



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

## UNC Charlotte – Lee College of Engineering Senior Design Program Company Information

<b>Company Name</b>	Mechanical Engineering	<b>Date Submitted</b>	11/20/2019
<b>Project Title</b>	Universal manufacturing apparatus for Carbon Fiber tube/ airfoils (UNCC_TUBE)	<b>Planned Starting Semester</b>	Spring 20

### Funding:

What is the source of funds that will be used to cover all of the direct costs of this project?

Self/ Grant \_\_\_\_\_

Is this source of funds already secured? Yes  No

### Technical Contact(s)\*

	Technical Contact 1	Technical Contact 2	Technical Contact 3
<b>Name</b>	Jerry Dahlberg	Mike Stokes	
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<b>Email Address</b>	<a href="mailto:Jdahlbe2@uncc.edu">Jdahlbe2@uncc.edu</a>	<a href="mailto:tmstokes@uncc.edu">tmstokes@uncc.edu</a>	

\*We would like to have more than one technical contact, so there is a back-up in case of travel, sickness, job re-assignment, etc.

### Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	4	Electrical	1
Computer		Systems	
Other ( )			

### Project Overview and Requirements:

The William State Lee College of Engineering has long been well known for a strong emphasis on the full scope of the design build process. The students are encouraged to utilize all of the tools and knowledge they have acquired when addressing a new or existing engineering problem. This has better prepared the students for real world issues they encounter when they reach industry and looks favorable on the University for supplying the students with these tools and knowledge.

Additional tools other than subtractive and additive manufacturing are available and could be used in extending the manufacturing capabilities of design projects and research in the college of engineering. Composite construction and fabrication are a useful manufacturing tool that could be an inexpensive means of adding to UNCC's capabilities. The Motorsports Research Lab has acquired some large amounts of 1x1 carbon fiber woven sheets that are rarely used in carbon fiber manufacturing because of the limited means creating the non-recurring tooling and the absence of a curing vessel.

The team would be responsible for the design, construction, and documentation of carbon fiber manufacturing apparatus (CFMA). This would aid the undergraduate, Kulwicki, motorsports lab, graduate research lab, as well as industry sponsored senior design projects in their ability to construct and utilize composite structural members in their designs. This is a tremendous advantage because of the high strength to weight ratio of carbon fiber. Additionally, the high costs that limit the use of composites is reduced once the means of fabrication is established (through the construction of the apparatus).

There are numerous methods to make and cure carbon fiber tubes. These methods include the use of pressure, heat and or time. Multiple design options should be explored to determine what is the most cost effective and easy to use apparatus. The team would then be responsible for the construction of an apparatus that would handle elevated temperatures and pressures needed for the curing process of the composites. The initial composite geometry tasked with fabricating would be a tube-like structural member varying in sizes: 2, 3, 4, 5, and 6 inches.

### **Expected Deliverables/Results:**

Deliverables include:

- The full design package of the manufacturing apparatus to include CAD drawings, wiring diagrams, data acquisition and analysis code, and appropriate calculations.
- The construction of the new apparatus will be in the Motorsports research shop.
- A user's manual with step by step instructions to include safety procedures.
- A Safety manual outlining all safety considerations for the equipment
- Multi-piece mold tool able to accommodate varying geometries through
- inserts should include:
  - o The use of as many off-the-shelf components as possible
  - o Mechanical system that will extract the mandrel in the post-cure process
  - o Mandrels of several sizes, ranging from 2 in to 6 in

**List here any specific skills, requirements, specific courses, knowledge needed or suggested**



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**(If none please state none):**

- Familiarity or interest in design, procurement, fabrication, and assembly.
- All members of the team will be required to take the Motorsports Pink Badge safety test and pass.