



Earning a Ph.D. from an Engineering-Based Safety & Ergonomics  
Program: The Case for a  
Flexible Campus-Based Approach

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## **Introduction**

Our Colleague, Dr. Mark Friend, very aptly points out in his article “Ph.D. Program in Occupational Safety” that we (i.e. the safety community) have a substantial challenge facing us in terms of the number of terminally (particularly Ph.D.) trained individuals being prepared for careers in safety. He notes that “The field of occupational safety is in danger of disappearing, or at least losing its identity, as top programs from around the country continue to rely on educators from allied (or even tangential) disciplines.”

Dr. Friends’ concerns are substantiated by the findings of a recent study by the National Institute of Medicine (National Academy Press 2000), which noted that only nine doctoral programs in safety were offered in the United States as of 1997. The report encouraged the use of distance learning and other alternatives to traditional education and training programs. The study also cited data indicating that while professional safety certification (CSP) appears to be rising, the proportion of those reporting themselves as Registered Professional Engineers (PE) appears to be declining substantially.

The solution Dr. Friend proposes to this problem is a Ph.D. program that is available completely on-line. Such an approach would eliminate geographic restrictions and tap into the existing pool of trained safety professionals who, for various reasons, cannot leave their current positions to fulfill the on-campus residency requirements integral to most Ph.D. programs. In response to this suggestion, the Academics



Practice Specialty Group has formed a working committee to investigate the feasibility of this option. We (the authors) fully endorse this inquiry and intend to contribute to its investigation in any way that we can.

As safety engineering professionals, we are faced with a unique challenge regarding on-line training, particularly at the doctoral level. Specifically, most science based, and particularly engineering, doctoral processes involve substantial use of laboratory and data processing facilities as part of the required research training. This “laboratory component” also involves heavy personal interaction and mentoring with research faculty, who assist candidates through all phases of their research. Accordingly, most engineering doctoral programs mandate some level of on-campus residency as part of their overall requirements.

Our Occupational Safety and Ergonomics Program (OS&E) at Auburn University is, we believe, typical of engineering based safety programs. A sequenced two-semester residency is required for all doctoral students. Our program, however, is probably somewhat unusual in that Auburn has a long (over 20 year) history of distance education through our Engineering Graduate Outreach Program (GOP). Further, included in our stream of graduates are individuals who have completed most or part of their coursework via the GOP route. Most GOP graduates have been at the masters’ level, although several of our doctoral graduates completed the majority of their coursework via the GOP and were on-campus only for a minimal time, including the required residency period. Thus, their experiences have been a true hybrid of on-line and campus based education. In light of this background, we felt it would be helpful to the community to survey the opinions of some of these graduates. Their responses form the basis for the remainder of this article.

## Context

Before discussing the survey results, we feel it is important to understand the context. The OS&E program at Auburn is an option in the graduate offering of the Industrial and Systems Engineering (ISE) Department at Auburn University (AU). Auburn is a Land Grant institution with focuses in education, engineering, science and business. The OS&E program is also one of the programs in the NIOSH supported Deep South Education and Research Center (ERC) for Occupational Health and Safety and engages in extensive interdisciplinary activities with the ERC program at the University of Alabama at Birmingham (UAB). OS&E program objectives coincide with AU’s Land Grant orientation and are:

1. **Education:** To provide OS&E educational opportunities for both full-time and part-time students at the graduate level through both on-campus and video/web-based course offerings.
2. **Research:** To advance knowledge in OS&E through faculty and student research and to enhance the research capabilities of OS&E students by involving them in faculty supervised research activities.
3. **Extension:** a. To provide opportunities for both basic and advanced continuing education in occupational safety and ergonomics for practicing engineering, supervisory, occupational medical, and safety personnel; b. To provide OS&E educational opportunities for full-time, on-campus students at the undergraduate level; and c. To provide assistance on a non-fee basis to those seeking information relative to OS&E.

The degrees offered by the ISE department are the Master of Science (MS), Master of Industrial and Systems Engineering (MISE), and the doctor of philosophy (Ph.D.). All are engineering degrees, i.e. there is no “safety” or OS&E degree. The MS involves a thesis and one semester of residency while the MISE requires a design project with no residency. As mentioned previously, the Ph.D. requires two consecutive



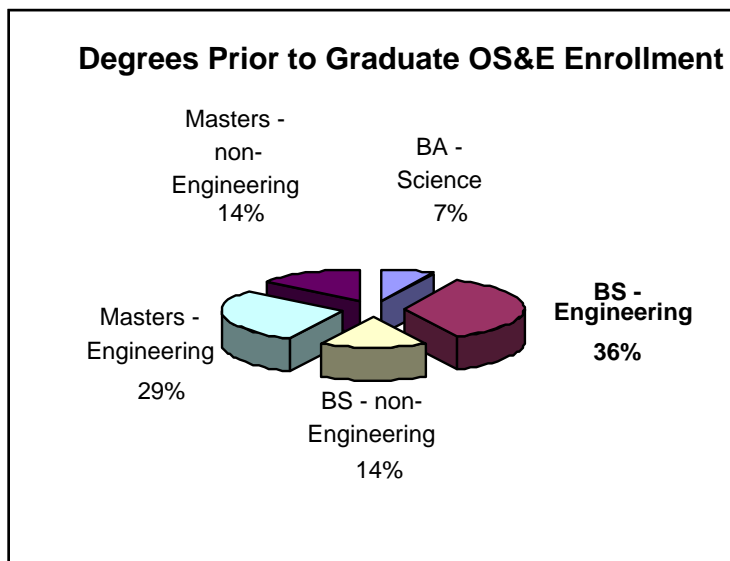
semesters of on-campus residency. Both masters' degrees require a minimum of 30 semester hours of coursework (including thesis or project). The doctorate requires a minimum of 48 hours of coursework beyond the bachelors' degree and at least 12 hours of dissertation. All students must matriculate in an 18 hour ISE departmental core consisting of courses in operations research, production planning and control, manufacturing systems, engineering economics, engineering statistics and safety/ergonomics. For acceptance into the program, students must demonstrate a strong background in science (at least through calculus based physics), mathematics through differential equations, and preferably, previous engineering education. All OS&E Students matriculate in two safety engineering, two ergonomics, industrial hygiene, and human factors course(s). Students entering the program with backgrounds in any of these areas may be exempted from courses on a case-by-case basis. In addition, doctoral students must take one advanced safety engineering and advanced ergonomics course, as well as a research methods course. Further, doctoral students are encouraged to matriculate in elective courses that are related to their chosen research topics. Doctoral elective courses historically have addressed such topics as biomechanics, exercise physiology, industrial psychology, survey design, hazardous materials management, and epidemiology. On-campus masters' students normally require 2 to 2 ½ years to complete their programs, whereas the norm for doctoral candidates is approximately 3½ to 4 years. The norms for outreach-based students vary widely, but take approximately 3-4 years for the masters' degrees and (very roughly) 3 to 5 years from the masters to the doctorate. Students who lack engineering backgrounds are typically required to take undergraduate leveling courses in ISE, adding another 6 months to one year to the expected degree completion time.

## Alumni Survey

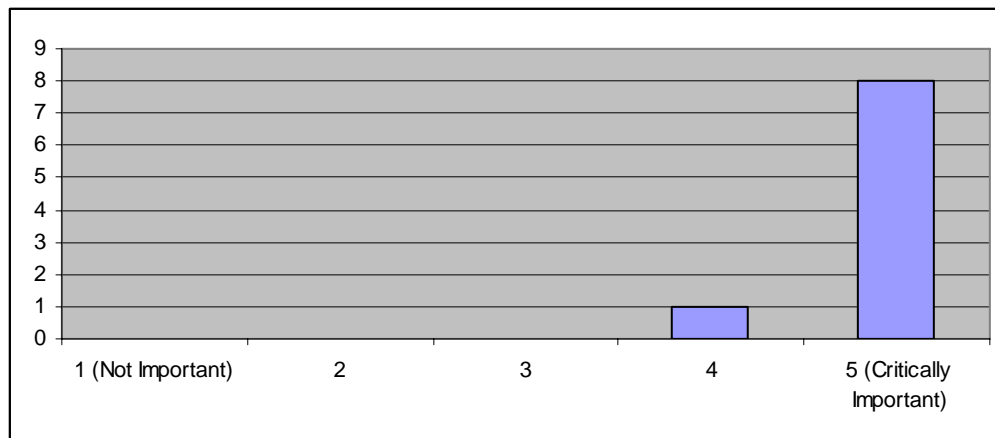
Our most recent alumni survey took place in February 2005. After designing the survey, we were assisted in the administration of the survey instrument by a private research firm, Censeo Research Services, of Birmingham, Alabama. The instrument was sent to recent alumni (25 masters and 10 doctoral) who graduated during the years 1998 through 2004. The overall response rate was 94% including 24 masters and 9 doctoral graduates. Results were compiled separately for the masters and doctoral graduates. The following responses were compiled from the doctoral graduates only (**bolded responses indicate highest frequency**):



1. What degree(s) did you hold prior to enrolling in the OS&E Program?

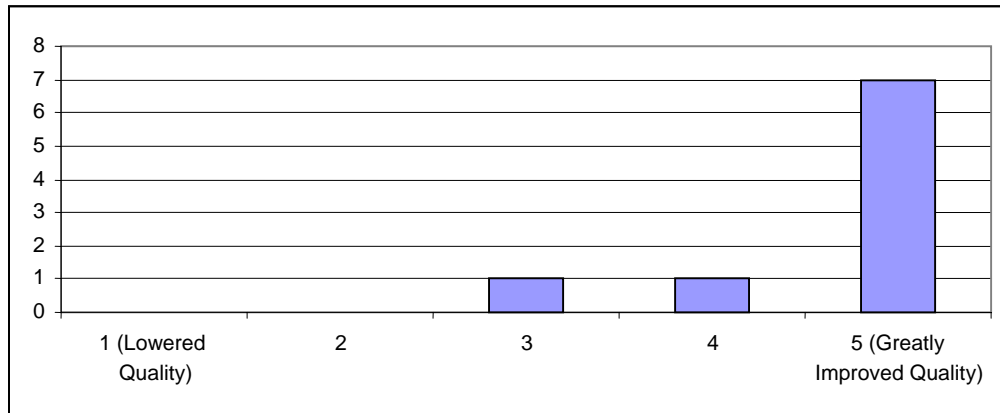


2. How important to you was it that the OS&E program, be engineering based? (Please rate from 1 → 5) [mean = 4.89]

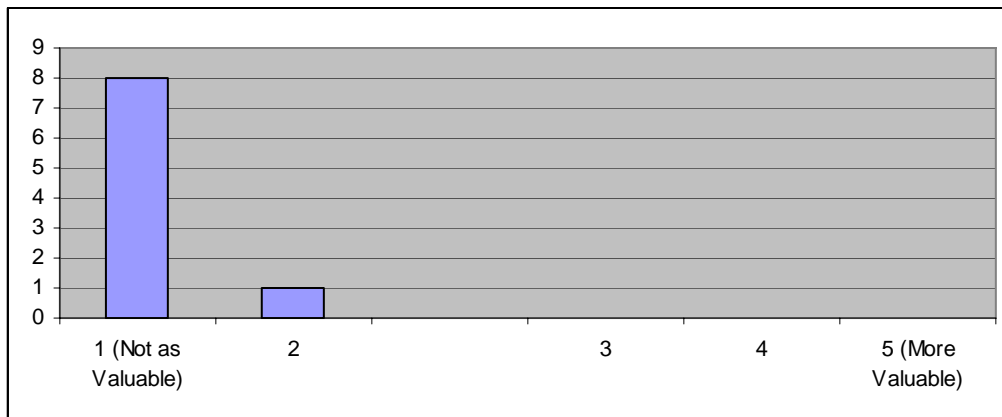




3. In your opinion, how much did attending an engineering-based Safety and Ergonomics program improve the quality of your education and training? (Please rate from 1 → 5) [**mean = 4.67**]

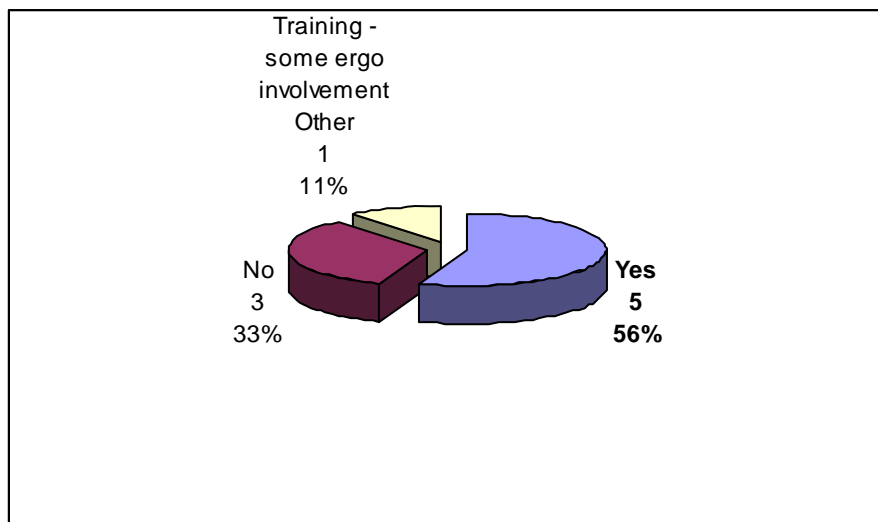


4. If your degree had been in a safety discipline area other than engineering (e.g. safety education, management, or science) what would be its value compared to your engineering-based degree? (Please rate from 1 → 5) [**mean = 1.11**]

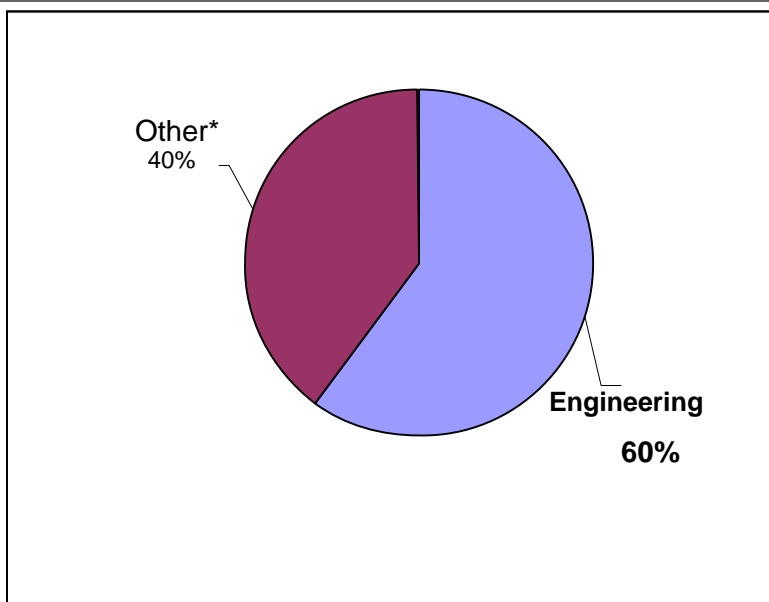




5. Are you currently employed in a field related to occupational safety and/or ergonomics?



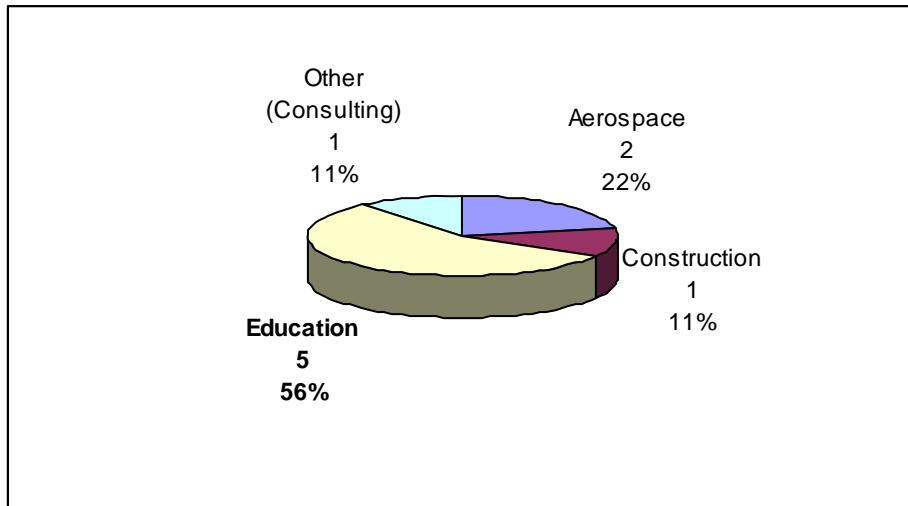
6. If your answer to the previous question was yes, where is the SH&E function located in your organization?



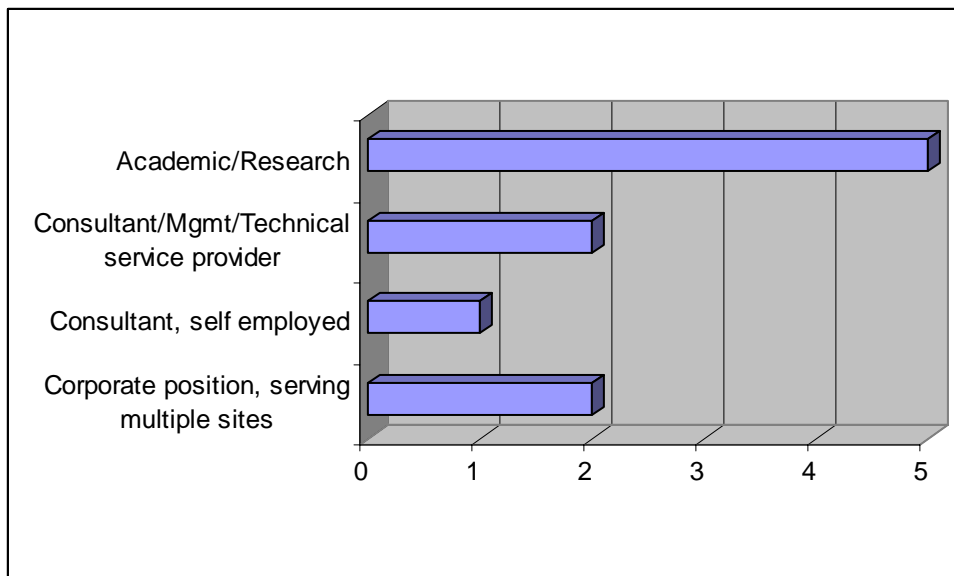
\*Other – 1. All areas – we provide consulting services in SH&E to other companies; 2. Independent Organization



7. In which category does your company/organization fall?



8. How would you describe your current position?





9. Please rate the Auburn OS&E areas listed below based on your experience:

	<b>1 (Poor)</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5 (Excellent)</b>	<b>Response Average</b>
Quality of Faculty	0% (0)	0% (0)	0% (0)	22% (2)	<b>78% (7)</b>	<b>4.78</b>
Faculty Accessibility	0% (0)	0% (0)	11% (1)	11% (1)	<b>78% (7)</b>	<b>4.67</b>
Quality of Electives	0% (0)	0% (0)	22% (2)	33% (3)	<b>44% (4)</b>	<b>4.22</b>
Quality of Industrial Engineering Courses	0% (0)	0% (0)	10% (1)	<b>70% (7)</b>	20% (2)	<b>4.10</b>
Quality of OS&E Courses	0% (0)	0% (0)	10% (1)	10% (1)	<b>80% (8)</b>	<b>4.70</b>
Dissertation, thesis, or project experience	0% (0)	0% (0)	10% (1)	20% (2)	<b>70% (7)</b>	<b>4.60</b>
<b>Total Respondents</b>						<b>9</b>

10. Your doctoral process had an on-campus/residency requirement designed to maximize your interface time with research facilities and faculty...

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Response Average</b>
How valuable was this requirement to you (1= Not Valuable, 5=Very Valuable)	0% (0)	11% (1)	0% (0)	22% (2)	<b>67% (6)</b>	<b>4.44</b>
Do you feel that the residency was necessary for you to accomplish	11% (1)	22% (2)	0% (0)	11% (1)	<b>56% (5)</b>	<b>3.78</b>



quality research (1= Not at all necessary, 5=Extremely Necessary)						
<b>Total Respondents</b>						<b>9</b>

11. Briefly explain why residency was or was not of value to your research experience:

**Total Respondents = 8**

1. Without the daily interaction with faculty, it would have been impossible to define and pursue a productive product in an efficient manner. I spent three years in Auburn's OS&E Video Outreach program, so I have a reference against which to compare. I could not have done the doctoral program without the residency.
2. a.) To have access to and develop close relationship with advisor/committee members. b.) Work very closely with the advisor. This is very important in receiving feedback. Interaction with the ISE community c.) Access to other courses offered only on-campus.
3. Research cannot be done without the ability to talk with others about methods, interpretations, direction, conclusions, etc. In my opinion, one cannot get a research degree [that is] worth anything unless there is significant face to face time spent with one's professor and committee members.
4. Face time w/ professors and grad students.
5. Had to fund my own research anyway. I could have done this anywhere given Auburn's limited instrumentation capabilities.
6. Although a project may be able to be completed without residency, a valuable doctoral program is based upon routine interaction with faculty. Participation in research (as an RA (research assistant)), perhaps other than your own area, is a very valuable learning experience. I learned much about the practical side of research including experimental design, data collection, and data analysis by interacting with faculty in many funded and non-funded research projects.
7. The personal interface value and learning were very important, although my research was conducted predominantly offsite. Therefore, I think some residency is important to solidify the vital networking and learning necessary at the PhD level, but the research does not necessarily need to be accomplished in-residence, particularly if Auburn facilities/resources are not needed. Overall - I believe some residency is essential, but the overall residency requirements should be evaluated on a case-by-case basis. This may afford even more participation by talented and interested professionals currently employed but without the ability to attend in residence for two full consecutive semesters. In this case, consideration of 2 semesters non-consecutive or 1 semester and multiple shorter visits, or 1



semester and a summer may be viable options, depending on the person, the program, the research, and the job situation. The current job environment demands competence (making a PhD in this area extremely valuable) yet simultaneously demands minimal time away from the fast-paced, constantly changing workplace. Thus, balancing these drivers with residency flexibility is a win-win for all. Auburn's reputation, robust distance education program, and flexibility to accommodate my residency/program desires were THE reason that I chose Auburn and completed the program. This is a significant discriminator in the current academic marketplace. I strongly believe that I am representative of a large segment of potential students that is vigorously searching for the appropriate programmatic mix. My recommendation is to strongly bolster the reasons I chose Auburn outlined above -- these are and will remain the strengths of the OS&E program at Auburn. Likewise, partnerships with the government and DoD, both of which are critically short of this skill set (OS&E), will be structural partnerships that yield stable, high volumes of students with immediate application in a high-responsibility, fulfilling work environment -- pursue these options with vigor as they almost mandate the program quality and flexibility afforded by Auburn.

8. Allowed for a significant amount of interaction with my major professor and other committee members. I also had the opportunity to participate in a number of different funded research projects during my time on campus. Further, being on campus allowed me to take a number of courses from other departments that were vital to my research area, and not offered in an outreach venue.

## Discussion

The respondents, as expected from their undergraduate backgrounds, show a very strong preference for graduate safety education that is engineering based. The majority of them are currently employed in OS&E or closely related fields, where the safety, health and environmental functions are in engineering or regulatory components of their organizations. Most work in academia (55.6%) or aerospace (22.2%), with their primary function being academic efforts and research. They were generally satisfied with their education experience at Auburn and rated their research/dissertation experiences as excellent.

Responses to the questions concerning a required residency for the doctoral process were, interestingly, very mixed. All except one respondent felt that the residency experience was valuable, due primarily to the interface with faculty and other graduate students. Distance education was cited as an effective way to accomplish coursework, but not as a substitute or an alternate mode for residency. When asked if residency was needed to accomplish quality research, three of the graduates (33%) appeared to disagree. One respondent, while agreeing that some form of residency is essential, strongly suggested that a case-by-case approach be used to determine residency requirements. This respondent also inferred that a pool of talented engineering professionals would probably be interested in doctoral programs that do not have extensive or consecutive on-campus requirements.



## Conclusions

The limited sample provided by the foregoing survey should be used with caution when drawing conclusions. However, some inferences can be drawn:

1. Doctoral graduates of the Auburn OS&E program are generally pleased with the education they received
2. Program graduates are employed, for the most part, in academic and research positions.
3. The research/dissertation experience is a valuable component of the doctoral experience in an engineering based safety program.
4. Interactions with faculty and other graduate students are perceived as valuable aspects of the doctoral process.
5. On-campus residency is an important part of the safety engineering doctoral education process.
6. The manner in which the on-campus residency requirement is satisfied should have some flexibility.

The impact these “inferences” should have on the current dialogue into the feasibility of an on-line doctoral process, can, of course, be widely debated. They do, however, suggest that if the discipline of engineering is to be considered an active participant, and then consideration must be given to some form of residency requirement. Exactly “how” the residency is satisfied is an open question and one that the engineering education community, itself, needs to rethink. And, “rethinking” appears to be absolutely necessary if the engineering profession is to remain a vital element in the safety community.

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