



## From Defense to Degree: Accelerating Degree Opportunities for Military Veterans

**Dr. David L. Soldan, Kansas State University**

**Dr. Don Gruenbacher, Kansas State University**

Currently serving as department head and associate professor, Dr. Don Gruenbacher joined the Kansas State University Department of Electrical and Computer Engineering in 1997. He was promoted to associate professor in 2002, and has served as the graduate program coordinator of electrical and computer engineering since 2004. During his career at Kansas State University, Dr. Gruenbacher has chaired and served on various committees at the department, college, and university level. He has been recognized as an outstanding faculty member by both Eta Kappa Nu and the Mortar Board. His research activities are focused in the areas of computer networks, communications, and digital design. Prior to joining Kansas State University as a faculty member, Dr. Gruenbacher was a member of the senior staff in the Space Department of the Johns Hopkins University Applied Physics Laboratory from 1994 to 1997 and from 1989 to 1990. He received a bachelor's degree in Electrical Engineering in 1989, a master's degree in 1991, and a doctorate in 1994, all from Kansas State. Dr. Gruenbacher has also completed engineering internships with both Motorola Inc. and IBM.

**Dr. Noel N. Schulz, Kansas State University**

Dr. Noel Schulz received her B.S. in Electrical Engineering and M.S. in Electrical Engineering degrees from Virginia Polytechnic Institute and State University (Virginia Tech) in Blacksburg, Va. in 1988 and 1990, respectively. She received her Ph.D. in Electrical Engineering from the University of Minnesota in Minneapolis, Minnesota in 1995. Noel joined the Kansas State University faculty in 2009 in the Department of Electrical and Computer Engineering. She started as associate dean for engineering in August 2012. Before joining Kansas State University, Dr. Schulz spent eight years at Mississippi State University where she was the TVA endowed professor in Power Systems Engineering. She has a total of over nineteen years of teaching experience including other schools such as Michigan Technological University, University of North Dakota, and Virginia Tech.

Noel is active in teaching, research and service. She enjoys teaching electrical engineering and power engineering topics to students. In research and graduate studies, she has been very active having graduated 40 MS and 12 PhD students; published 160 papers and 2 book chapters; and brought in over \$10 M in external research through individual and collaborative projects including an U.S. National Science Foundation CAREER award.

She has been active in the IEEE Power & Energy Society serving as Secretary from 2004-2007, Treasurer from 2008-2009, President-Elect 2010-11, and President for 2012-2013. Dr. Schulz is a member of Eta Kappa Nu (Electrical Engineering Honorary Society), Tau Beta Pi (Engineering Honor Society), the American Society for Engineering Education (ASEE), the Society of Women Engineers and the National Society of Black Engineers.

**Mrs. Blythe A Vogt PE, Kansas State University**

Blythe Vogt is a senior industry advisor and Ph.D. researcher on this project. She received her B.S. in Architectural Engineering from Kansas State University in 2001 and completed her M.S. in Architectural Engineering from Kansas State University in 2010 related to Curriculum Development in Architectural Engineering and Construction. Mrs. Vogt is currently pursuing her Ph.D. in Electrical and Computer Engineering with an emphasis in Engineering Education/Outreach under the supervision of Dr. Noel Schulz. Mrs. Vogt is employed full time as the director of Business Development for Affiliated Engineers Inc. (AEI) in Madison, WI. AEI is a recognized industry leader in the field of systems engineering consulting. Prior experience includes: project manager, project engineer, commissioning agent, and professional conference speaker. She has collaborated in the past with the University of Wisconsin-Construction Engineering and Management as an adjunct faculty, teaching one course each fall semester related to building



systems and was an assistant professor of Architectural Engineering and Construction Science and Management at Kansas State University from 2008 to 2012.

**Dr. William Bowes Hageman, Kansas State University**

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## Motivation

This paper is a continuation of reported progress on program development addressing curricular improvements in regards to integrating post-9/11 veterans into the engineering workforce. A 2009 NSF Workshop on Enhancing the Post-9/11 Veterans Educational Benefit<sup>1</sup> indicates that new, more generous veterans' educational benefits create opportunity to expand the technical workforce while benefitting those who have served our country. The workshop further indicates that the veterans comprise a diverse and qualified pool of future talent for the nation's engineering and science employers. Based on the high demand and increased opportunities for veterans in the workforce, a program has been developed to acclimate and accelerate veterans into an electrical and computer engineering degree. The projected shortage of trained technical personnel in renewable energy and energy distribution systems areas has been the targeted initial technical focus.

## Technical focus

This paper focuses on the program's impact and progress with developed tools and materials necessary to acclimate and accelerate military veterans towards successful bachelor degrees in engineering. Because of the opportunity to involve veterans in the workforce, researchers have developed a program to help integrate veterans into electrical and computer engineering degrees. The initial technical focus emphasizes renewable energy and energy distribution systems areas, which have been identified as critical areas with a large projected shortage of trained technical personnel. A 2008 NSF Workshop on the Future Power Engineering Workforce<sup>2</sup> indicated that "a serious need is emerging for more power and energy engineers to: a) replace retiring engineers so that critical expertise is maintained; b) meet rising infrastructure construction needs; c) modernize the grid as communications, computing, and electric energy technologies converge; d) help stem the tide of electric equipment manufacturing moving off-shore, and; e) solve arising engineering challenges, such as the development of advanced power electronics and energy conversion systems, new generation and storage technologies, and the integration of those technologies into the grid." The IEEE Power and Energy Society<sup>3</sup> has also indicated that "Immediate action must be taken to avoid letting a growing shortage of well-qualified electric power engineers slow progress in meeting critical national objectives."

Electrical utilities in the geographic region and engineering firms in the electrical power arena also recognize this upcoming critical workforce shortage, resulting in the formation of an industry consortium called the Kansas State University Electrical Power Affiliates Program (EPAP) in 2008. EPAP is a consortium of industry leaders committed to the continued excellence of engineering education in the area of electrical power and energy systems. The program can be leveraged to help with various aspects of this project, including the recruitment seminar, internships, and research projects. At the recruitment seminar, EPAP members discuss career opportunities for graduates in the power and energy field, as well as provide realistic technical problems or scenarios that can be presented to participants to increase understanding of the current challenges in this field. Students already in the program have the opportunity to

participate in research projects, internships, or co-ops sponsored by EPAP members. This program has funded multiple student projects, in addition to field trips to member facilities and national conferences and a mini Career Fair for the electrical power industry.

The energy systems emphasis builds on the existing expertise of the faculty at Kansas State University. Energy systems is one of the five areas of specialization in the electrical engineering program and attracts more than 25 percent of the undergraduate students. In addition, the department offers a master's degree with an energy systems emphasis. This master's program has been offered via distance education since 1992 and has approximately 25 off-campus students per semester. Currently the energy systems program produces approximately 15 to 20 bachelor's degrees, five on-campus master's degrees, and 7 to 10 off-campus master's degrees per year.

### Accelerated Bachelor's Degree

This paper focuses on the accelerated track for military veterans into bachelor's degrees in engineering. Contact with the military veterans prior to their arrival on campus to begin their schooling is crucial. This allows an initial thorough evaluation of the veterans' training, experiences, and expertise, conducted with the option of granting academic credit where appropriate. Current policies give little credit for military experience or training. One issue with the use of military credit, however, is that most of the academic credit is ungraded and current policies at many universities do not recognize courses that are evaluated as credit/no credit. A possible avenue to overcome these rules is the use of advanced placement exams (where they exist) and university-generated quiz-out exams. Other resources such as the American Council on Education<sup>4</sup> directory and regional university credits for community college work also provide ways to determine class equivalency.

The tools developed for this program<sup>5</sup> include online pre-assessments and linked subject-based tutorials to accelerate the veteran's entry or re-entry into the traditional math sequence beginning with Calculus I or higher. The same concept of online pre-assessment and tutorials followed by a proctored final assessment is also being developed for entry-level engineering courses. In the field of electrical engineering, the course to be used for evaluation is Circuit Theory I and, consequently, its prerequisite, Introduction to Electrical Engineering. These courses present basic concepts in electrical theory, engineering applications and an introduction to the circuits laboratory. As in mathematics, veterans complete an online pre-test with linked subject based tutorials prior to enrollment in the degree program. The veteran then has the option of completing a one-time proctored post-test for course credit (C or better). This approach leverages the veterans' existing technical knowledge acquired through the nature of their service posts and accelerates their entry ahead to follow-on technical courses.

The creation of accelerated courses specifically for veterans enrolled in the program is another aspect used to accelerate degree completion. Veterans may have a base of technical knowledge acquired through the technical nature of their military service and, therefore, assigning them to introductory level courses with traditional freshman and sophomore students does not respect their technical expertise nor challenge their capabilities and accustomed pace. The development of subject-based online tutorials is being used to accelerate the veteran's entry into the math and

circuits sequences. These tutorials include videos of laboratory exercises to ensure that veterans understand the equipment and terminology used in the introductory courses. Additional online courses will be developed in the area of computer based tools, including such programs as MatLab, P-Spice, and Verilog (used in an introductory course taken by all electrical engineering students.)

Another aspect of this project is the inclusion of summer internships for participants. These have been provided by members of EPAP as discussed earlier and by funded research projects at the University.

### Kansas State University and the Military Environment

Kansas State University is located near Fort Riley, a major U.S. military installation, and, as a University, has more than 60 years of experience providing educational opportunities to military personnel and their families. The University provides academics, activities, services and support for military families. Kansas State University has been ranked among the most military-friendly universities in the country by *Military Advanced Education* magazine and by *G.I. Jobs* magazine. In addition, courses are offered on Post and via the Internet. Military personnel stationed on active duty, their dependents, and members of the National Guard are eligible for in-state tuition.

A model partnership between Kansas State University and Fort Riley was recently renewed in order to serve as a model military-to-university-community partnership. The agreement sets the following objectives: enhancing each institution's ability to accomplish its mission through collaboration; enhancing the professional and personal quality of life for each institution's constituent communities; creating new and innovative opportunities and programs that add great value to each institution through partnership; and increasing capacity at each institution to steward, manage and sustain major resources through collaboration, innovation and partnership.

The University has numerous programs aimed at understanding and supporting the needs of military personnel as identified in the recent American Council on Education report<sup>4</sup>.

Today, courses and degree programs are offered to military students and their families through distance education, evening college, on-campus, and at the military installations. Military students bring a unique depth of experience to the classroom that is appreciated by fellow students and faculty. The University also has a Veterans Administration office on campus.

There are fifty-seven programs between Kansas State University and Fort Riley today that aim to: a) create new relationships; b) offer a diverse experience and perspective; c) build a stronger academic-military community; d) improve quality of life; and e) enhance education and professional development. There are many additional support structures that may or may not be available on any given campus. Key supporting components include the development of strategies to inform veterans of engineering workforce opportunities and the recruitment activities, and coordination with campus military veteran support staff and personnel at nearby military installations. Understanding available resources is vital to the overall success of a program.

## Project Success

Student success (C or better) in Calculus 1 (or higher) and follow-on entry level engineering courses will be the primary evaluation metric. Students and evaluation metrics will be tracked as individuals enter the program and reported when a significant number of metrics are accumulated.

It is important to evaluate the experiences of interested veterans to determine their preparation for academic study, including the evaluation of military education and experience for academic credit and/or advanced placement. The comprehensive evaluation of this phase of the program cannot take place until the accelerated programs are in place. However, initial feedback will be gathered from veterans concerning their perceived abilities for success in an accelerated program.

Recruiting strategies and materials<sup>6</sup>, including program overviews, workshops, focus groups, and surveys have been developed. The consequential effectiveness is being evaluated based on feedback from military active-duty and veterans, and evaluation instruments are being developed in conjunction with the development of recruiting materials.

The ultimate final evaluation of these programs will be the student retention and degree completion statistics. These statistics can be compared to those of other cohorts using data that has been compiled with NSF support since 2005. This database was constructed to provide the ability to analyze retention and graduation rates by freshman cohorts at the university, college, and academic program levels.

## Summary

This project is leveraging the training and skill sets of the returning veterans toward fulfilling a workforce need in power engineering. The goals are to provide the academic and non-academic support structures to allow the veterans to be successful in completing their degree requirements. After initial activities within the power area, researchers plan to expand the program into other areas of engineering, as well.

## Acknowledgements

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## References

1. *Veterans' Education for Engineering and Science*, Report of the NSF Workshop on Enhancing the Post-9/11 Veterans Educational Benefit, McLean, Virginia, April 13, 2009.
2. *National Science Foundation Workshop on the Future Power Engineering Workforce*, September 5, 2008.
3. *Preparing the U.S. Foundation for Future Electric Energy Systems: A Strong Power and Energy Engineering Workforce*, IEEE Power and Energy Society, April 2009.

4. *From Soldier to Student: Easing the Transition of Service Members on Campus*, American Council on Education, July 2009.
5. D. Soldan, D. Gruenbacher, N. Schulz, B. Vogt, R. Natarajan, “Work in Progress: Streamlining Pathways to Engineering Degrees for Military Veterans,” *2011 Frontiers in Education Conference Proceedings*, Rapid City, South Dakota, October 2011.
6. S. Lord, K. Kramer, R. Olson, M. Karsada, D. Hayhurst, S. Rajala, R. Green, and D. Soldan, “Special Session – Attracting and Supporting Military Veterans to Engineering Programs,” *2011 Frontiers in Education Conference Proceedings*, Rapid City, South Dakota, October 2011.