LIDAR EDUCATION AT GEORGIA TECH

Gary Gimmestad and Leanne West

Georgia Tech Research Institute, Atlanta, Georgia USA

1. INTRODUCTION

The Georgia Tech atmospheric laser radar (LIDAR) team has found that LIDAR technology is an excellent teaching tool for a wide range of topics in electro-optics and well as atmospheric science. Our education projects began in 2001 when we developed an eye safe LIDAR with undergraduate women at Agnes Scott College in Decatur, Georgia, and we have initiated several other projects since that time. The LIDAR education program at Georgia Tech is reviewed here with comments about future prospects.

2. THE AGNES SCOTT COLLEGE PROJECT

The Agnes Scott project, funded under an NSF Major Research Instrumentation grant, was comprehensive, including classroom instruction, laboratory exercises, system design and performance modeling, and construction of the instrument [1]. In the course of this project we succeeded at teaching all aspects of LIDAR engineering at the undergraduate level, so that the students had a complete understanding of the system. About 40 one-hour lectures were prepared in Power Point by the team, and those lectures formed the basis for future work in LIDAR education.

3. DEVELOPMENT OF COURSES

Starting with the Agnes Scott lecture series, we developed materials for courses in two other formats, a 3-1/2 day short course and a Georgia Tech academic course. The short course is now taught every August in Georgia Tech's professional education program [2]. Like the original lecture series, it is comprehensive, covering all aspects of LIDAR Engineering and using the signal-to-noise ratio of a measurement as the figure of merit. The course also includes laboratory demonstrations and one-half day of hands-on instruction in our LIDAR laboratories. The instructional materials were also used in an academic class during the spring semester in 2007. That course differed from previous offerings in that it was available to graduate students as well as advanced undergraduates. The graduate students were

required to presents talks in which they analyzed existing or proposed LIDAR systems, including space-based LIDARs.

4. THE CURRENT AGNES SCOTT PROJECT

The current two-year project with Agnes Scott College is funded under an NSF Course, Curriculum, and Laboratory Improvement Phase 1 grant. In this project, we are developing teaching materials to integrate the college's LIDAR into several academic classes, and we are upgrading data analysis software to make it much more user friendly. As a part of this work, we rebuilt the Agnes Scott College LIDAR to solve some long-standing problems and to make significant upgrades. The overall purpose of the project is to demonstrate a true handoff of the LIDAR system, so that the science faculty at a liberal arts college can make use of the LIDAR in classroom/lab instruction and also in undergraduate research projects.

5. THE LIDAR TEXTBOOK

There has never been a true textbook for teaching LIDAR technology. In recognition of this need, the GTRI LIDAR team submitted a successful book proposal to the Cambridge University Press, and we are under contract writing a textbook entitled *Lidar Engineering: Introduction to Basic Principles*. This textbook will be an invaluable resource for LIDAR education, and we anticipate that it will become a standard text worldwide.

6. FUTURE PROSPECTS

The GTRI LIDAR team intends to submit a CCLI Phase 2 proposal to NSF, and we are already recruiting partner school to participate in a web-based community of undergraduate LIDAR scholars. We are also developing a low-cost LIDAR instrument specifically for LIDAR education and training.

7. REFERENCES

[1] L.L. West, G.G. Gimmestad, D.W. Roberts, J.M. Stewart, J.W. Wood, and A.L. Bowling, "Atmospheric Laser Radar as an Undergraduate Educational Experience," *American Journal of Physics* **74**, 665-669 (2006).

[2] See www.pe.gatech.edu/def3005.

BIOSKETCH

Gary Gimmestad received his B.A. degree in physics from Saint Olaf College and his M.S. and Ph.D. degrees from the University of Colorado, also in physics. His research area is applied optics. Since 1986 he has been a Principal Research Scientist in the Electro-Optics laboratory of the Georgia Tech Research Institute, where he was named the Senior Faculty Leader in Remote Sensing Technology in 1988 and the Glen Robinson Chair in Electro-Optics in 2002. His primary research interest is in developing innovative laser-based remote sensing systems for a wide variety of atmospheric applications. He is a Fellow of the IEEE and SPIE, and a member of DEPS, OSA, AAAS, and AGU.