Aerodynamics Discussion

Aerodynamics and Hydrodynamics
of the Human Body, Birds, and Boeing

By Lance Winslow – 2000

The aerodynamics of the human body are very interesting indeed. This may sound somewhat funny, because human beings can't fly, however our desire to fly has enabled us to adapt and innovate to achieve the same purpose. Man has always dreamed of being able to fly like the birds. The aerodynamics of the human body are quite serious in many sports. To confirm this, just at Lance Armstrong in a tour to France. http://www.fascatcoaching.com/f_one.html

Bicycle racing aerodynamics against the relative wind are quite serious. In most bicycle races the riders are doing in excess of 60 mph for a large part of the race and the aerodynamics of the human being are as serious as they are in it modern day automobile performance, fuel economy and directional control. Wind Tunnel testing for bicycle racing gear such as helmets, racing frames, racing attire are coming place. We know that NASA material science is also used in modern sports from everything from skies to golf clubs, Jamaican Bobsleds to swimming suits and from marathon running shoes to those bicycle components.

Aerodynamics, material sciences and human geometry (biometrics, ergonomics) are as common in the Olympics as they are in Auto Racing, Dick Rutan and the X-Prize, Reno Air Races, Space Flight and in modern military equipment operation. In the Wright Brothers first aircraft the pilot laid out on the wing so he was fully part of the aerodynamics from the first flight.

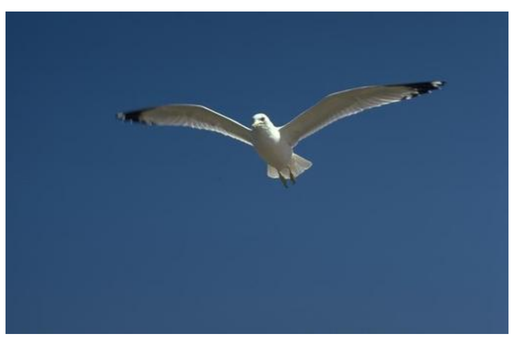
Now we have parachutes, parasailing, ultra-lights, Gyro-Copters, Jet packs, etc, where the aerodynamics of the human being is a huge factor. Having had the chance to race competitively street motorcycles in my day, I can tell you it is a huge component to performance. The human body is what it is, the bike is already quite aerodynamically designed, how the body is placed when you accelerate the motorcycle to 185 plus mph makes a huge difference. Whether you are shooting a man out of a cannon or jumping off the pier into the Annual Human Powered Flight Contest into the Hudson Bay, this is no joking matter, aerodynamics of the human body is just as important in racing, sport as it is for the birds in the sky or the fish which fly.

The aerodynamics and fluid dynamics of many species especially species of prey will ultimately decide their survival, if they fail to have the adequate speed, then they will not be able to eat. If a species, which is hunted cannot dodge or move fast enough then it will have no other option than to massively reproduce to avoid extinction or maintain tight formations, swarms, herds or social order to use the safety in numbers principle. The fastest bird, the peregrine falcon was clocked at 217 mph in Germany while in a dive. Most Falcon's can catch their prey in midair are at speed of around 100 mph, although usually much less. No wonder the Military named the F-16 the Falcon?

The spine-tailed swift has a maximum speed a high of 106 mph in level flight. Thus the Falcon might have a tough time extending its wings at that speed for the proper speed to catch it, thus it can live near Falcons without being eaten and the Falcon will then go after lesser prey with better odds of eating. If you look at the F-14 it has the ability to bring its wings out for slow flight and keep them swept for accelerated and sustained cruising speed, very similar to the bird. The first moveable winged jet aircraft was the well-known X-5, which variable in-flight wing configurations as did the F-111, B-1 and several others. Many aircraft have been designed to change various other configurations for many reasons, the F-8 Crusader changed its angle of attack and the SST and Concorde change its nose on take offs.

Most modern fighters have speed brakes to slow them down. All techniques stolen from nature, as birds adjust their heads in flight for visibility, adjust their angle of attack when approaching relative wind for faster climb, adjust wings for diving and stick out their feet to slow down. Well, yes these techniques were stolen from nature alright, that is pretty much the case, yet we have obviously improved on natures designs in this dimension. After all we are now building aircraft capable of Mach 5 and others, which can carry many hundreds of tons in payloads. In skydiving you learn quickly how to maneuver your body to achieve your intended path. A bird would do much the same only be 100 times better at it since it practices all day long every day.

Most ordinance, which is delivered, such as bombs need to be dropped well under the speed of sound so that they do not in fact create their own new trajectory as they fly away from where they are pointed and need to be delivered. Having been employed washing cars in my day, I can tell you we may in fact have stolen that idea too. Aircraft like birds do lots of adjusting and playing around with configurations to allow them to take advantage of various situations as needed, thus aerodynamically speaking man has copied the observations he has witnessed from birds since his first flight. How about another example, the Bald Eagle, the United States of America’s official mascot? Well it has a souring level flight speed of around 50 mph, which is quite fast in bird terms. While souring the adult Eagle’s wing span is between 6 and 7 feet.



Largest discovered was 7.9 feet, but the wings folded back can allow the eagle to dive at very fast speeds of around 75 mph as it would be most difficult to attain significant speed with such large wings extended. Different configurations and methodologies can also be applied to human body aerodynamics with a little bit of modification. All the while having an incredible accuracy in it’s vision, which would make military intelligence proud indeed as the F-15 Eagle relies enhanced equipment and the human component, which is 3-4 times less adapted than the eagle’s eyes, yet with the newest technology we again have adapted to better nature.

If we look at the aerodynamics of nature and the process of evolution we see the most adapted species in the air as the Eagle and Falcon, which are truly marvels of 100's of millions of years, we begin and appreciate our ominous task of re-engineering. As we look to build aircraft, MAVs, UAVs to serve mankind's needs we should make a note of this. As we develop smaller technologies and demand versatility we will definitely be looking at the best nature has to offer in the way of suggestions.

A human parachutist in a dive has been clocked also 217-mile per hour, the maximum speed for the Falcon. We might ask ourselves, is the organic aerodynamic speed limit for evolution on this planet 217 mph? This presently includes our knowledge of the flight speeds of our most adapted species on the planet presently. Is this figure correct for previous periods? What was the speed of the Pterodactyl? Was the air thinner or thicker under 10,000 ft. back then? Would it have needed to go faster, maybe, but if so from what?

Once you are the fastest and have no higher food chain component to go after, why would you evolve into a higher performing animal? Well if you played, had contests and displays of agility for procreation, pecking order, competed for territorial rights with your fellow species, then you might evolve to be better and have greater performance, developed higher cognition, hunting skills, defense skills and evolved to fly faster too. This is in line with current animal and human behavior in our current period and the writings of the past 10,000 plus years of written recorded history and observational study of species on earth.

We know from the study of aerodynamic, hydrodynamics and racing that there are also issues with ROI or issues with diminishing returns. For instance if a Pterodactyl were to fly faster, it would need to develop more muscle, lose weight, spend more time developing flight skills.

http://numbat.murdoch.edu.au/Anatomy/avian/avian2.html

However this takes time away from hunting. It would cause issues with its ability to fight off other pterodactyls and would mean more food intake was needed. So a happy medium would eventually be reached for continuation of the species, social order, etc. So then, is that compromise or happy medium 217 mph? A man descending in free-fall from an aircraft fully tucked and using the BMPs for rapid decent max'ed out at 217 mph, like the Falcon. It is highly interesting that these organic matter speeds that the highly evolved Falcon is so similar to the diving speed of a human being. We can learn a lot about how the human body interacts with the elements and the study of aerodynamics has lots to still learn from nature.

Aerodynamics and Hydrodynamics of the Marine Life and Uses for AI, UAVs, Robotics, and the Future

Air is 750 times less dense than the water in the oceans, yet so many of the same principles apply there as well. We are quite familiar with marine life and the performance abilities of sharks, dolphins, penguins, fish, alligators, etc. Mankind is quite fascinated by marine life and often tries to use these observations to create devices to serve him.

A Great White Shark can swim 7 times as fast as the Olympic swimmers in Athens taking the gold this year, yet it is not even close to being the fastest in the water. Powerful, yes indeed, but the need for speed limits its abilities to catch some of its favorite meals. Luckily humans are not one of them, as much as JAWS I, II and III would have you believe. The Great White Shark swims at about 25 mph. Squids can move through the water at 20 mph. The Blue Shark has been clocked in short bursts at 43 mph yet its average cruising speed in open water is between 17.7 and 24.5 mph.

The Mako Short Fin can travel at 10 times its body length per second, which is quite fast and amounts to over 46 mph at top speed. It can accelerate at 45 feet per second/ per second, faster than a rock can fall or a human accelerates after he departs a perfectly good airplane in search for an adrenaline rush to achieve sense of purpose. A human can swim at 5.04 mph, but only for short distances and you have to be a Mark Spitz or Michael Phelps to it for very long.

http://www.ncsu.edu/ligon/olympics/Spitz/MarkS.html

As good as these super star athletes are, they are no match for evolution, without modification. You might be happy to know that a barracuda will catch you and nibble before a great white shark will catch you in open water, they can swim at 27 mph, one of the fastest, well and hungriest fish in the water. Mammal Sea Life is quite adapted; Sea Lion 25 mph, Common Dolphin 24.7, Gentoo Penguin 17, Blue Whale 29.76, Bottle Nose Dolphin 17 mph. Many of the fish eaten by the marine life of prey are also quite adapted for instance the Pacific Salmon can swim at 14 mph. Then there are the flying fish, those, which leap out of the water and become airborne, thus proving that there is a similarity between the two realms. The flying fish flies at 35 mph and has been known to fly right into a boat, for an easy catch. The Leaping Albacore Tuna leaps at 40 mph great sushi no doubt, the Yellow Fin Tuna at 46.35, the Sword Fish 60 mph and the Sail Fish at 68 mph. Here is a claim from Barbados that a flying fish was clocked at 55 mph?

Well maybe, but not if Hurricane Ivan has anything to say about it because if that fish pops out of the water it is liable to be doing some 135 mph within a few feet of leaving the water's surface and might be airborne for quite a while too? Now that would certainly be a new record. Does this mean we might also wish to look at Fish and Sea Life Evolution in the aerodynamic designs of aircraft, UAVs, Blimps and Olympic Swim Gear? Yes, this is one of the points of this dialogue. Does this mean we should look at aviation designs for submarine, AUVs, ship hulls and underwater submersibles? Should we also be designing underwater bases for aircraft, spacecraft and double use vessels? Flying AUVs, which become UAVs? Designing flying torpedoes, Mechanical Fish and MAVs, which look like the flying fish photo too? Yes, it does. If you made a mechanical fish what good would it be? Hunting water mines, data relays, additional net-centric communication unit?

If nature can do these things, so can we and we have been constantly re-designing and bettering natures methods. If an eagle has 3-4 better times the eye sight and can see, react and adapt while in-flight that quickly, yet has less of a brain to coordinate all the data yet has also developed triple the reflex or response time, should we be looking into how this is done? For instance does an Eagle use some sort of visual frame bursting, for instance it knows the type of fish it likes to eat which tastes good and is the right weight and size and when it sees this it’s brain fills in the details and it’s eyes only focus on the slight variations of motion and detail so it knows where to pick it up at and how best to snatch it out of the water?

We know that our brains use up about 45% of the brain capacity in visual cognition. What does the Eagle do with all the many flights and all that data for it's memory, it cannot possibly store it all, does it have a Random Access Memory Data dump like when you windows computer crashes? Does it only save the frames and basic shapes and let the eyes fill in the rest of the details each time? We should test this as it is important to know.

We know the human brain can be fooled often enough when something appears to be close to something we are familiar with. What can we learn from these birds besides their aerodynamics. Is it possible to play optical tricks on an Eagle? For instance make a small AUV, which mimics a salmon fish? Will the Eagle be fooled by this? Old Eagle eyes, or will the Eagles excellent eye sight trigger another wave in it's brain, as if to ask itself; "Hey something is fishy about that fish?" Would such a thought from an Eagle significantly activate it's brain for a second look, before diving upon it's prey? It appears in humans this does activate an additional brain wave.

Since Eagles do not flock are do they communicate and navigate, migrate using ELF, entangled brains with other eagles? Only their immediate families from the same mother or nest? This too would be of value for determining AI for robotic UAVs as part of the net centric warfare situation.

As we look at Artificial Intelligence models perhaps we should be looking at other species, which seem to be able to do more with less. Less brain capacity, yet still think. Perhaps we ought to dump the ego into thinking that mankind is the only animal which can reason and adapt on this Planet, we have significant proof of other animals here doing quite fine in the thinking region. If we open our minds we may find other species may in fact supersede our abilities in many aspects. Is the future of robotics going to the birds with regards to UAVs and MAVs as the needs of mankind and the competitiveness of the species looks towards innovation as the ultimate contest and in our speed to achieve we find ourselves bettering hundreds of thousands of years of evolution with breakthrough after break through?

Robots to really assist us must have some fuzzy logic capabilities at minimum and to be most effective they must also have some artificial intelligence capabilities to serve our needs, as mankind has no end in sight to the tasks it wishes to assign to robotic apparatuses.

Press-on will solve all that mankind desires. There are clues everywhere and one might ask what is taking us so long anyway, where would you like to go today? We need to ratchet up the thinking here and move forward in this arena.

Aerodynamics of a Flying Disk or Flying Sphere

What are the Aerodynamics of a flying sphere. It has been said that in the future we may be flying around anti-gravity type spheres, but this does not mean it will not have to deal with relative wind in our own atmosphere. So what are the aerodynamics associated with sphere? Well believe it or not we can borrow much information from sports. Think of a baseball flying out of the field and into the stands signifying a Home Run or even a Grand Slam.

Can a flying sphere turn, like a curve ball in baseball? You bet it can with or without the anti-gravity control mechanism. Spin will determine much of this. Like a helicopter lateral control and anti-spinning devise to prevent the vehicle turning due to relative wind and uneven weight distribution, The sphere must have a proper center of gravity which makes things such as fuel difficult. The fuel used must be in the center of the sphere and it must be in a container, which shrinks as the fuel is used in exact proportion of the volume expended. Otherwise you will get the curve ball effect.

http://wings.avkids.com/Book/Sports/advanced/curveball-01.html

We can obviously learn a lot about sports for our aerodynamic studies on different types of future crafts. I think you will find that R and D can be spent when money is involved in Entertainment, such as the Ben Bova Novel "Mars" where the cliff dwellings were going to be turned into a giant tourist place, such future thoughts are based on the past as well. Capitalism tends to be able to support such things. Entertainment in the form of movies also funds many things.

Art imitates life. War also provides us with the must win efforts needed to put necessity in the mother's seat. Thus today we have satellite TV, Weather, Communication and such things as Nuclear Energy, Microwave ovens etc. A flying sphere must counteract the lift caused by it's shape as well. This may be a little more difficult to factor in as the speed changes, speed of wind changes both direction and speed, etc. Here are some thoughts on the effect of the relative wind on the 322 nippled object, which has become a symbol of American Wealth and recreation and elite status.

http://www.jsc.nasa.gov/er/seh/pg76s95.html

We know from studying UFO types of shapes that there are significant issues with vertical take-off spheres, the military and interested theorists have tested these things and discovered that the differences once up to speed are substantial almost to the point of being un-usable as it approaches super-sonic. Actually when traveling within a dense atmosphere or fluid like water, that shape does not work well compared to other shapes we have discovered;

http://www.webcom.com/petrich/writings/UFO_AA_Paradoxes.html#FlyingSaucer

When we study under water submersibles we also see interesting fluid dynamics involved. Since we have been building spheres for deep sea exploration we have studied these things. In fluid dynamics the only difference in that from air is the density of the fluid. If you drop a marble from a boat this is the flow it creates on it's way to the bottom. As we study all types of shapes, we see that some are better than others for different needs. Unfortunately a flying sphere is the best for combating gravity and control, but it is not the best for forward momentum within a dense atmosphere. Is our need to promote the sphere over other shapes a factor of our surroundings. Such as the moon, stars or Earth? And if the Earth is not involved in such innate needs since we did not even believe the Earth was roundish until the last millennium.

We may find that a sphere is not the best shape of a flying craft, which can defeat the effects of gravity. Actually gravity is a rather weak force when compared to other forces in such as that of ion bonding, quantum physics, etc. In the future controllable thrust through jets like that in a Jacuzzi may provide the answer to counteracting gravity and simultaneously providing stability while traveling within an atmosphere, ocean, gas or hot liquid. But probably the sphere although it lends itself to magnetic levitation to counteract gravity may not be as feasible for traveling through the same atmosphere at high speeds. If you have thoughts on how to complete a flying sphere project and provide adequate controls at both high and low speeds using other technologies.

Bonus Article:

Using Materials with Memory to Assist in Propulsion of Autonomous Vehicles in Any Medium

By Lance Winslow 2000

Birds flap wings, sharks move vehicle fins. Each of these organisms is naturally equipped for forward propulsion using the most efficient system possible against the medium through which it moves. In studying such a perfect model of motion, it's worth pondering whether human engineers can't put these same mechanical concepts to use in the construction of their aircraft machines. One idea worth testing is the incorporation of materials with memory into future design plans.

Memory Materials and Wing or Propeller Construction:

Memory comes into play when one considers the repetitive pattern of wing-flapping or fin propulsion. A moving mechanical object can easily mimic this same movement, provided the materials it's manufactured from are light enough and flexible enough. The fin or wing of said movement machine must ideally be designed, as is the muscular-skeletal makeup of a bird's wing, to return to normal position when bent. Relative water flows, created current from AUV, or increased back pressure from forward momentum against the artificial fin or wing, would force it back to its position. The forward propulsion of a propeller would cause it to bend out of shape and then it would once again correct itself. Clearly, in order for this to work, the lightness of the machine, the force by which it propels itself, and the density of the wing structure must all be taken into account. The "flying or swimming machine" will inevitably undergo many experiments before optimum physics and ultimate success is achieved.

Memory Materials, Self-Propelling Air/Water Crafts and Energy-Efficiency:

In our hypothetical memory-material model, the propulsion apparatus would wiggle and move forward and thus be less detectable... with less mechanism or springs and therefore less controlling surfaces, less murphyism, less wear and tear and less energy to propel. Thus weight savings-- not that it's a huge issue in water of 8.2 lbs per gallon, but every amount saved is an amount of efficiency.

Materials with memory are nothing new; look at a paper clip, spring, slinky, etc. A nickel titanium stint, when forced, could cycle some 100 times a second if I am not mistaken; and also cause a frequency and electricity. Think of how an electromagnetic pulse might confuse the enemy; and in a small mini UAV, act like a humming bird as it literally hovers to the target. The addition of a self-activation feature might allow your UAV to fly to the target, hover, send you pictures, GPS coordinates for smart bombing, larger UAVs for Hell Fire Missiles... and then finally drop on the target.

Memory Materials in Achieving an Unpredictable Flight Pattern:

Now let us take this into the contexts of a UAV or flying unit. The propeller or propulsion system moves the vehicle forward. The horizontal stabilizer, whether a canard or conventional tail, could force the aircraft down or up. The dihedral could have a somewhat memory of the way the grain in material is manufactured, causing it to flap like a bird with a muscle above the wing.

The force of the relative wind would cause the wing to bend downward until it sprung back, and thus you have an unpredictable flight pattern. You could have several vehicles flying in a swarm of flock, which were manufactured slightly less or more so they would be nearly impossible to hit. Yes, with the same propulsion output they could fly at similar if not exact speeds since the ups and downs would equal out. The flapping of the wings would reduce the amount of energy needed for sustained flight.

Memory Materials in UAVs:

Memory materials might also be used to build a motor in a UAV that would allow water to flow through, such as a diaphragm membrane, which might drive single piston. "Ferromagnetic" memory materials can be shaped for this type of use; for example, manganese or gallium. One might fit small units into capsules that are inserted into a tube and placed inside of a Navy Seal or fighter pilot suit. If one discovered a way to set these capsules to vibrate, the sound would give away their position for extraction or rescue.

Remember the movie *Core* when they found the craft, which was at the bottom of the ocean near a vent which caused the whales to find it? Polymers have also been used in cars and automobiles like the Saturn where you punch the door and it pops back out. Some polymers can stretch up to 12 times their length, again stretch Armstrong and flex back, whereas metals are not nearly as elastic, but can provide the rigidness and many are conductive of electricity.

An Added Component: Memory Materials as "Fuel in the Wings":

Another thought: include the insides of the wings themselves as part of the fuel. Meaning, the wing would ideally be constructed of a poly plastic that can be converted into engine power at the melting point. In essence, the wings dissolve upon arrival at destination... a problem, yes... but on a single no return mission of a UAV this would be quite acceptable. In the beginning of the flight, the structural integrity to fly in part would be the amount of strength to carry the fuel too. Here, the fuel and the wing are synonymous. The concept of the vehicle "eating itself alive" as it were, is similar to the marathons or ultra marathons I use to run when near the end of the race you were depleted and literally running on guts, body fat and sheer will power.

As the aircraft eats the inside of the wing which is made of a poly type plastic, it is dissolved, thus the aircraft converts this into energy and the weight is decreased meaning it flies even more efficiently. The last leg of the mission is down hill, and it flaps its way in a slow glide to the target or mission end point. The goal line to win a victory point in the overall battle; thus, scoring points against the opponent.

The reason we use the wing is that it can be hollow and it is at the C.G. point. If we take some from the tail then eventually a motor in the rear would deplete itself; however, the weight and balance would be out of check, unless a downward angle of attack and proper speed was continuous. One variation on this theme is to have the engine itself burn up like a Roman candle in the end, providing forward momentum and thrust. Since the chief purpose would be for multiple UAVs on a single mission, this might happen at different times and actually space out the mission and attack sequence. Meaning, the enemy would be under constant fire until the last UAV made its final death blow. This is of value when using UAVs as a diversionary force to keep the enemy occupied.

The wing spars could be made of the same types of plastics that surgeons use to expand heart arteries during operations. We know these techniques work on metal, plastic, carbon fibers, resilient composite, rubber of all types even (stretch Armstrong). We pick the lightest material and go for it. Nickel-titanium stints are also easily adaptable metal, and you would not need much. If you use nickel and poly fibers you could made a battery or find a suitable chemical reaction for fuel or propulsion or even poison gas on impact (forget I said that).

The engine in the rear might be made out of a clay type substance encased in cellophane which, once lit from the rear, would provide the thrust like a small C-65 Estes rocket engine. Once the engine was burned out, it could fall to Earth in cinders with a whistle on it so it made an intimidating sound and another diversion; a dud, or perhaps a small charge.

Other Uses for Memory Materials:

Tesla would enjoy this discussion immensely; he would laugh and come up with 50 other good uses... probably concepts a lot more noble since he was a proponent of strong defense as opposed to strong offense like Von Clauswitz. Nevertheless, the uses for UAVs are of supreme value and maybe in thinner mediums of fluid such as salt water, where the polymers might serve a more useful purpose without succumbing to corrosion over long journeys or long life missions.

Another use would be in a fire hose which, if laid on the ground, would wiggle like a snake. Using the basics of fluid dynamics, the snaking hose could function like a pump for long distances. As the flow rate is lost with the increase in distance from the fire hydrant, the flow slows. Consequently, dynamic pressure is reduced as less weight behind the flow becomes available. Lining fire hoses with materials which are memory manufactured will also make the hose easier to roll up for storage.

Material memory manufacturing will solve many future problems of mankind and add a safety cushion to emergency response, civil defense, scientific advancement and offensive military components.

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