



AKARA

AKARA PROJECT

शं नो द्यावापृथिवी पूर्वहूतौ शमन्तरिक्षं दृशये नो अस्तु ।
शं न ओषधीर्वनिनो भवन्तु शं नो रजसस्पतिरस्तु जिष्णुः ॥

-Early invoked may heaven and earth be friendly and airs mid region may good for us to look on;

To us may herbs and forests trees be gracious, gracious the Lord victorious of the.

“कं ब्रह्म खं ब्रह्म”

The sky is eternal mighty

{Perceive this to perceive the next}

Let us discuss and know about Indian ancient history:

**{DEPARTMENT OF PHYSICS AND ASTROPHYSICS,
UNIVERSITY OF DELHI (110 007), INDIA}.**

- **Comets in Ancient India:**

The ancient observers seldom witnessed some celestial bodies in space; and further found them going through metamorphosis. In the earliest (pre-telescope) era our illustrious ancestors found them in space on some particular occasions namely the lunar or solar eclipse. They observed some gradual growth, as the comet approaches the sun.

Comets are made of dust, organic compounds as frozen methane and ammonia as well as dry ice. They have rocky nuclei -1 to 10km weighing 10^{15} to 10^{18} kg. Because of small mass, comets have very low surface gravity so that the pressure exerted by the solar wind plasma pushes the ionized and volatile substances outwards as they come within few AUs ($1 \text{ AU} \sim 1.5 \times 10^8 \text{ km}$) of Sun, leading to tail formation. Recently, the tail of the comet Siding Spring C/2013 A1 had a brief encounter with Mars during October 19-20, 2014, that was monitored in situ by both NASA's fleet of martian spacecrafts (that included MAVEN as well as Indian Mars Orbiter Mission. At the time of writing this article, European Space Agency's Rosetta spacecraft, that has been cruising in space for about decade, succeeded in lowering its lander Philae on the $\sim 4 \text{ km}$ wide rocky nucleus comet 67P, on November 12, 2014.

- **Indian Vedic literature and comets:**

Vedas Rig, Yajur, Saama and Atharva, composed in archaic Sanskrit, are the oldest deciphered Indian texts. The word Veda in Sanskrit means (sacred) knowledge, with cognates in other Indo-European languages, such as (w)oida in Greek, wit (witness) in English and wissen in German (Witzel 2003). Rigveda (~ 1700 1500

BC), the oldest of all, consists of about 1028 hymns invoking mostly nature Gods, Goddesses and sacrificial Rites. It also includes secular observations, vignettes of Indo-Aryan life, their desires, struggles and battles (Griffith 1896). From the first mention of iron in Atharvaveda, the mantra portions of this text have been dated to about 1150 BC (Witzel 1995).

Archaeoastronomical arguments indicate that Vedas have preserved even older traditions. In Vedic texts, Nakshatras or lunar mansion' (bright stars and constellations lying along Moon's path) have an exalted status (Subbarayappa 2008). Krittika (Pleiades) is often listed as the first asterism among the 27 or 28 nakshatras, which according to Jacobi (1909), was due to its rising on the east during the vernal equinox, when these rituals were getting established. Because of the precession of equinoxes, it is Pisces at present, and not Pleiades, that rises on the east during the spring equinox. This strongly suggests that the vedic practices began in the period 3000 - 2000 BC (Jacobi 1909).

Shatapatha Brahmana (SBr), ~ 1000-700 BC, instructs one to light an auspicious sacrificial fire at the time of Krittika's rise in the east since Pleiades 'rises invariably in the due east (Chattopadhyaya 2008). SBr was obviously restating an ancient observation that had no bearing on the contemporary location of Krittika during its composition. Even Chinese annals of 2357 BC had recorded that Alcyone, the bright central star of Pleiades, was near the vernal equinox (Allen 1963, Chattopadhyaya 2008). Moreover, older Vedic literature referred to the Big Bear constellation as rikshas (bears, in archaic Sanskrit) indicating a common Indo-European origin of the vedic people. By about 900 BC, the stars of Ursa Major had been identified with seven Rigvedic seers, and hence the name Saptarishi or seven sages (Ghurye 1972).

- Asteroid discovery

As the comets been witnessed , simultaneously the discovery more about space was a quotidian aspect; very soon and there was the discovery of asteroids which led a great change as this was one of the brightest findings of the (achryas and

maharishis) scientists and discoverers (Giuseppe Piazzi ;first found in Jupiter and Mars orbit) till now.

- Alteration of an asteroid and comet:

Some asteroids are of S, M or of C types, some are having truncate temperature and some are having elevated; many of them are of satellite shaped or of any other type but comets are the structures composed of ice and dust.

Asteroid and comets are having one customary feature; they revolve around the sun in the same manner but as the comets are composed of dust and ice, when they get closer to the sun the particles gets vaporized.

- A special THANKS GIVING to {DEPARTMENT OF PHYSICS AND ASTROPHYSICS,

University Of Delhi (110 007), INDIA} as the whole text is taken from it.

Acknowledgement

We are so glad and proud to make as we got to know about much new theories that were not known before. This AKARA project became an incredible platform for all our team to be known about space and about asteroids. We were very much excited as well to make this project as included much more things and interesting new concepts.

A special THANKS GIVING to our school authority for providing this huge platform to embrace ourselves and to enhance our knowledge through this.

A prestigious and respectful THANKS GIVING to my teachers as this project was possible only because of them. Their support and guidance was very helpful and that strengthened us.

One THANKS GIVING to our parents as we were able to complete this project because of their blessings as well as their moral support made us confident.

AKARA

Terrene Prospecting

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[ASTEROID MINING]

1. INTRODUCTION

Introduction

According to NASA the most asteroid are found in the belt of Mars and Jupiter contains 700 quintillion matter worth of resources. As a large percentage of asteroids are pulled in by Jupiter's gravity. For this reason, Jupiter is known as the dumping grounds for our solar system. Many of the asteroids that are harmful to earth, the long period comets, tend to be sucked into Jupiter's gravity field.

The most valuable asteroid in the belt be 511 DAVIDA. It has a diameter of 326 km and has a resource value of almost 27 quintillion dollars. This asteroid is selected by AKARA and is

- **Why the name AKARA?**

Sanskrit a cultural language and the word AKARA taken from it, meaning 'MINING' or 'TO MINE'. We have given our project this simple but beautiful name because AKARA just, without any discrimination and without any violation of any society and culture means 'to mine', whether on space or on earth or any part of universe.

Introduction of our AKARA PROJECT team members

We are together a team of nine students of different classes and different mental capabilities. We are together making this project irrespective of being seniors or juniors.

Name of team members:

Name of team members:	Classes	Distribution of works for AKARA project :
Pakhi Srivastava	6 th	Pakhi has looked after the modeling part of drones.

		She made the sketch of drone.
Mohammad Uzair Jamil	6 th	Uzair wrote about what asteroid mining is and its needs including its purposes.
Lakshya Churiwal	6 th	Lakshya did the research work for types of asteroids (S, M and C asteroids).
Hiral Vaish	7 th	Hiral is the captain of AKARA PROJECT and is playing an important role in working of rock finder. She has done the written grease about technical portions in this project.
Jayati Patel	7 th	Jayati did the works regarding working of spacecraft and designing portions.
Pranjal Yadav	7 th	Pranjal has made the index and has added the required topics of AKARA project.
Divya J. Singhaniya	7 th	Divya has done the work regarding the asteroid hopping (future) mission.
Shikhar Singh	9 th	Shikhar is the captain of AKARA project. He is heading this project and has done the technical and mechanical systems including the communication system and the launching of the spacecraft and the

		measurements of the machineries which are the arduous portion which are there in our project.
Aadya Sharma	9 th	Aadya is the captain of AKARA project and has done the work regarding the written portion and has concluded all the alteration and introduction of the project.

1.1. EXECUTIVE SUMMARY

For space mining many interesting ideas have been introduced till now but in this project we are going to introduce you about, how can we mine and get the minerals and elements in most convenient and convincing form. AKARA Project shows you about what asteroid mining is, which orbit is the best for it, why this asteroid been selected etc... Our asteroid is 511 DAVIDA which is C type asteroid consists of metals, minerals, rocks, etc. Previous studies for asteroid mining retrieval have been constrained to studying only asteroids that are large enough to be discovered, and small enough to be captured and transported using earth-launched propulsion technology.

AKARA's Space craft will be moving to 511Davida for mining purposes. Space craft will consist of four compartments which will include a proper communication system, rovers and much more of them.

1.2. Problem and motivation

Exponentially accelerating technologies, backed by many scientists are bringing about incredible benefits to humanity, while requiring more resources and energy to be consumed to create these new devices.

On earth there is shortage of resources as due to gravity the valuable metals are going inside the core and that is the place where humans cannot enter.

Now as a solution the technology has become advanced and developed the new ways to mine on asteroid which, have led to greater opportunities for us to explore and learn.

Extraction methods are useful to great extent. As mining on asteroid is expensive but due to the requirements we have to extract minerals and face all the consequences being faced.

We hope that asteroid mining would not be expensive forever, soon the things will get changed and the mining will become common, as there are such missions coming like Asteroid Redirect mission (ARM) shown International interest and support , while commercial firms such as Planetary Resources are helpful.

Some of the notable and major asteroid mining challenges are as follows:-

- ❖ High cost of spaceflight (expensive)
- ❖ Unreliable identification of asteroids which are suitable for mining
- ❖ Challenges of extracting usable materials in space environment

1.3. AKARA CONCEPT AND SOLUTION

AKARA project gives you the solution to mine on asteroid safely and the solution of mining.

In ISS we can attach a long rod which will be revolving with a high speed. On the one end we will attach our miner (spacecraft). As it will rotate by 360° it will generate an angular velocity (w). After having a good amount of angular velocity, we will launch our spacecraft with the tangent when the asteroid will be closest. When it will be having a good amount of angular velocity, so less fuel will be used and for returning back to earth we will be having more than sufficient amount of fuel . This will be cost effective as well as will be helpful to us and to save the resource petroleum.

We will be having the thruster to reduce the speed of spacecraft such that it will be turning by 180 degrees and will be landing on DAVIDA rather than going between DAVIDA.

As soon as our spacecraft will reach the orbit of DAVIDA, our satellite will be launched and it will start revolving around it. The spacecraft will then be

landing against the surface of DAVIDA and the drones will be searching for minerals and as much resources will be start being extracted.

1.4. A VISION OF SPACE DEVELOPMENT

A vision of space exploration was a plan to explore about space and to know deeply about it from all the aspects. It is a way to develop a vision as well as new ideas to explore all about space/universe. Vision for space exploration was announced on 14 January, 2004 by President George W .Bush. It was a way to gain people's interest to space which is now one of the most (interesting) part of one's perspection. At the moment, we humans have developed new plans in space, we are having space settlement plans which could be one of the major achievements for us, asteroid mining plans which has raised the economical growth till a huge extent for many of the countries and has helped a lot to know about different kinds of elements and new types of metals.



1.5. ASTEROIDS WHAT AND WHERE?

Asteroids are small, rocky objects which orbit around the Sun. Although asteroids orbit the Sun like planets, they are much smaller than planets. They are also called as, **minor planets**. In short, Asteroids are small, rocky, icy objects that have no atmosphere and rough surface. Asteroids consist of minerals and different resources.

TYPES OF ASTERIOD

1 - C-Type asteroids (carbonaceous)

- The carbonaceous asteroids are abundant in the solar system (almost 75% of the known asteroids are of this type), especially on the edge of the asteroid belt between Mars and Jupiter (some astronomers say that another planet could have formed in that asteroid belt if Jupiter's gravity wasn't so massive,

but now a possible planet lies in pieces in between Mars and Jupiter). They are chondrite asteroids.

- They probably consist of clay and silicate rocks, and are dark in appearance. They are among the most ancient objects in the solar system and are useful to humans till a great extent.
- C-type asteroids are located in the outer part of the asteroid belt or outer solar system.
- These asteroids absorb almost all of sunlight incident on them (they appear dark because they don't reflect sunlight toward us to notice them).
- They are also the oldest rocks in our system. At a large distance of 3.5 AU away from the Sun, they are least deformed by solar heat physically or chemically, so they are ideal artifacts for scientists to examine.
- They are the most hydrated kind of asteroid present in our solar system .

2- S-Type asteroids (silicaceous)

- S type asteroids are made of silicate and iron-nickel (and magnesium silicates). They are the next most abundant group in our solar system .They are very common on the inner edge of the asteroid belt and have 17% of the total asteroids in the entire system.
- With an albedo of 0.2, they are fairly bright and easier to see when we compare them to C-type asteroids. The largest asteroid in this group is Eunomia at 330 km across which makes up 1% of the asteroid belt's mass.
- They are rarely found in other parts of solar system other than inner parts even though are present in plenty of quantity in the solar system.

3 - M-Type asteroids (metallic)

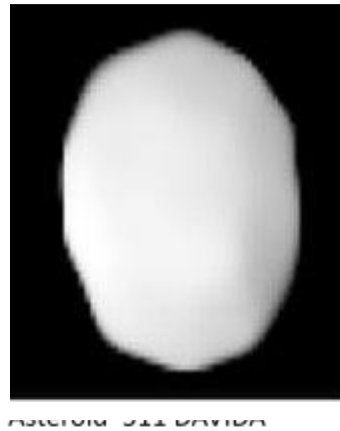
- While the M-type asteroids are the third most common asteroid group. They are located in the middle of the asteroid belt, and most if not, all contain nickel and iron.
- The most massive asteroid in this group is the 16 Psyche with a diameter of 120 miles or 200 km.

ABOUT ASTERIOD '511 DAVIDA'

511 DAVIDA one of the largest C-type asteroid. Worth around 27 quintillion (26,990,000,000,000,000) U.S. dollars.

Contains several valuable materials like- nickel, iron, cobalt,

Water, nitrogen, hydrogen, and ammonia .It was discovered by R. S. Dugan in 1903 and is named after David Peck Todd.



Diameter	298±4 km
Mass	(26.6±7.3)×10 ¹⁸ kg (38±2)×10 ¹⁸ kg
Temperature	~160
Density	1.92±0.53 g/cm ³ 2.97±1.30 g/cm ³
Dimensions	c/a = 0.70±0.06 (357 ± 2)×(294 ± 2)×(231 ± 50) km
Apparent Magnitude	9.50 to 12.98

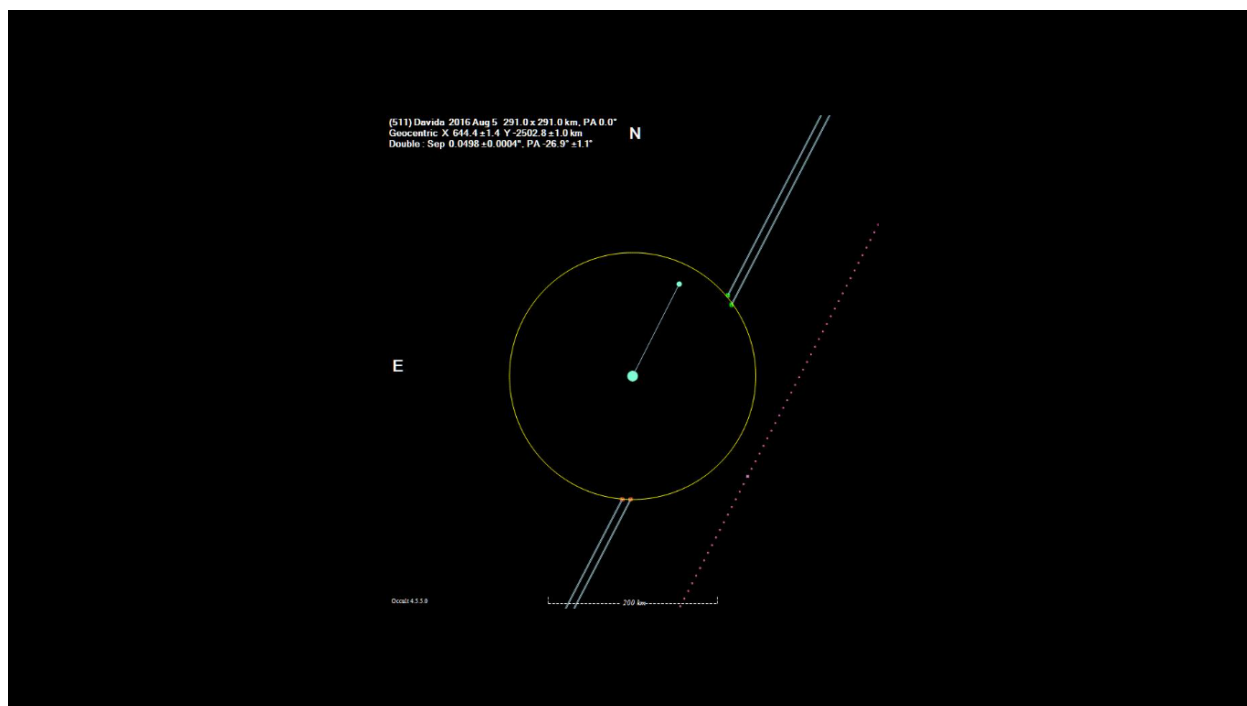
Absolute Magnitude	6.43
Spectral Type	C
Rotation Period	5.17 Hour

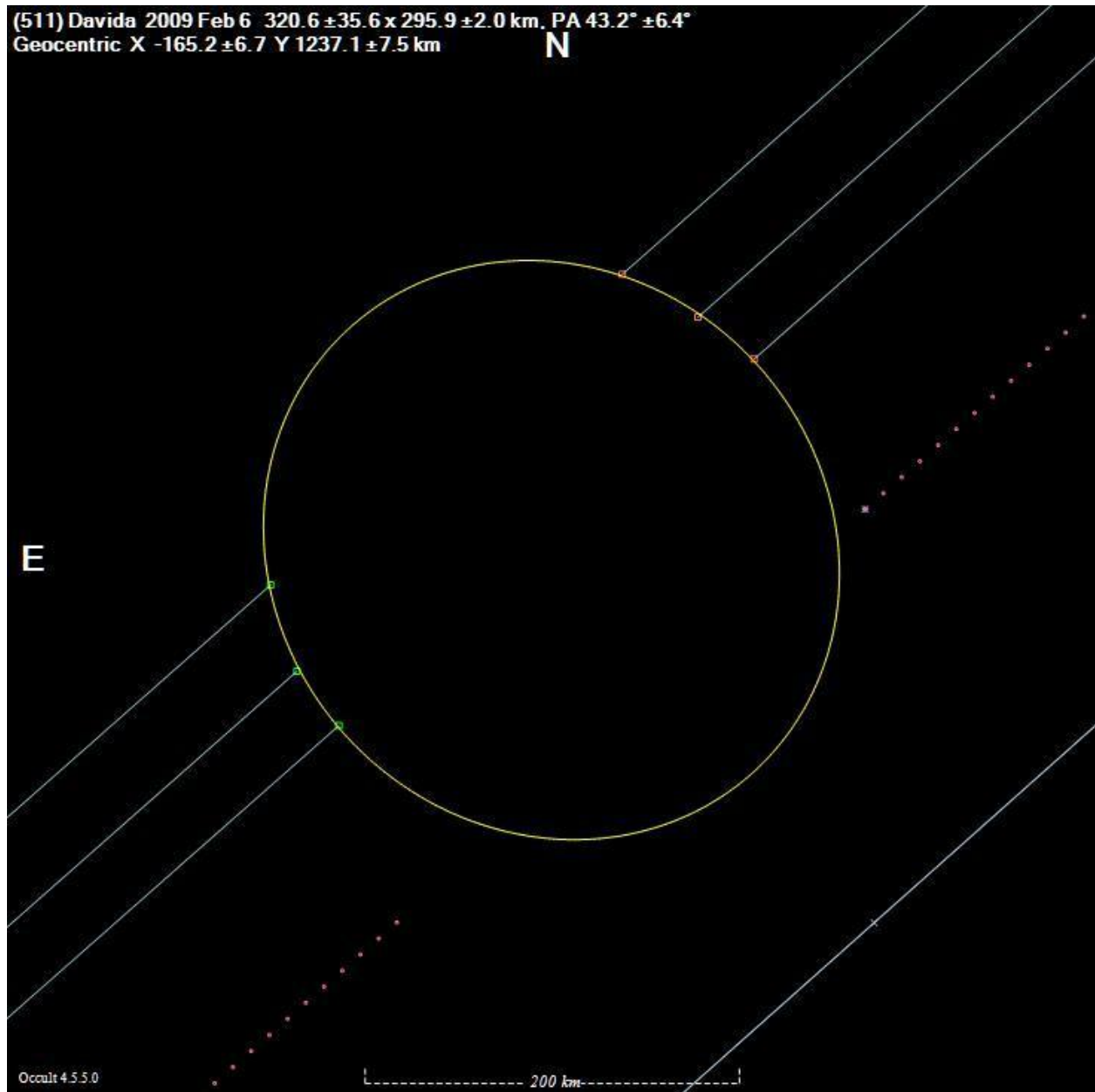
Davida's orbit is 1.59 AU from Earth's orbit at its closest point.

On January 11, 2003 the asteroid Davida asteroid was observed between 10:23 and 11:59 PM Davida was traveling at 0.55 arcseconds/minute towards the West-Northwest, meaning it moved about 53 arcseconds over the course of the observation. Davida is faint, it could be easily observed with a small telescope.

The (511) in Davida's title means it was the 511th asteroid to be included in the list of asteroids maintained by the International Astronomical Union. Its orbits at an average distance from the Sun of 3.17 AU, placing it a little under halfway between Mars and Jupiter. It takes about 5.64 years to orbit the Sun. The eccentricity (flatness of the ellipse) of its orbit is about 0.18, making its orbit less eccentric than that of Mercury's or Pluto's, but more eccentric than any of the other planets'. Its orbit is inclined by about 15.9 degrees to the plane of the ecliptic (the plane in which the Earth orbits the Sun). This inclination is twice that of Mercury, which is the planet with the highest inclination other than that of

Pluto's, which is about 17.2 degrees





511 DAVIDA ORBIT

2. AKARA phase I work

2.1. WHY ROCK FINDER WAS NEEDED:-

Efforts which utilize asteroid mining is known as FINDER. We can find different minerals in Earth but there are a lot more opportunities in the asteroid 511 DAVIDA. It consists of high amount of minerals.

These minerals can only be found using rock finder which is playing one of the most important role between the findings of ingot.

And for this we want asteroid finder machine. And we have made the design of the rock finder.

Whatever the value of minerals will be there it will be represented by the asteroid. The technology that's been used is incompatible among all the projects as the machineries are at variance.

This project at extent requires quantitative models of the impact of any kind of design decision extraction of asteroid resources, this is the biggest reason. So, because of this reason we will be using rock finder tool.

The grizzle asteroid miner is a stock character of recent events. One legal and the other technology have brought asteroid mining a step closer to reality. The legal step was taken when the central commerce science and transportation committee passed a bill titled H.R.2262 SPACE act of 2015. The bill has a number of measure designed to facilitate commercial space development, including a provision that gives individuals or companies ownership of any material that they mine in outer space. According to one estimate asteroid mining could ultimately develop into a trillion dollar market.

2.2. WHAT ROCK FINDER DOES:-

Rock finder is a design tool that began as a simple target selector for asteroid mining. It combines all type of asteroids.

Information with top level design assumption and all the capabilities of space craft, rovers, communication system etc. The main function of rock finder is, it help in finding the mineral particle in our asteroid 511 DAVIDA.

2.3. HOW ROCK FINDER WORK:-

Having a scanner in it which will help us in finding the mineral. It will be working like this :

- The camera placed above the finder will be detecting the minerals that weather it is deep in the ground or closer to the surface.
- It will give the instruction to the drill machine about the founded mineral.-
- We will be using a sensor name **THERMAL INFRARED SENSOR.**
- We will be using a camera name **OPERATIONAL LAND IMAGER.**

A rocket must withstand the strong forces during launch and be as light as possible. For the main frame most rockets use aerospace grade **aluminum** or **titanium** since both metals are very strong and light. First we are having a finder and on the top of that finder we are putting a camera . It will be light weight. Future rocket designs are even looking into using **carbon composite structure.** Aluminum, however melts at the high reentry temperature.

2.4. FUTURE DEVELOPMENT OF ASTEROID MINING:-

As not only us, there are many projects working on it progressively asteroid mining. Asteroid mining is one of the developing project worldwide. Future of asteroid mining, what has thought is, we will be trading with the space colonies present there. We will, in future not be bringing the asteroids on earth rather we are planning to go for asteroid development and trading with other space colonies. Now, you will be thinking that how this is possible that asteroid mining will be successful in future, but it is true because according to **wired and valeria Pellegrini** a asteroid **DAVIDA**. It diameter is 326 kilometer and the most interesting things about this is, this asteroid is identified as most valuable asteroid in asteroid belt. Resources value is estimated as 27quintillion (26,990,000,000,000,000) in U.S. dollars. So, this asteroid will help in making our asteroid mining successful in the future.

3. Architecture concept

3.1. Asteroid Spacecraft Design Method-

The methods which are used to provide or fulfill spacecraft capability is depend on the size of the asteroid and the types of requirements available, it is not important to assemble or to manufacture into the asteroid ,given that the cut price mass of bringing certain systems from Earth, therefore each function could in principle be doubled with mostly technical parts, the following investigation was accomplished on procedure to issue each spacecraft capability.

3.2. Metals used in spacecraft-

Metals are found and used virtually everywhere, common metals that are used to construct spacecraft are as follows-

- 1) Iron
- 2) Nickel
- 3) Aluminum
- 4) Titanium
- 5) Stainless Steel

The methods that can be used to make our spacecraft would be aluminum and titanium. Most of the structures of the space shuttle is aluminum like project Apollo11, it was made of an aluminum alloy. Using titanium alloys can also strengthen the body of the ship. Aluminum and titanium . Both materials have excellent corrosion resistance, manufactures discovered that titanium is more corrosion- resistance than aluminum.

3.3. Asteroid Spacecraft Subsystem Analysis -

The momentum system is in many sample the most crucial subsystem of the asteroid spacecraft. Spacecraft consists of compartments and will be having a satellite which will be launched in the orbit of 511 Davida and will be helping in communication system of our spacecraft. Our Spacecraft will have four compartments which will be consisting as the top part to be of satellite, second will be of rovers consisting of miner,detector, robots for mining, drones etc. and other requirements of the project.

3.4. Propulsion system of rocket –

As we have used the concept of angular velocity to launch our rocket from the ISS to Davida, so most of the fuel will be remaining unconsumed.

Afterwards when the mining will be completed then we will launch it from Davida to earth normally because the escape velocity of Davida is 0.182km/s ; 90-95% of fuel will be unused.

Given,

$$M = 40 \times 10^{18}$$

$$G = 6.67 \times 10^{-11}$$

$$R = 160$$

$$g_{\text{dauida}} = \frac{GM}{R^2} = \frac{6.67 \times 10^{-11} \times 40 \times 10^{18}}{(160)^2}$$

$$= \frac{6.67 \times 40 \times 10^7}{160^2}$$

$$= \frac{266.8 \times 10^7}{160^2} = \frac{2668 \times 10^6}{25600} = \frac{2668 \times 10^4}{256}$$

$$= 10.4218 \times 10^4 = \boxed{104218 \text{ m/s}^2} \text{ (approx).}$$

$$\begin{aligned} v_{\text{dauida}} &= \sqrt{2gR} = \sqrt{2 \times 1.04 \times 16 \times 10^3} = \sqrt{2 \times 104 \times 16 \times 10} \\ &= 4 \sqrt{2 \times 2 \times 5 \times 104} \\ &= 4 \times 2 \sqrt{5 \times 104} \\ &= 8 \sqrt{520} \\ &= 8 \times 22.803 \\ &= 182.42 \text{ m/s} \\ &= \boxed{0.18242 \text{ km/s}} \end{aligned}$$

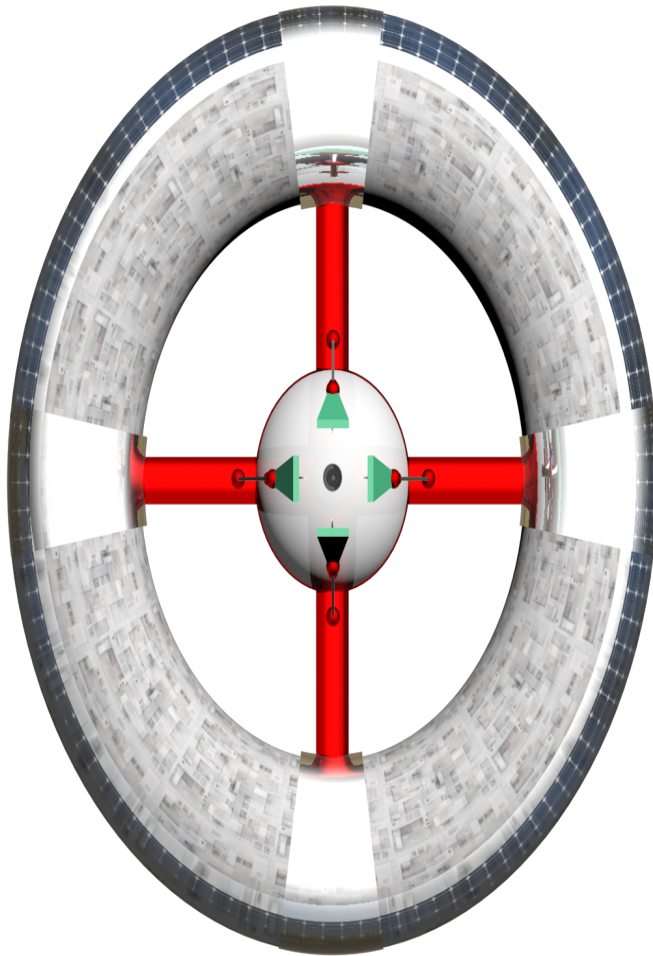
So, this way we are saving the fuel and dwindle up the cost.

Command and data handling system-

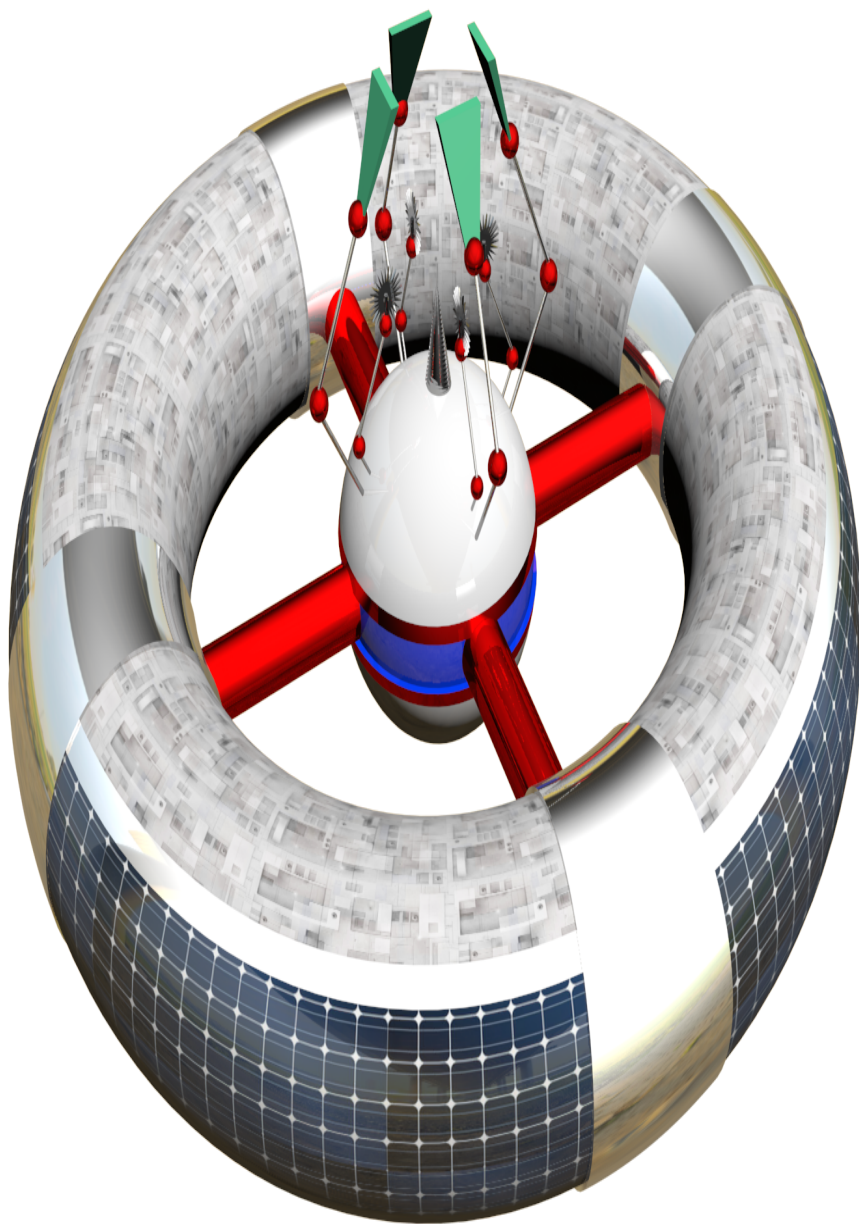
The near earth asteroid Rendezvous (NEAR) spacecraft's command and data handling system is made or discovered to manage or handle complex operation and collect all the information when the spacecraft is out of reach with ground control. During contacts of ground, the command and data handling system considers commands and loads of memory that used to tell a time ordered set of events to be followed, and it use to report the overall command and data handling system gives details on each of the components, and also tells that how the system was tested prior to integration of spacecraft.

4. Asteroid Spacecraft Design Methodology

4.1. Asteroid Spacecraft System Level Design



Phase – I of spacecraft



Phase – I of spacecraft

AKARA spacecraft consists of chambers having a storage space, satellite cabin and a rover compartment and have the mining machineries in it.

5. Communication System

For communication from DAVIDA to earth we'll launch a satellite to the orbit of DAVIDA and then we'll use the satellite present on mars to make communication tranquil.

5.1. Communication of rover:

The rover will communicate to earth / satellite using HGA {High-Gain Antenna}.

The rover will also be having transponders etc; to make a good communication system.

5.2. Communication of miner:

The miner will be moving begin the rover to mine the minerals for communicate the miner to the rover it will be having LGA {Low-Gain Antenna} and transponders.

5.3. Communication of Drone:-

AKARA's drone will be consisting of a chip which will be already connected to the satellite (communication system of AKARA) . The satellite will transmit the signals to the drone which will help it out to work.

6. Asteroid hopping {future} mission assessment:

Asteroids are one of the most ponderous elements dwelling in the space.

In the ulterior time period planetoid mining is going to be the preponderance valuable and expensive trade. It is embracing the biggest industrial opportunity

in future inclusive of ; as an emerging job opportunity that can procreate hundreds and thousands of plebeians employed as well as enroot a nation being proud of their country's citizens being on the payroll (employed) in space as a staggering golden contingency .

Employment in space will also be one of the needs for terrestrial beings in future As the technological and artificial rhythms are moving along ; rapid the more prosperous interpretations are emerging which are rapidly helping terrestrial life to grow and flourish. As AKARA project is not involving human interpretations in its mining methods but in future when the space settlements will be increased employment of people will be required as a basic life support because already due to ever increasing population and pollution caused by us humans our earth has started depleting. Thus eventually this could be one of the jobs that can be applicable for the human beings for their survival.

6.1. AKARA Artificial Intelligence

AKARA project gives an idea of including the artificial intelligence as it is the most required thing this date. It will look after all the systems and will make mining more easier as well as better. Humanoid is a technology which provide one the facility of improving more and making the work simpler and smarter.

7. Value Proposition of Asteroid for Exploration

511 DAVIDA worth up to \$27quintillion because it consists of nickel, iron, water, cobalt present in it as resources.

7.1. DAVIDA composition benediction

AKARA project is going to have a salutiferous business with the space settlements already existing in the space. AKARA project is having water in the asteroid selected by it which is obligatory to the space settlements. Space settlement programs are in crave of water and many other resources which are essential for human life support and are divest of them. We are going to merchandise with them and will have a earning profit which will be serendipitous and efficacious for terrestrial life and as well for imminent space

development in all the aspects (asteroid mining , space settlement programs and many more potent ideas for the aforesaid impetus in future as well as current situations).

Mining in space is a wearisome and grievous task but trading in space is exigent as well as propitious and salubrious. Trading in space includes all the processes same as we do here on earth but these measures only become a little difficult there at space; so to make them easier we have made our spacecraft in the manner such that it will clean the output material and will help to deplete its weight so that the material could get lighter will become easier to transfer and to travel.

8. Measurements:

Rovers – The rover will be having six wheels, three on each side. The size of wheel will be 50cm in diameter and 25cm in radius. The **suspension system** is how the wheels are connected to the rest of the rover interacts with the terrain of DAVIDA 511. When driving over the uneven terrain the suspension system maintains a relatively constant weight on each of the rover's wheels. The suspension minimizes rover tilts, as it drives.

- ❖ **Rover speed-** We will keep the rover as slow as possible so that we don't get a fault in any of the instruments. The speed will be 0.1mph (4.2cm/s).
- ❖ **Rover body-** # The length of the body will be 11 feet.
The width will be 10 feet.
The height will be 8 feet.
- ❖ **Robotic arm-** The length of robotic arm will be 3 (three) meters. At the end of the arm a camera will be there to capture the image of the terrain of DAVIDA 511.
- ❖ **Power-** The rover requires electrical power to operate. Without power, the rover cannot move, use its science instruments or communication. The rover will carry a radioisotope power system. It will take approximately 5 kg of **plutonium dioxide** as the source of steady supply of heat.
- ❖ **Communication-** for communication we will use HGA (High Gain Antenna) and LGA (Low Gain Antenna) (UHF; ultra high frequency) antenna. We will be

having satellite revolving around DAVIDA 511 and will be using Mars satellite to establish MRL. The rover will send signals to it and the process continues. The transmission rate will be approximately 20-25 mb/s.

Miner- The miner will also have a collection hit of area 1000m² (approx.). It will be having rotatable legs, 3 on each side. Then a control unit will be there for communication etc. and at the end there will be a driller.

Drone- The drone will be used to capture good images of DAVIDA 511.

9. Embracing benefits including ointments

BENEFITS :

- ☐ Future development of space as well as of our planet Earth.
- ☐ Simultaneously development of new technological equipments and utilities.
- ☐ Economical growth of a nation.
- ☐ Asteroid mining can be taken as a comprehensive growth of the human mortality.
- ☐ An increased opportunity of employment in forthcoming period.
- ☐ Forever income for human race as the belt of asteroids are vast than one's thinking of mind and will be usable for economical and financial benefits.

There are numerous acquisition of terrene prospecting other of it there are some ointments as well; which is frequent.

OINTMENTS :

- ☐ Asteroid Mining is expensive to an extent.
- ☐ There is involved risk in mining an asteroid.
- ☐ It becomes difficult to find the locus of minerals on asteroid.
- ☐ It is hard to find the proper way to inflict on asteroid and to asset the machineries to unearth the minerals.
- ☐ As the financial benefits in asteroid mining projects are kind of unforeseeable and that will lead to crash of economical value of a nation's

dollars i.e. currency but asteroid mining being an essential portion of future terrestrial life; this ointment will be negligible as it is a succeeding project, so will always be beneficial in forthcoming period.

10. Technical Feasibility Assessment:-

10.1. Functioning of rover:- In our rover there are many things like :-

- Camera.
- There wheels on each side.
- Scanners.
- Transponders.
- HGA (High gained antenna)
- LGA (Low gained antenna)
- Radio active power source.

It will move with the help of help of SUSPENSION SYSTEM with three wheels on each side. In the front side there will be a rotating arm for taking the photo. One more scanner will be there for mineral scanning. The transponder will be there for sending the signals to the miner. This is the work of ROVER.

AKARA ROVERS



[FRONT VIEW OF AKARA ROVER]



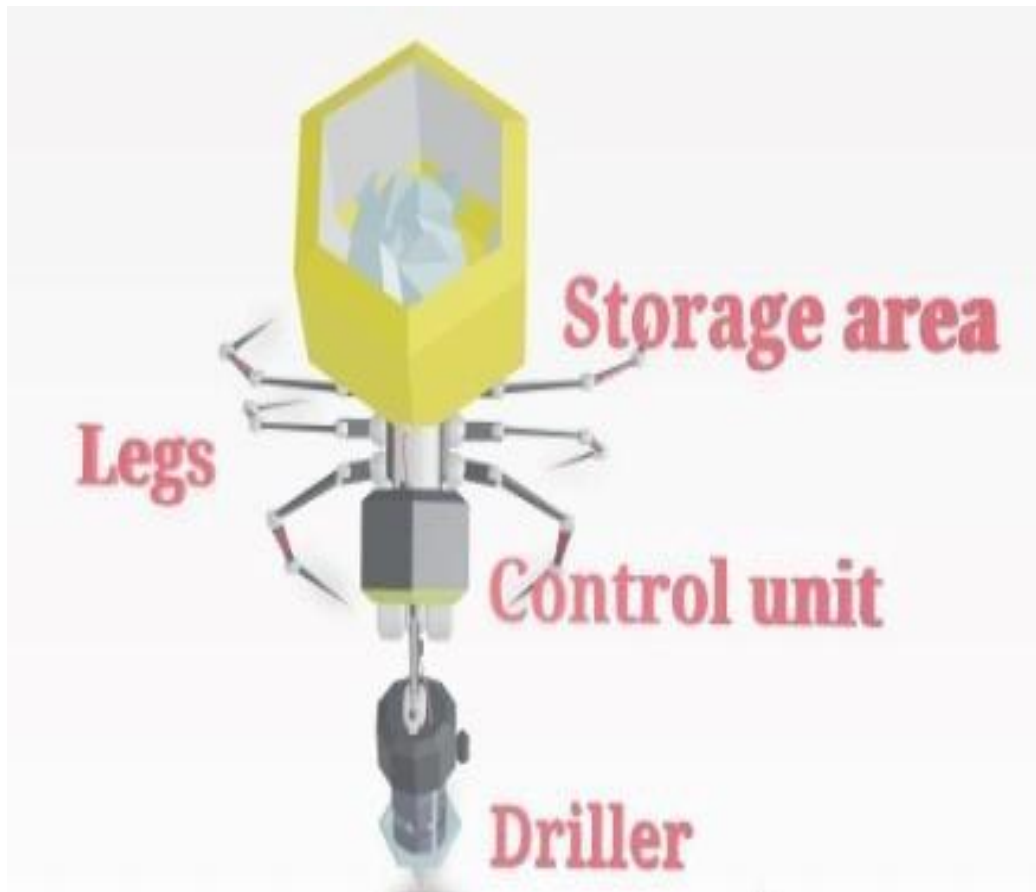
[SIDE VIEW]



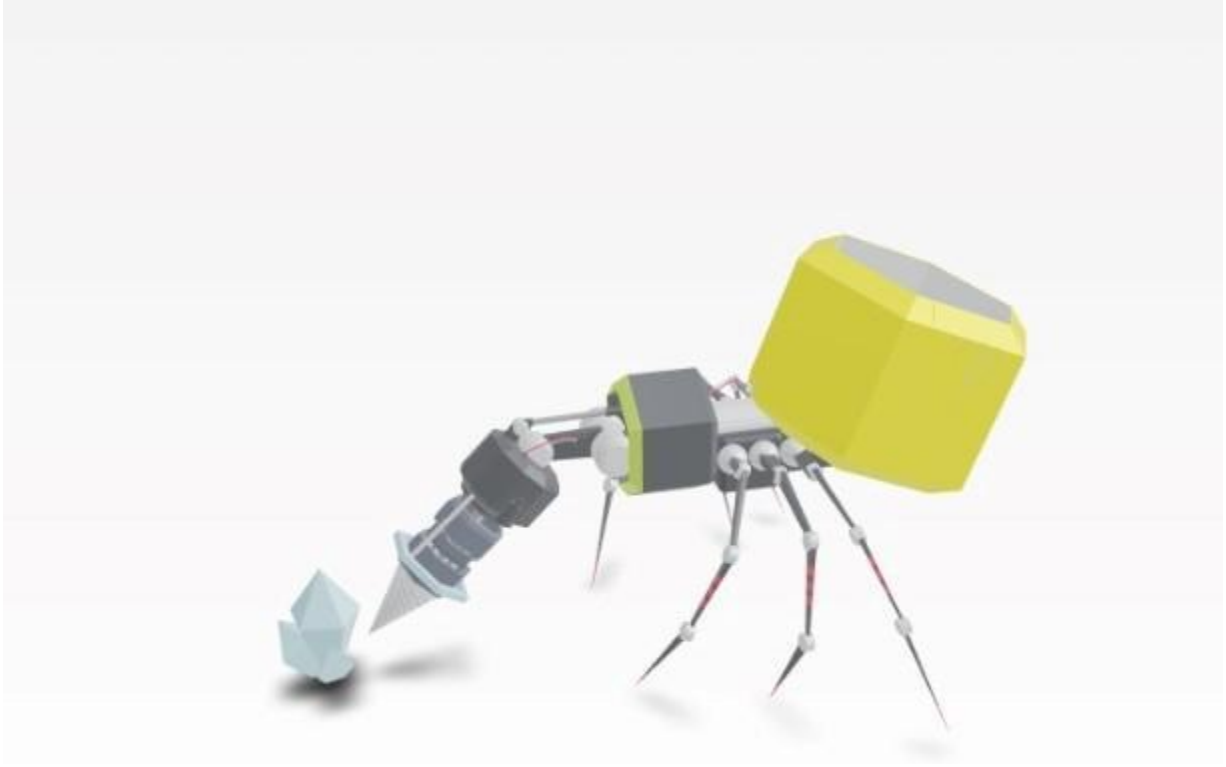
[BACK VIEW]

10.2. Functioning of miner :- In this miner a drill will be there for the mining purpose. While mining whatever the mined mineral is there it will get collected in top of that miner. And that material will too be dust free as the lower section above the drilling portion consists of duster which will be helping in the transfer of materials as the weight of the output material will then be reduced ; which is useful for transportation purposes.

AKARA MINER



[FRONT VIEW OF AKARA MINER]



[SIDE VIEW]

10.3. Functioning of drone :- There will be four landing legs and they will be rotatable. There will be four fans each side. There is a camera fixed in body which will give the signals and show us about where the minerals are actually present.

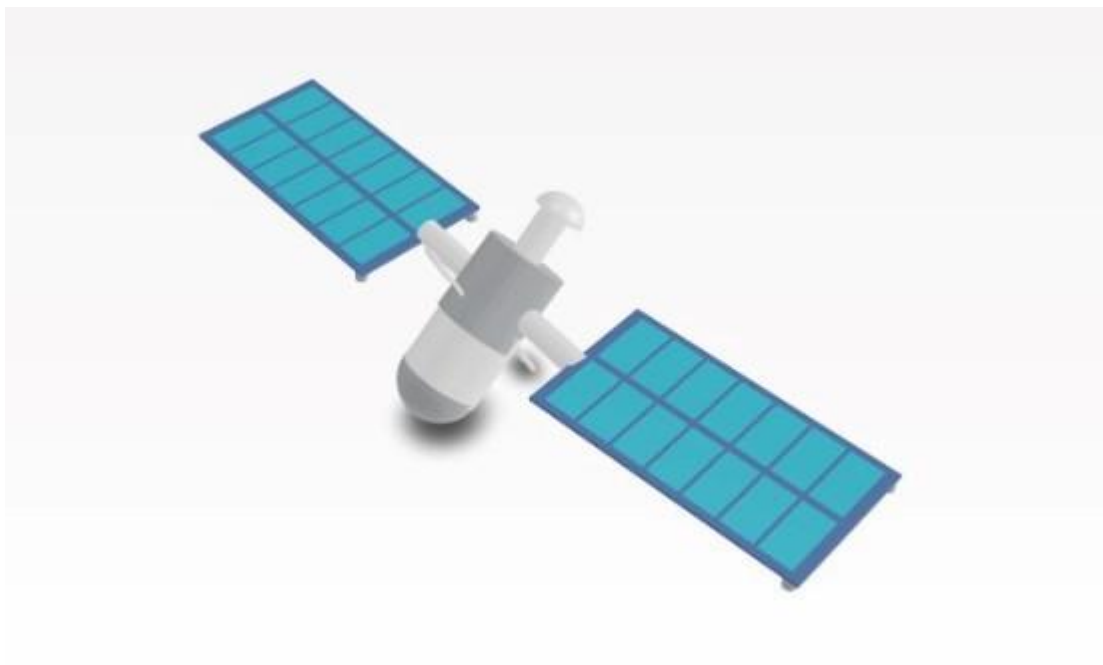
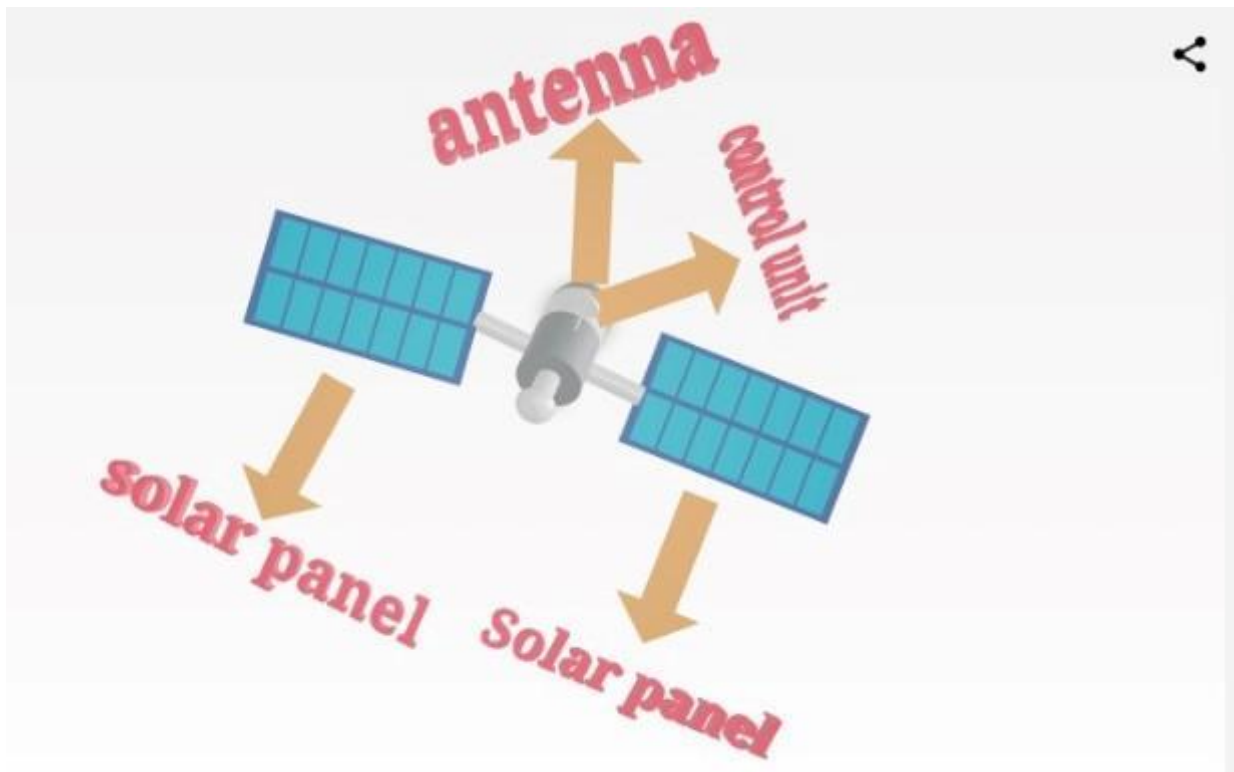
AKARA DRONE



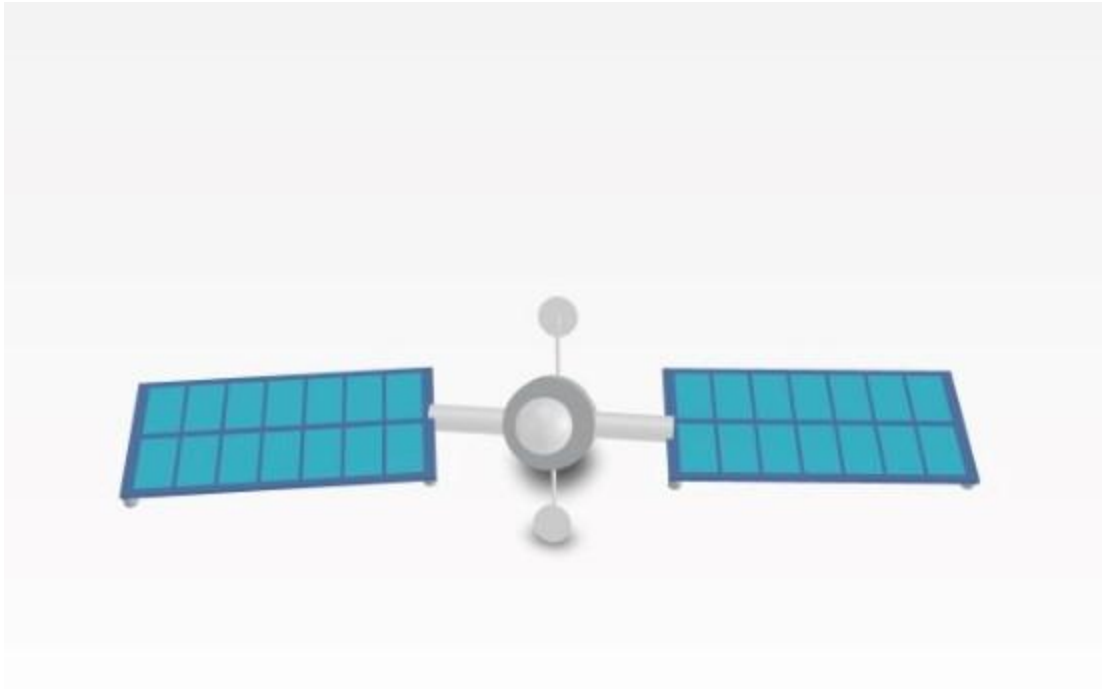
10.4. Satellite functioning :- Satellite is having the function to look after the communication system as we have the protrude to launch our satellite in the orbit of 511 DAVIDA. This will help in the propagation movement of our technical instruments (rovers, drone, etc).

AKARA SATELLITE

[DOWN VIEW]



[UPPER VIEW]



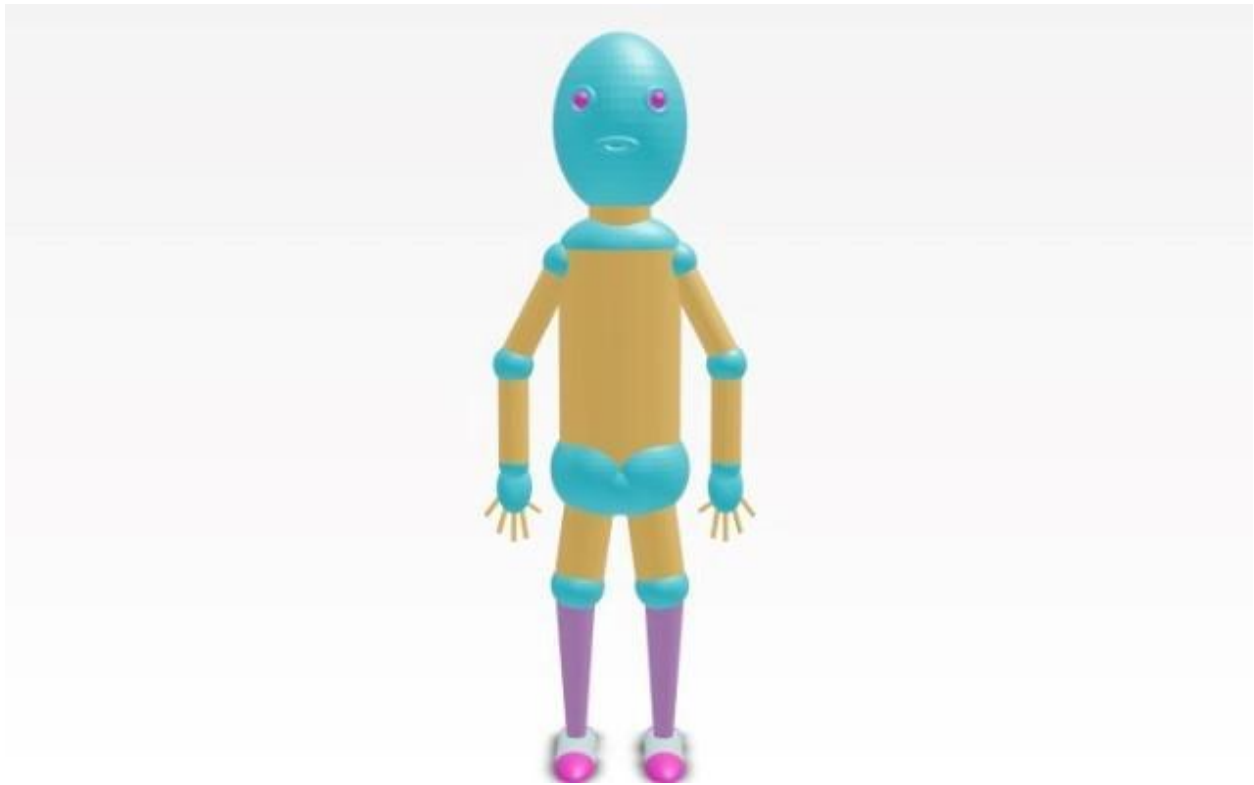
[FRONT VIEW]

10.5. Functioning of Humanoid

A humanoid is a non-human entity with human form or characteristics. We can use a humanoid in our project to check and maintain the rest of the system (rover, miners etc.) and detect any fault (if any), then repair it and to make communication more strong.

The humanoid will be having a large battery for source when 511 DAVIDA will be not facing the sunlight. For the rest when 511 DAVIDA will be in sunlight the humanoid will be having solar panels attached on the back of humanoid.

AKARA HUMANOID



[FRONT VIEW]

11. Technical Challenges and Risk Assessment:

Technical confrontation is a portion for not only of this intend but also of most the projects which are whether of any type. Technical challenges could be of different types as well as for incompatible reasons. There are many issues regarding the designing and the operating of AKARA project.

There were issues also in concluding out for the economical and financial benedictions and ointments for AKARA project. There many provocations for conjecturing out all over the map of our project.

Including the technical glitches this project faced some issues regarding the designing and structuring.

11.1. Technical challenges to address in future work

As asteroid mining is an expensive project; in future there will be expenditure as well as issues regarding finding the asteroids in the belts.

It is supposed to have less technical feasibility issues as it being the technological era will grow simultaneously and will have less mechanical problems and will be consisting of more pros than cons.

12. Key findings and conclusions

We the AKARA team concludes our project showing all the aspects of this project and showing the cons and pros. There will be challenges still remaining as asteroid mining will develop more and get more efficient ever.

Our projects shows how to save the fuel, it shows the process of asteroid mining in a new better way.

There is further more need of specific development of this project and is require to be rectified briefly.

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