**SimCenter: National Center for Computational Engineering**

**Aircraft Performance Design Contest**

Goal: To inspire third- and fourth-year HS students to learn about Engineering and Design, and motivate them to consider a career in a STEM-related field.

Background: Using a computational simulation-based tutorial on the SimCenter website, using a simple airfoil students can gain an understanding of the basics of fluid mechanics in different flight regimes . Based on the computed solutions for pressure on the airfoil surface, students will be able to estimate lift and drag.

Objective: Use the online fluid-flow simulator and online research to learn about two of the most important forces acting on an aircraft in flight -- lift and drag --, and to write a three-page paper explaining the results of your investigation for the following three flight regimes:

1. Low Speed (Subsonic, Mach = 0.55[[1]](#footnote-1)†): How and why do lift and drag change based on angle of attack[[2]](#footnote-2)‡?
2. Mid-Speed (Transonic, Mach = 0.75): How and why does shock formation change based on angle-of-attack?
3. High Speed (Supersonic, Mach = 1.05): How and why do lift and drag change based on angle of attack?

Lift and drag are calculated by numerically integrating the surface pressure around the airfoil, and then resolving the resulting force into components aligned with (drag) and perpendicular to (lift), the airfoil flight direction.

Rules: Students must submit a three-page write-up, double-spaced, using 12 point Arial or Times New Roman font, with 1 inch margins; this must include at least one self-made chart or graph. Entries will be judged for grammar, correctness of results, amount of content fit within constraints, and best use of graph/chart.

Contact: Submissions can either be sent electronically (in MS Word, OpenOffice, or PDF format) to [Vincent-Betro@utc.edu](mailto:Vincent-Betro@utc.edu) OR via mail to:

Vincent Betro  
UTC SimCenter: STEM Outreach

701 E. MLK Blvd

Chattanooga, TN 37403

Deadline: Submissions must be RECEIVED by noon, February 22, 2010

Prizes: All participants will receive a certificate, and the top three authors will be notified of their status by February 26, 2010 and will each receive a special prize. There will be an awards ceremony at the SimCenter on March 16, 2010 at 10 am, where all entering students will be presented their awards and then given a tour of the facility!

1. † Mach number is the ratio formed by dividing velocity by the speed of sound. [↑](#footnote-ref-1)
2. ‡ Angle-of-Attack is the angle between the airfoil chord line and the oncoming air flow. [↑](#footnote-ref-2)