Inflatable Airplane Design and Optimization for Low Reynolds Numbers

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In 1956, the Goodyear Inflatoplane was created to aid troops stuck behind enemy lines. Although it flew, it was not a commercial success, and the project was dropped in 1973. Recently, research was done on inflatable wings for various applications, however the field is still mostly unexplored. This project explores the possibility of creating a small UAV airplane made completely of inflatable parts. This plane has real world applications because it is light, extremely portable, inexpensive, efficient, and has the ability to carry many different sensors. Applications include use by the police force, search and rescue teams, and the scientific community. The first technical problem was maintaining a proper air seal. Pressing heat-sealing nylon with a mini soldering iron solved this problem. The optimal wing design was found by creating a two axis force balance using already made sensors. The designs were then tested using a self-built wind tunnel. The test models were created using high-density foam. The foam was shaped using a hot wire foam cutter. Wind tunnel tests were analyzed for comparative standard deviation to determine flow randomness, drag, lift, Reynolds number, lift to drag ratio, drag coefficient, lift coefficient, stall angle, best of each of the previous, and finally the sum of all non-stall lift and drag numbers. Following these results the best design was chosen. The final plane design was glide tested to assess its stability, and glide ratio.

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