

| Free Variables    | Units               | Description                                |
|-------------------|---------------------|--|
| $C_D$             | [-]                 | Drag coefficient                           |
| $D$               | [N]                 | Total aircraft drag (cruise)               |
| $D_{fuse}$        | [N]                 | Fuselage drag                              |
| $D_{ht}$          | [N]                 | Horizontal tail drag                       |
| $D_{vt}$          | [N]                 | Vertical tail drag                         |
| $D_{wing}$        | [N]                 | Wing drag                                  |
| $\Delta x_{ac_w}$ | [m]                 | Wing aerodynamic center shift              |
| $f_{fuel}$        | [-]                 | Percent fuel remaining                     |
| $I_{z_{fuse}}$    | [kgm <sup>2</sup> ] | Fuselage moment of inertia                 |
| $I_{z_{tail}}$    | [kgm <sup>2</sup> ] | Tail moment of inertia                     |
| $I_{z_{wing}}$    | [kgm <sup>2</sup> ] | Wing moment of inertia                     |
| $I_z$             | [kgm <sup>2</sup> ] | Total aircraft moment of inertia           |
| $l_{fuse}$        | [m]                 | Fuselage length                            |
| $l_{vt}$          | [m]                 | Vertical tail moment arm                   |
| $M$               | [-]                 | Cruise Mach number                         |
| $R$               | [nm]                | Segment range                              |
| $S_w$             | [m <sup>2</sup> ]   | Wing reference area                        |
| $V_{TO}$          | [ $\frac{m}{s}$ ]   | Takeoff velocity                           |
| $V_\infty$        | [ $\frac{m}{s}$ ]   | Cruise velocity                            |
| $W$               | [lbf]               | Aircraft takeoff weight                    |
| $W_{avg}$         | [lbf]               | Flight segment average aircraft weight     |
| $W_{buoy}$        | [lbf]               | Buoyancy weight                            |
| $W_{dry}$         | [lbf]               | Aircraft dry weight                        |
| $W_{end}$         | [lbf]               | Aircraft weight at end of flight segment   |
| $W_{fuel}$        | [lbf]               | Fuel weight                                |
| $W_{f_{primary}}$ | [lbf]               | Total fuel weight less reserves            |
| $W_{fuel_{wing}}$ | [lbf]               | Maximum fuel weight carried in wing        |
| $W_{fuse}$        | [lbf]               | Fuselage weight                            |
| $W_{hpesys}$      | [lbf]               | Power system weight                        |
| $W_{ht}$          | [lbf]               | Horizontal tail weight                     |
| $W_{lg}$          | [lbf]               | Landing gear weight                        |
| $W_{misc}$        | [lbf]               | Miscellaneous system weight                |
| $W_{mg}$          | [lbf]               | Main landing gear weight                   |
| $W_{ng}$          | [lbf]               | Nose landing gear weight                   |
| $W_{pay}$         | [lbf]               | Payload weight                             |
| $W_{start}$       | [lbf]               | Aircraft weight at start of flight segment |
| $W_{tail}$        | [lbf]               | Total tail weight                          |
| $W_{vt}$          | [lbf]               | Vertical tail weight                       |
| $W_{wing}$        | [lbf]               | Wing weight                                |
| $W_{zf}$          | [lbf]               | Zero fuel weight                           |

|                            |                            |  |
|----------------------------|----------------------------|--|
| $AR_w$                     | [–]                        | Wing aspect ratio                      |
| $\left(\frac{L}{D}\right)$ | [–]                        | Lift/drag ratio                        |
| $\xi$                      | [–]                        | Takeoff parameter                      |
| $a$                        | $\left[\frac{m}{s}\right]$ | Speed of sound                         |
| $b_w$                      | [m]                        | Wing span                              |
| $c_{root_w}$               | [m]                        | Wing root chord                        |
| $t$                        | [min]                      | Flight time                            |
| $x_{CG}$                   | [m]                        | x-location of CG                       |
| $x_{CG_{lg}}$              | [m]                        | x-location of landing gear CG          |
| $x_{CG_{misc}}$            | [m]                        | x-location of miscellaneous systems CG |
| $x_{TO}$                   | [m]                        | Takeoff distance                       |
| $x_b$                      | [m]                        | Wing box forward bulkhead location     |
| $x_{misc}$                 | [m]                        | Miscellaneous systems centroid         |
| $x_{hpesys}$               | [m]                        | Power systems centroid                 |
| $x_{lg}$                   | [m]                        | Landing gear centroid                  |
| $x_{mg}$                   | [m]                        | Main landing gear centroid             |
| $x_{ng}$                   | [m]                        | Nose landing gear centroid             |
| $x_{tail}$                 | [m]                        | Tail centroid                          |
| $x_{wing}$                 | [m]                        | Wing centroid                          |
| $y$                        | [–]                        | Takeoff parameter                      |
| $z_{bre}$                  | [–]                        | Breguet parameter                      |

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