# Steel, aluminum, nuts and bolts

Richard Bach

An airplane is a machine. It is not possible for it to be alive. Nor is it possible for it to wish or to hope or to hate or to love.

The machine that is called “airplane” is made of two sections, the “engine” and the “airframe,” each of which is built of common machine-building materials. There is no secret, no dark magic, there are no incantations said over any airplane in order to make it fly. It flies because of known and invariable laws which cannot be changed for any reason.

An “engine,” briefly, is a block of metal that has been drilled with certain holes and set with certain springs and valves and gears. It does not in any way come into life when it is bolted on the front of an airframe. Those vibrations through an engine are caused by the rapid burning of fuel within its cylinders, by the action of its moving parts, by the forces that a spinning propeller creates.

An “airframe” is a sort of cage built of steel tubing and sheet aluminum. It is tin and fabric and wire. It is nuts and bolts. An airframe is made to the calculations of the aircraft designer, who is a very wise and practical man who makes his living at this sort of thing and does not mess around with esoteric mumbo-jumbo.

There is no part in any airplane for which there does not exist a blueprint. There is no part which cannot be unscrewed into simple plates and castings and forgings. The airplane was invented. It did not “come into being,” it was never brought to life. An airplane is a machine as an automobile is a machine, as a chain saw is a machine, as a drill press is a machine.

Is there a voice in reply to this, from perhaps the newest of student pilots, saying that an airplane is a creature of the air, and so has special forces acting upon it that a drill press does not have?

Wrong. An airplane is not a creature. It is a machine: blind, dumb, cold, dead. Every force upon it is a known force. A million hours of research and flight tests have shown us all there is to know about an airplane: Lift-Weight-Thrust-Drag. Angles of attack, centers of pressure, power required versus power available, and parasite drag increases as the square of the airspeed.

Yet there are a few airplane pilots who somehow want to believe that this machine is an animal, that it is alive. Make certain that you do not believe it. That is absolutely impossible.

The takeoff performance of any aircraft, for instance, depends upon wing loading, power loading, airfoil coefficients, and upon density altitude, wind, slope and surface of the runway. All these are things that can be measured with tape measures and test machines, and when they are run through charts and computers, they give us an absolute minimum takeoff distance.

There is no sentence, no word, no hint in any technical manual ever printed that even remotely says that this machine’s performance can possibly change because of a pilot’s hopes or his dreams, or his kindness to his airplane. This is critically important for you to know.

I give you an example. I give you a pilot. Let’s say that his name is … oh … Everett Donnelly. Let’s say that he learned to fly in a 7AC Aeronca Champion. N2758E.

Then later, let’s say that Everett Donnelly became a first officer with United Air Lines, and then a captain, and that for fun he began looking for that same old Aeronca Champ. Let’s say he asked questions and wrote letters and searched for a year and a half across the country, and that at last he found what was left of N2758E, smashed under a fallen hangar at an abandoned airport. Let’s say he spent just under two years rebuilding the airplane, touching and finishing every nut and bolt and pulley and seam of it. And then perhaps he flew that Champ for five years, and perhaps he refused quite a few good offers from people who wanted to buy it, and perhaps he kept it in perfect condition because it was a part of his life that he enjoyed and because the airplane itself had become something that he loved.

Now let’s say that one day he landed in a high mountain field with a broken oil line. Let’s say he fixed the line, added oil from cans he always carried, and was ready for takeoff.

Now read this next part carefully. Let’s say that if Everett Donnelly does not take off at this time, he will be buried in the blizzard of December 8, 1966. Let’s say that there is no road to this mountain field, no civilization nearby. And let’s say that there is a stand of sixty-foot pines all around the field and that there is no wind.

I give you this situation. I then set these figures into a computer that is programmed with this particular Champ’s performance specifications and with this particular field’s terrain and atmosphere. The final sum that the computer presents, after clicking for a while, is a minimum distance of 1594 feet to clear a sixty-foot obstacle, assuming perfect pilot technique.

Everett Donnelly, not knowing as precisely as a computer, but knowing that the takeoff will not be an easy one, paces the distance at 1180 feet from the start of the roll to the base of the trees facing him. By pulling the tail of his machine back between two trees, he can increase his field length to 1187 feet. This means nothing. The field is 407 feet too short.

And now I give you some facts that cannot possibly make any difference in the takeoff roll of Aeronca Champion N2758E.

Let’s say that Everett Donnelly thinks of the blizzard on its way, of his cold death and the destruction of his airplane if he does not fly out of this field at once.

He remembers the first day that he saw the Champ, sun-yellow and faded red-earth trim, splashed with mud, hopping passengers and flying students from a little field in Pennsylvania after the war. He remembers working weekends and all summer to pay for learning to fly this machine.

He remembers fifteen thousand flying hours, and of finding the Champ again, under the hangar.

He remembers the years rebuilding and of Jeanne Donnelly’s first flight in it and that she will fly in no other machine than N2758E.

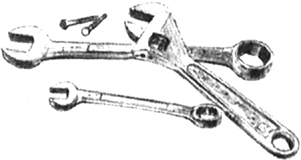
He thinks of his son’s first flight and instruction, and of his solo only a week earlier, on the morning of the boy’s sixteenth birthday.

And he swings the propeller of his machine and he steps into the cockpit and pushes the throttle all the way forward and the Champ begins to move toward the trees at the other end of the field, because it is time to go home.

Please believe that my research about airplanes is complete. There are no flaws in it. That research covers all the learning of all the aeronautical engineers and aircraft designers and mechanics since man first began to fly. There is no theory that these people have not checked and proved in practice.

And every one of them and every one of the facts are dead set against there being any hope for Everett Donnelly if he tries to make that takeoff from a field that is 407 feet too short. Better dig a cave and try to survive the blizzard; better let the airplane blow to shreds in the wind while the pilot tries to walk out of the mountains; better anything than try to clear an obstacle that is absolutely impossible to clear.

An airplane, I have shown, is a machine. This is not my idea, it is not what I have wished into being. It is not even me, writing this, but the tens of thousands of brilliant minds that have given mankind the speed and the technology of flight. All that I have done is merely ask, in my research, if any of them believes that an airplane is anything more than a machine. And in a thousand books and a half-million pages and diagrams and formulas, there is not one word, there is not one unspoken hope set against the mathematics and the computation of Everett Donnelly’s takeoff roll. Not one voice said that if conditions are right, that if a pilot loves his airplane and shows this in his care, then an airplane might just one time and for the briefest of moments become a thing alive, that can love in return and show this in its flight. There was not one word that said this could be so.



The computer clicked its answer and that was final. The figure given was the absolute minimum takeoff distance: 1594 feet.

There was no error, I assure you. The Champ could not possibly clear those trees. It was impossible for it to do so. By precise calculation, it must hit the trees twenty-eight feet above ground level at a true airspeed of fifty-one miles per hour. The impact, centered upon the right main wing spar, seventy-two inches from the wing-fuselage attach fittings, would be of sufficient force to collapse the main and rear spars. The inertia of the remaining aircraft weight, acting through a new center of gravity, would whip the aircraft to the right and toward the ground. Impact with the ground would cause stress on the engine mount in excess of design load factors. The engine would move backward through the firewall and fuel tank. Gasoline sprayed across the exhaust manifold would make a flammable vapor that would be ignited by exhaust flame from the broken cylinders. The basic structure of the aircraft would be consumed by fire in four minutes thirty-seven seconds, which may or may not be sufficient time for the occupant to recover from any induced unconsciousness of the impact and leave the machine. The last point, the sufficiency of that time, is uncertain because it does not fall within the realm of aerodynamics and stress analysis.

The whole point of my report to you, then, is that you remember this: The airplane that you fly is a machine. If you love it and treat it well, it is a machine. An airplane is a machine.

It is not possible for me to have seen Everett Donnelly this morning, shooting landings in his Champ and taxiing in for gas.

I couldn’t have said, “Everett, you’re dead!”

He couldn’t have laughed at me. “You gone crazy? I’m no more dead than you are. Tell me, how did I die?”

“You went down in the mountains, forty-two miles north of Barton’s Flat and the field was only 1187 feet long and the density altitude was 4530 feet and your wing loading was 6.45 pounds per square foot.”



“Oh, that. Sure I was down. Oil line broke. But I put a hose clamp on it and added some oil and took off again and flew home before the storm. Couldn’t very well stay there, could I?”

“But the takeoff roll …”

“You better believe it! I had pine needles in the landing gear when I got home. But the old Champ will do nice things every once in a while, if I’m good to her.”

It is impossible for that to have happened. It is impossible for anything like that ever to have happened. If you have ever heard of anything like this ever happening to any pilot, if anything like this has ever happened to you, it could not have happened. That would be impossible.

An airplane cannot live.

An airplane cannot possibly know what “love” is.

An airplane is cold metal.

An airplane is a machine.