INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	*ASML*	**Date Submitted**	*05/8/2026*
Project Title	*High Precision Low Cost Linear Air Bearing Stage Phase 3 (ASML_AIR3)*	**Planned Starting Semester**	*Fall 2026*

Senior Design Project Description

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	4-5	Other/any (see skills list section below)	0-1

Company and Project Overview:

ASML is the leading photolithography tool supplier to the semiconductor industry. We engineer, design, build, market, install and maintain the machines that print the majority of the semiconductor chips used in computers, cellphones and elsewhere.

ASML's headquarters are in The Netherlands, where the main engineering and integration site is located. The company also has two large hardware engineering and production sites in the US: Wilton CT (ASML US), and CA (Cymer). Cymer produces the light sources that enable the lithography process. This includes Deep Ultraviolet Lasers (193nm wavelength - light path in air and water) and the Extreme Ultraviolet Light Source (13nm wavelength – light path in very low pressure hydrogen). ASML US in Wilton produces all variants (including DUV and EUV versions) of several major modules of the TWINSCAN® Lithography machine: The Reticle Stage, the Reticle Handler, and several optical modules, including Wafer Alignment, Wafer Level Sensing (topology mapping), and Actinic Light Uniformity Compensation. All EUV modules are designed

to operate in ultra-clean vacuum environment. In addition, Wilton also produces the optical module of the YIELDSTAR® in-line wafer inspection tool.

This Student Project will be sponsored by the Mechanical Development Group of ASML US Wilton CT, and will target one of the mechanical issues that are intrinsic to our capability to keep up with an aggressive roadmap, where our machines have to perform at ever decreasing error levels to enable printing ever smaller features on chips, and remain attractive to our customers in a competitive environment. The problem is how to achieve precise and stable positioning of critical elements of our machines while reducing cost. Cost reduction is important for ASML for both DUV and EUV product lines. DUV faces strong cost pressures from competition. EUV costs are very high, and we are trying to reduce them to make our machines more affordable to semiconductor fabs.

Project Requirements:

The students, in consultation with advisors at UNCC and ASML, shall:

Acquire a basic understanding of typical precision mechanics positioning devices, of possible interest for this project. The students will also learn how to implement and use position sensors to accurately measure relative displacements in test samples.

The goal of the project is to produce new designs for key precision structural components that can be produced at low cost, in comparison to our present designs and construction techniques. This includes optimizing structures so that they can be made of alternative materials that can be obtained at low cost due to economy of scale resulting from their widespread use in commercial products. Also designing components so that they can be constructed using low-cost methods.

Expected Deliverables/Results:

Low Cost Precision Linear Direct Drive Air Bearing Stage

- Engineer, design and build a precision Single Degree of Freedom (SDOF) direct drive linear air bearing stage from low-cost materials.
- Implement a high precision metrology system to measure intended displacement along the axis of travel and unwanted deviations perpendicular to the axis of travel.
- In this third phase of the project, the students are allowed to build on the developments of the previous teams and re-use/re-purpose their hardware and software.

- We envision exploiting commercially available materials for constructing the air-bearing guideways of the stage, for example:
    - Granite and “quartz” plates in the thickness and grades commercially available for consumer countertops
    - Float glass
    - Epoxy/aggregate casting material

- We envision exploring and prototyping at least one of:
    - Moving magnet configuration linear motor
    - Printed circuit board (wireless coil) linear motor

- We expect the stage to:
    - Have a constant speed motion range of at least **+/- 150 mm**, measured from the origin of the metrology system.
        - Have positioning accuracy better **than 5 mm** when moving at constant speed through the above-specified range.
    - Accelerate from zero to a constant speed of at least **1 m/s** within **1 s**.
        - This includes having settled to within the accuracy specified above, while still at least **151 mm** away from the origin.
    - Scan at least **100** consecutive full motion cycles, in-spec, without pause and without damage or degradation.

- We expect the stage and metrology system to be fully operational, in-spec, under automatic control by the end of the project
- The exact scope of the project should be negotiable at the outset. The sponsor and the faculty advisor will help the students finalize the goals during the first couple of meetings with the team.
    - Therefore, the above requirements are not yet mandatory at the time of issuing this proposal.

Disposition of Deliverables at the End of the Project:

Need to know: The ASML sponsor will define the scope and content of this project such that it will be possible to successfully complete by the students without requiring disclosure of any company-proprietary information. No ASML-proprietary information shall be disclosed to the students in the course of this project.

Public Domain: Any and all intellectual property to be created by the students in the course of this project shall be considered to be in the public domain. Therefore, it is explicitly allowed to be presented at the Student Expo and/or published.

Hardware Disposition: All the hardware purchased or constructed in the course of the project shall remain at UNCC and shall be available for possible reuse by future ASML projects.

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

Communication and project organization/leadership skills

- Periodic progress reviews with the sponsor (weekly ~ 1 hour),
- Concept Design Review and Prototype Design Review meetings
- All meetings on MS Teams or Zoom

Skill/knowledge/interest:

- *Mechanical Engineering: Precision mechanics.*
- *Mechanical Engineering: Metrology*
- *Mechanical Engineering: Manufacturing.*
- *Mechanical Engineering: Test set-up and general lab skills.*
- *Any engineering discipline: Interfacing and controlling motion and metrology systems. Hardware and/or software.*

At the outset of the project, ASML requires no specific knowledge beyond acceptable academics in Engineering. However, the individual(s) must be willing to dedicate substantial effort towards “on the job” learning in the areas outlined above.