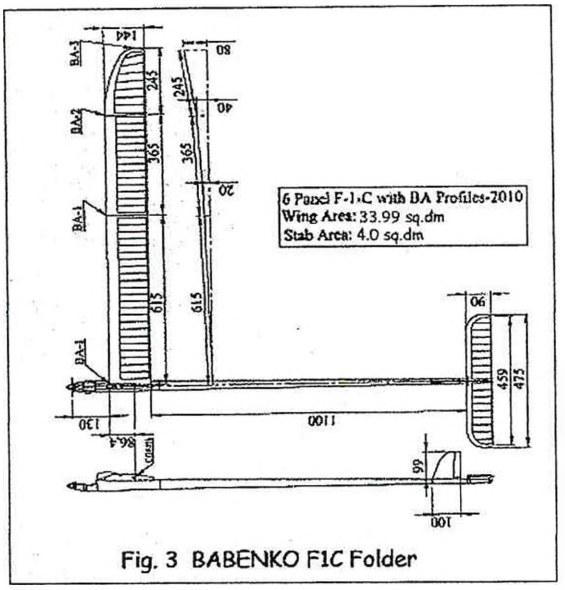

Fig. 3 BABENKO F1C Folder

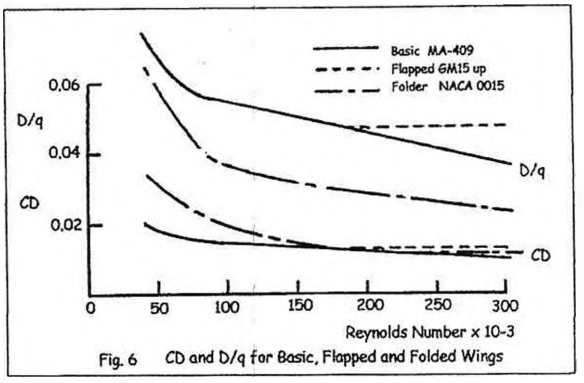

Fig. 6 CD and D/q for Basic, Flapped and Folded Wings

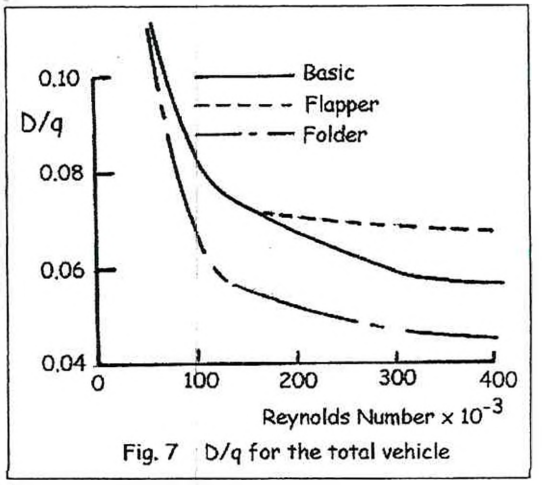

Fig. 7 D/q for the total vehicle

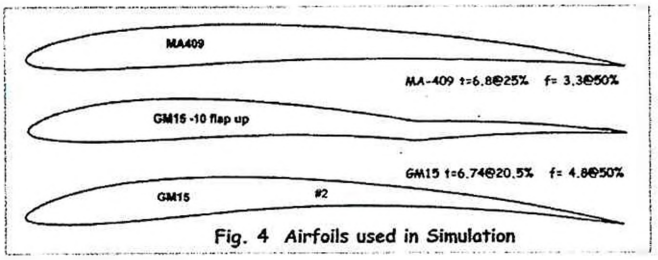

Fig. 4 Airfoils used in Simulation

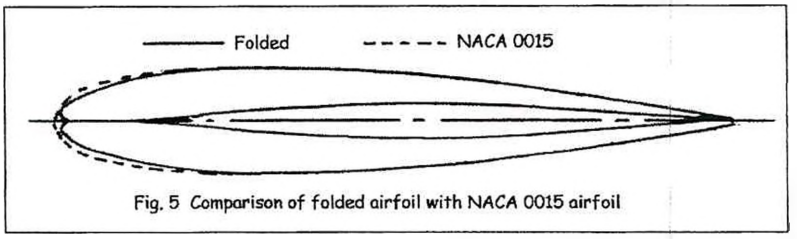

Fig. 5 Comparison of folded airfoil with NACA 0015 airfoil

Drag can be written as

$$Drag = C_D q_\infty S$$

or

$$Drag = \frac{D}{q} q_\infty$$

where D/q is the sum of the drag coefficient of each component multiplied by the reference area for that component. The use of the Drag/q parameter allows for the resizing of individual components without having to change the overall reference area. Since some of the configurations simulated have different wing areas, the D/q parameter is used in this simulation.

The transition phase consists of a decelerating ballistic coast described by:

$$ma = -\frac{D}{q} q_\infty - weight$$

Modern high performance models normally terminate this phase by a control input which forces the model to rapidly nose over into the glide. In this simulation it is assumed that the model climbs vertically until the control input. At which point no additional altitude is gained.

The glide phase is the final flight phase. At this point the flight is governed by the equation:

$$V_{sink} = v = \frac{C_D}{C_L}\sqrt{\frac{2W}{\rho S C_L}}$$

The first two phases (climb and transition) were conducted using the finite-difference method of numerical integration. A description of the method is presented in reference 2.

Model Geometry

The F1C used in this study is based on the Babenko folding wing model presented in reference 3 and shown in figure 3. All configurations simulated use the same components and geometry as this model. The only exception is the airfoil section and associated aerodynamic characteristics. The fixed wing configuration uses the MA-409 airfoil developed by Michael Achterberg. The Flapped wing uses the Gil Morris GM-15 airfoil in both flaps-up and down modes. The MA409 and GM-15 are shown in figure 4.

The airfoil for the folded wing is approximated by the NACA 0015 symmetrical airfoil for flight under power. In the glide mode, the airfoil is approximated by the GM-15