Research and Education in Composite Materials and Structures at Virginia Tech

Any tribute to the longevity of the Department of Engineering Science and Mechanics at Virginia Tech would not be complete without mentioning the many activities in the department focused on the study of composite materials and structures. These activities began in 1969 with the successful funding of a proposal submitted to the Department of Defense THEMIS project. At the time it was the largest single funded research grant at Virginia Tech, and the activities continued for six and one-half years. Ten faculty members and 25 graduate students performed research funded by the grant. This grant was followed by many other grants and contracts over the years, one of the largest single one being the NASA-Virginia Tech Composites Program. The Program, which was funded from the mid-70s to the mid-90s, was a cooperative effort in graduate research and education with the NASA-Langley Research Center in Hampton, Virginia. Close to 100 graduate students graduated from the Program. The Program led to numerous other research projects in the area of composite materials and structures with the NASA-Langley Research Center. Other strong research programs, such as those in the Materials Response Group and the Center for Adhesion and Sealant Science, dealt directly with composite materials. Scores of students were supported by these activities. Two state-wide initiatives, Composites in Virginia and the Virginia Institute of Materials Science, were a direct result of the research being conducted at Virginia Tech at the time. A number of students were supported by these initiatives. Because of the numerous activities at Virginia Tech in the composite materials, the Center for Composite Materials and Structures was formed to leverage talents and resources. The Center was successful in raising revenue and the Center held annual reviews wherein research results were presented to industry and government researchers.

Coincident with all the research activities, a variety of courses in composite materials and structures were developed. The first course, a dual-level undergraduate/first-year graduate introductory course entitled Mechanics of Composite Materials, was developed in the mid-70s, one of the first such courses in US universities. There followed the development of other courses that built upon this introductory course. Courses devoted to the study of composite plate theory, the manufacturing of composite structures, the mechanics of composite strength and life, the design of composite structures, and advanced analysis methods were available to the many graduate students. These courses complemented classic courses in continuum mechanics, elasticity, fluid mechanics, plasticity, visco-elasticity, plates and shells, finite elements, experimental methods in solid mechanics, wave propagation in solids, and others. These courses prompted graduates students to sell T-shirts one year that proclaimed "I learned my ABDs at Virginia Tech" and another year that listed "Top 10 Reasons to be in Composites at Virginia Tech," No. 2 reason being that "Two elastic constants are not enough."

The department has also been successful in hosting four major conferences which focused on composite materials and structures: The IUTAM Conference Mechanics of Composite Materials: Recent Advances in August 1982; the 3rd Annual Technical Conference of the American Society for Composites in October 1989; the IUTAM in 1998; and the 16th Annual Technical Conference of the American Society for Composites in September 2001; and the Seventh International Conference on Durability of Composite Material Systems (DURACOSYS) in September 2006. These conferences were well attended and the proceedings are still of interest.

While the number of research grants in the area of composite materials has decreased relative to previous times, activities in composite materials and structures continue with applications to wind turbines and other alternative energy sources, civil structures, aircraft and space structures, smart materials, and characterization of dynamic response. In addition, combinations of traditional carbon fibers with carbon nano-tubes or other nano-materials appear to have considerable promise for increasing the performance of materials and structures in the future.