Aerodynamics of a solar car

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The Challenge

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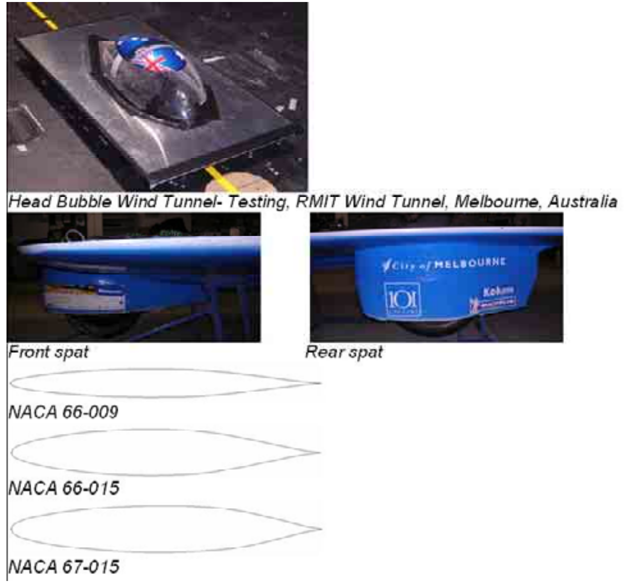
Aurora 101

Problem: The requirements for a solar car are different from those for a conventional car because all the energy used to run the solar car is provided by the sun and the storage capability of the solar car's batteries. Whereas a conventional motor uses 10 kW to travel at 100 km/h, an electric motor uses as much as a hair dryer, i.e. 1.5 kW (source: Speed of light)! Therefore it is important to gain as much energy as possible and to reduce all sources of loss in the system, such as aerodynamic drag and heat loss, in order to operate a solar car effectively.

Main Focus: Reducing aerodynamic drag can provide considerable energy savings and can be achieved by choosing the right shape for the car and reducing the weight of the batteries.
The rules that have to be followed to improve the aerodynamic properties are as follows:

- Maximise laminar boundary layer
- Ensure attached flow
- Reduce wetted and frontal area
- Reduce interference drag
- Zero lift: Lift is drag!
- High standard surface finish
  (Source: The Leading Edge)



Car components and shapes

Solution: The NACA 6- Series- Aerofoils are designed to maximise the region of laminar flow, the lowest drag boundary layer.
The Aurora 101 which participated at the WSC 2005 used a NACA 66- Aerofoil for its body contour. The second digit denotes the distance from the leading edge to the point where turbulent flow occurs. In this case, the Aurora solar car had a 60% laminar layer.
This thesis analyses the effect of a NACA 67, i.e. 70% laminar boundary layer.
The aerofoils were analysed using the program AeroFoil. The analysis shows that at 80 km/h NACA 67-015 has 5.4% less drag than NACA 66-009. Its different shape affects its kinematic properties, therefore studies on the suspension were made as well.
The above results suggest why the NACA 67-015 is worth analysing more accurately!