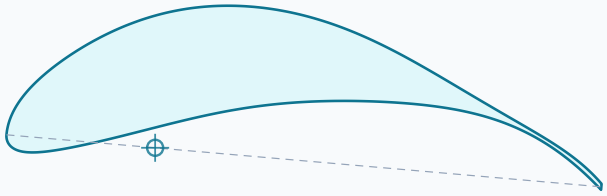
Aero Design Studio

CMA-ES Wing CFD Analysis
Single-Element · Lift orientation · V = 0 m/s
XFOIL Viscous Panel Method · 05 September 2026

> Sign convention: standard aerodynamic convention applied. Downforce-producing wings show negative Cl, Cm, and L/D; lift-producing wings show positive values.

WING CONFIGURATION

Main element	Custom profile	**Chord E1**	1000 mm
AoA E1	5°	**Re (E1)**	1,000,000
Span	0 mm	**Velocity**	0 m/s
Endplates	No	**Ncrit**	9



Profile cross-section (not to scale)

✓ **Convergence: 20/21 points converged (95%)**

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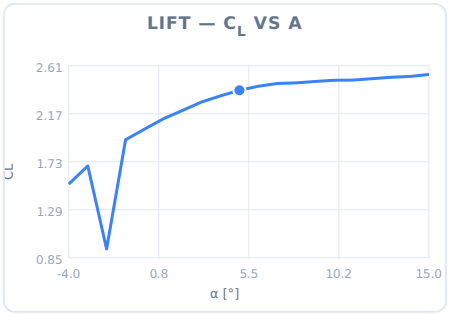
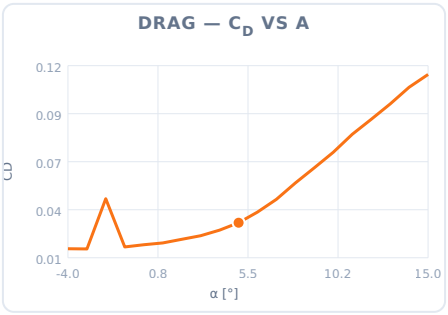
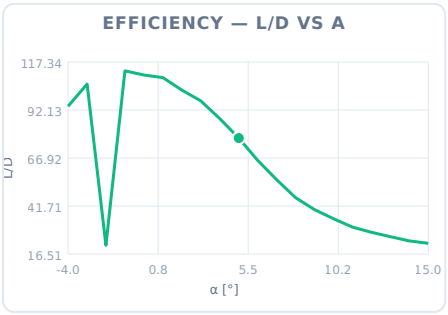
CUSTOM PROFILE **Custom profile** Re = 1,000,000 · Ncrit = 9 · chord = 1000 mm

✓ **20/21 points converged (95%)**

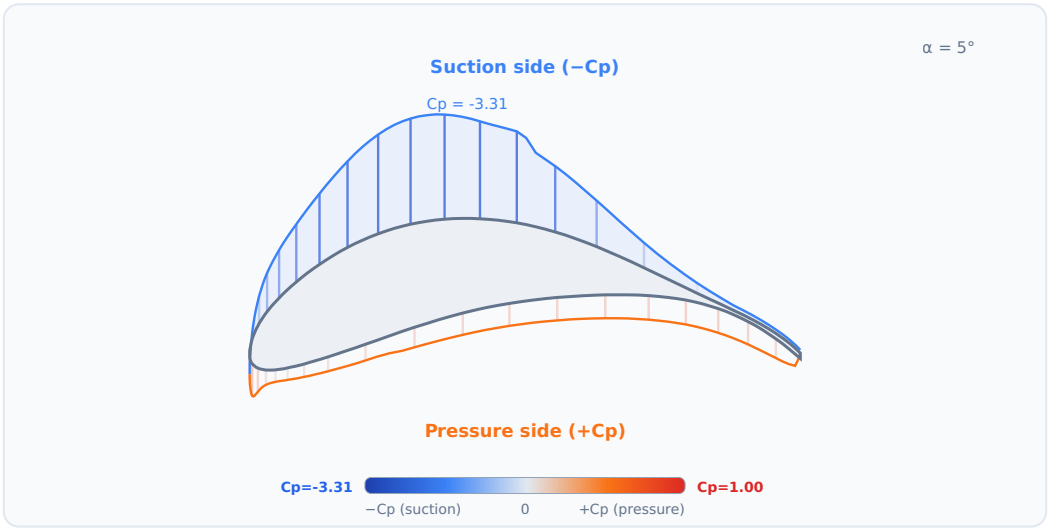
C_L MAX	A C_L MAX	C_D MIN	L/D MAX	C_L@A=0
2.5296	**15.0°**	**0.01602**	**112.8**	**2.0299**



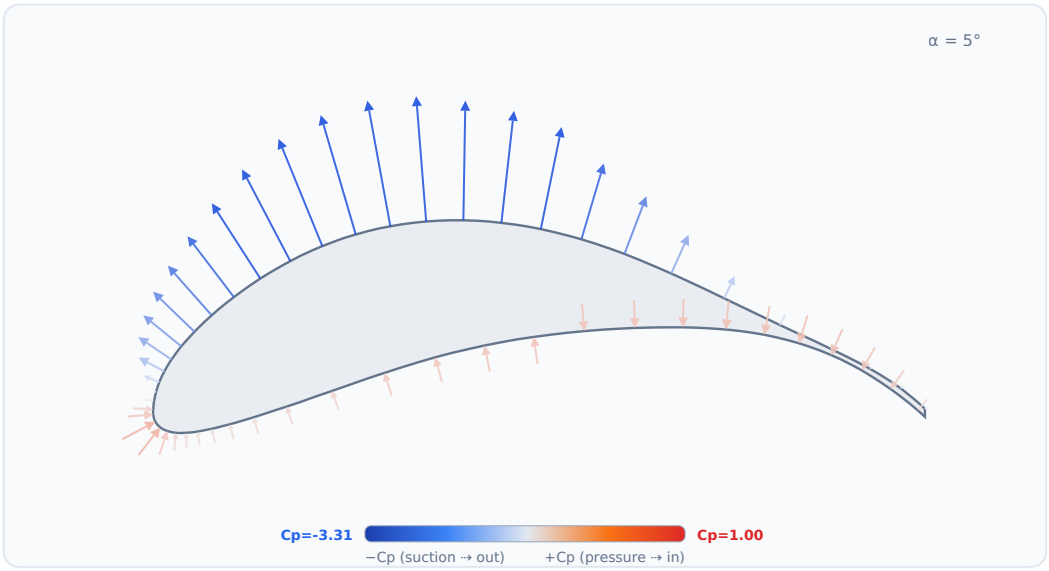




PRESSURE DISTRIBUTION (C_P) — A = 5°



PRESSURE VECTORS — A = 5° (SUCTION ⇢ OUTWARD, PRESSURE ⇢ INWARD)



POLAR DATA TABLE

α°	C_L	C_D	C_M	L/D
15.0	2.5296	0.11430	-0.3492	22.1
14.0	2.5103	0.10707	-0.3534	23.4
13.0	2.5032	0.09769	-0.3587	25.6
12.0	2.4906	0.08908	-0.3645	28.0
11.0	2.4771	0.08061	-0.3708	30.7
10.0	2.4764	0.07047	-0.3787	35.1
9.0	2.4651	0.06183	-0.3865	39.9
8.0	2.4520	0.05317	-0.3943	46.1
7.0	2.4468	0.04402	-0.4037	55.6
6.0	2.4205	0.03679	-0.4113	65.8
5.0 ◄	2.3839	0.03081	-0.4185	77.4
4.0	2.3337	0.02664	-0.4252	87.6
3.0	2.2759	0.02348	-0.4318	96.9
2.0	2.2003	0.02143	-0.4358	102.7
1.0	2.1252	0.01947	-0.4403	109.2
0.0	2.0299	0.01838	-0.4413	110.5
-1.0	1.9337	0.01715	-0.4421	112.8
-2.0	0.9345	0.04431	-0.2113	21.1
-3.0	1.6938	0.01602	-0.4342	105.7

-4.0	1.5267	0.01621	-0.4190	94.2

Method: XFOIL viscous panel method with e^N transition model (Ncrit = 9). Biot-Savart inter-element coupling for multi-element configurations. 3D estimates use Prandtl lifting-line ($C_{L,3D} = C_{L,2D} \times AR/(AR+2)$).

DISCLAIMER

This report is generated for informational and educational purposes only. Results are based on XFOIL 2D viscous panel method simulations and do not constitute professional engineering advice. Multi-element corrections use a lumped-vortex Biot-Savart model which provides approximate inter-element coupling. 3D performance estimates use lifting-line theory and may differ from CFD or wind tunnel results. All design decisions and safety assessments remain the sole responsibility of the user. Do not use these results for safety-critical applications without independent verification.

SOFTWARE & LICENSES

XFOIL by Mark Drela & Harold Youngren, MIT.
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