PROJECT TITLE: Simulation of Air Jets used to Create Consumer Products at High Manufacturing Rates

Urmila Ghia  
683 Rhodes Hall  
Department of Mechanical and Materials Engineering  
Cincinnati, OH 45221  
ghiau@ucmail.uc.edu  
Phone: (513) 556-4612

Co-Mentor: Joe Grolmes  
UC Simulation Center  
Email: grolmes.jl@pg.com

Co-Mentor: Rakesh Gummalla  
UC Simulation Center  
Email: gummalla.rr@pg.com

Project Description

a. Background: Hot air is often used in industrial processes to create consumer products. Examples range from hot air spraying of adhesives to substrates, to hot air impinging on substrates to create molten regions. Each of these enable subsequent bonding of one substrate to another during the manufacturing of consumer products. As such, engineers need methods and models to design and trouble-shoot “air-assisted” processes.

b. Research Area: Simulation of internal and external flow of heated sub-sonic and super-sonic air jets.

c. Research Tasks:
   i. How much air flows through a heated nozzle?  
   ii. What is the temperature of the air jet after it exhausts from the heated nozzle?  
   iii. For supersonic flows, where is the location of the shock?  
   iv. How much energy and momentum is in the air jet if it is used to spray an adhesive or melt a substrate?

d. Training/Support:  
i. Mentors will provide nozzle geometries and operating conditions.
ii. Mentors will provide access to software packages to assist in the research tasks.
iii. Mentors will meet weekly with students (preferably at UC Sim Center).

e. Additional Expectations:
i. Conduct literature searches to help answer the research tasks.
ii. Provide brief weekly summaries of progress.
iii. Provide final summaries of each research task.

Desired Student Major: Engineering student with interest in Aerospace Engineering.