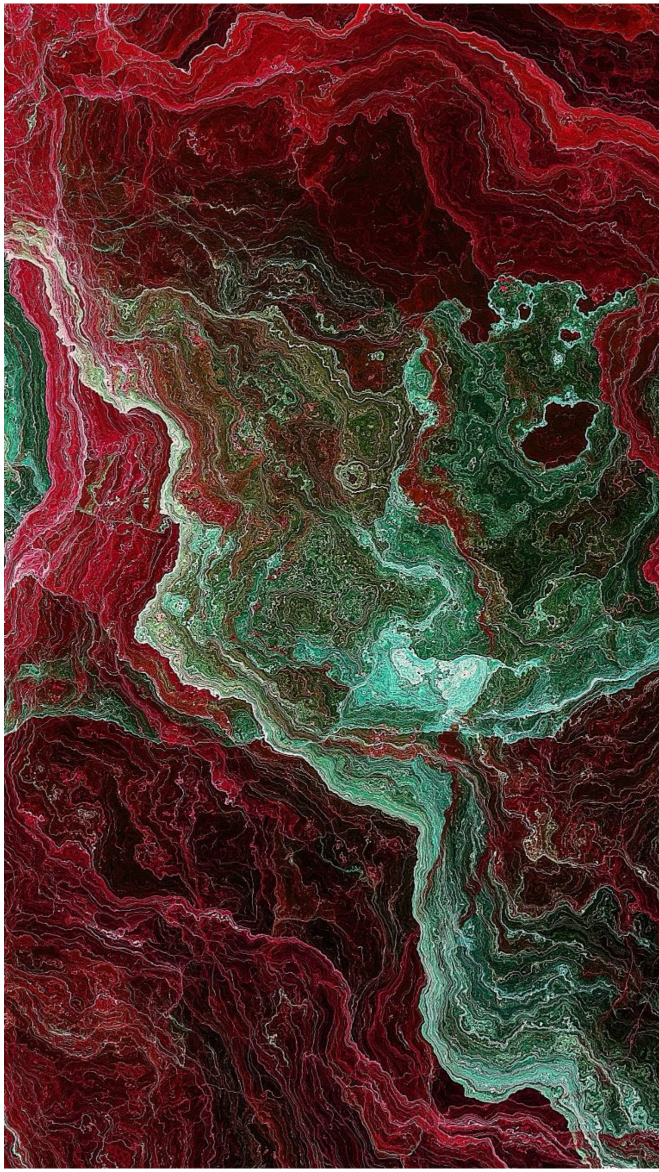
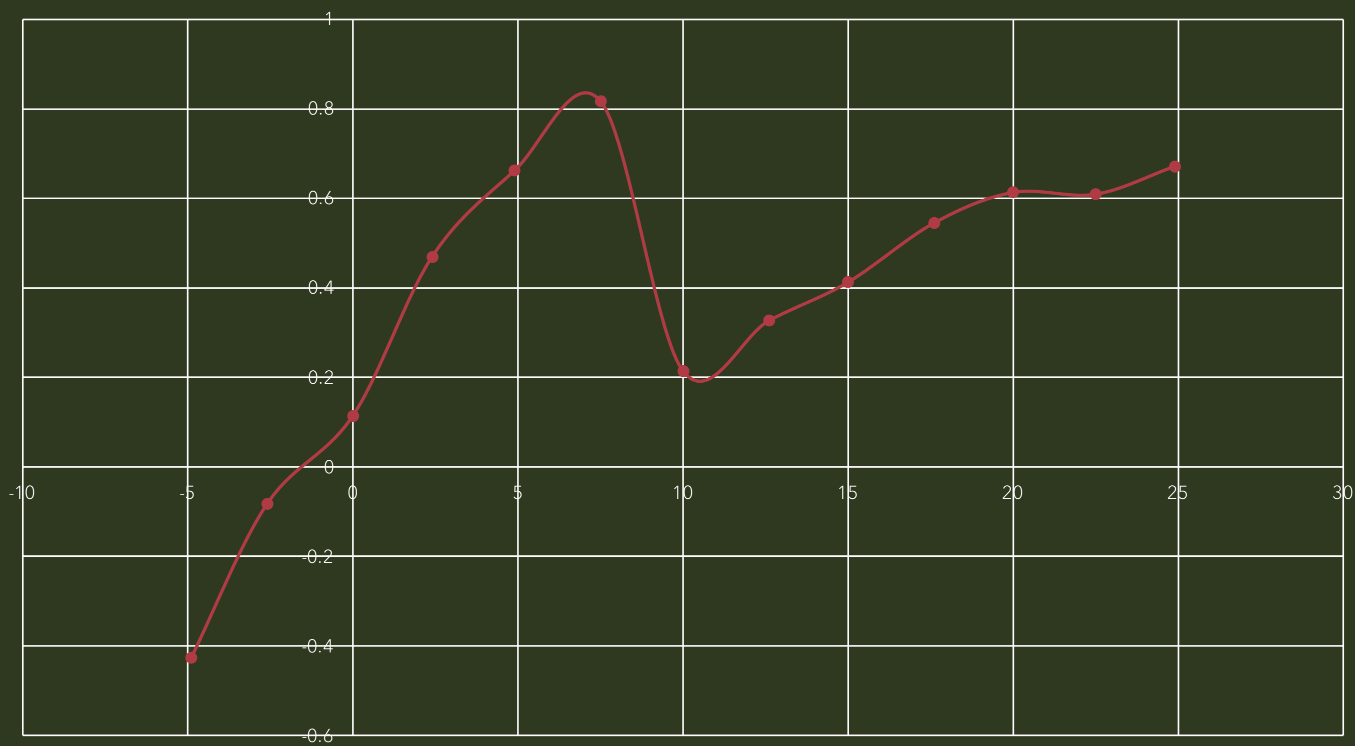


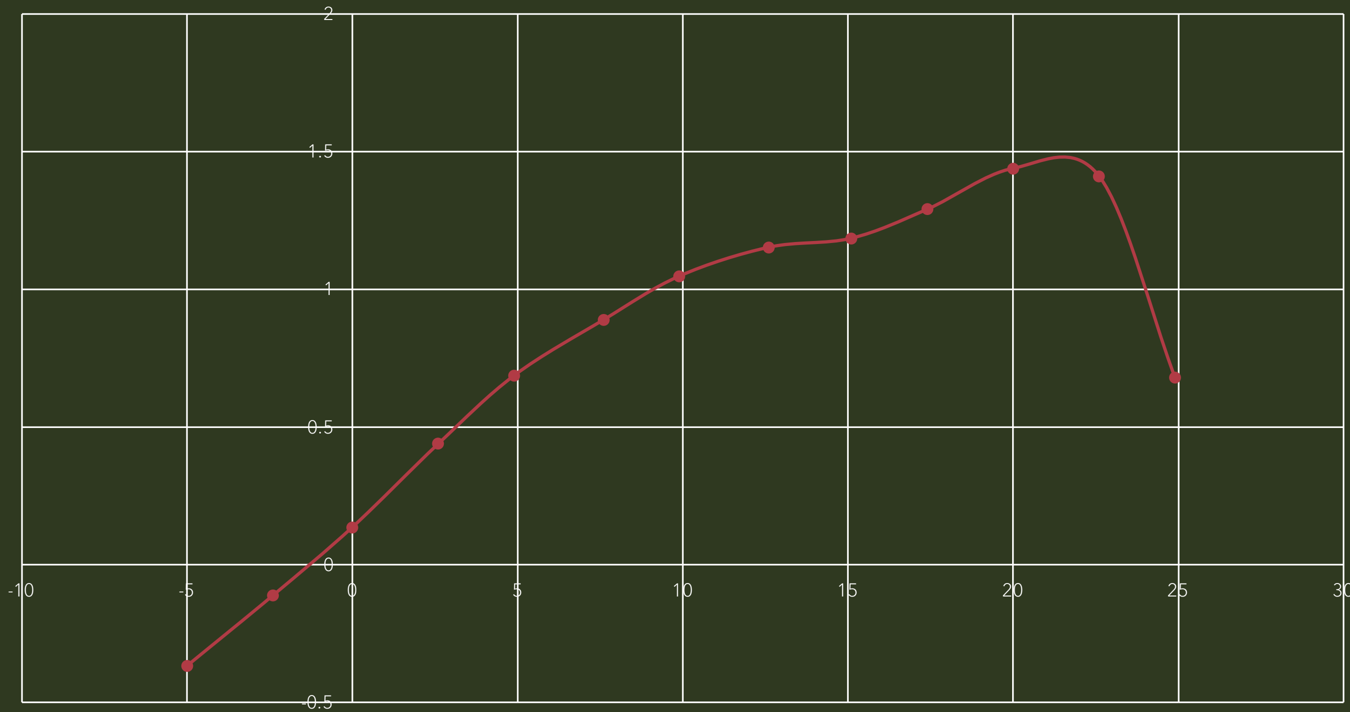
AERODYNAMICS

Graham Wilson

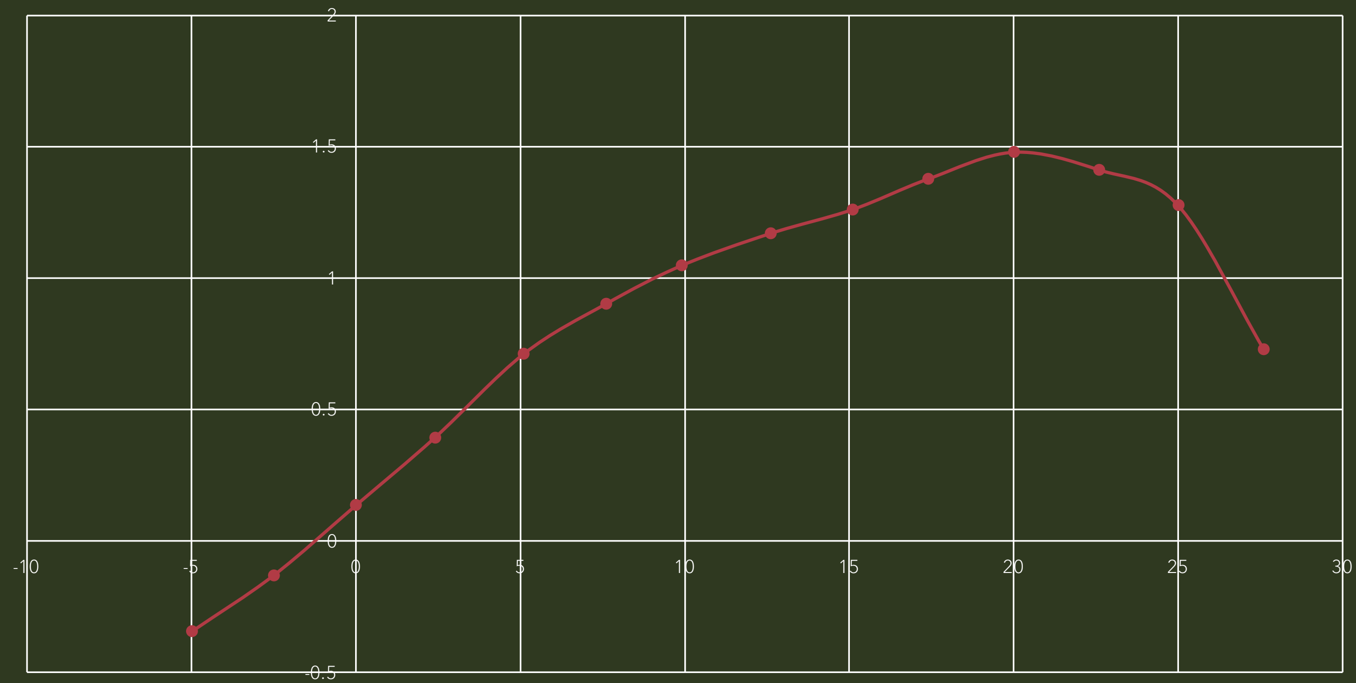
C_L VS α (10M/S)



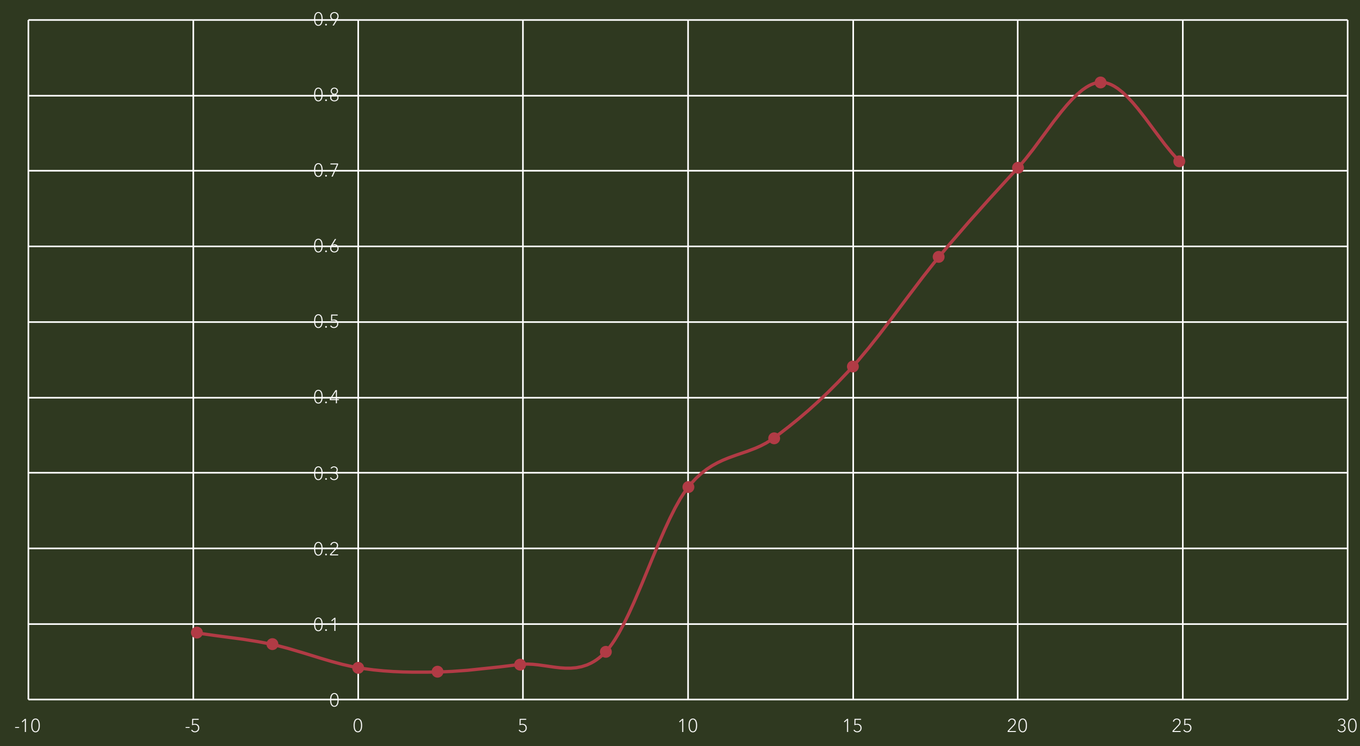
C_L VS α (15M/S)



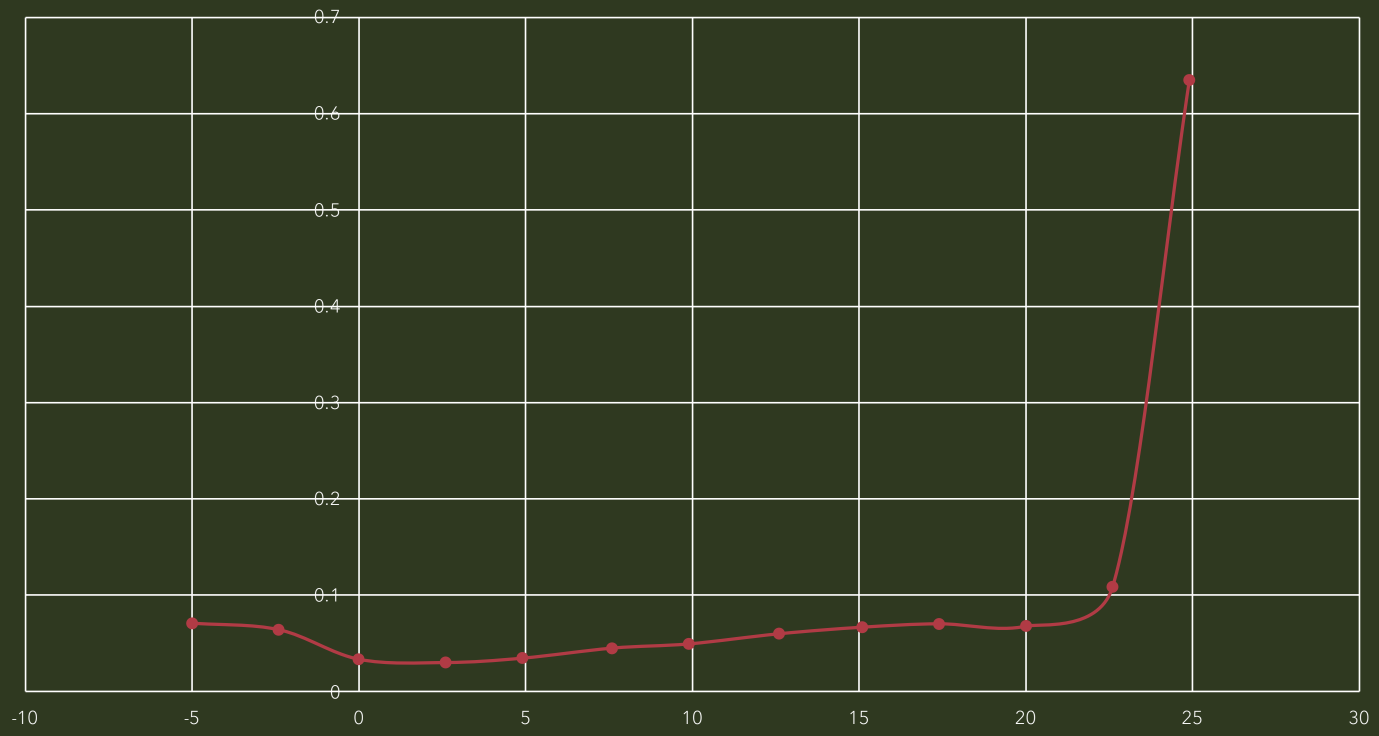
C_L VS α (20M/S)



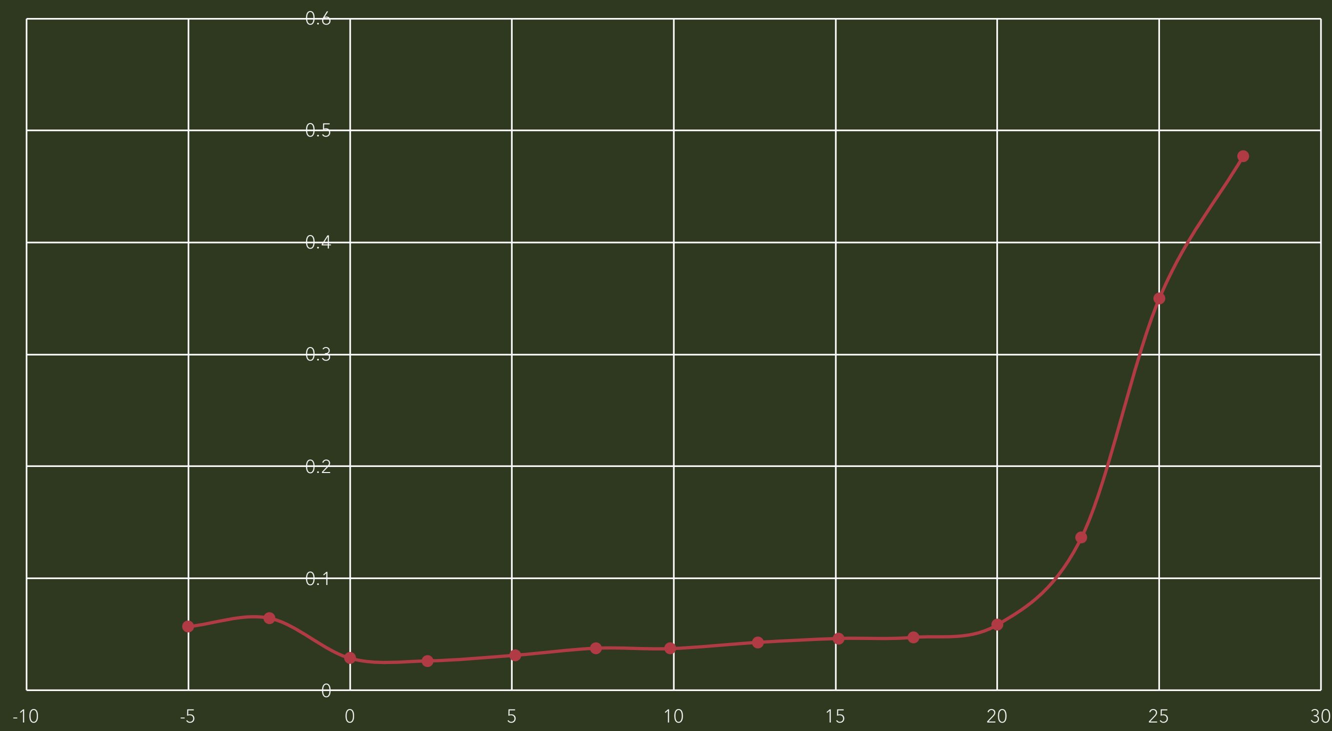
C_D VS α (10M/S)



C_D VS α (15M/S)



C_D VS α (20M/S)



ANALYSIS

10 m/s (Low Re)

- CL vs AoA
  Stall Angle: ~15°
  Max CL: ~0.95
  Zero-lift AoA: -4°

- CL at α=0°: 0.4

- CD vs AoA
  Min CD: ~0.03
  CD at stall: 0.12

  Gradual drag rise

15 m/s (Medium Re)

- CL vs AoA
  Stall Angle: ~15.5°
  Max CL: ~1.1
  Zero-lift AoA: -4°

- CL at **α**=0°: 0.45

- CD vs AoA
  Min CD: ~0.025
  CD at stall: 0.15

- Sharper drag rise

- 20 m/s (High Re)
- CL vs AoA
  Stall Angle: ~16°
  Max CL: ~1.2
  Zero-lift AoA: -4°

- CL at α=0°: 0.5

- CD vs AoA
- Min CD: ~0.02
- CD at stall: 0.18

- Most abrupt drag rise

ANALYSIS- REYNOLDS NUMBER EFFECTS

- Lift Characteristics

  Maximum CL increases with Reynolds number

  Stall angle slightly increases with Re

  Lift curve slope becomes steeper at higher Re

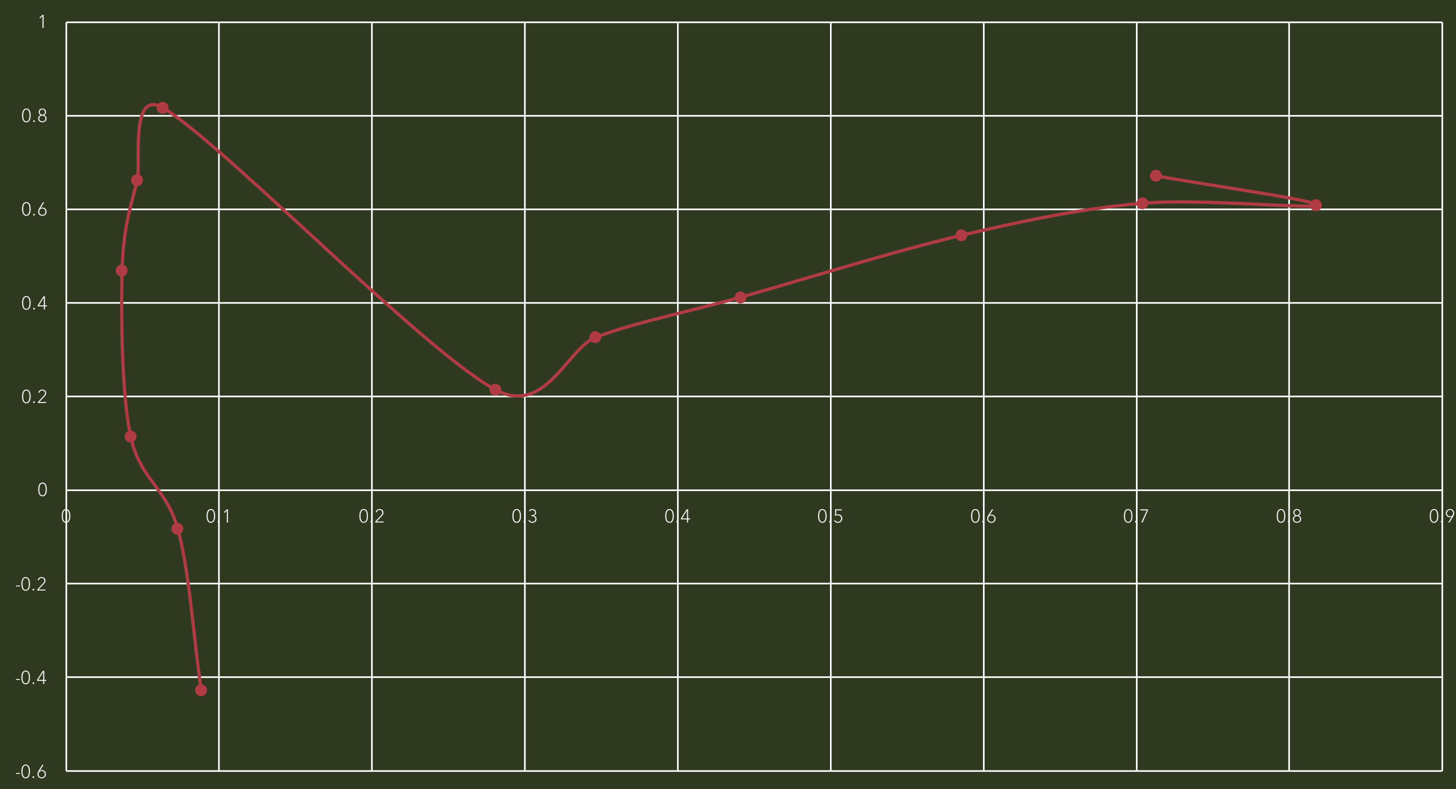
- Drag Characteristics

  Minimum CD decreases with increasing Re

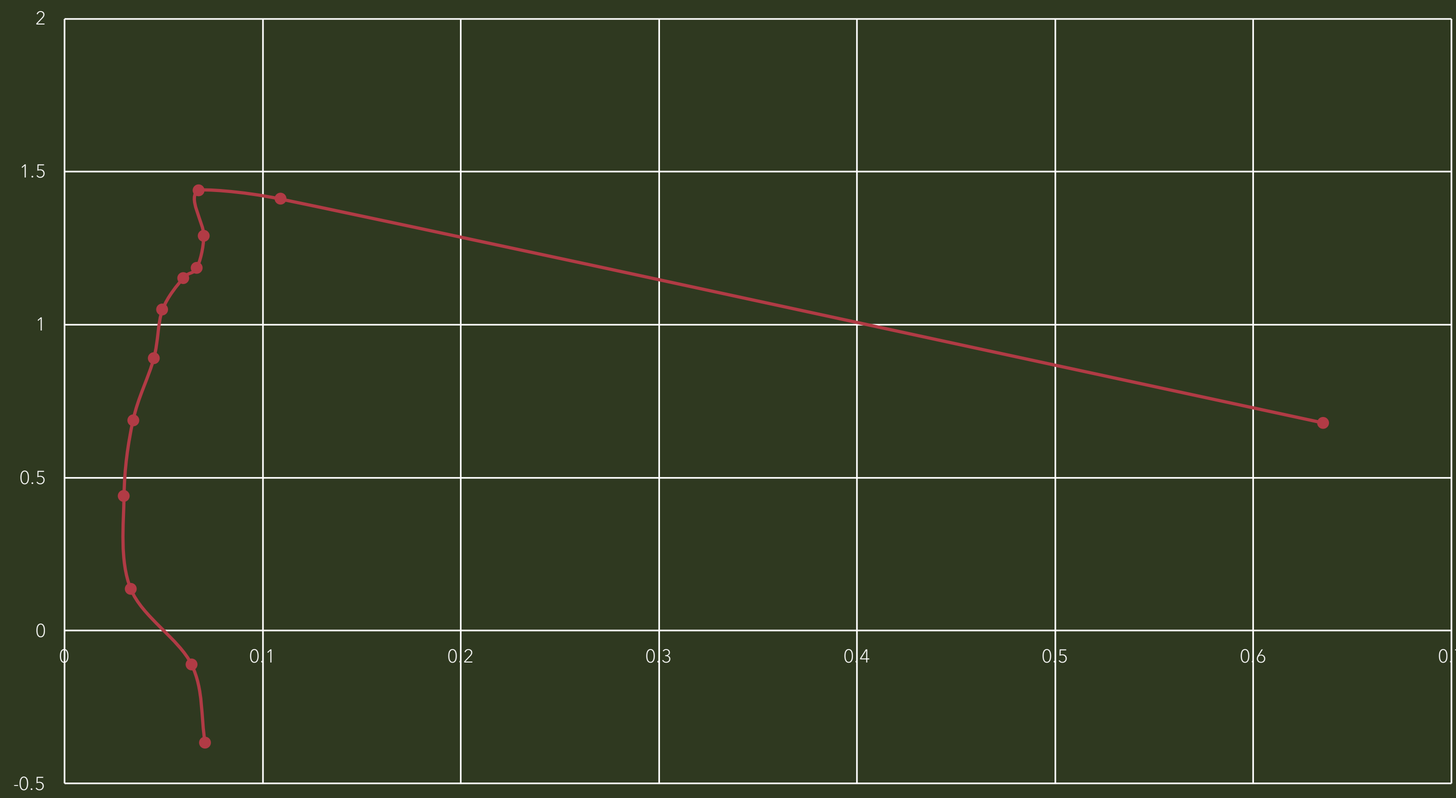
  Drag rise at stall becomes more pronounced

  Lower drag across all AoA at higher Re

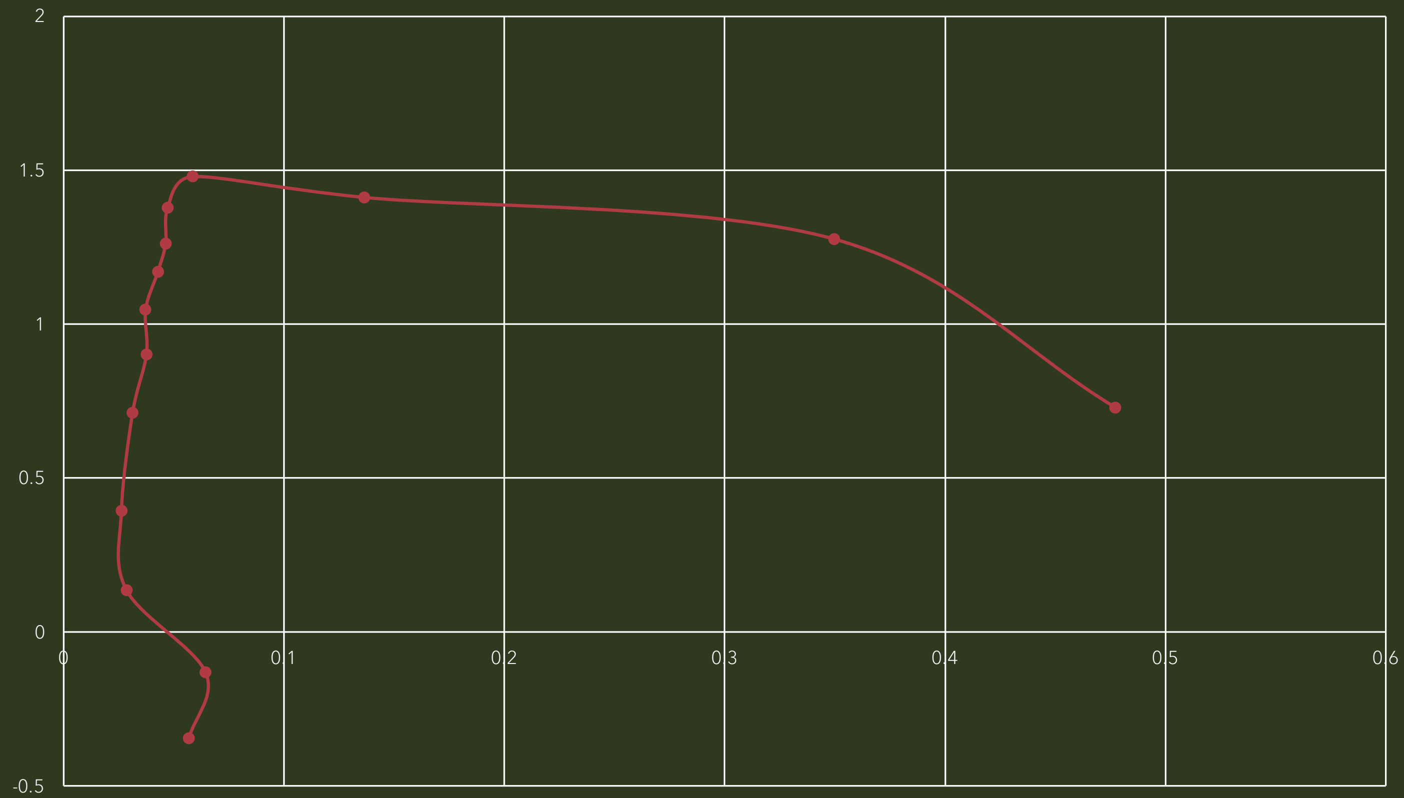
C_L VS $C_{D(10M/S)}$



C_L VS $C_{D(15M/S)}$



C_L VS $C_{D(20M/S)}$



ANALYSIS- DRAG POLAR

- 10 m/s
- Min CD: 0.030
- CL at min CD: ~0.35
- α at min CD: 2-3°
- L/D max: ~12

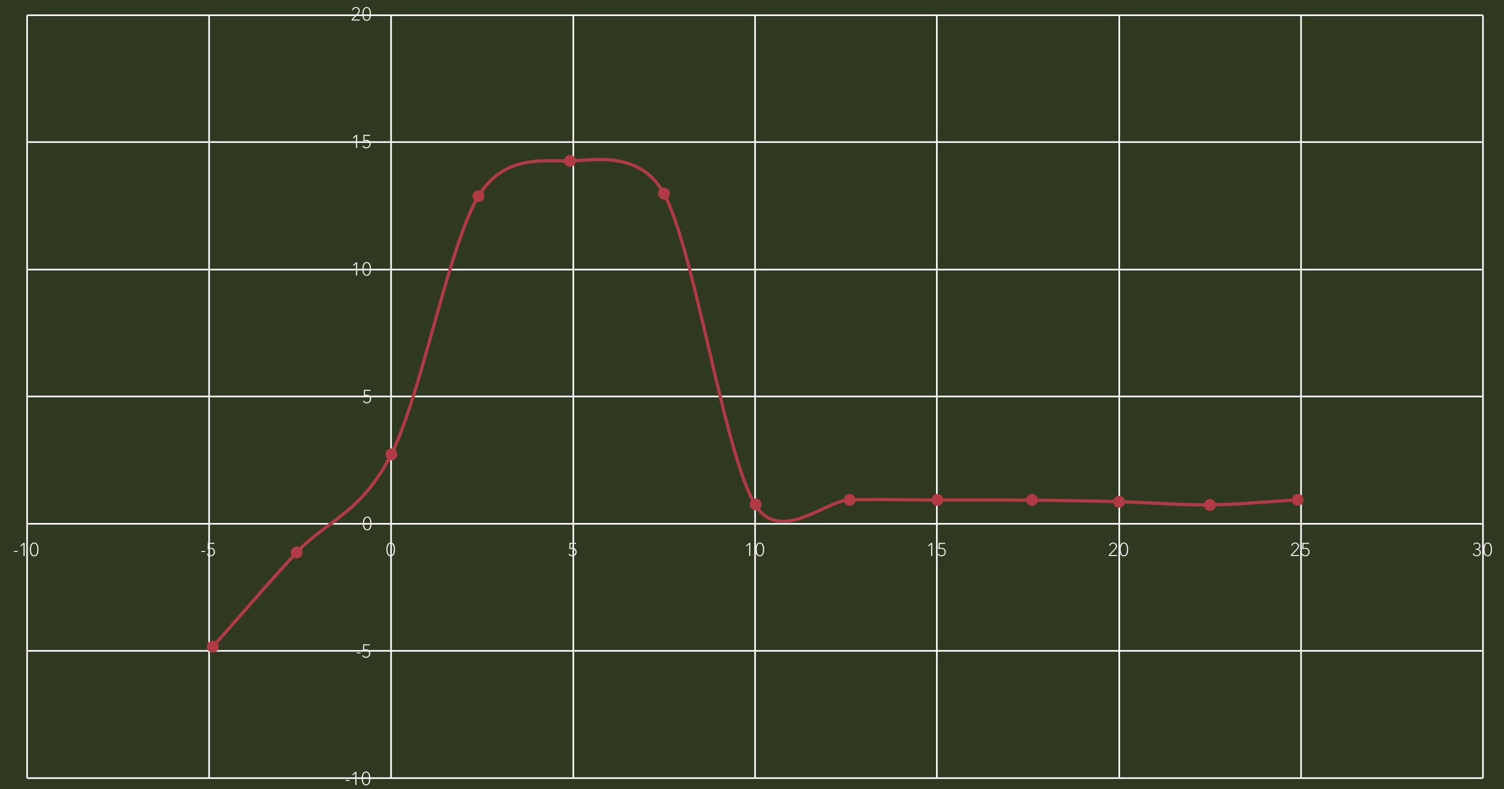
- 15 m/s
- Min CD: 0.025
- CL at min CD: ~0.4
- α at min CD: 2-3°
- L/D max: ~15

- 20 m/s
- Min CD: 0.020
- CL at min CD: ~0.45
- α at min CD: 2-3°
- L/D max: ~18

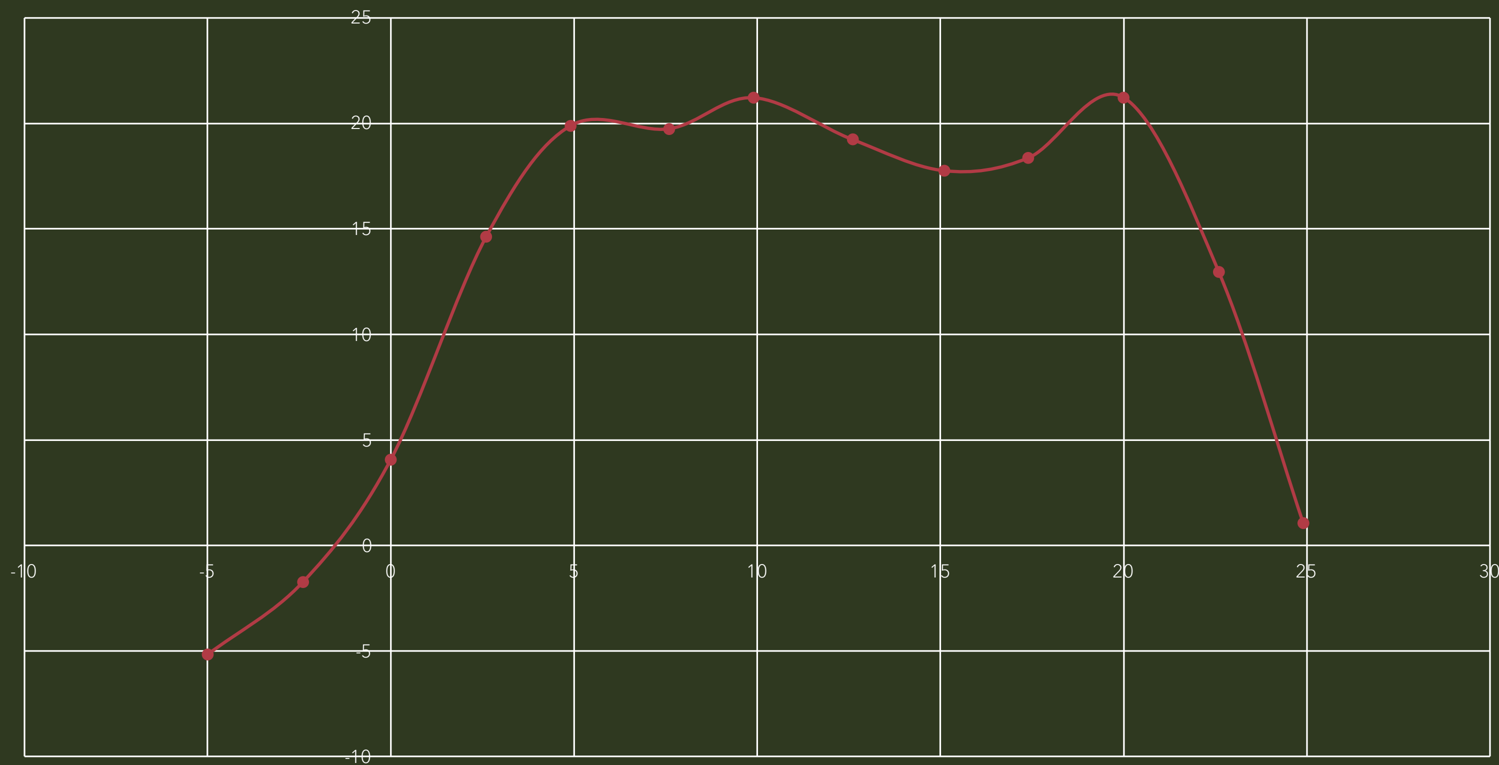
ANALYSIS- DRAG POLAR

- Minimum Drag Angle:
- Remains relatively constant at 2-3° across all Reynolds numbers
- More well-defined minimum at higher Reynolds numbers
- Drag Polar Shape:
- Lower minimum drag values at higher Reynolds numbers
- More distinct drag curve at higher Reynolds numbers
- Better overall aerodynamic efficiency (L/D) at higher Re
- Performance Improvements:
- 33% reduction in minimum drag from 10 m/s to 20 m/s
- Wider range of efficient operating CL values

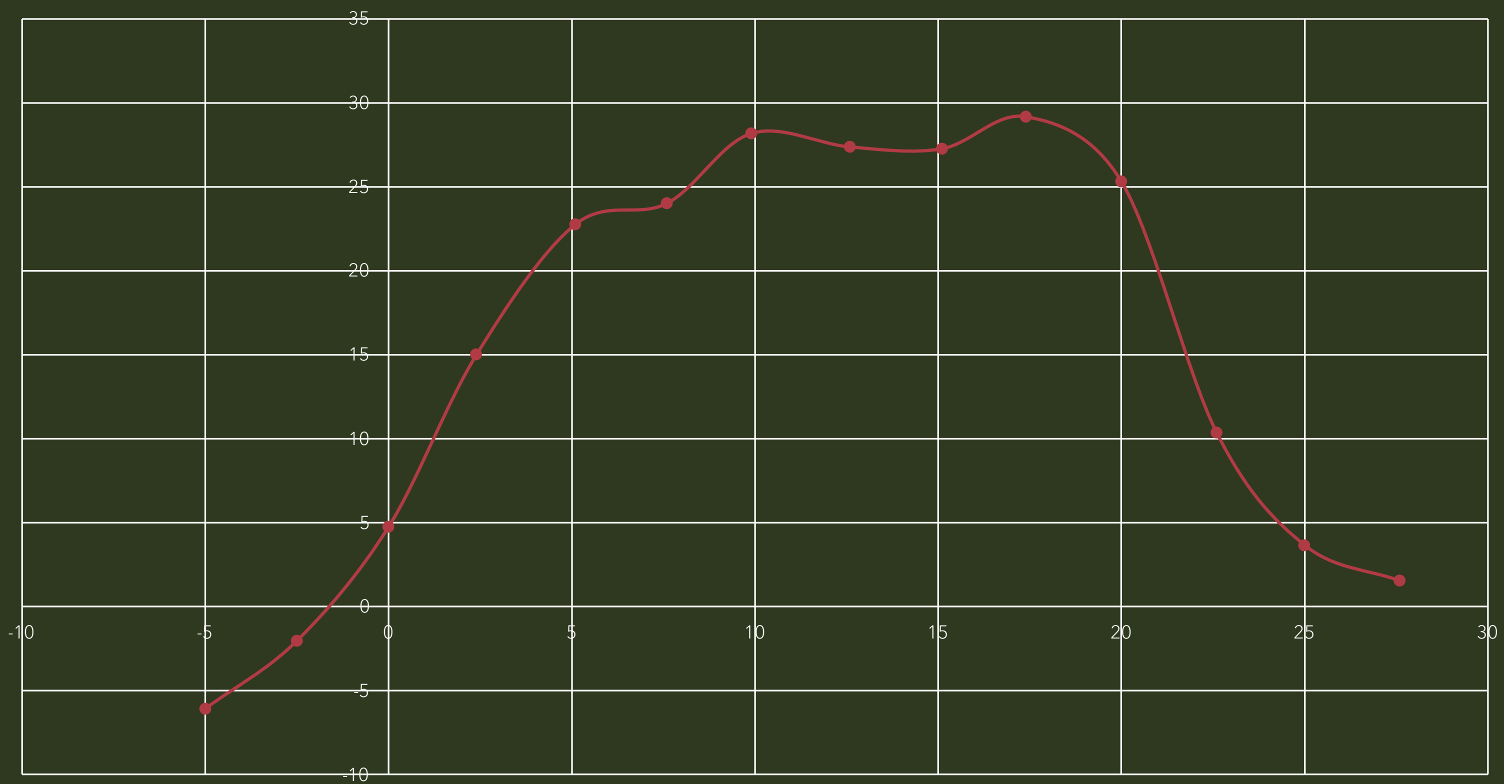
C_L/C_D VS $\alpha_{(10M/S)}$



C_L/C_D VS α (15M/S)



C_L/C_D VS α (20M/S)



ANALYSIS

Velocity (Re)	Max CL/CD	Optimal α	Characteristics
10 m/s (Low)	~15	5-6°	Sharp peak, rapid decline
15 m/s (Med)	~21	10°	Broader efficient range
20 m/s (High)	~29	15°	Widest efficient range

Reynolds Number Effects:
Higher Re → Better efficiency (max CL/CD ↑)
Higher Re → Larger optimal angle of attack
Higher Re → Broader range of efficient operation
Conclusion: Best performance at 20 m/s, α ≈ 15°, achieving CL/CD ≈ 29.
Higher Reynolds numbers improve boundary layer attachment and delay flow separation