Design, Analysis and Research Corporation (DARcorporation)

ERRATA: Airplane Design Part VI

Year of Print, 1987, 1990
(Errata Revised November 17, 2014)

Please check the website www.darcorp.com for updated errata

page xx	$\bar{x}_{ac_h} = x_{ac_h} / \bar{c}$
page 27, Eqn (4.9)	$C_{L_w} = C_L - C_{L_c} \frac{S_c}{S} - C_{L_h} \frac{S_h}{S}$
page 28, 4th line	add "in radians" after wing twist angle.
page 46, Eqn (4.33)	$C_{D_{L_{fus}}} = 2\alpha^2 \frac{S_{b_{fus}}}{S} + \eta c_{d_c} \lvert\alpha\rvert^3 \frac{S_{plf_{fus}}}{S}$
page 47, Figure 4.20	$M_c = M \sin\lvert\alpha\rvert$
page 49	
Eqn (4.39)	$C_{D_{L_{fus}}} = \alpha^2 \left(S_{b_{fus}}\right) / S$
Eqn. (4.41)	$C_{D_{o_{fus}}} = \left(C_{f_{fus}} \left(\frac{S_{wet_{fus}}}{S_{fus}} \right) + C_{D_{N_2}} + C_{D_A} + C_{D_{A(NC)}} + C_{D_{b_{fus}}} \right) \frac{S_{fus}}{S}$
page 52, Eqn (4.43)	$C_{D_{L_{fus}}} = F \left\{ 2\alpha^2 \frac{S_{b_{fus}}}{S} + c_{d_c} \frac{S_{plf_{fus}}}{S} \lvert\alpha\rvert^3 \right\}$
page 70, 9th line	Should read "... of 4.2.2.1 but with the appropriate..."
page 73, Eqn. (4.60)	Add: $\varepsilon_n > 0$ *for upwash and* $\varepsilon_n < 0$ *for downwash*
Last line	Should read: *Chapter 8.*
page 77, Eqn. (4.63)	$\Delta c_{l_2} = +0.056(i_n)$ with i_n expressed in degrees
page 86	
3rd line	Should read: ... *from Eqn. (4.6)*
Eqn. (4.74)	'*Chapter 9*' should be '*Chapter 8*'

page 88, Figure 4.52	b_f / b label on figure should be b_{f_o} / b .
page 89, Figure 4.53	Add: $\frac{b_{f_i}}{b} = 0.6$ to bottom plot margin.
page 97, Figure 4.60	Figure title should read TAKE-OFF WEIGHT ~ $W_{TO}/1000$
page 104	The word "inremental" should be replaced by "incremental".
page 105, Eqn (4.84)	$$\Delta C_{D_{trim_{prof}}} = \left(\Delta C_{D_p}\right)_{\Lambda_{c/4_h}=0} \cos\Lambda_{c/4_h}\left(\frac{S_{ef}}{S_h}\right)\left(\frac{S_h}{S}\right) + \left(\Delta C_{D_p}\right)_{\Lambda_{c/4_c}=0} \cos\Lambda_{c/4_c}\left(\frac{S_{cf}}{S_c}\right)\left(\frac{S_c}{S}\right)$$
page 115, Eqn. (4.88 and 4.90)	1.33 should be replaced by 1.328.
page 142	The reference to Chapter 6 in Part IV should be Chapter 7
page 146	The word "form" should be replaced by "from" (last sentence on page).
page 171, Eqn. (6.25)	Replace $\dot{m}_{gas}$ with $\dot{m}_a$ Where $\dot{m}_a$ follows from Eqn. (6.19)
page 177, 22nd line	Section on supersonic jet inlets should be Section 6.2.3.4
page 181, Eqn. (6.44)	$$F_{inl} = 1 + 1.75\left\{\left(\frac{\mu_{inl}-1}{\mu_{inl}}\right)\left(\frac{1}{\frac{A_m}{A_c}-1}\right)\right\}$$
page 224, Figure 8.9	The NACA 63-005 airfoil should be a NACA 63-006 airfoil.
page 229, Eqn. (8.7)	$$\Delta c_l = \eta_1\left(c_{l_{\delta_{f_1}}}\right)\left(\delta_{f_1}\right)\left\{\left(\frac{c+c_1}{c}\right)\right\} + \eta_2\left(c_{l_{\delta_{f_2}}}\right)\left(\delta_f\right)\left(\frac{c'}{c}\right)$$
page 233, Eqn. (8.10)	$$\Phi_{TE_{UPPER}} = arctan\{10\frac{y_{90}-y_{100}}{c}\}$$

page 236
Figure 8.26 The values for lifting effectiveness, c_{l_δ} should be negative.

page 245, Eqn. (8.20) $\alpha_w = \alpha + i_w$

page 259, 9th line add "at $\alpha = 0$" after leading edge flaps.

page 268, Eqn. (8.32) Should be

$$C_{L_o} = C_{L_{o_{wf}}} + C_{L_{\alpha_h}} \eta_h (S_h/S)\left(-\varepsilon_{o_h} - \alpha_{o_{L_h}}\right)$$
$$+ C_{L_{\alpha_c}} \eta_c (S_c/S)\left(\varepsilon_{o_c} - \alpha_{o_{L_c}}\right)$$

where: $\alpha_{o_{L_h}}$ and $\alpha_{o_{L_c}}$ can be found using the method of Section 8.1.3.1.

page 269, Eqn (8.37) For jet airplanes, the horizontal tail dynamic pressure should be calculated from:

$$\eta_h = 1 - \frac{2.42\sqrt{C_{D_{o_w}}}\cos^2\left(\dfrac{\pi\, z_{h_{wake}}}{2\,\Delta z_{wake}}\right)}{\dfrac{x_{h_{wake}}}{\bar{c}} + 0.30}$$

where:

$C_{D_{o_w}}$ is the wing zero-lift drag coefficient as found from 4.2.1.1.

$$z_{h_{wake}} = a\sin\left(\gamma_h - \alpha - i_w + \varepsilon_h\right)$$
$$x_{h_{wake}} = a\cos\left(\gamma_h - \alpha - i_w + \varepsilon_h\right)$$
$$\Delta z_{wake} = 0.68\bar{c}\sqrt{C_{D_{o_w}}\left(\frac{x_{h_{wake}}}{\bar{c}} + 0.15\right)}$$

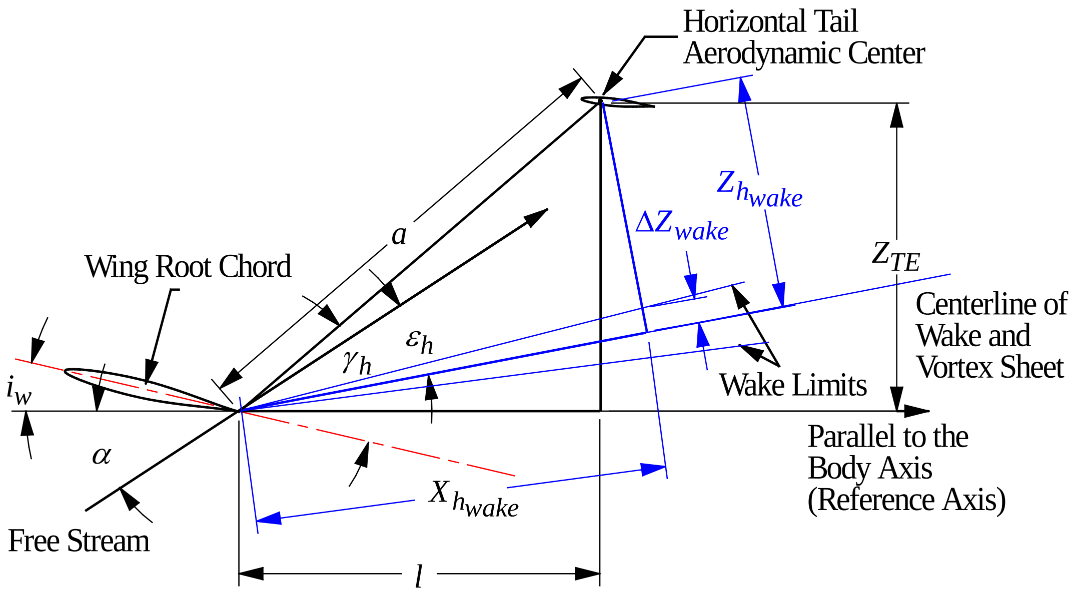
page 269, Eqn (8.37) (Cont.)

with:

a and γ_h shown in Figure 8.63;
$\bar{c}$ as the wing mean geometric chord;
α as the airplane angle of attack;
i_w as the wing incidence angle; and

$$\varepsilon_{cl} = \frac{1.62 C_{L_w}}{\pi A}$$

page 270, Figure 8.63 Should be



page 272, Eqn. (8.48) $K_h = \frac{\left(1 - \left|\frac{h_H}{b}\right|\right)}{\sqrt[3]{\frac{2l_h}{b}}}$ (absolute value added)

page 273, Figure 8.65c All capital subscripts "H" should be lower case subscript "h"

page 273, Figure 8.65c apply absolute value as in Equation 8.48

page 275, Eqn. (8.50) Parenthesis after ε_{0h} should be moved to after $d\varepsilon/d\alpha$.

page 279, Fig. (8.70) Units for $\frac{\left(\frac{\Delta\varepsilon_f A b_f}{b}\right)}{\Delta C_{L_w}}$ should be *degrees*

page 280, Eqn. (8.54)

$$\Delta C_{L_{max}} = K_{cw} \Delta C_{L_{max_w}} - \left(C_{L_{\alpha_w}}\right)_\delta \Delta\alpha_{w/c} + (S_c/S)\Delta C_{L_{max_c}} + (S_h/S) C_{L_{\alpha_h}} \left(-\Delta\varepsilon_f\right)$$

page 281, Eqn. (8.55) The subscript "g" should be added to the variable 'r' in the second line of equation.

page 305, Eqn (8.73)	The bar over the 2 should be over the c.
page 311, Eqn (8.74)	The first term on the r.h.s. should read: $\left(\bar{x}_{ref} - 0.25\right)\Delta C_{L_w}$ where: ΔC_{L_w} is the wing lift increment due to flaps.
page 320, Eqn (8.78)	Replace 'i_w' with '$-i_w$'.
page 323, 1st line	Should read *airplane zero angle of attack. . .*
page 333, Eqn. (8.97)	$\varepsilon = \varepsilon_{o_h} + \alpha\left(\frac{d\varepsilon_h}{d\alpha}\right)$
page 335, Eqn. (8.100)	$\varepsilon = \varepsilon_{o_c} + \alpha\left(\frac{d\varepsilon_c}{d\alpha}\right)$
page 340, Eqn. (8.107)	$K_{T_i} = \frac{550 SHP_{AV_i}\sqrt{\rho}}{\left(2W/S\right)^{3/2} D_{P_i}{}^2}$
page 342, Eqn. (8.108)	$\left(dC_m/dC_L\right)_N = \sum_{i=1}^{n}\left[\frac{\left(dC_N/d\alpha\right)_{P_i}\left(d\bar{\varepsilon}_{P_i}/d\alpha\right)\left(l_{P_i}\right)(0.79)\left(D_{P_i}\right)^2}{S\bar{c}C_{L_{\alpha_w}}}\right]$
page 342, Eqn. (8.108)	0.79 should be replaced by $\frac{\pi}{4}$.
page 357, Table 9.1	Third row, second column 0.8 should be replaced by -0.8.
page 374, Eqn. (10.8)	$C_{T_{X_1}} = C_{D_1}$
page 375, Last Line	$\partial C_D/\partial C_m$ should be $\partial C_D/\partial M$.
page 377	
Eqn. (10.12)	$C_{m_u} = -C_{L_1}\left(\partial\bar{X}_{ac_a}/\partial M\right)M$
Eqn. (10.13)	$C_{T_{x_u}} = \left(1/\bar{q}S\right)\left(\partial P_{req}/\partial u\right) - 3C_{T_{x_1}}$

Eqn. (10.15) $C_{T_{x_u}} = (M_1/\overline{q}S)(\partial T_{reqd}/\partial M) - 2C_{T_{x_1}}$

page 382, Eqn (10.24) Add a ')' to the end of Equation 10.24

2nd line below Eqn (10.24) Equation '(10.23)' should be equation '(10.22)'.

page 390, Fig. (10.16) z_h should be 'the vertical distance between the horizontal tail aerodynamic center to the fuselage center line'.

page 397, 6th line from bottom Replace C_{y_β} by $C_{y_{\beta_v}}$

page 398, *Eqn (10.44)*

$$C_{n_{T_\beta}} = -\underset{i=1}{\overset{i=n}{Sum}}\left[\left\{(dC_N/d\alpha)_{p_i}(0.79)(D_{P_i})^2(l_{p_i})\right\}\Big/Sb\right]$$

page 401~415, Fig.30~33 $z_v = z_p \cos\alpha_f - l_p \sin\alpha_f$

page 401, variable description for Eqn. 10.47 Add 'deg^{-1}' after σ_{β_α}, σ_{β_Γ}, $\sigma_{\beta_{\varepsilon_t}}$

Add 'deg' after α_f, Γ, ε_t

page 417, Eqn (10.50)

$$C_{y_p} = 2C_{y_{\beta_v}}\left(\frac{z_v \cos\alpha - l_v \sin\alpha - z_v}{b}\right) + 3\sin\Gamma\left(1 - \frac{4z}{b}\sin\Gamma\right)(C_{l_p})_{\substack{\Gamma=0\\C_L=0}}$$

where: z - is the vertical distance between the cg and the wing root quarter-chord point.

$$(C_{l_p})_{\substack{\Gamma=0\\C_L=0}} = \frac{k}{\beta}\left(\frac{\beta C_{l_p}}{k}\right)_{C_L=0}$$

page 418, Figure 10.35 Replace $\frac{\beta C_{l_p}}{k}$ with $\left(\frac{\beta C_{l_p}}{k}\right)_{C_L=0}$

page 419, Eqn. (10.55)

$$\frac{(C_{l_p})_\Gamma}{(C_{l_p})_{\Gamma=0}} = 1 - \frac{4z_w}{b}\sin\Gamma + 12\left(\frac{z_w}{b}\sin\Gamma\right)^2$$

page 421, Eqn. (10.60)

$$C_{l_{p_v}} = \frac{2}{b_w^2}\left|\left(z_v \cos\alpha - l_v \sin\alpha\right)\left[\left(z_v \cos\alpha - l_v \sin\alpha\right) - \left(Z_{ac_v} - Z_{cg}\right)\right]\right| C_{y_{\beta_v}}$$

where: z_v and l_v are defined in Figure 10.27

page 421, Eqn.(10.62)

$$C_{n_{p_w}} = \left\{\left(C_{n_p}/C_L\right)_{\substack{C_L=0\\M}}\right\} C_{L_w} + \left(C_{n_p}/\varepsilon_t\right)\varepsilon_t + \left[\Delta C_{n_p} \Big/ \left(\alpha_{\delta_f}\delta_f\right)\right]\alpha_{\delta_f}\delta_f$$

page 422, Eqn. (10.66) $\alpha_{\delta_f} = \Delta c_l / \left(c_{l_\alpha}\delta_f\right)$

page 424, Eqn. (10.71) $\left(C_{L_{q_w}}\right)_{M=0} = \left(0.5 + 2\frac{x_w}{\bar{c}}\right) C_{L_{\alpha_w}}$

page 430, Figure 10.42 Y-axis values should be divided by -4

page 435, Eqn. (10.89) $C_{D_{i_h}} = \frac{2C_L}{\pi Ae} C_{L_{\alpha_h}} \eta_h \frac{S_h}{S}$

page 439,

Eqn. (10.97) $C_{D_{i_c}} = \frac{2C_L}{\pi Ae} C_{L_{\alpha_c}} \eta_c \frac{S_c}{S}$

Eqn. (10.100) $C_{m_{i_c}} = C_{L_{\alpha_c}} \eta_c \overline{V}_c$

page 440, Eqn (10.102) Replace $c_{l_{\alpha_h}}$ with $c_{l_{\alpha_c}}$

page 446, Eqn (10.110) $c_{l_\delta} = \frac{c_{l_\delta}}{\left(c_{l_\delta}\right)_{theory}}\left(c_{l_\delta}\right)_{theory} k'$

where k' is found from Figure 8.13

page 447,

Eqns. (10.111) & (10.113) It is assumed that: $\left(C_{l_\delta}\right)_{left} = \left(C_{l_\delta}\right)_{right}$

page 454 & 456,

Figures 10.52 & 10.53 The final value read from figures should be $\left(\frac{C_n}{h_{sp}/c}\right)$, not $\left(\frac{C_n}{h_{sp}c}\right)$.

page 461, Eqn. (10.123) Should read:

$$C_{y_{\delta_r}} = K_b C_{L_{\alpha_v}} \frac{S_v}{S} \left\{ \frac{c_{l_\delta}}{\left(c_{l_\delta}\right)_{theory}} \right\} \left(c_{l_\delta}\right)_{theory} \left(\frac{k'}{c_{l_{\alpha_v}}} \right) \left\{ \frac{\left(\alpha_\delta\right)_{C_L}}{\left(\alpha_\delta\right)_{c_l}} \right\} \eta_v$$

Eqn (10.123) is correct for a single vertical tail <u>only</u>. For a twin vertical tail:

$$C_{y_{\delta_r}} = 2 \left(\frac{C_{y_{\beta_{v(wfh)}}}}{C_{y_{\beta_{v_{eff}}}}} \right) K_b C_{L_{\alpha_v}} \frac{S_v}{S} \left\{ \frac{c_{l_\delta}}{\left(c_{l_\delta}\right)_{theory}} \right\} \left(c_{l_\delta}\right)_{theory} \left(\frac{k'}{c_{l_{\alpha_v}}} \right) \left\{ \frac{\left(\alpha_\delta\right)_{C_L}}{\left(\alpha_\delta\right)_{c_l}} \right\} \eta_v$$

where: $\left(\frac{C_{y_{\beta_{v(wfh)}}}}{C_{y_{\beta_{v_{eff}}}}} \right)$ is found from Figure 10.17.

All other parameters are the same.

page 467, Eqn. (10.129) $\left(c_{h_\alpha}\right)_{theory}$ is found from Figure 10.63b. The parameter $\frac{c_{l_\alpha}}{\left(c_{l_\alpha}\right)_{theory}}$ in Figure 10.63b is itself found from Figure 10.64a with the assumption that $\tan\frac{\Phi'_{TE}}{2} = \frac{t}{c}$.

page 470,
1st line (10.126) should be (10.128).

Eqn. (10.130) $\frac{c_{l_\alpha}}{\left(c_{l_\alpha}\right)_{theory}}$ is obtained from Figure 10.64a with the assumption that $\tan\frac{\Phi'_{TE}}{2} = \frac{t}{c}$.

page 484, Eqn (10.145) Replace ‘α_δ’ with ‘$-\alpha_\delta$’.

page 486, Eqn. (10.149) $\left(c^{t}{}_{h_\delta}\right)_{\alpha,\alpha_t}$ should be replaced by $\left(c^{t}{}_{h_\delta}\right)_{\alpha,\delta_t}$

page 521, Pressure (psia) for 200,000 ft should be 0.002655 psia
Pressure (psia) for 200,131 ft should be 0.002641 psia
Pressure Ratio, δ, for 154,199 ft should be 0.001095