

# A NOT SO DIFFICULT GUIDE TO ROCKET SCIENCE!

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**Abstract:** A comprehensive analyses on rocket science with and without space shuttle with extensive analysis of docking mechanism of the shuttle with MIR and ISS.

**Comments:** All associated images and references are provided at the end of the paper.

ROCKET SCIENCE WITH APPLICATION TO

✓ ROCKETS WITHOUT SPACE SHUTTLE

✓ ROCKETS WITH SPACE SHUTTLE

We are now living in the space age where the possibility of interstellar travel is beginning to shed new light in the eyes of the theoretical and experimental physicists. Space enthusiasts are getting larger day by day. Space tourism is beginning to be a potential candidate for humankind. Large payloads such as heavy satellites are placed in the orbits both geostationary and sun-synchronous to observe the distant planets and nebulae along with GPS and mapping of terrestrial field, crop plantation, missile interception, studying sun, studying the information systems along with a large scale application of military data handling with satellite telephone systems. Space-Stations have been developed by carrying payloads in the low earth orbit and assembling them by the astronauts in Extra Vehicular activity. The famous example is the ISS or The International Space-Station. Planning is calibrating on building high scale Megastructures in Space to protect humanity in case of mass destruction. Science-Fiction is not so far ahead. Dyson Spheres will be built soon enough to harness energy from the Sun... To harness solar energy directly from the Sun by application of a large solar disc and then after it has been successfully completed, humans will prepare themselves for making a new device to harness the energy not only from a single star like sun but also from a collection of many thousands stars of the milky way. Now a days, beside sending manned vehicles and satellites to the space, unmanned vehicles of sophisticated techniques engineered with a high level of accuracy has been applied to send probe to our neighbor planets. These probes can be advantageous to mankind as they are robotic in nature and therefore it can travel along the surface of the planets and examined the soil for the discovery of bacteria or other living organisms along with a meteorological rock study with the implication of the adverse solar radiation and its harmful effects on the human kind. These technologies have been made possible, for, giving necessary guidance to the Earthman's that what precautions needs to be taken for the humans if they travel to those nearby planets. Besides all these, it has been researched to attach a cable from earth to space directly in low level orbits about 300-350 kilometers for smooth transferring of payloads to the space stations at a cheaper way with a short period of time by avoiding the complexities of rocket mechanics and related fields. Material engineers are struggling to find a suitable material for such a cosmic cable that can withstand immense stress and strain along with space hazards if arises any. Moreover, in order to avoid the complexity of the orbital maneuvers and coasting for a longer period of time in space in order to get the appropriate window of orbital transfer to distant planets, a base is theoretically studied to get established in the moon, our satellites. If we can successfully build a base in moon, then from there we can move to higher planets. This base should also contain many advantageous task like rocket refueling, payload eliminating and so on.... As Probes on Alien planets has been already sent, scientists are now thinking of establishing artificial structures in those planets namely Mars where the astronauts can stay and examine the neighborhood for a better understanding of the planetary condition. This houses should be artificially Gravitated and pressurized in order to provide a life-like conditions for mankind. There will be also several layers of protective sheath surrounding those house as because the cosmic radiation and high energy cosmic ions can cause health hazard to humans. There will be artificial plantation from which we can get oxygen along with sufficient payloads of food and scientific instruments and other arrangements for a healthy living. Astronauts can spend about 6 months to 1 year in those Planetary-Space-Stations where there will be a permanent base for the returning capsule. The way in which it works like this – There will be a Capsule situated all the time in Those Planets where the future human base will be, then when these capsules are ignited then they will move up beyond the planetary atmosphere and joined with another module orbiting the planet. The module plus the capsule will make an orbital transfer in order to get back to the high earth orbit, then low earth orbit and finally descending on the oceans where Earthman's should retrieve them from the module. Space-Shuttles have already been developed by some countries including USA and Russia. Those shuttles are very useful in satellite or payload deployment in the earth orbits and returning to Earth. Reusable launch vehicles are designed to minimize the cost of space travel. As on one end the distance of navigation gets increased, the other end focuses on minimizing the cost and thereby making the space journey within the reach of humankind. One method that has already been studied and experimented is the GRAVITATIONAL ASSIST in which just like the vectors laws of addition,

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the spacecraft while passing from a surrounding planet will automatically absorb its speed and gets a boost. This has already been proved helpful for minimizing the fuel and the time of the reach of destination. As it's not possible to carry large space stations by a rocket as a payload fairing, therefore, it can be plausible and advantageous to build and assemble a large scale space station into space by accumulating smaller payloads by consecutive shuttles or rockets. They can also be made to act as a bridge of interplanetary exploration. But will all the increase in knowledge about space and the advancement of technology, our space journey must not be limited to the neighboring terrestrial planets or their satellites, it needs to be extended to the far away stars and thereby making it as interstellar flight. Space journey should be from one exoplanets to another exoplanet at such a high speed of that of light that time itself will be frozen as per relativity. Like, take an example, if 200 years passed on Earth, then only 2 years have passed for the spacecraft. This leads to time dilation which is very advantageous and is documented in many science fiction movies and novels. But although this all seems to be a very far-reached future possibility which may or may not even happen, one crucial importance is to map our universe or the observable universe with an acute precision so that each and every objects location and distance of them with respect to earthly coordinates can be measured. A 3D MAP may be more beneficial. A 3D map like a Projection through which humans will get an ATLAS like guide to the entire universe as far as it has been observed. Although our recent technologies are insufficient to digest the dreams of space enthusiastic, we may use some extraordinary propulsion systems or maybe we may try to mimic the propulsion systems that the UFO's or Aliens have made when their craft is visible from Earth. Each of the galaxies are some million light years along with a distance of some another million light years between the two.... But this kind space travel is not impossible. This is based on 2 facts,

**FACT 1)** We have enough evidence that there was a time when the aliens used to land on Earth and communicate with them. They are called Ancient Aliens. We have enough archaeological evidence of Ancient VIMANAS or Flying machines portrayed in different paintings and sculptures from the distant past. Through significant proceedings in this lane of study, we may find some viable information about them or how they visited earth? Why they visited Earth? From where they visited earth? Many Ufologists, historians, archaeologists, anthropologists have claimed that there is enough evidence to dictate that there was a time in Distant past where the earthmen learned several techniques and technology regarding medicine, architecture, weapons from the aliens. And if you think this stuff properly then you may notice the fact that.... After every consecutive 5000 years, there has been a boost in the technological advantages and the time period when these ancient paintings are done, the timeline matched. It is also quite obvious that, from the Maya, Sumerian, Java, Inca, Harappa, Mexican, Egyptian technologies, still now we humans got surprised that how did they achieve those architectural complex structures and how do they compute the astronomical calculations with so precise mathematics? We are astounded by seeing that this sophisticated accomplishment can only be achieved if they are guided by some ancient aliens or Prometheus who once visited the earth. There are structures in the past which requires helicopter or a flying machine to monitor for the accuracy of measurement.... As far as we can guess those ancient humans don't have flying machines but still they had managed to do this. How? There must be someone to guide them. If we can properly excavate the ancient ruins and structures, then there can be a chance that we might get jumped over to some serious conclusions beneficial to the mankind for the Space-Race. It can be further assumed that, in the distant far away past, when the pre-modern humans saw the aliens coming in fiery chariots or lighting machines descending from the sky with strange dresses and antennas on their head and very sophisticated tools beyond imagination, then there lies an obvious possibility that humans thought them to be gods and portrayed them in Epics, Ancient texts, rock carvings and Scriptures.

**FACT 2)** Still now many UFO Sightings occurred and there are reasons for alien abductions. But it's not our job to decide whether they are true or not as most people said that these are false statements but according to the conspiracy theorists, some countries are there where the aliens have visited and information about them are kept classified. Different regions of Australia, United States of America, Istanbul, Phoenix (Arizona), Alien encounters have occurred and the neighboring peoples shows the strange pattern of flickering lights hovering around the sky after a regular intervals and strange sounds have been heard. UFO abduction is also not a case to be ignored although it lacks sound evidence. UFO-Sort of things needs to be taken seriously and if any country negotiated with the aliens regarding their technology then these should not be kept as Government Classifieds, this should be made accessible openly by humans all over the Earth as because without cooperation we can't succeed. Our civilization or more prominently, the humans or modern humans appeared to earth some 60,000 Years ago and we have progressed tremendously and is still progressing as the day passes by. But its quite obvious that if there exists any civilizations in any of those exoplanets which lies in a habitable zone, then if they are some million years old.... Then just make a simple comparison to 60,000 and Million that is 1,000,000 and decide that if humans in such short span of time progressed such a huge bit in technology then it is very much possible for the Aliens to atop our technology by some many orders of magnitude and thereby making the Humans-dream interstellar travel Possible. Maybe, in the faraway distant future, we might get close to them.... But as of now, let the time decide what we should do and hopefully one day we can meet our ancestors in some distant perhaps millions of light years away, in some exoplanets of different galaxies which provides the womb of life to Earth.

Now, if we need to delve deeper into the mechanism of interstellar travel we need to study the rocket science and the various modes of propulsion attached with it. Besides a rocket propulsion there are many things that needs to be considered....

Let's see this part by part for easier understanding as the rocket itself sounds very complicated. But in general, it's not, so let's find out,

**Rocket Science comes in 7 parts whose scientific name is Space-Craft Systems Engineering.**

## 1. Payload

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Physics is a stupendously enchanting subject when it comes to rocket science. It is ambient and evolving. To elicit its importance one has to go deeper into the final stages of the rocket and that's the payload. It is composed of two fairing. Two on each side but not antipodal. A rocket scientist can only say or extrapolate the plausible jargon in deducing the profound orbital mechanics needed in respective corrections when the payload bursts it's fairing thereby engulfing the indoor unit or the payload into a continual mechanisms of orbital injection. The last stage of the rocket is usually placed into the orbit as it is only detached when the rocket enters the orbital parabolic trajectory. Therefore, the implacable faith of the satellite depends totally upon the orbital injection when and only it ejects its payload of satellite into the orbit. The firing while getting separated from the bifurcation of the last stage of rocket injects the satellite into a primary orbit. The rocket gets separated and faded away into the horizon of spatial oblivion. The injected momentum is so huge that the rocket gets a backward Koch while driving the spring module ejected during payload separation. The payload has small thrusters attached to it which encapsulates the final orbital trajectory of the spacecraft into the deep space with its Periapsis remains constant but the apogee continually engraving dusting position. The craft will be either a polar satellite or a fly by module which then escapes from the earth's sphere of influence and gets attached to the other planets motion by a law of vector addition which inhales the metastatic force of the target planet incubating the force of the destined rocket. The gravity as becomes feeble so the craft can acquire a speed of about 2,000 Km/Sec on an average during interplanetary flight. The fly by module adjusts it's optimal accuracy by means of trigonometric substitution thereby creating an angle of an accuracy of 1 Degree Second with a spin stabilization for the receiving and transmitting of the ground-stationed wave through parabolic dishes. The fly by will enter the other planets gravity if it's only a fly by or else it may remain to circulate or orbiting the Earth thereby making inconsistent communication with the ground station located somewhere on the earth for its effective coherent amplitudinal frequency. The shape of earth is an oblate spheroid and so proper attitude dynamics is need to stabilize the craft as because a short margin of error will make the craft a re-entry into the atmosphere thereby causing a crash landing onto the earth's surface. The main victim of the craft is the donut shaped Van Allen radiation belts in the magnetosphere and the 21 kilometer bulge at the equatorial envelope. The fly by on the other hand will make gravity assist (a phenomenon in rocket science) and will reveal the deposit mystery of the cosmos by the interstellar probing action.

As we have seen that the payload splits away into two parts called the fairing into space which carries the satellite or humans into the cosmos. It comprises the 30% of the mass of the Rocket. Two distinct feature regulated with the payload are the...

I. Centre of Mass.

II. Centre of Pressure.

Centre of Pressure always remains ahead of the Centre of mass because of the stability achieved by the mass of a two-body problem.

## 2. Propulsion Systems

*It has 4 types of Propulsion.*

Ion Thruster Propulsion with electrically charged ions along with some inert gas like xenon or argon with a very high specific impulse but lower thrust impulse. There is another type of impulse called the pressure impulse which we will now get into.

Specific impulse is generated by the momentum of the propellant and measured in seconds.

Pressure impulse is that the pressure inside the rocket or space craft is 200 times more than the surrounding pressure. So, as pressure moves from high to low... The gradient wants the inside pressure to get equal with the ambient or surrounding pressure and hence produces a force. This force acts as the Newton's third law "The opposite reaction" helps the rocket to move upward.

Thrust impulse is the impulse produced by the thrusters from the convergent divergent bell shaped rockets nozzle by solid or liquid propellants as because the convergent-divergent in fluid dynamics makes the gases ejecting from the rocket achieve subsonic to supersonic speed and these gases along with fire helps to produce a specific impulse or a momentum which directs the rocket to move upward. The fuel used are mainly kerosene, hydrogen, monomethyl-hydrazine, and in order to ignite fire an oxidizer is used which is generally liquid oxygen.

*Solid Propulsion Systems.*

It is used as a solid fuel with an oxidizer for ignition inside the combustion chamber of the rocket.

*Liquid Propulsion Systems.*

The fuel is liquid like Monomethyl hydrazine or Kerosene with an oxidizer for burning. Liquid Nitrogen in cryogenic state is also used.  
 $N_2O_2 + \text{Oxidizer} \rightarrow H_2O + \text{Heat}$

*Cryogenic Propulsion Systems.*

Cryogenic is a very important term used in modern rocketry. Well, the details of this Quantum Hydrodynamics can be traced back to the year 1930, when one Herman and one Indian Scientist tried to establish a different structure of atom altogether based on a research conducted 200 Years ago in 1730. Yes, Albert Einstein and Satyendranath Bose. The Bose-Einstein Condensate or the 5th State of matter. The most abundant has obtained in the universe is Helium-4 isotope. It is a boson with Zero Spin obeying Bose-Einstein Statistics having 2 Protons, 2 Neutrons, 2 Electrons. "0" or integer Spin. Spin is a property of angular momentum which is  $h/2 \pi$ .  $360^\circ$  makes a complete Spin of a subatomic particle. However, there is another isotope of Helium, Helium-3 which obeys Fermi-Dirac Statistics having half-integer Spin, but Helium-3 can fuse with another Helium-3 to form a Helium-4 isotope. Helium-3 isotope has 2 Neutrons, 1 Protons, 2 Electrons. Now comes the cryogenic concept?

What will happen at  $0^\circ$  Kelvin or  $273.16^\circ$  C or  $459.99^\circ$  F. Well, it's the lowest possible temperature ever attained on this universe and called as "ABSOLUTE ZERO". When temperatures are increasing, the gas molecules become loosely packed with a tremendous kinetic energy. The opposite happens when the Temp is cooled. The Gas molecules becomes so tightly packed that the atoms have got "0" Kinetic Energy thereby clumped together to form a "Super-Atom" called Bose-Einstein condensate.

It is crucial to understand the fluid dynamics of Helium-4 isotope. Cooled it to  $0^\circ$  Kelvin or near to it as absolute zero is quite impossible, the Helium will become a superfluid that will have a distinct property. The super cooled helium will behave as a solid with zero viscosity and zero kinetic energy. The friction becomes zero and inertia will take over. The outcome is amazing – A gas which turned to a liquidized solid when stirred, it will continue to whirl until eternity as there is no friction between the atoms inside it. In the Liquid Propellant Rocket Engine, This property is used to cool Liquid Nitrogen which in turn can be used as a Rocket Fuel and gives the rocket a higher specific impulse (measured in seconds as the momentum in opposite directions combined by Newton's 2nd and 3rd Law of Motion) which helps the rocket to achieve a speed of 7.8 Km/Sec (Parabolic Trajectory) to 11.2 Km/Sec (Hyperbolic Trajectory) and thereby attaining the escape velocity to reach the outer space.

#### *Hybrid Propulsion System.*

It comprises of Thrusters attached to satellite or Strap-On's attached to Rocket for providing additional force to break the potential wall of Gravitational Pull of the Earth.

After discussing about the elements of Propulsion, it is necessary to give the readers an idea of a rocket engine. Rocket Engines are the easiest configured engines in mechatronics engineering technology. Even the engine configuration is so simple that compared to it... The engines of a Plane or even a car is very gruesome. So, a rocket engine consists of 4 parts,

### **I. The first Part**

#### *The Fuel Tank and Pump*

There are two separate fuel tanks one for the propellant and one for the oxidizer. The oxidizer burns the propellant upon being ignited. A propellant is usually a kerosene or a much more stabilized one that is Monomethyl hydrazine (MMH) which is a volatile hydrazine chemical with the chemical formula  $\text{CH}_3(\text{NH})\text{NH}_2$ . And Oxidizer is liquid oxygen. Note that both the propellant and oxidizer are liquid. There are in two separate tanks. And there is a pump which pumps the mixture of the two into a separate chamber for ignition. The pump maintains the pressure flow and make the flow ideal and whenever needed according to the needs thereby controlling the reactions.

### **II. The Second Part**

#### *The mixing Chamber and The combustion Chamber*

Here in the mixing chamber the propellant and oxidizer is mixed and the mixture then goes through a pipe to the combustion chamber where they are ignited by a electric spark. If liquid nitrogen is used, then the typical formulae of the reaction is...

$\text{N}_2\text{O}_2 + \text{O}_2 + \text{---} \rightarrow \text{H}_2\text{O} + \text{Propulsion}$

$\text{H}_2\text{O}$  produced gets evaporated by the amount of heat generated. This heat results in the thrust which is used to levitate the rocket upwards into space following Newton's Third law of motion.

### **III. The Third Part**

#### *The Nozzle*

The Rocket Nozzle is very important in propulsion mechanics as because the nozzle can't be under expanded or over expanded as because the thrust vector will be then de-stable which will make the rocket turn its head and flies with an improper trajectory. The nozzle should be

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ideally expanded with a half angle divergence of  $60^\circ$  and half angle convergence of  $15^\circ$  which is needed for the fluid dynamics as because the heat flow will reach supersonic speed with a maximum thrust.

Rocket works on the principle of conservation of momentum and the thrust must be isentropic and adiabatic. The principle of the second law of thermodynamics hold as because the Enthalpy in addition to the entropy must be conserved with a tradeoff for total kinetic energy of the thrust vector. The fuel when ignited and starts to burn then it's volume gets increased and the pressure becomes 200 times more than the ambient pressure as because due to the pressure gradient the high pressure will tend to flow towards low pressure which will thereby produce a thrust impulse in the order of pressure impulse that will kick the rocket upwards. Bernoulli's Principle is very important in rocket dynamics. And moreover there should be adequate space inside the nozzle so that the rocket can withstand the vibrations or the supersonic jerking and also the nozzle doesn't gets leaked out due to the increase of the interior pressure.

#### IV. The Fourth and The Final Part

##### *The Cooling Pipes*

Liquid hydrogen when cooled at about  $-253^\circ\text{C}$ ... Then they become cryogenic and thereby helps in Cooling the surrounding impact zone. The nozzle is surrounded by a coiling of the cooling pipes through which liquid hydrogen runs and this helps the nozzle to keep cold and prevents it from melting as the temperature runs around  $175^\circ\text{C} - 250^\circ\text{C}$ . Cooling pipe also is used in the maintaining of the heat of the overall rocket nozzle as it equates the cold with the propellant heat thereby causing the rocket to be good and steady during the flight time. The most important thing while making a rocket is the Nozzle as because it should be ideally expanded so that the Thrust vector should be Vertical and spherical.... Over expanded will spread the thrust and under expanded will shrink the thrust. Again according to fluid dynamics the nozzle should be converging first and then diverging which will make the thrust flow supersonic. Maximal thrust can be gained if half angle convergence is  $60^\circ$  and half angle divergence is  $15^\circ$ .

#### 3. Staging

A rocket is divided into 4 stages each with a different propulsion system for a better performance and extra advantage to speed is an important impact. This is because, in order to attend the escape velocity that is  $11.2\text{ km/sec}$ , the consecutive stages of the rocket must be shed off from the payload or the main part as this would make the rocket lighter and therefore easier to ascend upwards.

#### 4. Attitude Control.

Satellites are always oscillating due to the changing gravitational effect of Earth from equator to poles as because the shape of the earth is an oblate spheroid with a  $21\text{ Km}$  bulge at the equator. This provides extra pull. Moreover, The drag and lift forces of the atmosphere makes the orbit of the satellite unstable thereby causing the requirements of thrusters which are small rockets attached with the spacecraft to give the 1-Degree Second angle accuracy for targeting the satellite to a proper stabilized direction.

#### 5. Insulation

To prevent the rocket from charged solar particles or debris the satellite is covered with a 25 layers of insulating material which acts as a protection to also temperatures of around  $-200\text{-degree}$  centrifuge during night time to  $+140\text{ degree}$  centrist during day time. Moreover, the satellite had its own lithium powered battery which gives the craft the power supply in absence of light during eclipses when the silicon powered solar plates are unable to provide power. Moreover, the satellite has parabolic dish for reception and transmission of signals from Earth and beyond along with On-Board-Data-Handling Systems which are small computers to improve the rockets performance.

#### 6. Orbital Mechanics

This was first predicted by Sir. Isaac Newton in the form of Newton's Canon published in the "Systems of the world" in early 1700 Century AD. The speed of  $7.8\text{ Km/Sec}$  is used for any object to circulate around the Earth. The speed of  $11.2\text{ Km/Sec}$  is the escape velocity and beyond this there is a hyperbolic trajectory. There are two ways in which a satellite can gain speed. The Gravity Assist which absorbs the law of vector addition along with the Hohman-Transfer which helps to transfer from one orbit to the other by Changing Perigee keeping the Apogee constant.

#### 7. Lander or Orbiter

A lander lands in a Planet after several orbital corrections by means of Spring and separable airbags which helps to protect the lander while hitting the surface of any planet from destruction. It contains it's aero-dynamic brakes along with the parachute needed to check the speed. There are several scientific instruments attached with the lander for examining the surface soil and thereby gives a clue to the Geology along with small Microbe-Aliens present in the Planets Soil.

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An orbiter is a spacecraft used to orbit the planet in a special orbiter mechanics and examining the planet's atmosphere and structure by means of Infrascopy without touching the Physical Surface. Now a days, with immense use of sophisticated engineering tactics, a special type of habitable orbiter has been constructed in the low earth orbit and that is the International Space Station. International Space Station is an observatory Centre for astronomy from the space. It is situated at LEO or Low Earth Orbit at a distance of 325-345 kilometers from sea level of earth. It is not totally free from the Sphere of Influence or the Potential Well of gravity of the Earth. That's why a small amount of atmospheric drag occurs into ISS, as a result of which small rocket boosters are often needed to fire up to make it stabilize in its orbit. It is mostly in a coasting phase... The engines are shut off and follows a normal elliptical trajectory in revolving the earth due to the Space-time curvature. The ISS is governed by solar power photovoltaic effect plates. Orbital mechanics is very important in respect of ISS as it is in a low earth orbit. Mostly, the LEO is free from the influence of satellites and so the ISS is free to wander upon the arena of space. Sometimes orbital transfer is required to come in contact with the HST or the Hubble Space Telescope by means of orbit fusion. ISS is the key observatory in space which has no hindrances from the chaotic weather conditions of the Earth's atmosphere. It is the artificial satellite. The largest one with a dozen crew inside it.

*(In astronautics or orbital mechanics the orbits can be changed from elliptical to circular and vice versa by a slight addition of velocity provided they are coplanar in the conic sections)*

The biggest contribution which came into rocket science is the using of a Space-Shuttle as it is reusable and hence it can go to the orbit and move back to the earth many times which ultimately minimizes the cost. Indian space shuttle program is developing and it is taking time of Upto 5 years with 600 engineers of ISRO to develop a Prototype of the Shuttle and tested it experimentally and successfully. The most challenging task of preparing a space shuttle is to consider its thermal calibration after an atmospheric reentry. And that's the most difficult in the designing of a shuttle. A shuttle is just like an aeroplane but a modified and smaller one. It has its own oxygen for combustion as because it can't take oxygen from such higher altitudes like the normal aeroplanes as the atmosphere is relatively thin. It has wings but Sharp shaped and not flexible like the aircraft as because it's wind has a very little function while compared to the normal aeroplane. A space shuttle is launched from Earth base by 2SRB and 1LRB OR Solid Rocket boosters which gets separated earlier and falls into the Pacific Ocean and the liquid rocket boosters which gets separated at a relatively higher level into the Indian Ocean. After that the space shuttle continues in a parabolic trajectory and does the job of deploying satellites, carrying humans from the international space station or docking at ISS or maybe doing some orbit maneuver as and when needed for repairing some sorts of other floating space crafts. Now comes the crucial stage... It has to land on Earth and thus need to make an atmospheric reentry. First the smooth blue curve of the earth separating black space is viewed from the shuttle. Next is what viewed is an indigo colored sky. The spacecraft has to descend to the sea level at a very high speed in just 300 seconds. The acceleration is immense. It gets nearer to the escape velocity. The speed increases with an increase in acceleration. The huge speed along with the friction of the atmospheric air molecules causes the front part of the spacecraft to get heated Upto 3000° C which is equivalent to burning a solid metal to liquid. The friction induces heat and the space shuttle in on fire. In addition, the speed traces to a maximum of 37 Mach that is 37 times the speed of the Sound which makes a turbulent shockwave that vibrates the spacecraft ferociously due to the increasing amount of pressure as the sound is actually a pressure wave. The shuttle slowly loses the altitude from 1,00,000 to 60,000 to 50,000 to 40,000..... The nose of the shuttle is covered with many silica tiles called as the heat shield which helps to protect the shroud of the spacecraft from getting burned away and fuses the heat to the other areas of the body. Now there comes a need for an aero braking system. The critical angle of attack of the wings are at 60° with a nose high position for an un-streamlined airflow which helps in stalling and reducing the airflow past the wings at a proper magnitude thereby causing the shuttle to lessen its velocity. This is done to check the current vibration of the shuttle in a direct contact with the Earths SOI or Sphere of influence as because the axis of the shuttle may get disturbed. After that the critical angle of attack is lowered to 15° for a gliding pathway the shuttle used to follow afterwards. After that the undercarriage is lowered and the space shuttle cuts the main engine off and glide through the atmosphere. The parachutes from the apt of the shuttle opens up and gives a backward push from the air passed across the shuttle which thereby reduces the speed to a great check. Ultimately the shuttle lands to the runaway at a high temperature onboard. The architecture of space shuttle or the orbiter is fairly a complex mechanism. It is an embedded rocket inside an aeroplane with an additional support of external fuel tank for orbital ascent.

#### The shuttle has 5 Parts

- [1] The front Fuselage
- [2] The mid Fuselage
- [3] The aft fuselage
- [4] The external tank
- [5] The solid rocket boosters

The space shuttle front fuselage is divided into Front deck for the accommodation of the Pilots (2) and along with this a GPC or General purpose computer which has been spread equally to all the sides of the front fuselage so that it can be accessed from everywhere in a redundant way. There are windows of thick glass outside the front fuselage for the thermal protection of reentry along with silica tiles. The deck is made of titanium and molybdenum alloy and this make it perfect to withstand the acoustic shock wave which is spread over the blind curved surface of the nose cone of the shuttle in an equally distributed manner.

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The mid deck provides the emergency material and also it contains flexible beds for the rest room of the crews. It also contains generator and pumps. It is a fully pressurized zone.

The lower deck is used for odor/bacterial and waste management system.

The mid fuselage is the most important part of the shuttle as it contains an airlock door which ultimately leads its way to the payload. The payload can be a satellite or other things like the utility materials for the crew of the international space station. There is one important thing in the payload bay and that is the robotic arm. The arm is just like a hand with hinges and joints and can be controlled from the front fuselage controlling panel. The arm usually attaches itself with the satellite that is at the payload bay by means of hook and then deploy them into space. It can also be used for repairing tasks.

The aft part contains three SSME or space shuttle main engine nozzles along with the flap wings along with two delta wings, a rudder and a parachute for the aerobraking mechanism while landing. The aft fuselage is very important as it is used for the direction maneuverability as well as the nose high and nose down with the left right motion by means of wings attached with it. It is quite similar to that of an aeroplane.

At first the fuel that is hydrogen and oxygen is ignited by means of a ignition spark. Then they pass through the turbo pumps for the increase in pressure and gets mixed with the oxidizer and ultimately to the combustion chamber. From there the fuel is directed outside through the converging diverging nozzle with a supersonic velocity as per the fluid dynamic and then after going to a certain height the two solid rocket thrusters got separated from the SSME. The SSME still provides the liquid fuel to the shuttle. At the time of the MECO or Main Engine Cut Off, the Liquid booster got separated from the shuttle body by means of opening of the latches and there after the OMS or Orbit maneuver System burn is done to get the appropriate orbit. This burn is done more than one time for the reach of the particular orbit.

Once the shuttle reached the orbit it is ready for its orbital dance. It approaches towards the international space station with a slight velocity as because a large velocity will deflect its course of action and the exhaust plumes can be of a serious problem. The shuttle then starts to move round the earth with a speed of 7.8 Km/Sec. As both the ISS and the orbiter is moving at the same speed so, the orbiter gradually increases its speed to .1 Km/Sec and made a circular run around the ISS docking Port. The mid fuselage contains the hinge and the latches that fired open the payload bay doors into the space. The shuttle finally narrows the diameter around the ISS and then docked to the ISS. The docking part of the Shuttle is fairly complex and its called ANDROGYNOUS PERIPHERAL DOCKING AND BERTHING MECHANISM. The international space station is a home for the astronauts for carrying out scientific experiments and they need to be mobile for the movement between the earth and the ISS. For this reason, the space shuttle is used and it is docked to the ISS via the docking port and then from there the astronauts can move freely between the space station and the shuttle in order to return to Earth.

The robotic arm of the shuttle then starts to regulate its duty by means of three joints, the shoulder joints, the elbow joints, the wrist joints along with 3 Degrees of rotation. The arm then grapples the Payload from the mid fuselage and maneuvered them to the ISS. After its successful completion the shuttle gets undocked from the ISS. It closes its Bay door by putting the robotic arm manipulator inside and makes the atmospheric reentry.

This is the most crucial stage of the shuttle. It is now ready for the atmospheric reentry. The two rudders open up in both sides and the shuttle takes a nose high position. It slowly glides through the atmosphere. The silica tiles protect the shuttle from the heat of the reentry and the shuttles blunt face makes the heat distributed over its whole body. Finally while landing the temperature rises to 3000 degree centigrade and the shuttle is on fire. The temperature slowly cools down and the shuttle adjusts its flaps for a perfect pitch control and ultimately at the last part of the decent the parachutes opened up and the shuttle is on the runway for the ultimate return.

### 3 Dangerous faults can happen during the total procedure.

- A. POGO - The vibration of the fuel with the rpm of the tank may damage the nozzle cone. So, Precautions need to be taken.
- B. CAVITATION - The pressure gradient formed when the fuel flows from the turbo pump in 4000 eps for an increase in pressure. So, in the low pressure area sometimes bubbles may form which leads to catastrophic incidents.
- C. FUEL SLOSHING - The gravity of the rocket is estimated as the function of the acceleration over 2.5g-3g. If 3g is exceeded the shuttle will tear apart. So, as the gravity becomes lower in the upper part of the atmosphere, the liquid fuels tried to rise up due to weightlessness condition and this may reduce the fuel flow to the Preburner for combustion. But due to the acceleration... Artificial gravity of 3G is produced which prevents this activity.

Now, we will explain a different types of Propulsion, Or basically the advanced propulsion. It is triggered by Sunlight. This mode of propulsion is a very crucial candidate for the UFO's. so, lets begin with this one,

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What is the most dominant thing in our solar system? Everyone will say The Sun... But there is another thing which is the sun's Chromosphere, the plasma envelope that surrounds the core of the Sun and emits the radiation. There are some regions on the chromosphere which are called as Sunspots or the Umbra Part of the Chromosphere. This are the region where the inside temperature of the Sun's core are absorbed by the outside layer and makes a turbulent region over the Sun called as Sunspots. This region emits radiation. Tremendous radiation. The solar radiation. This is even accompanied by turbulent solar flares moving at a speed of 50 Km/Sec approx. and accompanied by ionic electron and proton. This solar radiation is hazardous to any spacecraft orbiting the Sun. The atmosphere of Sun has two parts... The first layer or the Photosphere, The second layer or the Corona. The temperature of the outside layer is sometimes cooler and so the solar radiation gets absorbed and thereby providing dark spectral lines known as Fraunhofer Lines of the Sun's atmosphere. The heliosphere is the region dominated by the Sun. The heliosphere extends far apart from the earth's atmosphere and comes to an abrupt end in a region called heliopause. Our magnetosphere is the region dominated by earth's magnetic fields. The solar particles along with charged protons and electrons got attached to the magnetosphere and forms a donut shaped fiery region called Van Allen Radiation belts. This is a tremendous hazard to any orbiting spacecraft. Moreover, the ionosphere is also effected by the Sun's atmosphere. There is a region of hydrostatic equilibrium which according to fluid dynamics is a region where the fluid (in this case air) flow remains constant. The Ground station which transmits radio signals to the satellite orbiting above the ionosphere or 1000 Km above the earth's sea level for reflected back by a phenomena known as Faraday rotation which is the interruption of the linearly polarized radio waves interacting with a magnetic field and thereby forces to return back to the earth without reaching the satellite. This is a threat to communication systems. The temperature is slowly decreasing above the earth's surface Upto stratosphere where the temperature is roughly -57 degree Celsius. But the temperature increases to 600-800 degree Celsius in the ionosphere which is very warm. The atmospheric pressure declines rapidly as a result of the thin gravitational pull from the earth's sea level.

So, Sun is a threat to the Spacecraft mechanisms but there are one alternative sources available. The effect of solar radiation imparts a momentum or pressure on the thin Fabric and the pressure becomes more as the fabric becomes thinner and thinner measured in per cubic centimeter of the area in terms of Pascal. The radiation pressure is almost nil in the earth's low atmosphere but the pressure dominates from the ionosphere. In the region of magnetosphere to the region of heliosphere the pressure of solar radiation increases exponentially and even there is a region at the outer boundary of the heliosphere which is called the heliopause where the solar radiation got a higher intensity of several hundred Pascal's Along with a high speed of 100 Km/Sec called the magnetosphere. This is also a region which marked the region of bow shock that is the solar winds get supersonic or the Mach # is  $> 1$ . This bow shock is a region dominated by a high pressure with a higher density and this may provide a hazardous effect to any object getting near to it.

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But the impulse of momentum is extremely useful to a particular type of spacecraft which is made by a thin parabolic dish of fabric with a very less thickness of 3-4 microns and thereby makes the highest exposure to the Solar winds. The winds in turn creates a high pressure or imparts a high momentum on the parabolic dish fabric which will provide a potential source of power to the spacecraft which is driven by solar radiation pressure. The more it comes closer to a star or sun, the more will be the solar radiation pressure on its dish and the more power it can generate from the impart of the solar radiation linear momentum. But this sort of a spacecraft is very difficult to be made as because to provide power to the craft the parabolic dish must have to be large in length and thereby is very difficult to accommodate in the payload of the rocket prior to launching it in the orbit as because the more the dish area, the more the radiation exposure, the more the power of the spacecraft.

Well, this type of spacecraft may prove useful to the future generations which can only fly by means of the linear momentum of the solar radiation without any liquid hydrogen, oxygen, nitrogen, kerosene and monomethylhydrazine as a fuel. Well, photon propulsion can be a possible candidate for the Extraterrestrials. As because it doesn't need any physical fuel either liquid and solid moreover as the craft passes close to a star its velocity will be increased by the impact of the solar radiation. And also this velocity in the hard vacuum of the space will result in a tremendous speed which may be possible for the UFO kind of propulsion.

## DETAILS ON DOCKING MECHANISM

The international space station is a home for the astronauts for carrying out scientific experiments & they need to be mobile for the movement between the earth & the ISS. For this reason the space shuttle is used & it is docked to the ISS via the docking port and then from there the astronauts can move freely between the space station & the shuttle in order to return to Earth.

The Rocket which lifts the shuttle consists of 1 Main Liquid Tank, 2 Solid Rocket Boosters along with the orbiter or the shuttle itself. During ascent of the first mode... The rocket rolls along its longitudinal or X axis for a Pitch correction in its lateral or Y axis. The Pitch correction is needed in order to alleviate the weight of the rocket along with the shuttle in a lower magnitude. The Elevons are deflected for the load free in the Pitch correction axis. Along with the roll axis rotates the rocket and directs its thrust vector in such a way that the Nose of the rocket is in a nose high position with a  $-4^\circ$  angle of attack with the X axis along with a  $0^\circ$  angle of attack with the Pitch axis. Now after the first stage ascent the solid strap-on boosters are jettisoned but only that can happen if the pressure of the Boosters is less than 50 Psi. If the boosters are jettisoned at a higher velocity then the Yaw or the Z (transverse) axis will rotate the thrust vector and the shuttle will be out of control. The throttling of the engine is at 100% but when the Max-Q is reached then the dynamic pressure of the

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rocket is so high due to the relative wind gusting in opposite direction that the throttling is reduced to 65-78% to minimise Max-Q. Now it's time for the engine to be jettisoned from the External Tank. Now after jettisoned the rocket begins with a nominal horizontal trajectory with almost a straight line in the same plane as that of the target axis. The Roll axis of the shuttle is positioned to a azimuth direction for the correct orbital inclination with respect to a target vector in order to track the Target Position properly.

The second stage ascent occurs after MECO or the Main Engine Cut Off. In this case the liquid external tank is jettisoned with an angle of not less than 48° angle of attack so that no torque is produced in the shuttle and it can stalk in this high angle of attack and reduce the aerodynamic drag. Soon after the External tank is jettisoned the shuttle closes the latches of the turbo pump and dump the excessive hydrogen & oxygen from the feed lines into the space with the help of liquid helium to prevent any explosion with the interaction of atmospheric oxygen. The sonic boom occurs with a splash of water from the cloud around the rocket. The Boom Cone was still there after a certain time.... The rocket then follows a spiral trajectory until it starts its main engines into power for the orbital manoeuvre.

Now, after MECO, the main duty of the shuttle is to get into a proper orbit. For this it performs a OMS 1 burn in order to get into a circular orbit. Then it will perform a OMS 2 (Orbital Manoeuvre System) burn in order to get into a highly circular orbit. Now, as the shuttle is in a position to achieve its target in a proper interception, the shuttle required its GPC (General Purpose Computer) to make a target Coordinate interception. Now, the main duty is the PROPER GNC (Guidance Navigation & Control) to be perfectly aligned in respect of the target for docking. Here the target is the ISS. The shuttle first compute its omicron angle that is the intersection of all the Yaw, Pitch & Roll axis along with their rotation with respect to the target vector. In this case the Phase angle is computed first, that is the coordinate of the shuttle along with the projection of the shuttles coordinates into the targets orbital plane. This phase angle once contributed.... The vectors of the shuttle and the target are summed up to get a relative position with respect to Sun. Solar illumination is necessary in the background of the stars in the dark because, the only way the shuttle can see its target is due to the reflection of the sunlight from the target or ISS with respect to sun. So, the first coelliptic burn should be initiated after the sunset as the target will be gradually visible at the sunrise. Proper timing of the burn or launch window is necessary as because of the shuttle can't trace its target in the proper time then the whole process will be terminated as there will be no reflection of the target from the Sun. Coelliptic is a special type of ellipse with 2 semi-axis together. The shuttle is in a different altitude than the target. The target is in the up & the shuttle is in the down. So, the shuttle is moving at a relative high velocity than the target. The shuttle is now performing its height adjustment manoeuvre for reaching the height of the same coplaner plane. It then burned its second coelliptic burn to get in front of the target. Now, the shuttle is in a station keeping point that is just behind the target but some thousand feet below. Now, the shuttle will make the Terminal Phase Injection in order to get nearer to the target vector. Here from, the shuttle will rotate the ISS at a diameter of 200 kilometre. Remember one thing, both the shuttle & the target are in a same velocity that is 7.8Km/Sec & for this.... The shuttle needed to burn its RCS Jets or Reaction Control Systems Jets in order to an increment of 0.1 Km/Sec velocity. Ti or Target Intercept begins from T-100 to T-0..... Then the shuttle will move closer to the ANDROGYNOUS PERIPHERAL DOCKING SYSTEM. Now, As the shuttle is needed to be stabilised so from both the +/- X direction it will fire the RCS jets but due to this there provides a spontaneous reaction in the Upward position in negative or -Z axis. This will result in the aerobraking in a minimal magnitude. The shuttle must not fire its upward RCS jets as because this will increase the Plum impingement with a warm air that may affect the solar panels of the ISS. So, the shuttle will now be in a stable position and is ready to dock with the ISS.

The docking system has two parts... The ISS docking post is Passive with a docking ring, 12 hooks and latches. The active docking part is the external airlock of the shuttle with a camera and hook engagement ring. The shuttle will engage itself with the docking port but is now in an unstable equilibrium due Rho the difference in the centre of gravity of the shuttle and the space station. So, the shuttle will continue in a pendulum trajectory but to much oscillation may affect the station or the target if the shuttle crushed in it. Now, as the relative velocity is quite different to the ISS & the shuttle, the pendulum swing will occur for half an hour and then it will gradually stops and the misalignment is automatically adjusted by the shuttle crew with the help of a camera mounted on the shuttle airlock docking port. The hook will engage & the latches will tighten and the shuttle finally docks with the International Space Station (ISS).

## AEROTHERMODYNAMICS/ATMOSPHERIC REENTRY & HEATING

Indian space shuttle program is developing and it is taking time of Upto 5 years with 600 engineers of ISRO to develop a Prototype of the Shuttle & tested it experimentally & successfully. The most challenging task of preparing a space shuttle is to consider its thermal calibration after an atmospheric reentry. And that's the most difficult in the designing of a shuttle. A shuttle is just like an aeroplane but a modified & smaller one. It has its own oxygen for combustion as because it can't take oxygen from the higher altitudes above 1,00,000 ft as the atmosphere is relatively thin. It has wings but Sharp shaped and not flexible like the aircraft as because it's wind has a very little function while compared to the normal aeroplane. A space shuttle is launched from Earth base by 2SRB & 1LRB OR Solid Rocket boosters which gets separated earlier & falls into the Pacific Ocean & the liquid rocket boosters which gets separated at a relatively higher level into the Indian Ocean. After that the space shuttle continues in a parabolic trajectory of 45-60° inclination with the celestial equator and does the job of deploying satellites, carrying humans from the international space station or docking at ISS or maybe doing some orbit manoeuvre as & when needed for repairing some sorts of other floating space crafts. Now comes the crucial stage... It has to land on Earth and thus need to make an atmospheric reentry. First the smooth blue curve of the earth separating black space is viewed from the shuttle. Next is what viewed is an indigo coloured sky. The spacecraft has to defend to the sea level at a speed of 26,790 mph to a total of

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1,00,000 feet in just 250 seconds. The acceleration is immense. It started from  $2.1 \text{ m/Sec}^2$  to  $9.8 \text{ m/Sec}^2$ . The speed increases with an increase in acceleration. The huge speed along with the friction of the atmospheric air molecules causes the front part of the spacecraft to get heated upto  $3000^\circ \text{C}$  which is equivalent to burning a solid metal to liquid. The friction induces heat and the space shuttle is on fire. In addition the speed traces to a maximum of 37 Mach that is 37 times the speed of the sound which makes a turbulent shockwave that vibrates the spacecraft ferociously due to the increasing amount of pressure as the sound is actually a pressure wave. The shuttle slowly loses the altitude from 1,00,000 to 60,000 to 50,000 to 40,000..... The nose of the shuttle is covered with many silica tiles called as the heat shield which helps to protect the shroud of the spacecraft from getting burned away and fuses the heat to the other areas of the body. Now there comes a need for an aero braking system. The critical angle of attack of the wings are at  $60^\circ$  with a nose high position for an un-streamlined airflow which helps in stalling and reducing the airflow past the wings at a proper magnitude thereby causing the shuttle to lessen its velocity. This is done to check the current vibration of the shuttle in a direct contact with the Earth's SOI or fear of influence as because the axis of the shuttle may get disturbed. After that the critical angle of attack is lowered to  $15^\circ$  for a gliding pathway the shuttle used to follow afterwards. After that the undercarriage is lowered and the space shuttle cuts the main engine off at 25,000 feet and glide through the atmosphere. The parachutes from the apt of the shuttle opens up and gives a backward push from the air passed across the shuttle which thereby reduces the speed to a great check. Ultimately the shuttle lands to the runway at a high temperature onboard.

## INCAPABILITY OF THE CONVENTIONAL ROCKET SCIENCE

In this  $10^{12}$  galaxies with each galaxy holding approx 10,000 to 40,000 exoplanetary solar systems and the evidence of the ancient paintings and sculptures with the pictures of spaceships and various UFO sightings, it is very clear that UFO's are visiting Earth. But from where in this 96 billion diameter observable universe. We have no answer. And what we have achieved. Voyager 1 & 2 crossing the solar system and robotic mission in Mars and Human mission in Moon.

*Peoples are excited about Falcon Heavy, Starship and other things but it's time to consider the real incapacibilities of Earthians in Interstellar Travel.*

Points of incapacibilities:

1. A rocket burns an excessive amount of fuel in a few minutes (both solid and liquid propellant) and ion thrusters in space.
2. A rocket usually have a speed very very less than that of light, not even some fractions to consider.
3. The ISRO's GSLV MK-3 weights around 200 adult elephants. Now imagine the weight of SpaceX Falcon Heavy and starships.
4. Rockets are incapable of using warped spacetime to travel a large distances.
5. All rockets have a huge surface area and massive containing 60 to 80% fuels.
6. Humans in the rocket can't survive for long enough due to high induced accelerations and long journey periods because it's impossible for the humans to hibernate as shown in Interstellar movie.

What needs to be done:

1. Using the ambient gravity to create a repulsive force that would accelerate the spaceships at a speed even greater than that of light without using any conventional fuel.
2. The weight and size of rocket reduces to 90% because fuel is not necessary to utilise the ambient gravity as force fields.
3. Lighter spaceships makes high acceleration and research should be started on etheronic medium to cultivate proper ways of travelling through vibrations of the superluminiferous ether rather than through normal spacetime.
4. Reduce the surface area of Rockets and make it look like a disk as because the warped passages makes the disk to rotate preserving its symmetry thereby conserved energy according to Noethers Theorem.
5. If rocket uses warped spacetime, or warp drive, or superluminal speeds in etheronic mediums, then humans won't have to stay for thousands of years inside a spaceship to go for a distance of Mega Parsec (1 Pc = 3.28 Light Years).
6. Scientists should concentrate on the researchers of Thomas Townsend Brown, Biefeld, Hutchison, Nicola Tesla, Eugene Podkletov, Prof. John Searl.
7. People lives for approx 80 years in average and in warped spacetime time being constant, age doesn't matters.
8. MICHAELSON-MORLEY experiment should be revised and redone and reinterpreted to consider the etheronic effect and the medium of propagation of Zero-Point Energy in spacetime.

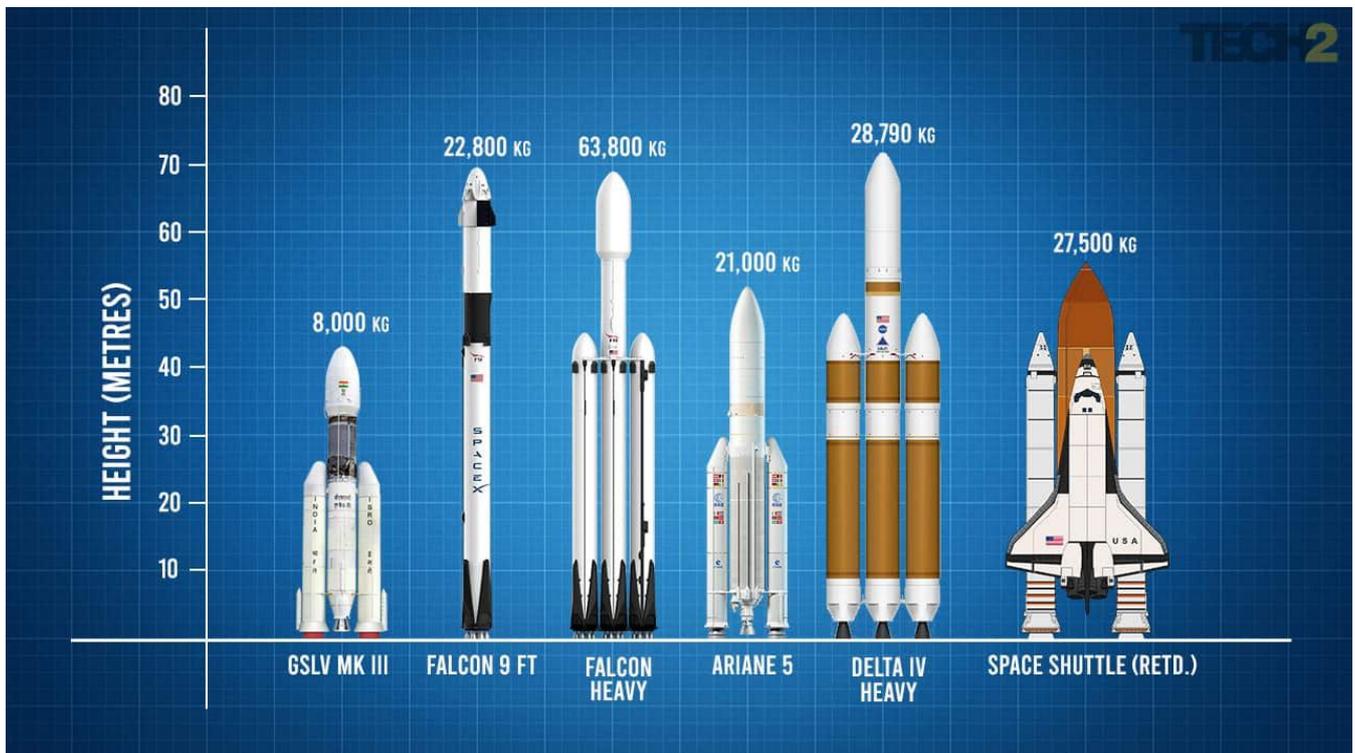
*Today's rocket science if continued in the way it is, it won't go any further than Mars.*

ASSOCIATED PICTURES:



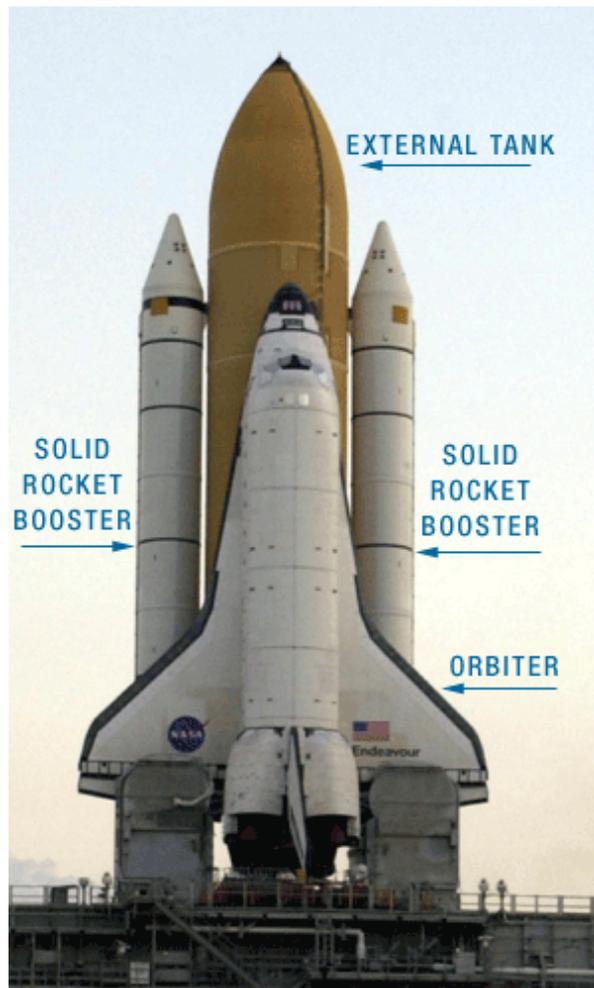
(Atmospheric Heating & Reentry. Courtesy: NASA)

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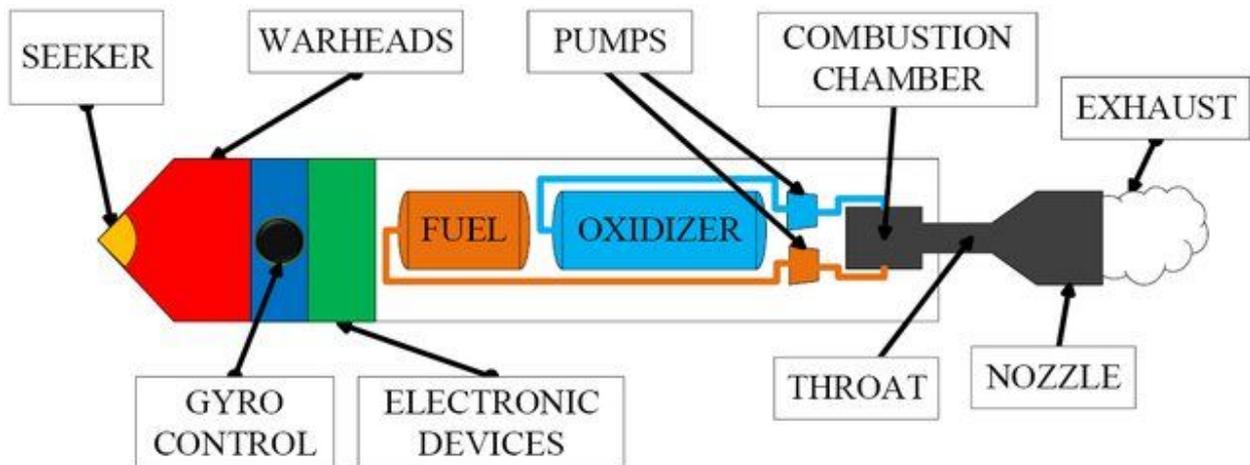


(Comparison of ISRO GSLV MK III to other rockets around the world. Courtesy: <https://www.firstpost.com/tech/science/how-does-isro-gslv-mk-iii-fare-against-some-of-the-worlds-most-powerful-rockets-6841311.html> )

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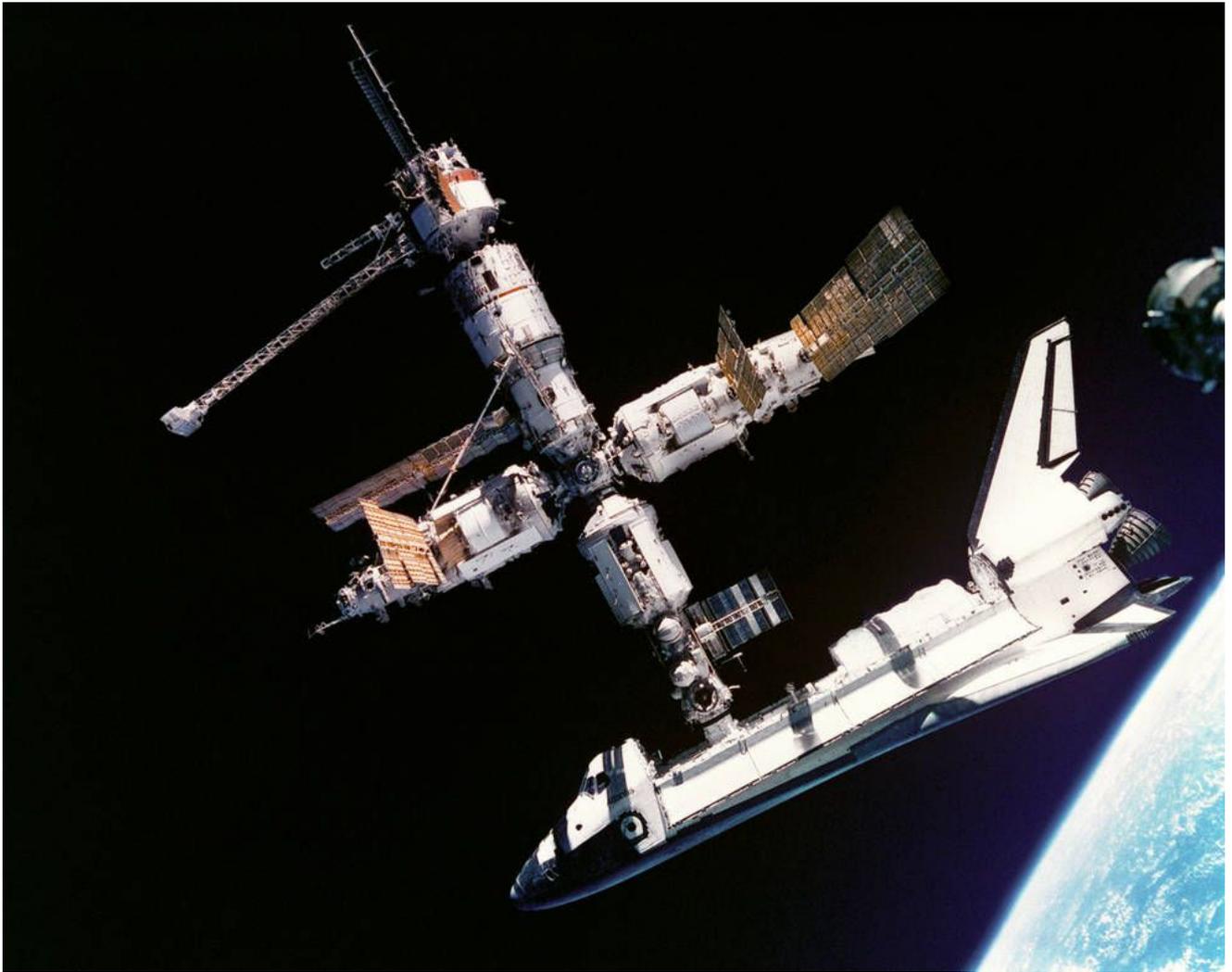


(Different parts of a rocket carrying a space shuttle. Courtesy: [https://www.nasa.gov/returntoflight/system/system\\_STS\\_prt.htm](https://www.nasa.gov/returntoflight/system/system_STS_prt.htm) )

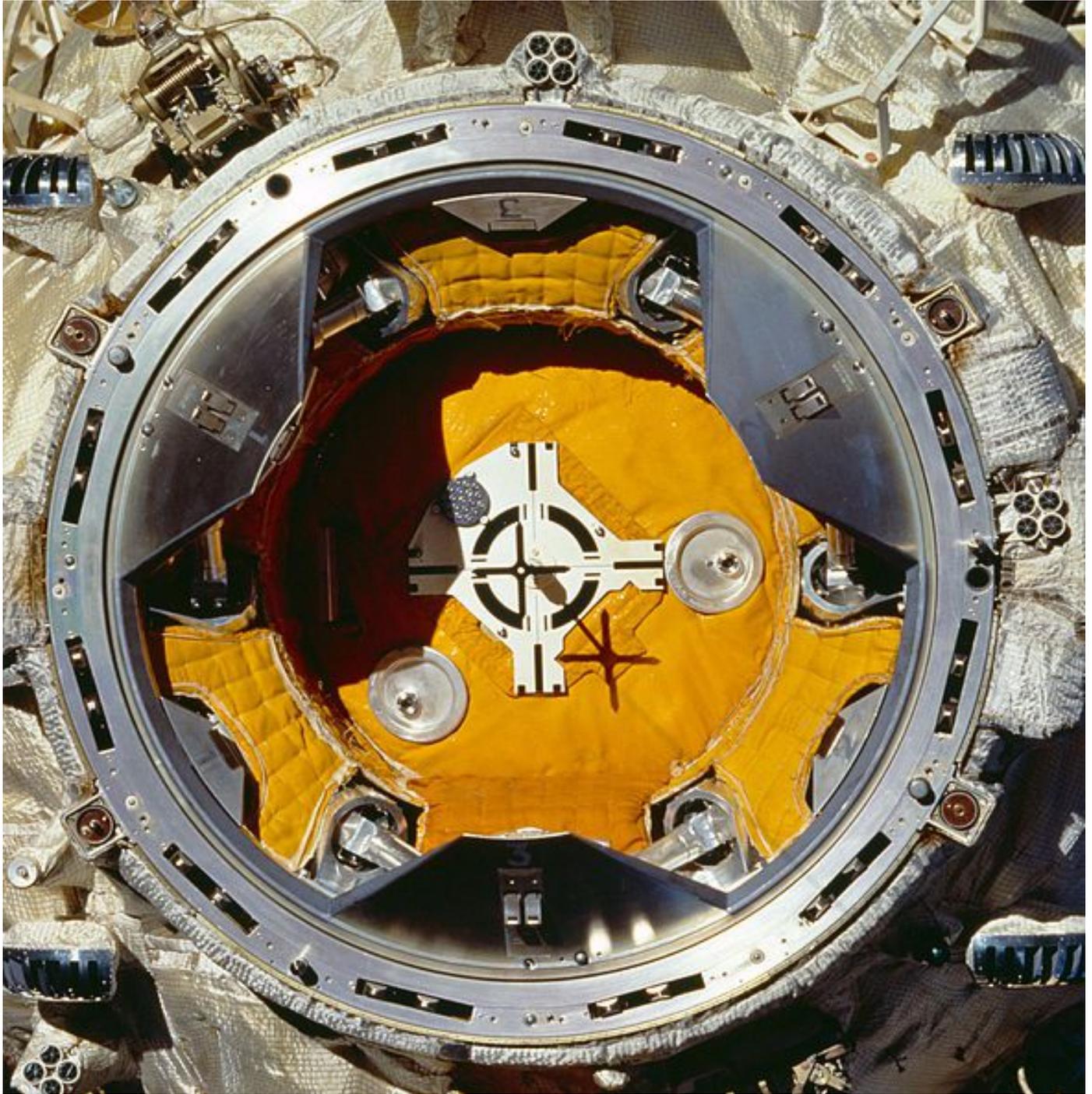


(Different parts of a rocket engine. Courtesy: ÇAtalbaş, C., & Gulten, A. (2017). A Novel Approach for Optimization of Nozzle Angle and Thrust Vectoring Controller via a Sub-Mutation Genetic Algorithm. International Journal of Innovative Computing, Information & Control: IJICIC, 13(6), 1929–1940. <https://doi.org/10.24507/ijicic.13.06.1929>)

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(Space shuttle Atlantis docked with MIR space station. Courtesy: <https://www.nasa.gov/atlantismets-mir>)



(Docking port of the space shuttle with MIR. Courtesy: [http://images.jsc.nasa.gov/luceneweb/caption.jsp?searchpage=true&to\\_day=31&from\\_year=1993&from\\_month=11&to\\_year=1996&date\\_search=Go&from\\_day=1&to\\_month=12&hitsperpage=100&pageno=7&photold=STS063-711-069](http://images.jsc.nasa.gov/luceneweb/caption.jsp?searchpage=true&to_day=31&from_year=1993&from_month=11&to_year=1996&date_search=Go&from_day=1&to_month=12&hitsperpage=100&pageno=7&photold=STS063-711-069))

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(Canadian Robotic arm of Space Shuttle. Courtesy: <https://www.cnet.com/pictures/canadarm-the-zero-gravity-grappler-pictures/2/>)

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