



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

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

|                      |   |                                  |                   |
|----------------------|---|----------------------------------|-------------------|
| <b>Company Name</b>  | <i>MEES</i>   | <b>Date Submitted</b>            | <i>04/09/2019</i> |
| <b>Project Title</b> | <i>High Speed Slide for Ultra-Precision Machining</i><br>UNCC_SLIDE | <b>Planned Starting Semester</b> | <i>Fall 2019</i>  |

### Funding:

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

Is this source of funds already secured? Yes   x   No \_\_\_\_\_

### Technical Contact(s)\*

|                      | <b>Technical Contact 1</b> | <b>Technical Contact 2</b> | <b>Technical Contact 3</b> |
|----------------------|----------------------------|----------------------------|----------------------------|
| <b>Name</b>          | Matthew Davies             | Nick Horvath               |                            |
| <b>Phone Number</b>  | 704-687-8326               |                            |                            |
| <b>Email Address</b> | madavies@uncc.edu          | nhorvat1@uncc.edu          |                            |

\*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:

| <b>Discipline</b>            | <b>Number</b> | <b>Discipline</b> | <b>Number</b> |
|------------------------------|---------------|-------------------|---------------|
| Mechanical                   | 1-3           | Electrical        |               |
| Computer                     |               | Systems           |               |
| Other (                    ) |               |                   |               |

### **Project Overview and Requirements:**

Freeform optics are revolutionizing the optics industry. However, the speed of ultra-precision machines is insufficient to take advantage of the new technology by producing optics and optical systems at sufficiently low cost. To enable this, ultra-precision, new ultra-high-speed machining centers operating at 10x - 100x current speeds/accelerations and having accuracy equal to or better than current machines are necessary. This project will involve the design, construction and testing of a single ultra-precision high speed linear axis with target speeds of 20,000 mm/min, accelerations of 0.5 g to 1 g, and dynamic positioning accuracy of 10-20 nm. The slide is a building block of envisioned ultra-high-speed, ultra-precision, machining centers for next generation freeform optics and optical systems. The over-arching idea is to transform optical systems from the manufacturing paradigm of element-by-element manufacturing followed by painstaking assembly and adjustment to one of monolithic system manufacturing where the optical surfaces are all machined in a single set-up, thus eliminating many of the assembly and adjustment costs. It is envisioned that the preforms for the optical systems could come from additive manufacturing.

The requested staffing is 1-3 mechanical engineering students well-versed in CNC machining and metrology.

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

Deliverables include:

- High speed linear axis system with drive, control, and position metrology incorporated
- Travel: > 100 mm
- Maximum Speed: > 10,000 mm/min (1.7 m/s)
- Acceleration: Able to accelerate up to maximum speed and decelerate back to zero speed within the full travel limit
- Motion Accuracy in Travel Direction: < 100 nm
- All required course materials and assignments

### **List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):**

- Familiarity or interest in manufacturing technology
- Familiarity or interest in optics
- Familiarity or interest in metrology technology