FLUIDS/BERNOULLI'S PRINCIPLE Unit 18 , Dr. John P. Cise, Professor of Physics, Austin
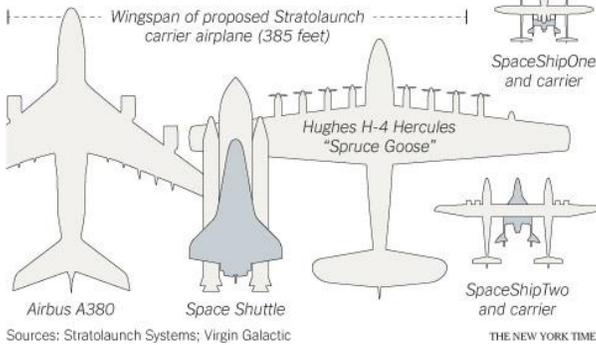

Tycoon's Next Big Bet for Space: A Countdown Six Miles Up in the Air

385 ft long wing

LIFT

Carrier airplane

17.2 ft wide at center

Weight = 1.2 X 10⁶ pounds

Boeing 747 engines

Rocket

Heavy Lifter

A company led by Paul G. Allen plans to build the largest plane ever, and use it as a carrier to launch rockets to low-Earth orbit.

Wingspan of proposed Stratolaunch carrier airplane (385 feet)

SpaceShipOne and carrier

Hughes H-4 Hercules "Spruce Goose"

Airbus A380   Space Shuttle

SpaceShipTwo and carrier

Sources: Stratolaunch Systems; Virgin Galactic   THE NEW YORK TIMES

INTRODUCTION: From NASA on Bernoulli's principle the lift on a plane Is given by: $L = (C_L)\rho A V^2/2$ where (C_L) = coefficient of lift , ρ = density of air at 30,000 ft = 8.91×10^{-4} slugs/ft³ , A = area of wing , V = speed of plane. Lift up on plane MUST = weight of plane

QUESTIONS: (a) **Find area of wing ?** (b) **Assume this plane is flying at 30,000 ft at 500 mph. Find the speed of plane in ft/s? 88ft/s=60 mph (c)Find the coefficient of lift(C_L)? ,(d) Does this value of (C_L) you found in (c) seem reasonable considering the chart at left?**

ANSWERS: (a) ~ 5005 ft² , (b) 733.3 ft/s, (c)1.33 (d) yes
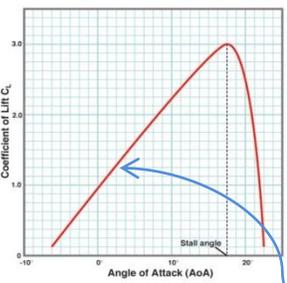
One of the richest men in the world is going to build the biggest airplane ever. And then he is going to use it to launch rockets. Paul G. Allen, the billionaire co-founder of Microsoft, said Tuesday that he was entering the rocket business with a concept seldom used until now: a plane that can take off the conventional way and then, at 30,000 feet, launch a rocket to orbit, carrying with it satellites, supplies and — eventually — people. The first rocket launching could be as soon as 2016. "You have a certain number of dreams in your life that you want to fulfill," said Mr. Allen, an avid philanthropist who has also financed efforts like a radio telescope listening for alien transmissions, "and this is a dream that I'm very excited about." The airplane that his new company, **Stratolaunch Systems**, plans to build will be larger and heavier than the Spruce Goose, Howard Hughes's record-setting flying boat that flew, just once, in 1947. **With (((((wings that will stretch 385 feet)))))** — longer than a football field — it will dwarf the double-decker Airbus A380, which is the biggest commercial passenger plane flown today. It will take off from a runway, fly to a normal cruising altitude and then drop off a rocket, eliminating the need for costly launching pads.

Stratolaunch will have headquarters in Huntsville, Ala., which is known as "the Rocket City" because of its role in the history of spaceflight, and an aircraft hangar in Mojave, Calif.

This time around, the carrier airplane will have **six 747 engines and a gross ((((weight of more than 1.2 million pounds.))))** It will use a 12,000-foot runway. By getting rid of the specialized launching pads used by NASA and other space agencies, Stratolaunch officials say they will be able to reduce costs, offer more flexibility and avoid bad weather by simply flying their airborne launcher to a patch of clear sky.

Instead of a tiny space plane like SpaceShipOne, Stratolaunch's carrier airplane will cradle a full-size rocket, a variant of SpaceX's Falcon 9, weighing about half a million pounds. The plane will take the rocket to 30,000 feet, almost six miles high, and then drop it. The rocket's engines will then ignite and the tail fins will turn the rocket's direction upward. The airplane will return to the airport and, in a quick turnaround, could be ready to launch another rocket by the next day. The payload capacity will be about 13,500 pounds to low-Earth orbit — less than the Falcon 9 and other larger rockets like the Atlas V and Delta IV.