UNDERGRADUATE SUMMER RESEARCH PROGRAM PROPOSAL

- Project title: **Thermal degradation of stereolithography 3D printed molds for aerospace composite production.**

- Faculty advisor: **Dave Kim**

- Project description

  Stereolithography (SLA) is a revolutionary additive manufacturing or 3D printing process that has significantly impacted industries worldwide. SLA utilizes photopolymerization to solidify polymeric liquid resin layer by layer, creating highly detailed three-dimensional objects. Many aerospace manufacturers employ SLA technology for soft tooling applications, referring to creating temporary molds or tooling fixtures using more flexible and less durable polymers than traditional hard tooling materials like steel or aluminum. However, one critical consideration in applying SLA soft tools is their susceptibility to thermal degradation. While SLA resins can exhibit excellent mechanical properties, they often lack the heat resistance necessary for the composite bladder molding process – the focus of this project. Rooted in Dr Kim's research collaboration with a local aerospace manufacturer, which uses bladder molding processes to manufacture hollow composite structures of unmanned aircraft systems (UAS), this hands-on project offers an undergraduate research assistant the opportunity to design, conduct, and analyze the mechanical properties of thermally degraded SLA 3D-printed coupons and molds currently used in active UAS projects. The assistant will operate a brand-new SLA machine, a coordinate measuring machine, a programmable furnace, and our Instron tensile tester, available in our labs under engineering technicians, graduate students, and the supervisor (Dave Kim). The empirical modeling of the thermal degradation will draw the optimal bladder molding process conditions for SLA 3D-printed molds.

- Deliverables
  - Design, setup, and conduct the SLA 3D printing process to print coupons and mold samples.
  - Evaluate the dimensional accuracies of SLA-printed coupons and molds.
  - Conduct mechanical property tests for thermally degraded SLA coupons and molds.
  - Analyze the force and displacement data to draw the optimal process conditions.
  - Document the processes and the results.

- Time requirements
  1) The expected duration of the project, up to 240 hours.
  2) Flexible Mon-Fri, 8am-5pm, May 16 thru Aug 5; EXCEPT from July 1 to July 15

- Constraints
  - None

- Required skills and knowledge
  - Completion of MECH 309 (mechanical property testing) and MECH 310 or machine shop experience

- Preferred qualifications
  - Excellent work ethic (professional behavior, encompassing integrity, responsibility, quality, discipline, teamwork, and effective communication.)