

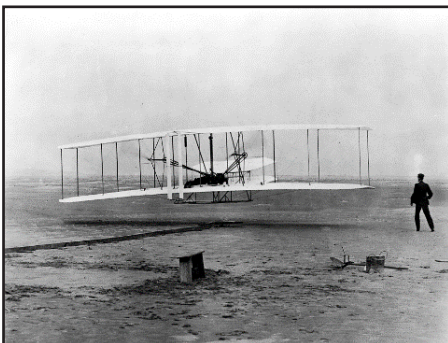
# Too Slow? Not Anymore!

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If someone ask me why I chose aviation I would in return pose the question, why do you want to walk when you can fly? Humans being at the top of the food chain have the natural tendency to push through obstacles to reach any target and conquer. Thus hunger in the evolving process, is in our blood. Once my mother told me "If you cannot jump over a wall, try to penetrate through it." May be that was the mind set which motivated our ancestors to conquer everything that seemed impossible, starting from the land, sea and finally the sky. Let me take you through where they were then, and where we can go through the skies, reaching the stars.

**How slow were we then and how far are we now?**



**Fig 01 : First Flight**

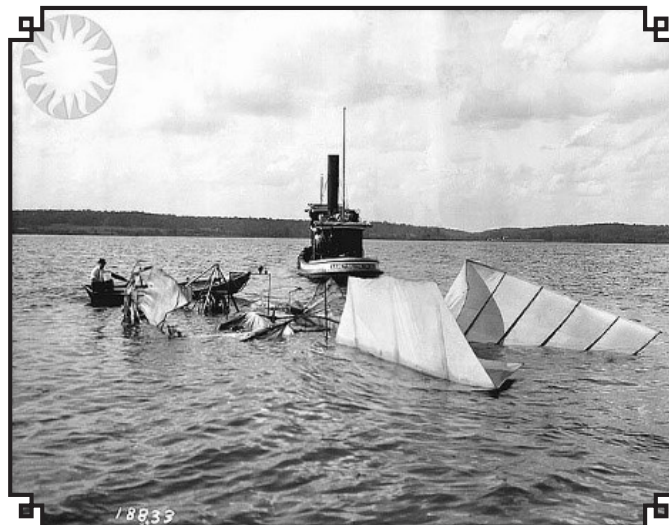
All of us try hard to grow up faster since we were infants. When we crawl we think of walking, when we walk we think of running. But there were two crazy brothers who wanted to think a bit more stupid than all of us, "the common people". They thought of flying when they started running. And yes, we were barely driving at that time! The legendary Wright brothers Orville and Wilber were these crazy brothers who wanted to jump over the wall but went through it. Today their crazy efforts have



**Fig 01 : Wright Brothers**

been responsible for one of the best inventions in the world, THE AIRCRAFT! This has the informal reputation of being the first man made machine that made all human beings to open their mouth, widen their eyes and say wow!, while looking up to see it fly. From the first day of 1903, when these

brothers were able to keep their dreams above the ground for 59 seconds , we have come a long way to travel from our home nation to literally any place we like (even to the North Pole if you really want to). There is no end or limit to how





**Fig 02 : SapceX 'Falcon 9' (Landing)**

crazy people can be, and no one likes to be second to anyone else, and that is why today we have excelled the Wright brothers, and come this far to reach places that they could not, through sky.

There is a famous saying "Time is Money", and Speed is equal to Distance divided by time. Even a 5 year old child knows that the greater the speeds we reach, the more money we make. A 5 year old does not know that, but they also have the tendency to do things faster and then sit and cry. That is why we seek faster ways to get things done, not to cry, but to sit and relax.

People in aviation use big words like efficiency, safety, quality, and

accuracy, but ultimately what is necessary is to get things done quickly. So our life goal is to make flying faster (safer too, otherwise no one will dare to fly!). Today global aviation has reached a point where it is possible to fly 15,348kms in 18.38hours. That is impressive!

Musk is. You will then think that this man is so greedy that he has so much of money, and yet wants to reuse the same rocket again and again. But that is how it was possible to break natural barriers. Today it is possible to use the big boy in aviation "The Airbus A380" to carry 550 passengers including the crew in a single flight to any destination. People are still "apex"



**Fig 03 : Concorde**

**Why do we need to go faster?**

What is impressive is when we reach the level that we can not break the natural barrier. You can google and find out who Elone

predators, and the competitiveness that comes with nature is still in the genes. It is possible to take many people for a long distance, but only a few need to go quicker than the others.



**Fig 04 : Burning Engine of Concorde**



**Fig 05 : Concorde Crash Site**

If light is made out of particles why is it not possible to travel like light quicker than anyone else? Thus it is possible to keep pushing the limits. The common fast planes for people are "Jets", where even the name sounds fast. But a jet is the flow of air out of the engines, where with different flows come different names, such as subsonic, supersonic and hypersonic. These are basically regions of air flow out of the engine and around the



**Fig 06 : Lockheed SR-71 “Blackbird”**

aircraft, which are differentiated with the speed. Though it has still not been possible to reach the speed of light, it has been possible to break through the speed of sound.

It has been possible to send people through the skies at the speed of sound. Are we satisfied? Not yet is the answer. Now the craze is to go beyond the speed of sound, at 5 to 10 times higher speeds. That is the stage that hypersonic aircrafts have reached. The names Kfir, Mig and F-35 are well known (at least in movies). These are the jets that have broken the sound barrier, and flown beyond the speed of sound. Why is it not possible to send more people at the speed of sound? As a matter of fact it can be done and it has been done. How, unfortunately this did not end well. The Supersonic civil aircraft “Concorde” was built in 1976 to make life a bit easier, but failed to serve the purpose for which it was meant.

The British-French Turbojet plane was able to deliver high-end supersonic transport for commercial purposes from 1976 to 2003 with the performance over Mach 2.04 (2,180km/h). Being one of the two supersonic money-

makers the other was the Soviet-built Tupolev Tu – 144, which demonstrated the Russian competitiveness in this field since 1977. But with great achievements come great catastrophies as well.

But what may not be known is that everyone who flew in this marvel spent \$12,500, valued at the 2018 Dollar rate (approximately Rs. 2.2 mill) for a round trip to New York-London and back, which is 30 times the normal fare to fly the same route. The 25th of July 2000 can be considered one of the darkest day in the aviation industry, when 109 people died in a single piece of debry where a 43.5 cm long and 3.4cm wide skid from the tire led to the piercing of the fuel tank which then started a fire in the engine, causing this huge beast to scream down to the ground like a firework. (You can read further about this crash by searching for Air France flight 4590).

This does not mean that people will give up with such disasters, when their is motivation to accomplish harder things and more noble things in life. The Concorde flew for 3 more years till it retired in 2003. In 2018 NASA revealed the resurrection of the Concorde, with the introduction of the second generation of supersonic passenger carriers, and is on the verge of giving more speed to peoples’ lives. The X-59 QueSST, the brother of Concorde, is to scream in the airspace of US in 2023. Hopefully, for the best this time!

### How fast can we get?

If one goes supersonic, it may be possible for everyone to go faster. That is where people walk to the edge of the flat earth and understand that it is round, and that helps them to walk further, towards the hypersonic region.

Today there are future designs that are seen only in science fiction and dreams. Everything starts with a dream, but it may not be the same person who achieves it in the end. However, there are dreams that may reach reality. Hypersonic dream is now in the second stage of scientific discovery. It is in the design stage, with a number of conceptual and theoretical designs in hand.

Many may have watched X- men, and imagined how cool it would be to have the X-plane. US Air Force had the real experience with it, reaching 3 times faster than the speed of sound. Untill the Lockheed SR-71 Blackbird was featured in the X-men movie, no one thought that this kind of aircraft can exist. But since 1960s, and retiring in 1998, the blackbird had cruised through the skies spying on everyone. The X-men’s X-plane and the Blackbird are in figure 6. We have heard how fast the X-plane can fly, but Lockheed company and USAF have seen how fast it can fly with a top speed of 3,529km/h, and the world has understood that they can push the limits further. Being the fastest air-breathing manned aircraft since 1976 the urge for even higher speeds has not ceased. Now we are in the age of hypersonic aircrafts, and the race has begun. As could be expected the

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competition is between the worlds' top superpowers, USA and Russia. USA is now in the lead with Boeing X-51 Waverider, which is an unmanned experimental aircraft reaching 5 times the speed of sound (Mach 5) and that is around 6,174km/h. Where is Russia? Have they given up the race?

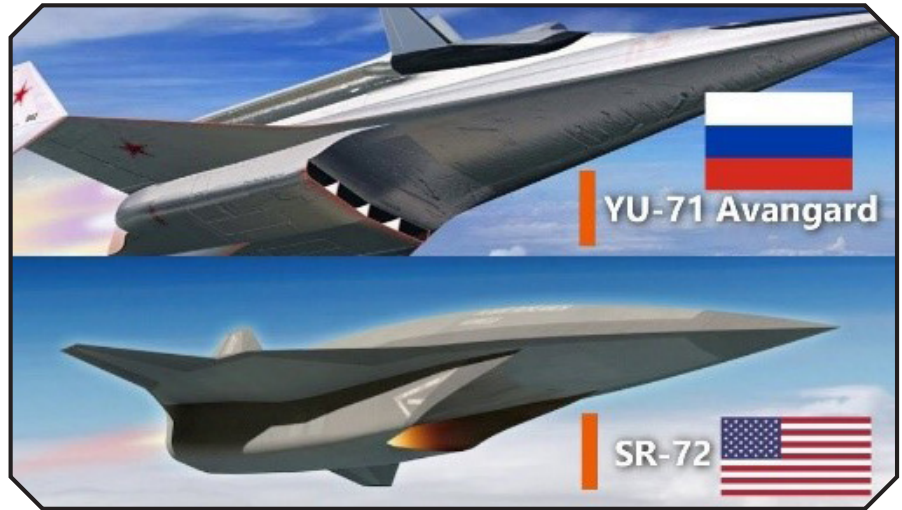
Russia is far ahead with lesser conventionality in certain aspects. The Avangard (Hypersonic glide vehicle) is the latest hypersonic aircraft of Russian origin. While Americans' have pushed the limits from Mach 12, Russians' have pushed the Mach 20 range with just payload. This is a design inspired by the Waverider design.

'Waverider' design is not magic but a surfboard, which rides the sea waves. In this, a wedge – shaped fuselage is specially designed to generate lift, as the air density is much less at high altitudes, whereas it would be really hard to gain any lift with conventional wing shapes. With this shape, that problem is no longer there, as it gains lift by surfing on the shockwaves generated.

Shockwave is a specific phenomenon that happens when



**Fig 08 : Sonicboom**



**Fig 07 : World Giants' Hypersonic Race**

any object moves faster than the speed of sound. In simple terms, the air that is pushed by the object creates an area with increased pressure which is then preferred to as a 'pressure front'. When this pressure front move at supersonic speed, it creates a dense and pressured air cloud which is called a shock-wave.

Most of you might know or have seen the cone shaped cloud generating around the aircraft when it flies super-fast. As shown in the figure this cloud is formed due to condensation of water vapour in air. This happens when the air

pressure around the aircraft drops, and so does the temperature, creating a cloud around it. That is how someone can show to a friend that, this jet is flying faster than the speed of sound.

The concept design of HyperSoar aircraft which focused on passenger transport, was developed to reach Mach 12 (14,700km/h), but there were so many barriers to overcome. How can a plane go that fast and not burn up to ashes? In fact it will burn up to ashes.

In the case of rockets, the necessity is to gain the speed to reach outer space so it could glide. If that is possible, the same process can be used for the plane as well. The HyperSoar is being developed to jump at hypersonic speed to outer space, and there after have a sustained glide and keep on jumping.

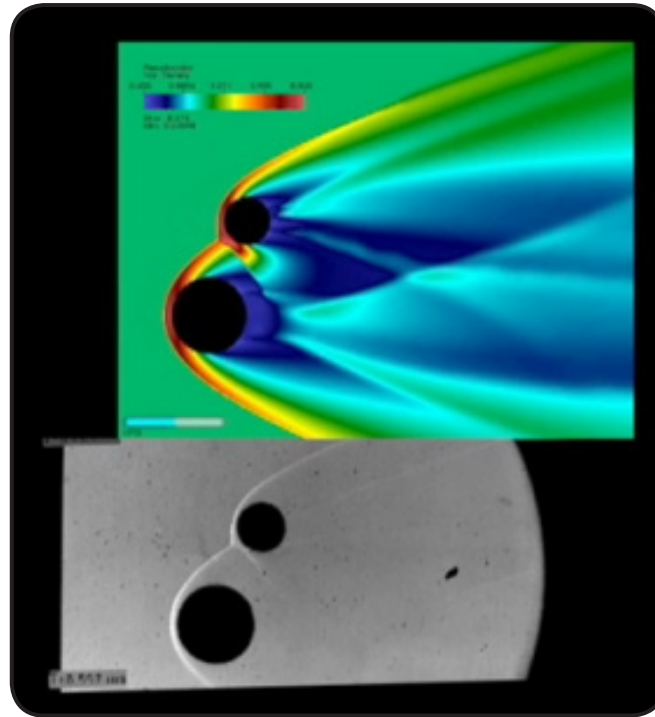
Though theoretically it is possible to achieve this goal, in practical conditions, it is likely that future generation may have the opportunity of witnessing what we can only observe today in fiction.

**New Secrets (that I found while writing this article)  
Riding a Supersonic Shockwave**

We all know about internet surfing, sea wave surfing, crowd surfing etc. but here is the extreme end of surfing which no one might ever be able to physically do in one's lifetime, and that is, "Shock-wave Surfing". A shockwave is well known, but to ride that wave is insane. It was commented at the outset that humans are a little bit crazy and that craziness brings out the best ideas. Today it may not be an idea, but tomorrow who knows, someone may surf a shock-wave as well. This may be explained in the following terms. One may dislike Newton for doing such a great job in finding his theories and then making our student lives even harder. But is it not well recognized that everything he said has been applied even in high speed air-travel? It was no doubt irritating to even remember how annoying physics was because of him, but here is what even Newton did not know after he passed on his knowledge, that crazies will take it

to an extreme.

The Massachusetts Institute of Technology (MIT) has run simulations and a practical test with two nylon balls through a supersonic flow of air with Mach



**Fig 09 : Shockwave Surfing**

4. The two balls while creating their own shock-waves, the aerodynamic forces acting on the smaller ball was able to work with Newton's 3rd law, and keep its trajectory with the force of the larger ball's shock-wave. This trajectory amazingly

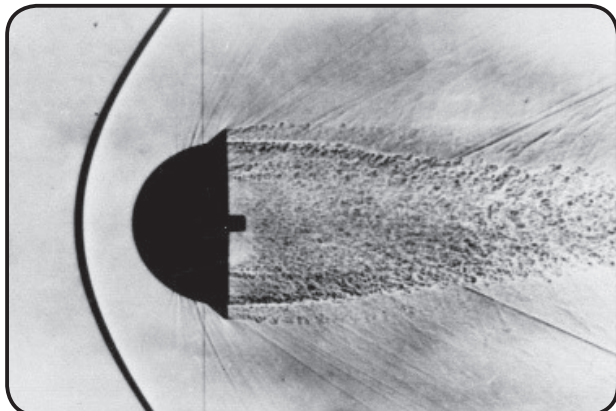
took the path of the bow wave of the larger ball and the small ball was surfing on that wave. The figure shows both the practical and simulational result of this Shock-wave surfing.

Shock-waves have its brothers and sisters too. Normal

Shock-wave the big brother, Oblique Shock-wave, Bow Shock-wave, Moving Shock, Detonation Shock, Attached Shock and Recompression Shock.

Bow shock gets its name due to its shape. This shock –wave is detached from the object and shaped like a bow. This shape is shown in the image. We as aviation enthusiasts have seen and are still seeing all the marvels in the world to rock the aviation science. Every day we try to make a breakthrough to achieve the impossible. Even in Sri Lanka we have great minds that have reached to the world's best, and pushed their limits to such extents that they have become legends. Dr Sarath Gunapala and Dr Keerthi Devendra are two of them who shook the world of science in aviation and rocketry.

Let this knowledge be of help to improve enthusiasm towards aviation in making the skies your home, and become legends for the generations to come. Let them be blessed to see the Planes jump and the Jets surf!



**Fig 10 : Bow Shock**



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