$k_{M-\Lambda}$:

$$M\cos(-\Lambda_{c/4}) = 0.0294\cos(-4.29158^\circ) = 0.029318$$

$$\frac{A}{\cos(-\Lambda_{c/4})} = \frac{7.86442}{\cos(-4.29158^\circ)} = 7.88631$$

$k_{M-\Lambda} = 1$

k_f:

$$\frac{l_f'}{b} = \frac{11.5625}{72.5} = 0.159483$$

$$\frac{A}{\cos(-\Lambda_{c/4})} = 7.88631$$

$k_f = 0.9875$

$\left(\dfrac{C_{l\beta}}{C_L}\right)_A$:

$$A = 7.86442$$
$$\lambda = 0.5445$$

$\left(\dfrac{C_{l\beta}}{C_L}\right)_A = -0.0004$

$\Gamma = 2 \ (deg)$

$\left(\dfrac{C_{l\beta}}{\Gamma}\right)_i$

$A = 7.86442$

$\lambda = 0.5445$

$\Lambda_{c/2} = -4.29158 \ (deg$

$\left(\dfrac{C_{l\beta}}{\Gamma}\right) = -0.0002375$

$K_{M\Gamma}:$

$MCos(-\Lambda_{c/2}) = 0.029318$

$\dfrac{A}{Cos(-\Lambda_{c/2})} = 7.88631$

$K_{M\Gamma} = 1$

$\left(\dfrac{\Delta C_{l\beta}}{\Gamma}\right) = -0.0005\sqrt{A}\left(\dfrac{d^2}{b}\right) = -0.0005\sqrt{7.86442}\left(\dfrac{5.719^2}{72.5}\right) = -0.000633$

$\left(\dfrac{\Delta C_{l\beta}}{\Gamma}\right) = -0.000633$

$\left(\Delta C_{l\beta}\right)_{z_w} = \dfrac{1.2\sqrt{A}}{57.3}\left(\dfrac{z_w}{b}\right)\left(\dfrac{2d}{b}\right) = \dfrac{1.2\sqrt{7.864}}{57.3}\left(\dfrac{-3.8125}{72.5}\right)\left(\dfrac{2 \cdot 5.719}{72.5}\right) = -0.000487$

$\left(\Delta C_{l\beta}\right)_{z_w} = -0.000487$

$$\left(C_{l_\beta}\right)_{\Lambda, P} = 0.8988 \left[(-0.0005)(1)(0.9875) + (-0.0004) \right]$$

$$+ 2 \left[(-0.0002375)(1) + (-0.000633) \right]$$

$$+ (-0.000487)$$

$$\boxed{\left(C_{l_\beta}\right)_{\Lambda, P} = -0.00303 \, 1/\text{deg}}$$

Wing   Contribution   to

Lateral   Stability

M #	$\left(\dfrac{1}{\text{deg}}\right)$ $\left(C_{l_\beta}\right)_{\Lambda, P}$
0.0294	−0.003031
0.04408	−0.002585
0.05877	−0.002429
0.07347	−0.002357
0.08816	−0.002317

$$\left((\ell_\beta)\right)_V = -k\left(C_{L\alpha_V}\right)\left(1 + \frac{\partial\sigma}{\partial\beta}\right)\eta_V \bar{V}_V \left(Z_V \cos(\alpha) - \ell_V \sin(\alpha)\right)$$

$k\left(C_{L\alpha_V}\right)\left(1 + \frac{\partial\sigma}{\partial\beta}\right)\eta_V \bar{V}_V$ was found while calculating the directional stability.

Alpha at different velocities was found using AVL.

M#	α (deg)	$(\ell_\beta)_V$ $\left(\frac{1}{rad}\right)$
0.0294	19.426	−0.025215
0.04408	5.63196	−0.080742
0.05877	1.1573	−0.097956
0.07347	−0.88866	−0.10569
0.08816	−1.99734	−0.109885

Lateral Stability (wing + v-tail)

$$\left(C_{l\beta}\right)_{\Lambda, \Gamma, V} = \left(C_{l\beta}\right)_{\Lambda, \Gamma} + \left(C_{l\beta}\right)_V$$

$(1/\text{rad})$

M#	$\left(C_{l\beta}\right)_{\Lambda, \Gamma, V}$
0.0294	−0.198879
0.04408	−0.228852
0.05877	−0.237127
0.07347	−0.240736
0.08816	−0.242639