Analysis of Optimal Rotor Shape: Year 3

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For many years, there has been research conducted by organizations such as NASA on the possibility of having a space capsule utilize rotors. However, what areas of research tend to lack is an evaluation of the exact build of the capsule, namely, the rotors. Thus, the idea that rotor adjustments played a huge part in the descent of a space capsule was tested with the hypothesis being that a larger chord length resulted in better flight. First, a CFD simulation of the airfoil NACA 4412 was carried out to understand the pressures and the factors taken into account with a helicopter rotor. Following this, a momentum theory approach was taken to further explain, mathematically, how autorotation would work in an idealized case. A Reynolds number was also taken using assumptions of the Momentum Theory To differentiate potentially different rotors, a Blade Element Momentum simulation was taken that showed an efficiency curve that was wider in a shorter chord length than a wider chord length. Before this, two examinations of heat on the capsule were taken and showed similar results. The data and calculations imply that a rotor-based space capsule is may be possible with thinner, yet still strong rotors, the calculated Reynolds shows a very turbulent flight. This coupled with the Blade Element Momentum Theory and the heat flux show expectations of flight, what is expected to further predict is an engineering goal of constructing the capsule using a specific rotor setup, most likely coaxial.

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