C-130 and A320 Engine Integration Using Flightstream

Logan King
Department of Aerospace Engineering, Auburn University, Auburn, AL, 36849

Engine integration is an area of great focus in the aerospace field. Many times, a company will come out with a new engine that is more powerful and fuel efficient than previous engines and it is up to engineers to determine if the older models can be re-engined or if they must completely redesign and create a new model. Such a task could prove to be quite time intensive and costly without the proper tools. One might assume that putting the engines directly on the wings might be the best solution due to savings in weight and structure; however that greatly affects the flow across the wings around the engines. On the other hand moving the engines further away to increase flow across the wings adds weight due to the nacelles. Finally it is important to determine the optimal shape of the wings in conjunction to the wing placement to ensure the best fuel economy for given mission objectives. It quickly becomes a balancing act involving a very high number of variables that can prove quite difficult to solve. An engineer might be able to make educated guesses about engine placement based on basic aerodynamic theories and historical data for previous models. This might even result in a configuration that is very near the optimal solution. However with airliners where fuel costs are everything, a configuration resulting in a lift to drag ratio of just a few percent less than optimal, could equate to the loss of tens of millions of dollars every year.

Over the past few years an Auburn Aerospace student named Vivek Ahuja has developed a program called Flightstream as a part of his dissertation. Flightstream is an unstructured mesh panel code and mesh generator, meaning that it can solve for the flow around aerodynamic bodies and calculate forces such as lift and drag. While not as accurate as Navier-Stokes based computational fluid dynamics, Flightstream is still fairly accurate and can be used in a fraction of the time. This makes Flightstream a more realistic choice for optimization in the creation of a preliminary design. In this seminar the theory behind Flightstream will be discussed, and Flightstream will be used to attempt to find the optimal engine locations for an A320 and C-130 like aircraft.