 2.81) than Strassen. If successful, this improved matrix multiplication algorithm would speed the solution of many large numerical problems of interest to Sandia and the larger world of computational simulation. The second part of Grey's proposal is to continue his work on communication-avoiding linear algebra methods in which he will analyze how current algorithms are likely to scale to future exascale computers and contribute communication-avoiding algorithms to the Trilinos library."

Of John's proposed work at Sandia, the committee noted that "He will carefully study the results of his atomic-level simulations to develop general constraints for a higher-level simulation. He will move from 2D to 3D, verifying the code performs correctly on randomly generated disorder instances, and validating the code vs. physical experiments. The final step is to use his validated 3D model to optimize the design of a qubit, also with computational and experimental validation. His proposed research could make a critical contribution to the development of a scalable silicon-based quantum qubit."

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The *Lab News* recently asked Grey and John to describe the work they intend to pursue at Sandia. Here's what they had to say:

Grey Ballard — "Numerical simulation has emerged as the 'third pillar' of science along with theory and experimentation. With increasingly powerful computational resources (both hardware and software), scientists are able to simulate physical phenomena that would otherwise be too expensive, too dangerous, too time-consuming, or simply impossible to observe. However, harnessing the full capabilities of current and future computers is an ongoing challenge, and the size and quality of simulations are limited by the computational time required.

GREY BALLARD

"In my research at Sandia, I'm interested in improving fundamental computations — those used by a wide range of computational scientists — so that they return accurate solutions more quickly, allowing scientists to work more interactively with their data, solve larger problems, and increase the quality of their simulations. Sandia is already a leader in this field of scientific computing, with numerous projects innovating new approaches for solving the hardest problems as well as developing and maintaining widely used software libraries. I hope to contribute to some of Sandia's ongoing projects, including working with Mike Heroux and the Trilinos project. I'll also be working with Tammy Kolda on a project to use computer-aided search to discover new and dramatically faster algorithms for matrix multiplication, one of the most fundamental computations.

"I was attracted to Sandia primarily by its people — the chance to work with the best researchers in the field — and its focus on applying advances in computational research to bigger and better science. Working at Sandia, I'm confident that my research will have a positive impact both on Sandians and on the broader scientific community."

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John Gamble — "Quantum information technology has the potential to revolutionize the computation landscape in ways that advances in conventional computers cannot. Since the 1990s researchers have known of code-breaking, simulation, and other quantum algorithms of critical importance that run fundamentally faster than all their known classical counterparts. Despite this, the largest fully controllable quantum computer demonstrated to date has just 14 quantum bits — a far cry from the billions of bits found in the memories of contemporary computer systems.

"One of the most important obstacles to scaling up quantum computers is the characterization and mitigation of disorder, which if left unchecked easily spoils the delicate physics that gives quantum computers their greater power in the first place. At Sandia, my research will focus on dealing with disorder in semiconductor-based quantum computers. The main challenge in studying this topic is disorder's inherent randomness. To probe its impact on devices, I will develop and apply numerical simulations that capture its essential physics while being efficient enough to collect high-quality statistics. By working with researchers in Sandia's substantial quantum computing effort, my goal is to use these simulations to develop the disorder-resistant devices necessary for scale-up to be feasible.

JOHN GAMBLE

"For these types of simulations to produce informative and useful results, tight collaboration between theory and experiment is critical. Sandia has this key element, and taken together with its in-house computing and fab capabilities, was the clear winner for me to start my post-PhD career. It's an exciting time to be working on quantum computing with prospects for scale-up on the horizon. I'm thrilled to join a world-class organization and team, and to be able to push forward toward useful, practical quantum information technology."

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Sandia seeks applicants for FY15 Truman Fellowship

Truman Fellowship: Sandia is seeking applicants for the FY15 Truman Fellowship. Candidates must have been awarded a doctorate within the past three years or complete doctoral requirements prior to the start of their appointment in October 2014. Additionally, they should have solved a major scientific or engineering problem, as evidenced by a recognized impact in their field. Candidates must be seeking their first national laboratory appointment (pre-post-doc internships excluded) and have the ability to obtain and maintain a DOE Q clearance. A grade point average of 3.5 undergraduate and 3.7 graduate is preferred. Please announce the fellowship availability at professional society meetings or university recruiting events and encourage qualified individuals to apply.

Application deadline is Nov. 1.

For more information, see the Truman Fellowship website (http://go.usa.gov/jPfh) or contact Yolanda Moreno (7911) at 284-2106.