A popular verse of the *Gita* advises "detachment" from the fruits or results of actions performed in the course of one's duty. Being dedicated work has to mean "working for the sake of work, generating excellence for its own sake." If we are always calculating the date of promotion or the rate of commission before putting in our efforts, then such work is not detached. It is not "generating excellence for its own sake" but working only for the extrinsic reward that may (or may not) result.

The principle of reducing our attachment to personal gains from the work done is the *Gita's* prescription for attaining equanimity. It has been held that this principle leads to lack of incentive for effort, striking at the very root of work ethic. To the contrary, concentration on the task for its own sake leads to the achievement of excellence – and indeed to the true mental happiness of the worker. Thus, while commonplace theories of motivation may be said to lead us to the bondage or extrinsic rewards, the *Gita's* principle leads us to the intrinsic rewards of mental, and indeed moral, satisfaction.

Conclusion

Knowledge is the manifestation of what is already innate in man. The east believes that any of the competency or skill can be learnt and the superlative degree of efficiency can be achieved by equipping oneself with knowledge, having self-conviction to achieve it and by thinking deeply thinking and meditating on the competency concerned.

There lies an infinite man behind the finite and an immortal man behind the mortal man which are not within sensory cognition. Improving ones efficiency to a superlative degree with vidya, sraddha and upanisad exposes the infinite and immortal man within who has the energy to achieve any objective which nourishes and heals the world. This constitutes human excellence.

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# Aviation Science of the Ancient India: A Challenge for Modern Intellectuals

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**Abstract**
India is not only a homeland for Yogic culture and Vedic tradition but also for science and technology. Many great sages authored vast literature of which the sage Bharadwaja's *Vaimaanika Shaastra* (Ancient Indian Aeronautics) is one of the most renowned and relevant even for the current days. There is mention of the usage of aircraft in the Epics-Ramayana and Mahabharata. In the Ramayana both the words *"Vimana"* and *"Ratha"* have been used. According to Ramayana, Ravana used pushpakavimaana, which was captured from Kubera. However, Rama took charge of this aircraft, after killing Ravana and used it to reach Ayodhya along with Lakshmana, Seeta and his others. Gayopakhyaana, in Mahabharata, also talks of using aircraft.

Western science estimates the life of this aeronautical science to be of about 5000 years. The Indian scientists and critics have a different opinion about adjudging the number of years. They say that the aircraft was used extensively during Ramayana and Mahabharata time indicating that the aeronautics was a much developed branch by that time. Reference to flying vehicles as *Vimana* occur in the *Mahabharata* about 41 places of which the air attack of Salva on *Krisna*'s capital Dwaraka deserves special notice. The Asura king Salva had an aerial flying machine known as Saubha in which he came to attack *Dwaraka*. This clearly indicates that the aircraft science was developed much before and we took the references from the different ancient sources to prove it.

The question which we aimed in this paper is that if we had such technology and such science, which is still science fiction to us with all our modern science in action, where did all this vanish? Now there are a number of theories in our ancient scriptures for which we have no particular evidences. The problem which are facing in these days is that the Sanskrit Pundits those we have do not understand modern science and physics. And the modern day intellectuals do not understand Sanskrit.

**Key Words**- Vimana, aviation, bharadwaja, physics, Mahabharata.

**Introduction**
India is not only a homeland for culture and tradition but also for science and technology. Many great sages authored vast literature of which the sage Bharadwaja's *Vaimaanika Shaastra* (Ancient Indian Aeronautics) is one of the most renowned and relevant even for the current days. There is mention of

the usage of aircraft in the Epics-Ramayana and Mahabharata. In the Ramayana both the words *"Vimana"* and *"Ratha"* have been used. According to Ramayana[1], Ravana used pushpakavimaana, which was captured from Kubera. However, Rama took charge of this aircraft, after killing Ravana and used it to reach Ayodhya along with Lakshmana, Seeta and his others. Gayopakhyaana[2], in Mahabharata, also talks of using aircraft.

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The Rig Veda, the oldest document of the human race includes references to the following modes of transportation: Jalayan[4] – a vehicle designed to operate in air and water; Kaara[5]- a vehicle that operates on ground and in water; Tritala[6]- a vehicle consisting of three stories; Trichakra Ratha[7] – a three-wheeled vehicle designed to operate in the air; Vaayu Ratha[8]- a gas or wind-powered chariot; Vidyut Ratha[9]- a vehicle that operates on power.Also in the Yajurveda[10] it is stated that "O royal skilled engineer, construct sea-boats, propelled on water by our experts, and airplanes, moving and flying upward, after the clouds that reside in the mid-region, that fly as the boats move on the sea, that fly high over and below the watery clouds. Be thou, thereby, prosperous in this world created by the Omnipresent God, and flier in both air and lightening". Kathasaritsagara refers to highly talented woodworkers called *Rajyadhara* and *Pranadhara*[11]. The former was so skilled in mechanical contrivances that he could make ocean crossing chariots. And the latter manufactured a flying chariot to carry a thousand passengers in the air. These chariots were stated to be as fast as thought itself.

It is interesting to note that the Academy of Sanskrit Research in Melkote, near Mandya, had been commissioned by the Aeronautical Research Development Board, New Delhi, to take up a one-year study, 'Non-conventional approach to Aeronautics', on the basis of Vaimanika Shastra. As a result of the research, a glass-like material which cannot be detected by radar has been developed by Prof Dongre, a research scholar of Benaras Hindu University. A plane coated with this unique material cannot be detected using radar.

But perhaps the most interesting thing, about the Indian science of aeronautics and Bharadwaja`s research in the field was that they were successfully tested in actual practice by an Indian over hundred years ago. In 1895, full eight years before the Wright Brothers` first flight at Kitty hawk, North Carolina, USA, Shivkar Bapuji Talpade and his wife gave a thrilling demonstration flight on the Chowpatty beach in Mumbai.

An even more astonishing feature of Talpade's aircraft was the power source he used- An Ion Engine. The theory of the Ion Engine has been credited to Robert Goddard, long recognized as the father of Liquid-fuel Rocketry. It is claimed that in 1906, long before Goddard launched his first modern rocket, his imagination had conceived the idea of an Ion rocket. But the fact is that not only had the idea of an Ion Engine been conceived long before Dr Goddard, it had also been materialized in the form of Talpade's aircraft.

Mr. Talpade, a resident of Mumbai, was an erudite scholar of Sanskrit literature, especially of the Vedas, an inventor and a teacher in the School of Arts. His deep study of the Vedas led him to construct an aeroplane in conformity with descriptions of aircraft available in the Vedas and he displayed it in an exhibition arranged by the Bombay Art Society in the Town Hall. Its proving the star attraction of the exhibition encouraged its maker to go deeper into the matter and see if the plane could be flown with the aid of mercurial pressure. For the one hundred and ninetieth "richa" (verse) of the Rig Veda and the aeronautical treatise of Bharadwaja mention that flying machines came into full operation when the power of the sun`s rays, mercury and another chemical called "Naksha rassa" were blended together. This energy was, it seems, stored in something like an accumulator or storage batteries. The Vedas refer to eight different engines in the plane and Bharadwaja adds that they are worked by electricity.

Mr. Talpade carried on his research along these lines and constructed an aeroplane. In his experiments he was aided by his wife, also a deep scholar of the Vedic lore, and an architect friend. The plane combined the constructional characteristics of both "Pushpaka" and "Marut Sakha", the sixth and eighth types of aircraft described by Bharadwaja. It was named "Marut Sakha" meaning "Friend of the Wind".

With this plane this pioneer airman of modern India gave a demonstration flight on the Chowpatty Beach in Mumbai in the year 1895. The machine attained a height of about 1500 feet and then automatically landed safely. The flight was witnessed, among many others, by Sir Sayajirao Gaekwad, the Maharaja of Baroda and Justice Govind Ranade and was reported in "The Kesari" a leading Marathi daily newspaper. They were impressed by the feat and rewarded the talented inventor.

Unfortunately Talpade lost interest in things after his wife`s death, and after his own death in 1917 at the age of 53 his relatives sold the machine to Rally Brothers, a leading British exporting firm then operating in Mumbai. Thus the first ever attempt at flying in modern India, undertaken and made successful by an Indian, in a plane of Indian manufacture and built to Indian scientific specifications, slid into the limbo of oblivion.

Col. Olcott rightly says that "The ancient Hindus could navigate the air, and not only navigate it but fight battles in it like so many war-eagles, combating for the domination of the clouds. To be so perfect in aeronautics they must have known all the arts and sciences relating to the science, including the strata and currents of the atmosphere, the relative temperature, humidity, density and specific gravity of the various gases[12]".

Ancient Sanskrit literature is full of descriptions of flying machines – Vimanas. From the many documents found it is evident that the scientist-sages Agastya and Bharadwaja had developed the lore of aircraft construction.

The "Agastya Samhita" gives us Agastya`s descriptions of two types of aeroplanes. The first is a "chatra" (umbrella or balloon) to be filled with hydrogen. The process of extracting hydrogen from water is described in elaborate detail and the use of electricity in achieving this is clearly stated. This was stated to be a primitive type of plane, useful only for escaping from a fort when the enemy had set fire to the jungle all around. Hence the name, "Agniyana"the second type of aircraft mentioned is somewhat on the lines of the parachute. It could be opened and shut by operating chords. This aircraft has been described as "vimanadvigunam" i.e. of a lower order than the regular aero plane.

Aeronautics or Vaimaanika Shastra is a part of Yantra Sarvasva of Bharadwaja. This is also known as Brihadvimaana Shastra[13]. Vaimaanikashastra deals about aeronautics, including the design of aircraft, the way they can be used for transportation and other applications, in detail. The knowledge of aeronautics is described in Sanskrit in 100 sections, eight chapters, 500 principles and 3000 slokas. Great sage Bharadwaja explained the construction of aircraft and way to fly it in air, on land, on water and use the same aircraft like a sub-marine. He also described the construction of war planes and fighter aircraft.

In 1875, the Vaimanika Shastra, a fourth century B.C. text written by Bharadvaja, using even older texts as his source, was rediscovered in a temple in India. It dealt with the operation of Vimanas and included information on the steering, precautions for long flights, protection of the airships from storms and lightening and how to switch the drive to "solar energy" from a free energy source which sounds like "anti-

gravity." Vaimaanika Shastra explains the metals and alloys and other required material, which can be make an aircraft imperishable in any condition. Planes which will not break (abhedya), or catch fire (adaahya) and which cannot be cut (achchedya) have been described. Along with the treatise there are diagrams of three types of aeroplanes[14] – "Sundara", "Shukana" and "Rukma".

The aircraft is classified into three types[15]- Mantrika, Tantrika and Kritaka, to suit different yugas or eras. In kritayuga, it is said, Dharma was well established. The people of that time had the devinity to reach any place using their Ashtasiddhis. The aircraft used in Tretayuga are called Mantrikavimana[16], flown by the power of hymns (mantras). Twenty-five varieties of aircraft including Pushpaka Vimana belong to this era[17]. The aircraft used in Dwaparayuga were called Tantrikavimana, flown by the power of tantras. Fifty six varieties of aircraft including Bhairava and Nandaka belong to this era[18]. The aircraft used in Kaliyuga, the on-going yuga, are called Kritakavimana, flown by the power of engines. Twenty-five varieties of aircraft including "Sundara", "Shukana" and "Rukma" belong to this era[19].

Bharadwaja states that there are thirty-two secrets of the science of aeronautics[20]. Of these some are astonishing and some indicate an advance even beyond our own times. For instance the secret of "para shabda graaha", i.e. a cabin for listening to conversation in another plane, has been explained by elaborately describing an electrically worked sound-receiver that did the trick. Manufacturing of different types of instruments and putting them together to form an aircraft are also described.

It appears that aerial warfare was also not unknown, for the treatise gives the technique of "shatru vimana kampana kriya" and "shatru vimana nashana kriya" i.e. shaking and destroying enemy aircraft, as well as photographing enemy planes, rendering their occupants unconscious and making one`s own plane invisible.

Bhardwaja also provides a bibliography. He had consulted six treatises by six different authors previous to him and he gives their names and the names of their works in the following order : Vimana Chandrika by Narayanamuni; Vyoma Yana Mantrah by Shaunaka; Yantra Kalpa by Garga; Yana Bindu by Vachaspati; Kheta Yaana Pradeepika by Chaakraayani; Vyoma Yaanarka Prakasha by Dundi Natha.

As before Bharadwaja, after him too there have been Sanskrit writers on aeronautics and there were four commentaries on his work. The names of the commentators are Bodh Deva, Lalla, Narayana Shankha and Vishwambhara.

Evidence of existence of aircrafts are also found in the Arthasastra of Kautilya (c. 3rd century B.C.). Kautilya mentions amongst various tradesmen and technocrats the Saubhikas as `pilots conducting vehicles in the sky`. Saubha was the name of the aerial flying city of King Harishchandra and the form `Saubika`[21] means `one who flies or knows the art of flying an aerial city`. Kautilya uses another significant word `Akasa Yodhinah`, which has been translated as `persons who are trained to fight from the sky.` The existence of aerial chariots, in whatever form it might be, was so well-known that it found a place among the royal edicts of the Emperor Asoka which were executed during his reign from 256 B.C. – 237 B. C.

However, Bharadwaja's Vaimanikashaastra is not as popular as Vaastu or Ayurveda due to various reasons. Vaimaanikashastra was never considered to be of much use in day to day life during ancient days and experimenting with the concepts was difficult due to the technicality and scientific nature. It was also considered that the Vaimaanikashastra would be misused if it was put to common man's knowledge. Historians also quote yet another interesting reason of theft of the shaastra during invasions.

There are other shastras like the Vaimanik Shashtra which is a text about aeronautics and discusses the construction of vimanas, or the chariots of the gods, mythical self moving aerial cars. It covers the following things:

1. The secret science constructing aircrafts which will not catch fire and indestructible by normal means
2. The secret of making aircrafts motionless
3. The secret of 100% stealth aircrafts
4. The secret of espionage using remote hearing
5. The secret of espoinage using remote viewing
6. The secret of radar technology for viewing remote enemy planes
7. The secret of making enemies un-concious
8. The secret of destroying enemy planes

The propulsion of the vimanas is used by a "mercury vortex engine" apparently a concept similar to electric propulsion. The evidence of the mercury vortex engine can be found in the "Samarangana Sutradhara[22]" The 11th Century treatise on architecture. The Indologist William Clarendon, who has written down a detailed description of the mercury vortex engine in his translation of *Samaranga Sutradhara* quotes thus,'Inside the circular air frame, place the mercury-engine with its solar mercury boiler at the aircraft center. By means of the power latent in the heated mercury which sets the driving whirlwind in motion a man sitting inside may travel a great distance in a most marvelous manner.

The method of propulsion i.e. anti-gravitational was based upon a system analogous to that of "laghima," the unknown power of the ego existing in

man's physiological makeup, "a centrifugal force strong enough to counteract all gravitational pull." According to Hindu Yogis, it is this "laghima" which enables a person to levitate. The manuscripts,texts were also said to reveal the secret of "anima[23]", "the capability of invisibility" and "garima", "how to become as heavy as a mountain of lead."Moving in the sky (akashgamana)[24] is also stated in the yogic texts as an outcome of some yogic practices.

In the Sanskrit Samarangana Sutradhara[25], it is written, "Strong and durable must the body of the Vimana be made, like a great flying bird of light material. Inside one must put the mercury engine with its iron heating apparatus underneath. By means of the power latent in the mercury which sets the driving whirlwind in motion, a man sitting inside may travel a great distance in the sky. The movements of the Vimana are such that it can vertically ascend, vertically descend and move slanting forwards and backwards. With the help of the machines human beings can fly in the air and heavenly beings can come down to earth."

The questions that come to our mind are that if we had such technology and such science, which is still science fiction to us with all our modern science in action, where did all this vanish? Now there are a number of theories in our ancient scriptures for which we have no particular evidences. The problem which are facing in these days is that the Sanskrit Pundits those we have do not understand modern science and physics. And the modern day intellectuals do not understand Sanskrit.

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[23] Cf.-Vyasa on Patanjala Yoga Sutra,3.45

[24] Patanjala Yoga Sutra,3.42

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