Co-Flow Jet Airfoil for Ultra-High Efficiency and Quiet Aircraft

Patent: US8485476 B2

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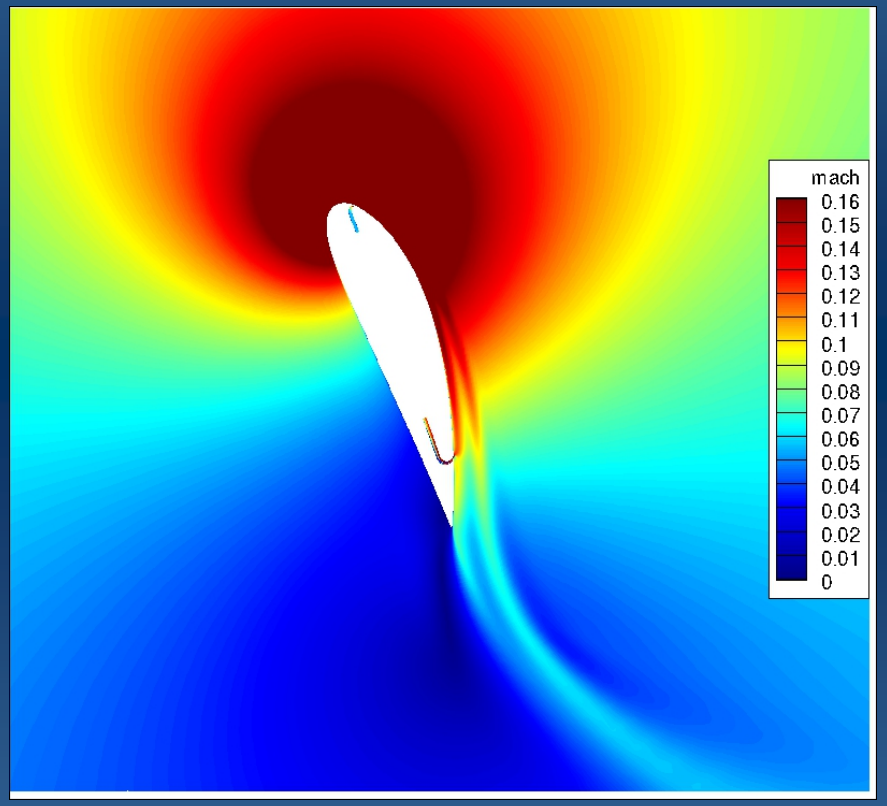
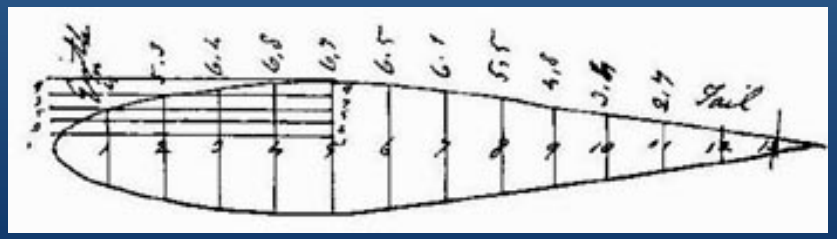


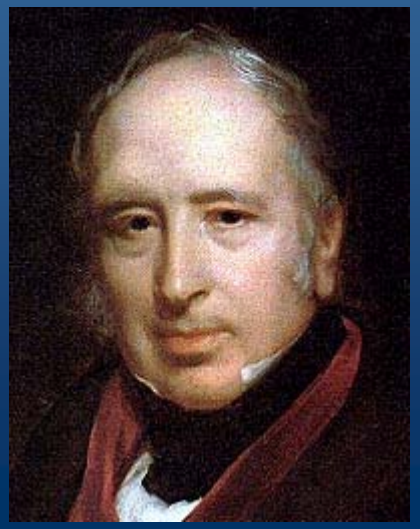
Research Sponsors: DARPA, NASA, AFRL, ARO, AFOSR, CIRA, Emil Buehler Perpetual Trust.

Airfoil: The fundamental element of aircraft



mimicked from dolphin

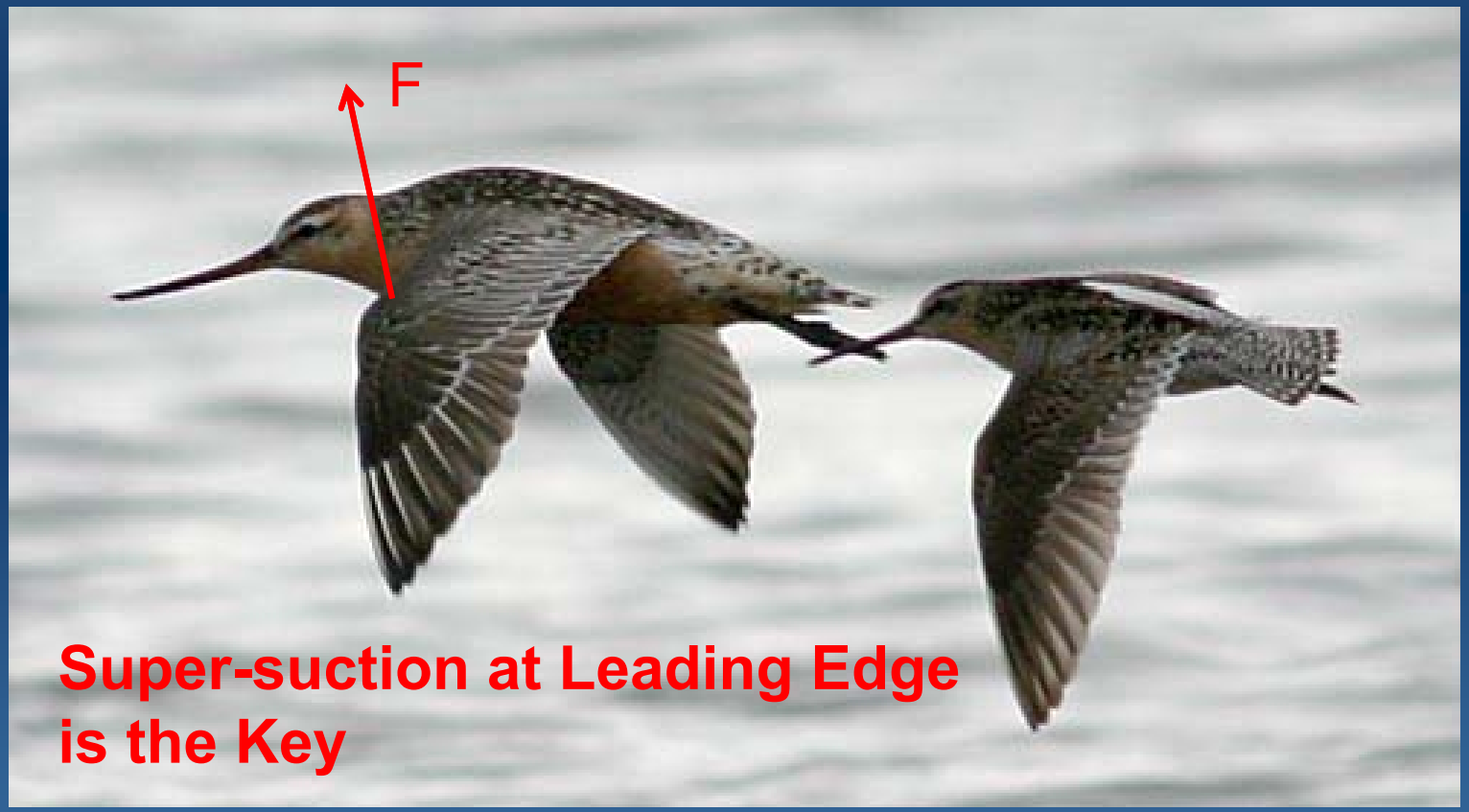
Sir George Cayley Bt. (1773 - 1857)
Father of Aeronautics



- Little new transonic airfoil improvement since 1960's supercritical airfoil.
- Little new subsonic airfoil development since 1940's NACA and European Airfoils.

Bird Wings: Super-Efficiency at Cruise

- Alaska Shorebirds, nonstop flight from Alaska to New Zealand in 9 days, 7145miles, V=14.8m/s=33miles/h.
- Bird's flapping wings generate lift and thrust due to the supersuction at leading edge at downstroke.



Bird Wings: Super-High Lift Coefficient at Landing

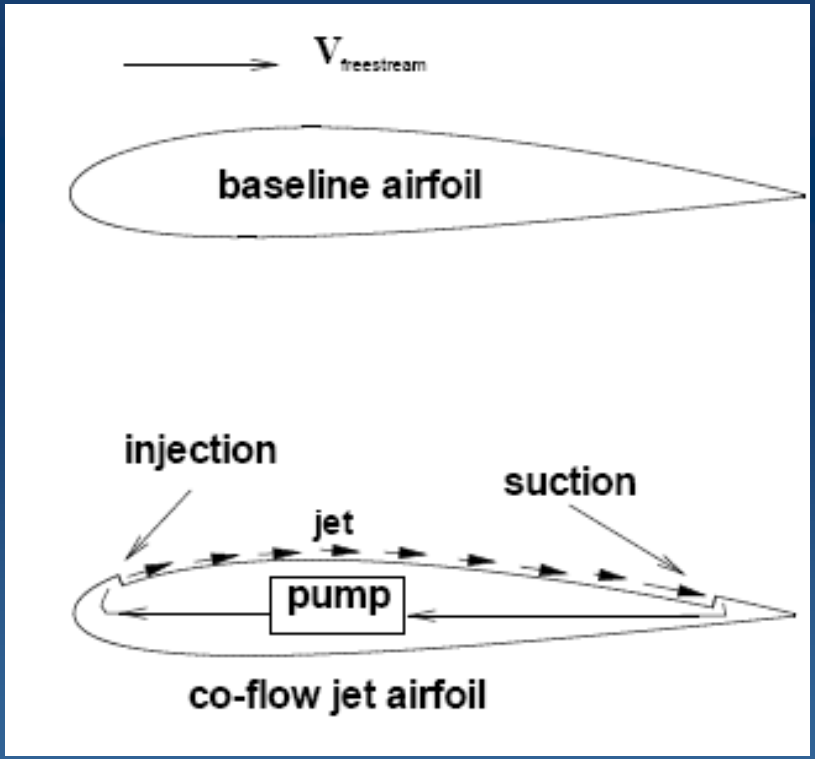
- Owl's Preying Maneuver, ultra-high AoA and Lift, no stall
- Quiet due to no wake turbulence noise

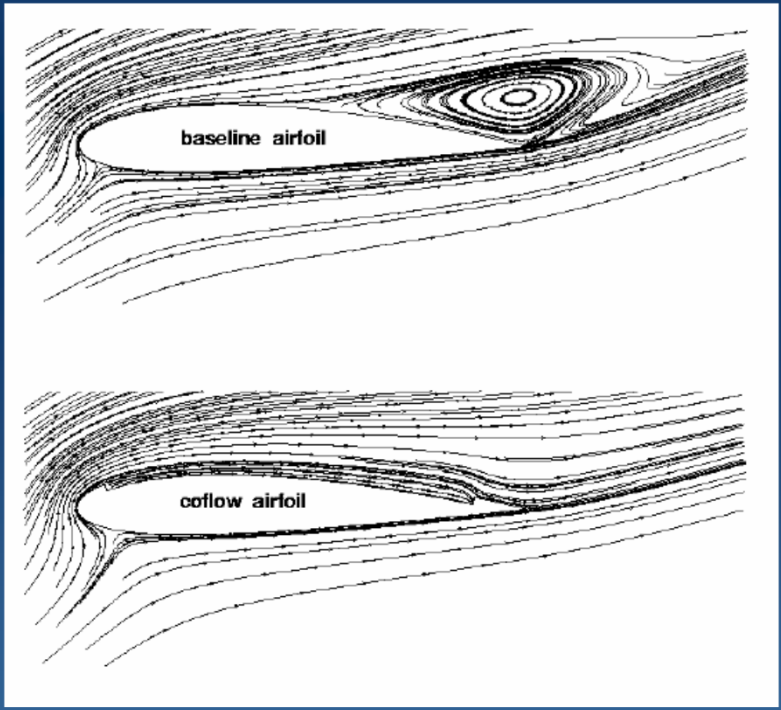
Learn from Nature

- How can we generate supersuction with fixed wings?
- How can we use one set of wings for both high efficiency cruise and ultra-high lift at takeoff/landing?

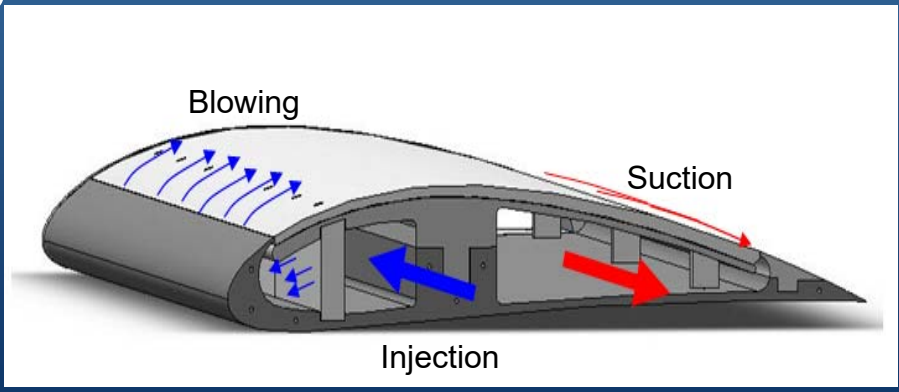
Co-Flow Jet (CFJ) Airfoil: Ultra-High Efficiency

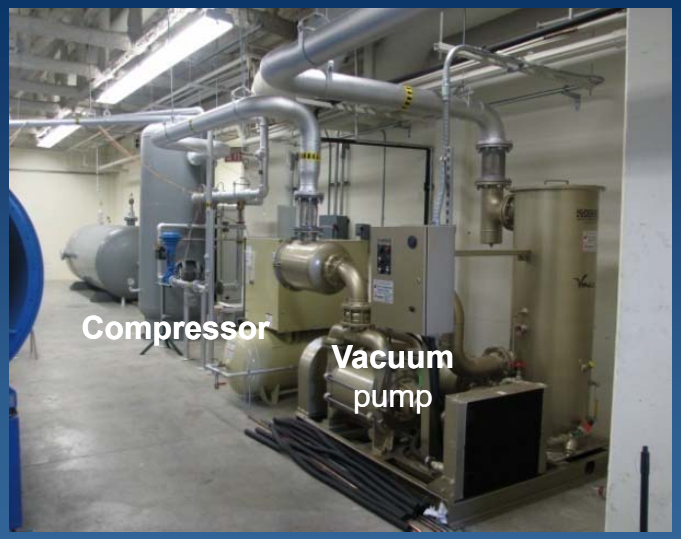
- High Lift, Low Drag, High Stall Margin,
- Low Noise, Low Energy Expenditure
- Zero-Net Mass Flux Flow Control
- Leading Edge Supersuction with Fixed Wing

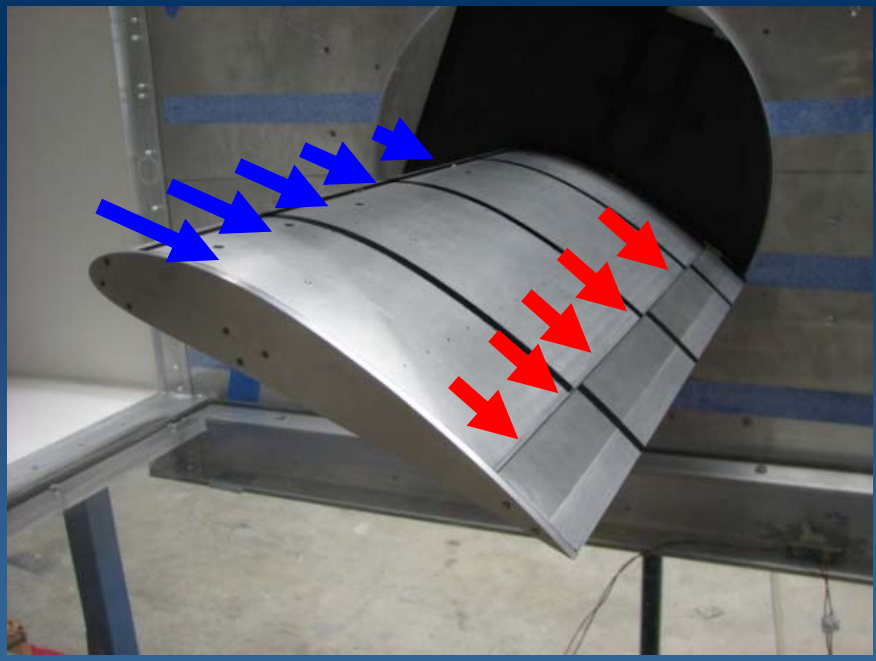




Wind Tunnel Experiment of Co-Flow Jet Airfoil
University of Miami

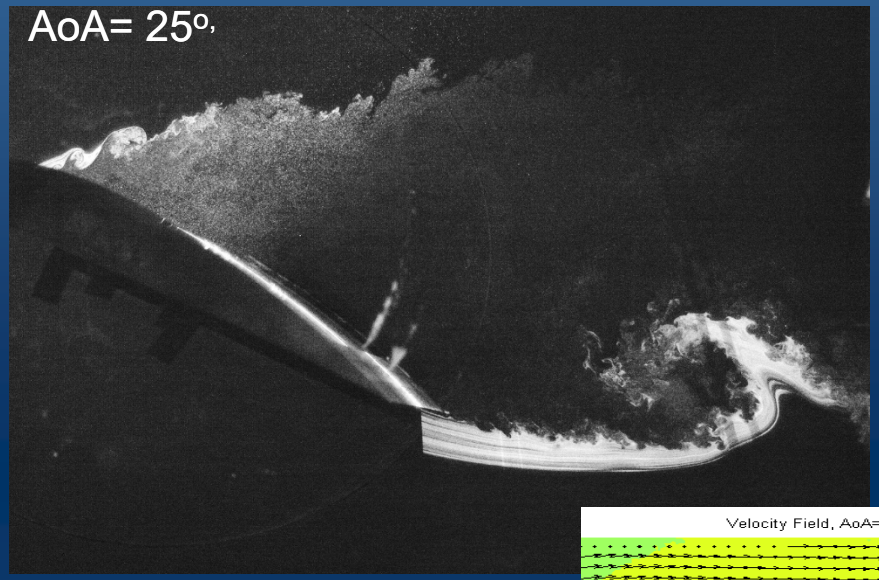




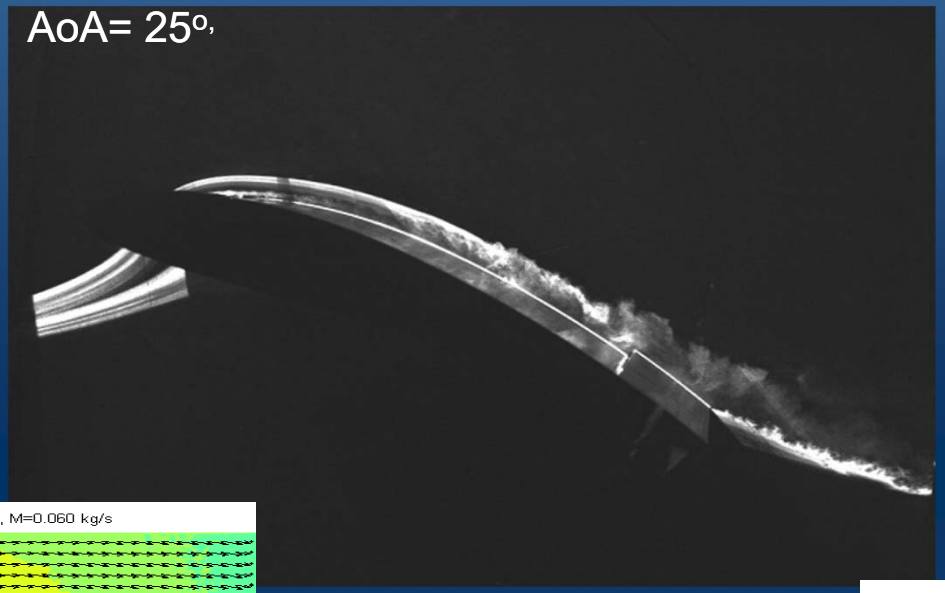


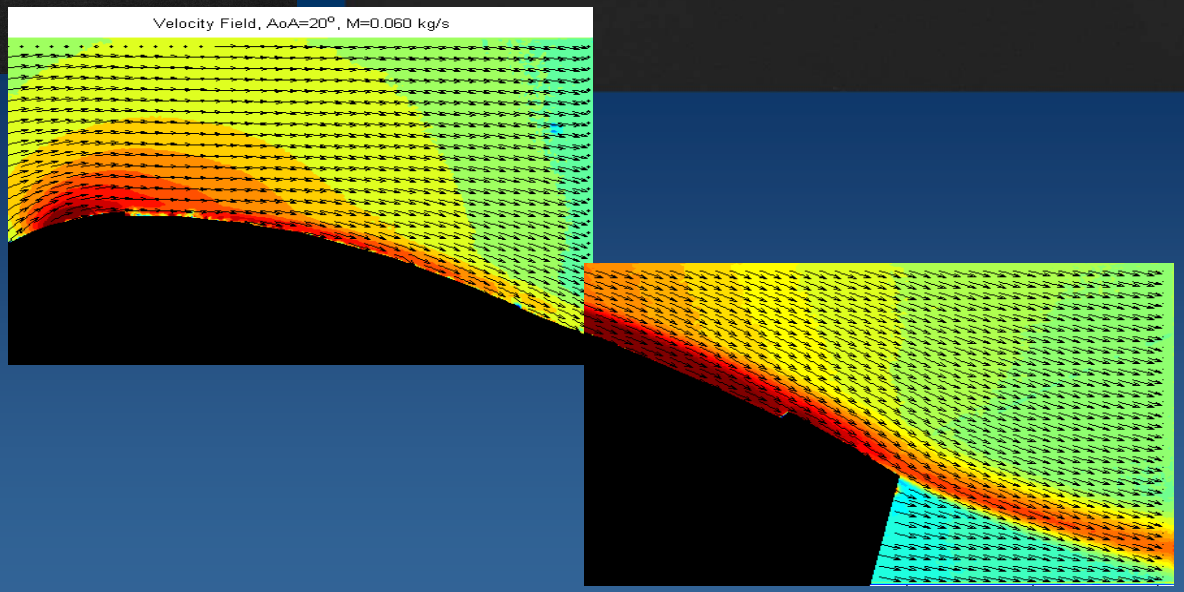
Co-Flow Jet Airfoil Flow Control Experiment

Airfoil Flow Separation, No Control, AoA= 25°,



Co-Flow Jet Airfoil, No Flow Separation, AoA= 25°,



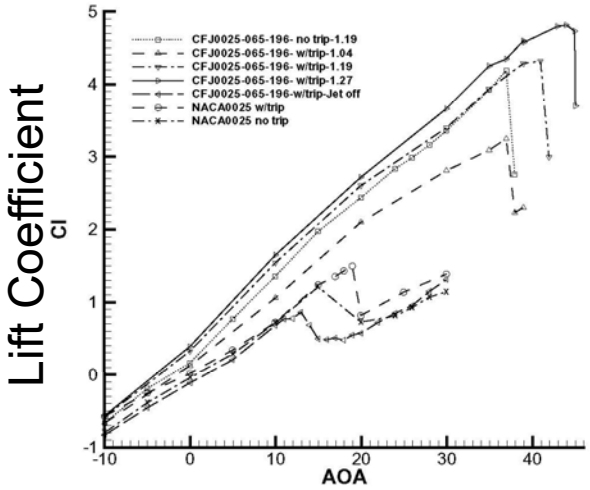


- CFJ Airfoil has No Flow Separation,
- Reduce wake, generate thrust
- Very low energy expenditure

Ultra-High Lift, Low Drag, Low Energy Expenditure

Lift vs Angle of Attack

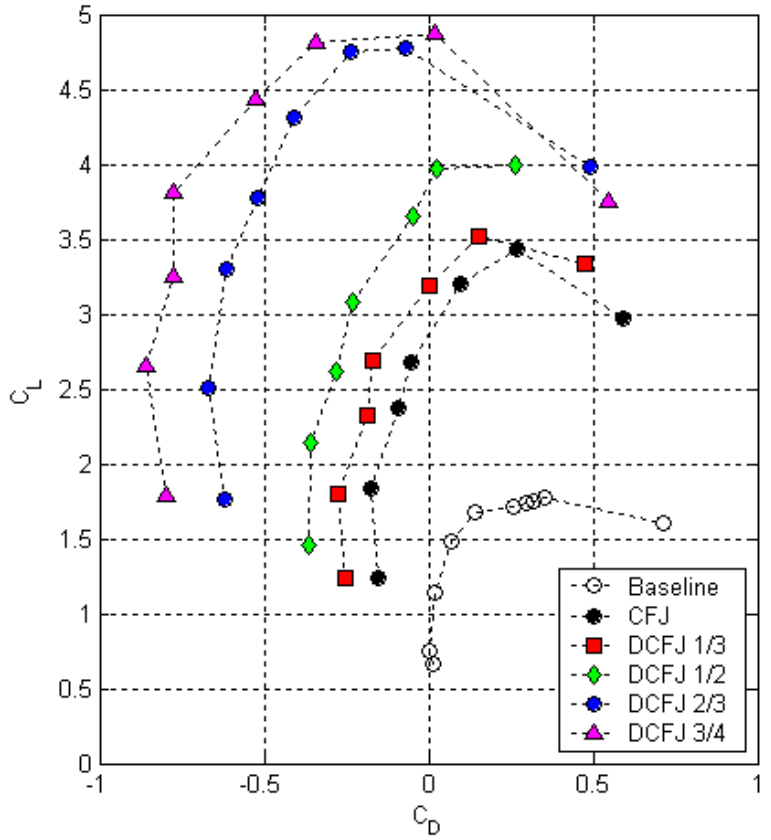
Wind Tunnel Test Results



Comparison of the tested lift coefficient for baseline NACA0025 and CFJ0025-065-196 airfoil

Drag polar, Thrust generated

Cμ*=0.30

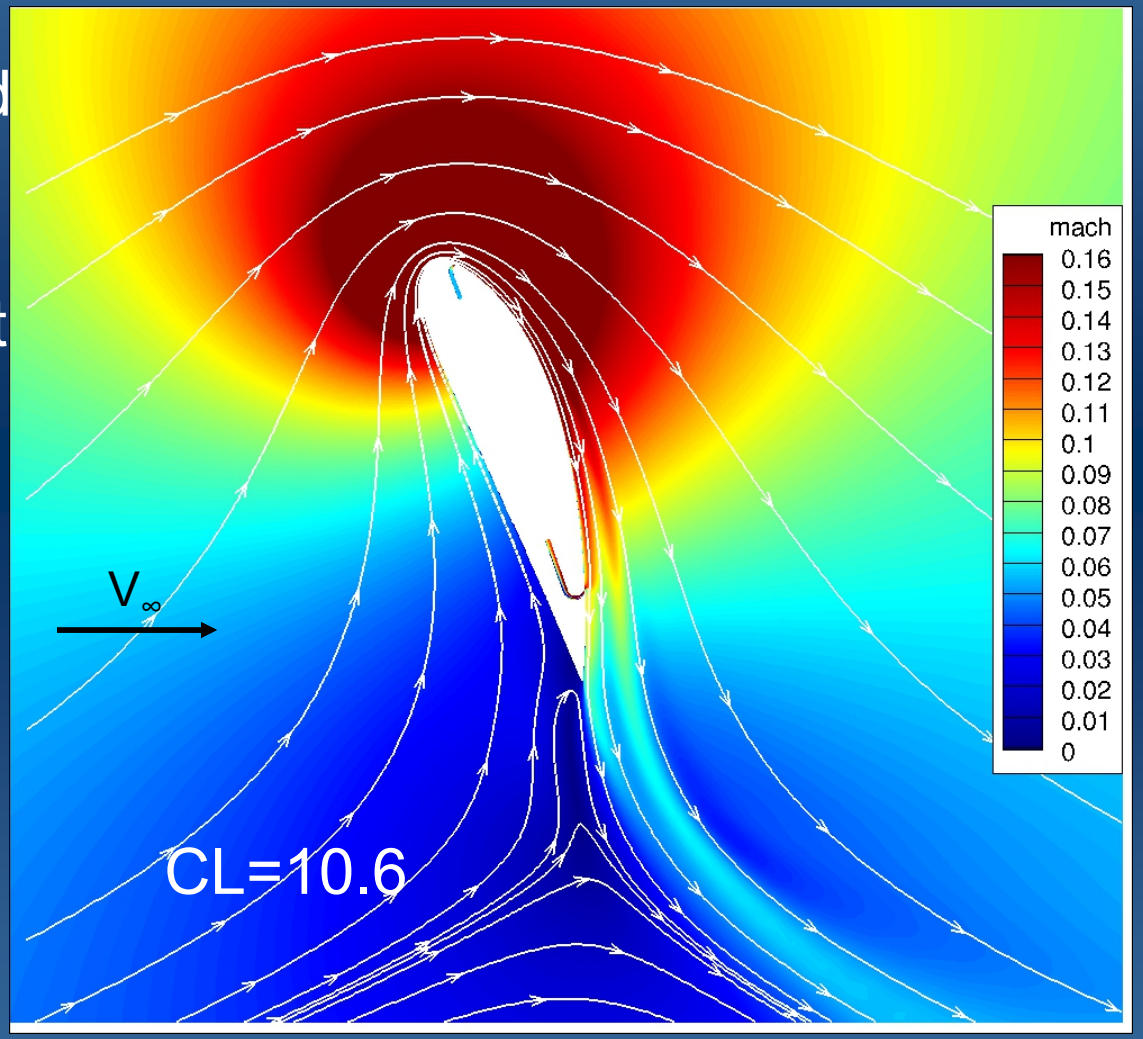


Unconventional drag polar, high lift with high thrust, low energy expenditure

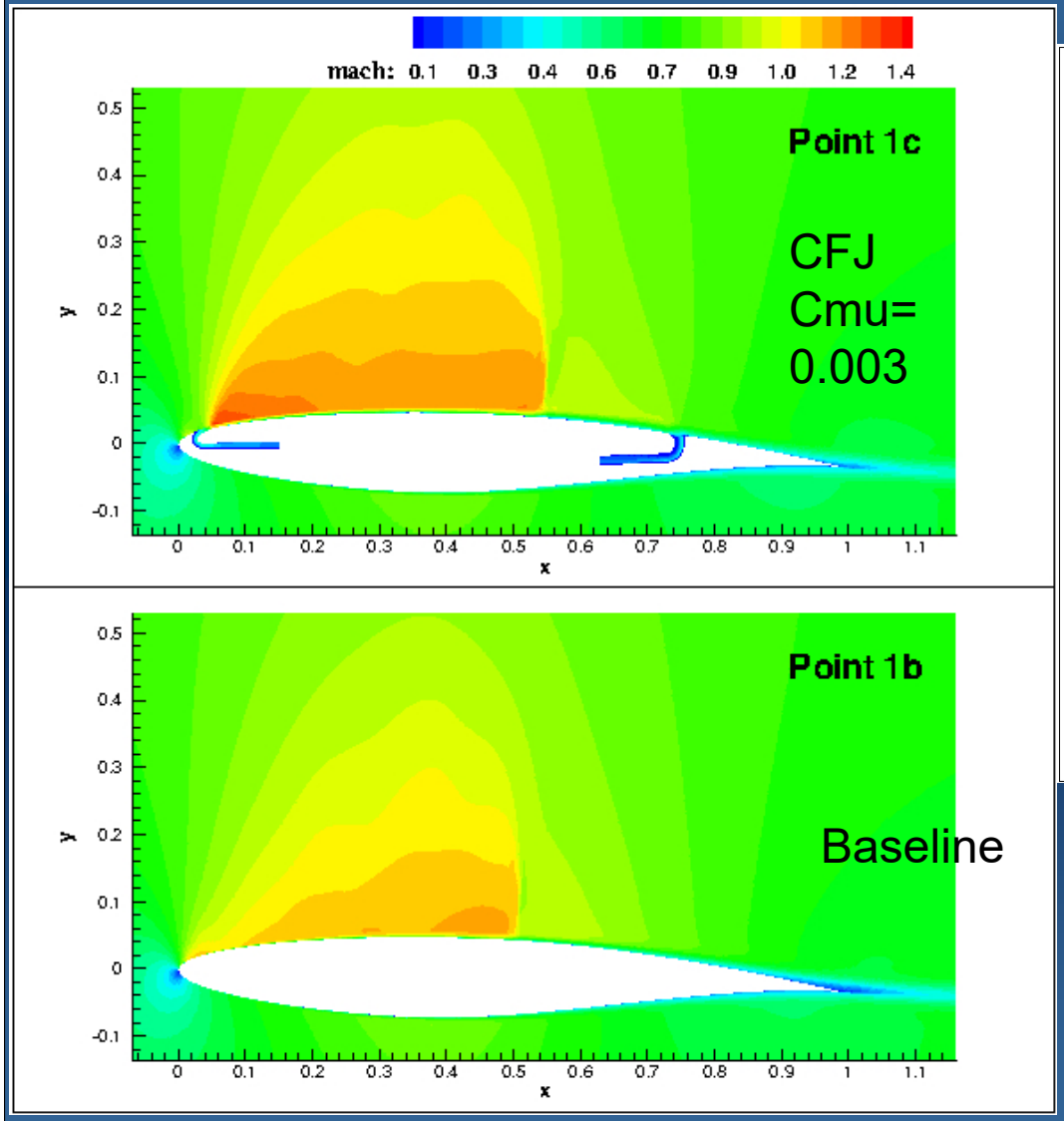
Super-Lift Coefficient (greater than CL_limit=2π (1+t/c))

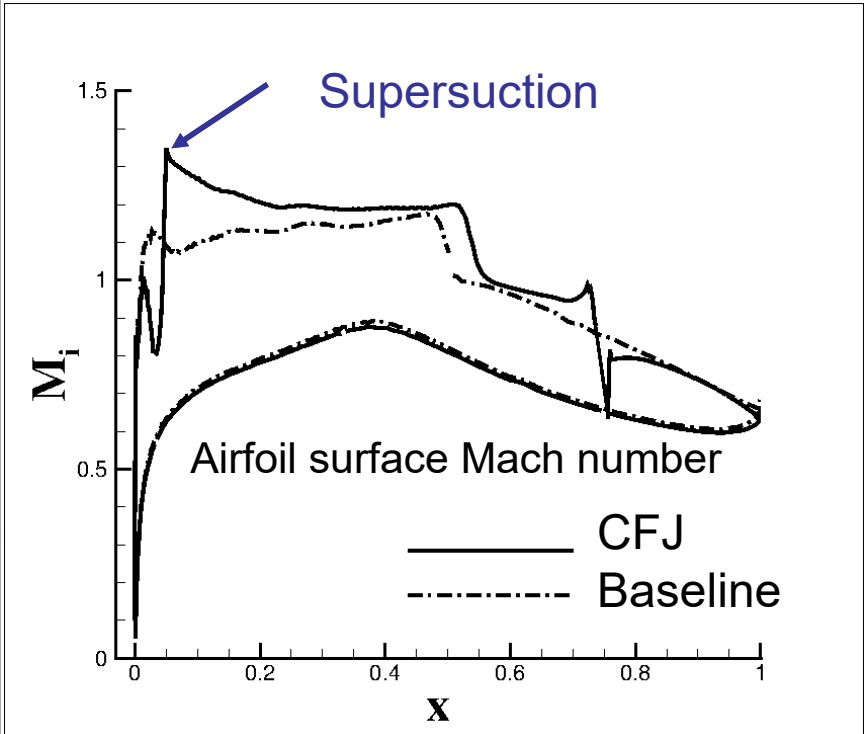
CL=10.6, Cmu=0.35 M=0.067, Flow Attached at AoA=70deg. The circulation is so high that the stagnation point is detached from the airfoil.

Owl's wing effect achieved by CFJ Airfoil at high AoA, high lift, no stall, no wake, no flap system.



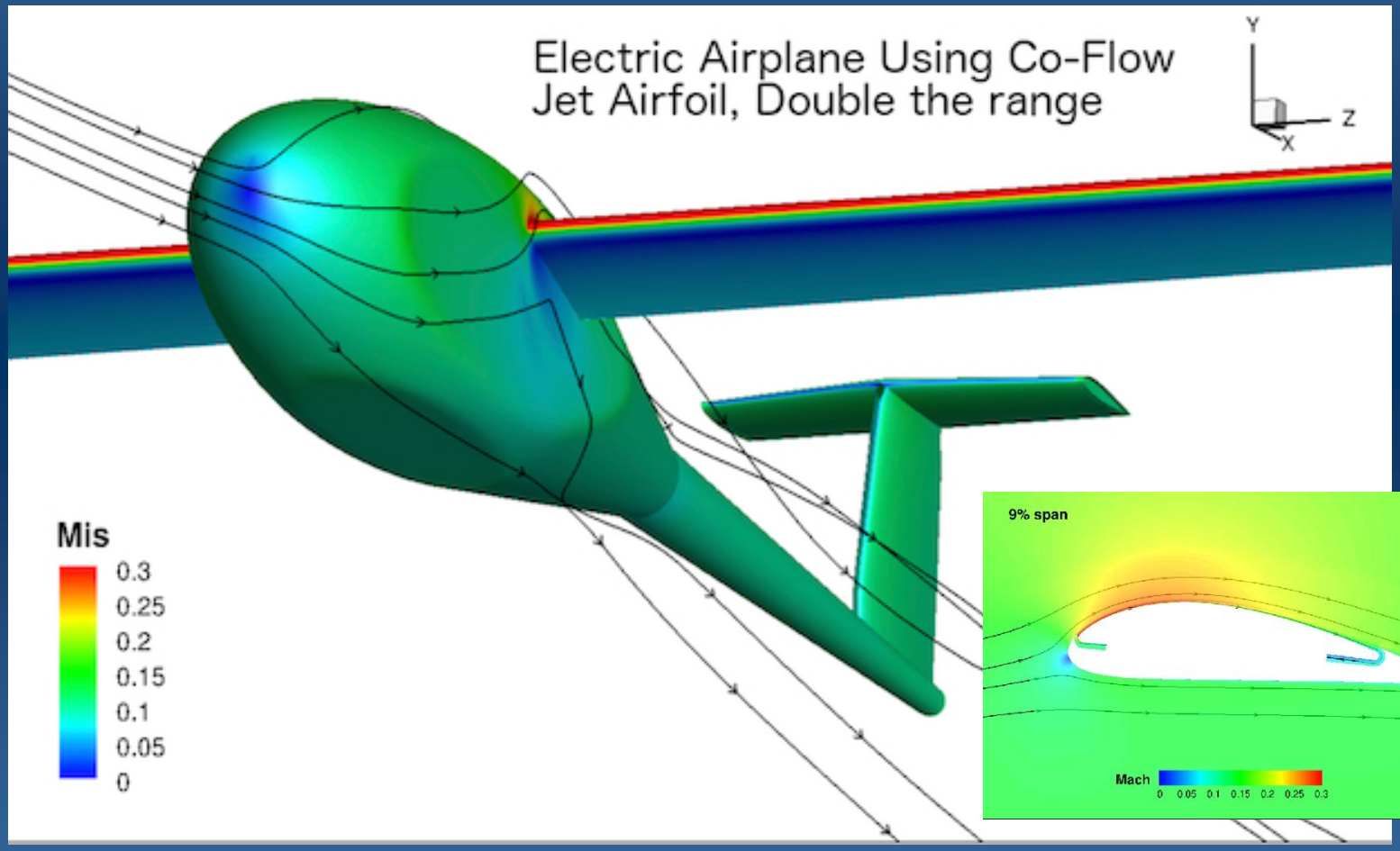
CFJ Airfoil improves transonic cruise performance



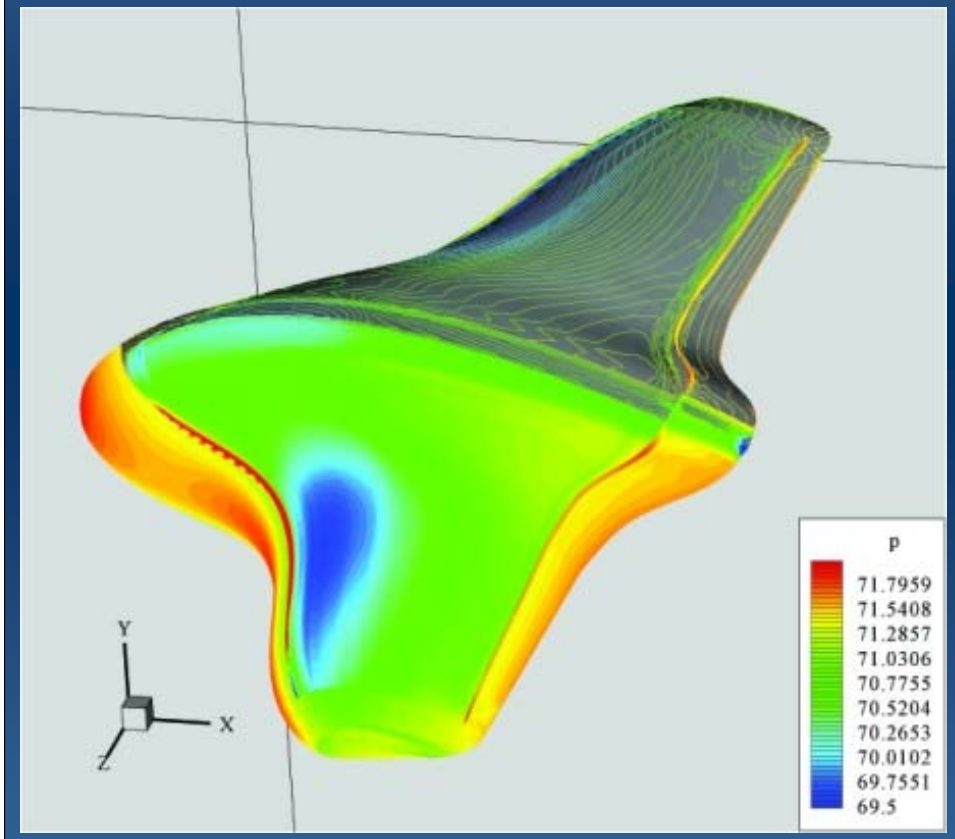


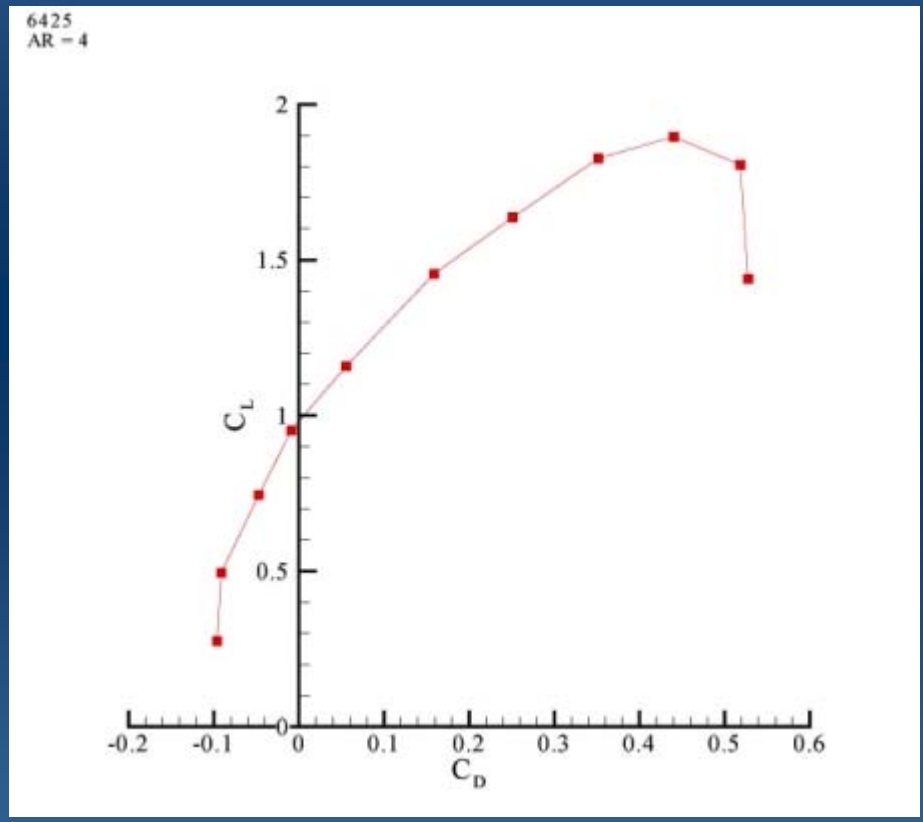
M=0.73, L/D improved by 14.7%,
CL improved by 18%,
Productivity efficiency improved
by 36%

Electric General Aviation Airplane Using CFJ, 4 Passenger, Range of 360miles, 3X of SoA



“Engineless” aircraft propelled by CFJ Wing





Mars Aerial-Ground Global Explorer Using CFJ

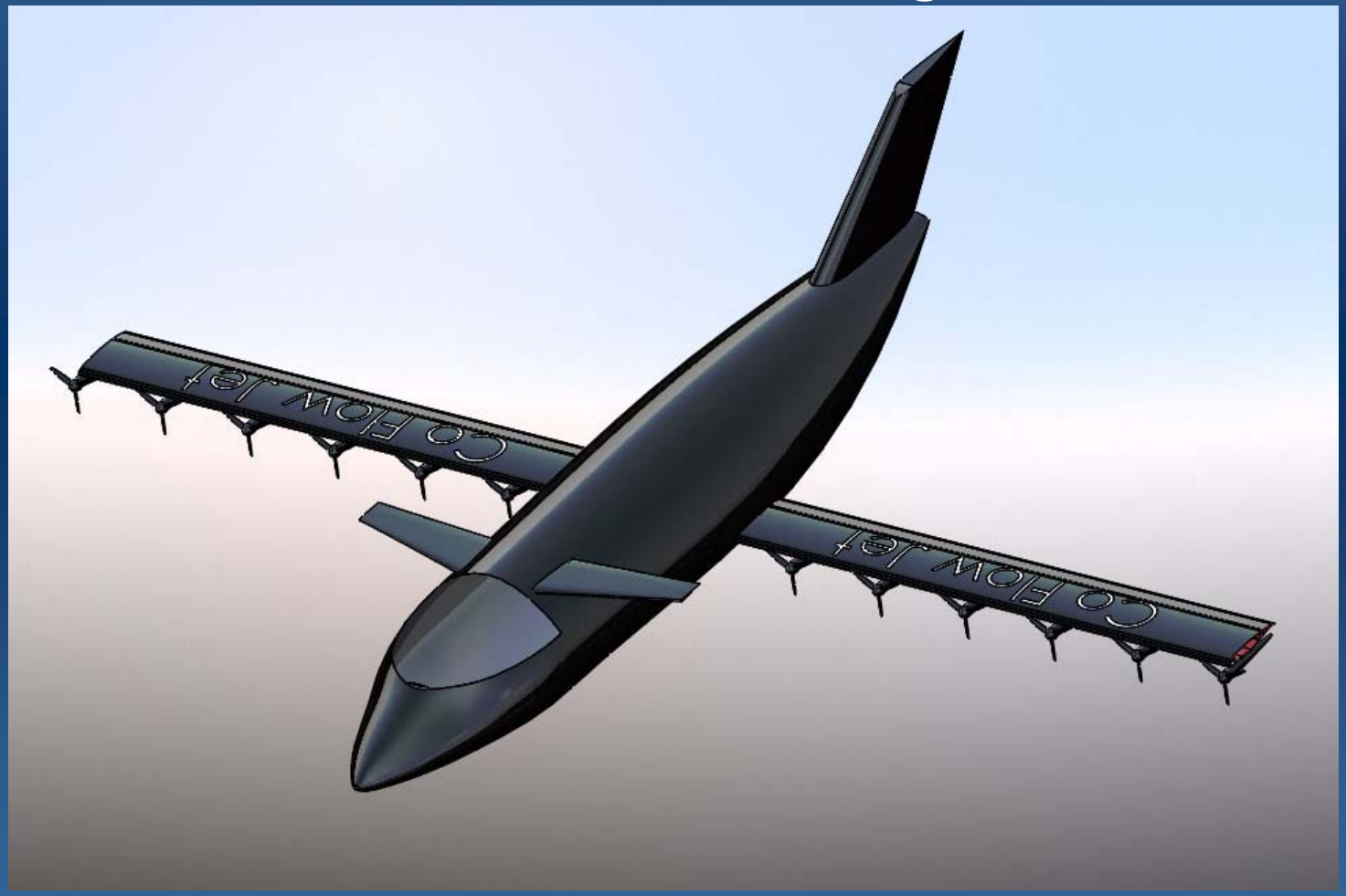
Vertical takeoff/landing, Circle Mars 160 times

Impact: CFJ airfoil revolutionizes aviation from the most fundamental element: the airfoil.

- Ultra-High Cruise Productivity Efficiency to Substantially Increase Range and Payload.
- Extremely Short Takeoff/Landing due to Super-Lift Coefficient
- Applicable from subsonic to transonic
- Flapless system to reduce noise, weight and cost
- Smaller size due to high wing loading(high CL)
- CFJ wing with thrust forms a new way of distributed electric propulsion, Ideal for hybrid-electric propulsion.

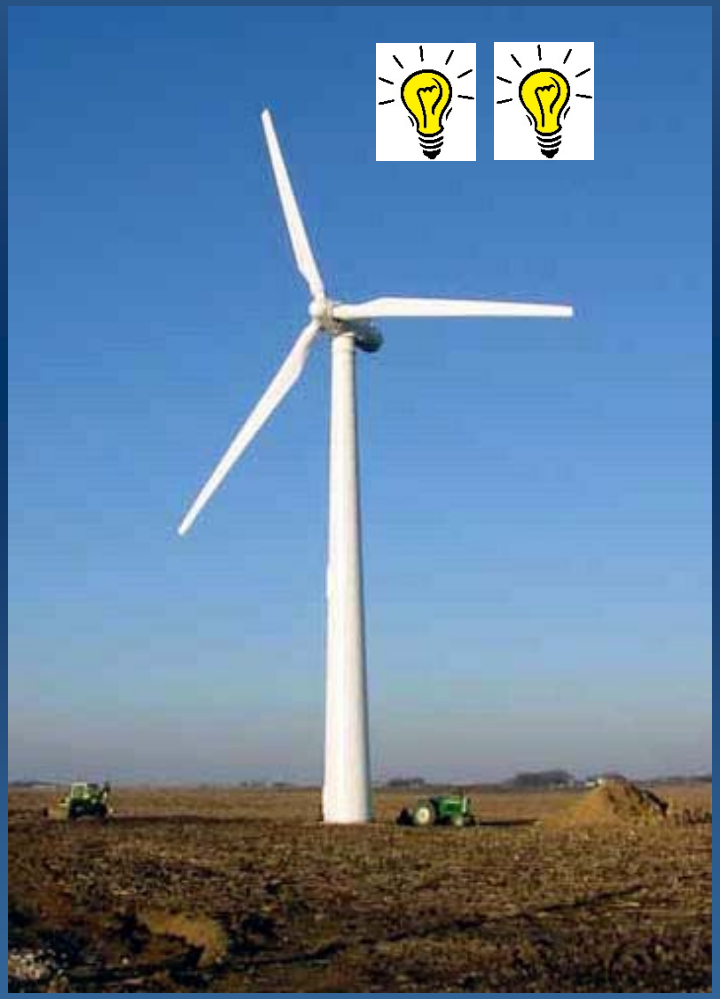
Product development: GA electric CFJ aircraft, 4 passengers, R=360miles, V=220miles/h, Double the range of the same size electric GA.

Product development: CFJ Transonic business Jet with hybrid (fuel + electric) propulsion, at least 30% more efficient than conventional aero design.

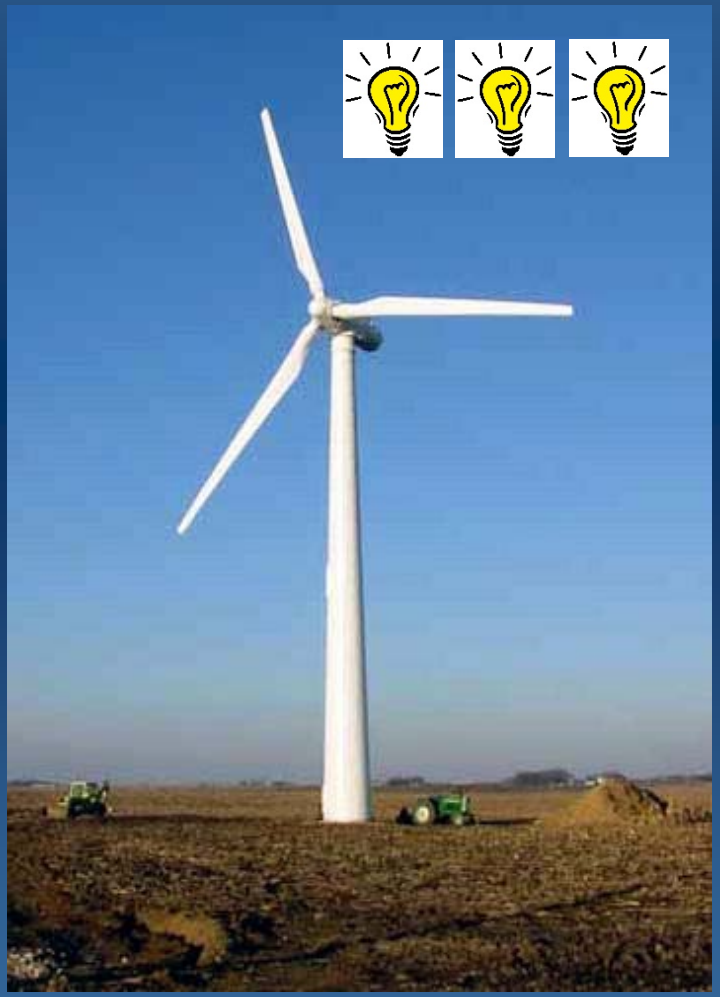


Ultra-High Efficiency Wind Turbine Using CFJ

Conventional Turbine



CFJ Turbine, 30% more power



Leadership Team

Gecheng Zha, PHD,
President,
Professor on Aerodynamics, CFD, Aircraft Design,
Inventor of CFJ Airfoil Technology

Joseph Johnson, PHD,
VP of Marketing,
Associate Professor on New Product Development, Strategic Brand Management, Marketing Strategy

Peter Trogos,
VP of Business Development,
Former Academic Ambassador of Dassault Systèmes,
Industry Advisor at ASME,
BS of Mathematics

Engineering Team Leaders:

Dr. Yan Ren, Mr. Yunchao Yang (Ph.D. Candidate)

Annual BBQ in Dr. Zha's house

Mission: Transform Aviation Industry with Ultra-High Efficiency Coflow Jet Wing from Subsonic to Transonic Speed.

Objective: Commercialize CFJ Technology to Benefit Society.

Collaboration and Investment welcomed.

Together, We change the world.

Coflowjet.com

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