***PROJECT***

***Introduction:***

Humans have always been seduced by distance and nothing is less tangible than sky and stars. They were also afraid of it, but now, thanks to science progression they have gone further, trying to learn how universe work and trying to win their own limits going out the solar system. Humans are powered by a challenge against themselves trying to overcome their limits and create new ones, trying to fulfill their curiosity. Space has always been linked to other living entities, the possibility of extraterrestrial creatures isn’t excluded. Humans have always tried to look for new forms of life trying to communicate with them.

Basing our suppositions on recent attempts like Pioneer and Voyager missions we have found out the principal problems to take into account. We have looked for a way to make a possible message comprehensible to every type of entity, supposing the presence of some essential sense, like touch and the perception of tridimensional space. We have also thought about a new kind of propulsion completely innovative and a way to make our message recognizable in the vastness of space like radio waves at different frequencies.

***Propulsion: (Photonic propulsion)***

Our idea was to produce a project based not only on the message to send to the space, but also on the type of mission and the type of launchers. We have decided to use photonic propulsion based on the thrust given by photons emitted by lasers.

This type of propulsion is a new and innovative method that includes recent technologies. In fact lasers are being taken into account in many recent studies. This could be a test in order to try velocities comparable with light speed. It would be a complete new way of propulsion, which is propellant free. More over the materials chosen comes from recent technologies and it would be a proof of their resistance at high temperatures and also through time. It wouldn’t try only the specific part of the sail but also all the parts that link different components.

Thrust is based on the conservation of momentum, in fact even if photons are massless they carry momentum, in this way photons can produce thrust in the same way as matter can.

The system would use many lasers with a power of 10kW each, producing a total power of 100GW. For our purposes it’s enough a total power of 100MW.

In this way we can find the force given to our probe, because F=Power/Light Velocity

F=100\*106W/3\*108=0,33N

Knowing the force given by the lasers, the velocity that our probe needs to reach in order to escape from the solar system we can find out the maximum mass of the probe and the lasers lighting period.

We have estimated also the possible mass of the system, considering the materials of the sail, the hardware and the “message” so the time capsule. In total it would be, more or less, about 2kg.

So, our data are:

* Power: 100MW
* F=0,33N
* Escape velocity: 16,7 km/s=16700m/s
* Mass=2kg

We have considered an escape velocity of 18km/s in order to be sure to reach it.

More over we have considered a uniformly accelerated motion, because we can neglect the thrust lost by the use of the laser and we want to have just an estimation of data.

Considering: a=Δv/Δt

Considering: F=ma

We have: F=m Δv/Δt

Thanks to all the estimations the only remaining variable is time.

Δt= m Δv/F Including all data the result is a time of 120000s, about 33 hours deferred in 5 days.

Just to make sure that this data could be applied to real uses, we have looked the production cost of electrical energy, finding an amount of 100000$, which is very reasonable considering the total prices for space missions.

So, as a final resume:

The complete probe, including the sail would be send to the space thanks to vectors used for other mission, because it would be a waste to use a single vector for a payload of only 2kg. Then, once it is in the space, it is hit by the light array and it starts to be accelerated following the laws explained previously.

***Composition of the project:***

The idea is to create a probe composed of few different parts. The system is composed by a central core in which most of the parts are attached. At the beginning during the launch inside the vector all the sails are closed and they incorporate the capsule that contains the message system. Once they are in the space and come out the vector, the sails are spread out and they start to propel the system thanks to the light arrays. Once the right escape velocity it’s reached, so after 33 hours more or less, they detach thanks to explosive bolts. Now, the only remaining parts are the message plate made in titanium, the communication system (antenna and audio-visual system) and the case in graphene, which has a curved shape, similar to a bullet. We have chosen this shape for the graphene part because it allows the probe to redirect small debris that could be cause of damage of the whole system. Its purpose is mainly defensive. The central core is stuck inside the graphene part, and it has reliefs on it, which are a part of the message, and are used also to show the message contained in the capsule. Inside the “bullet” there is all the system containing the message, which is audiovisual.

More over outside the capsule there will be solar panels that have the job to store solar energy. Then an antenna is connected to the solar panels and it sends radio waves in order to make the system recognizable. In fact if the probe get closer to a star, the energy increases and so the frequency of the waves, improving the recovery possibilities of the probe because all these changes could be recognized.

The probe is provided also of an internal storage connected to the audiovisual device to hold hundreds of terabytes of data. The whole hardware is put in vacuum to prevent minor damages such as chemical or magnetic ones.

***Materials:***

Our system is composed basically of 3 principal materials.

The sail is made in nanotubular carbon because it is resistant to high temperatures, impacts and it’s lightweight. The remaining central core of the probe, after the detachment of sails is in Titanium. It has be chosen for the resistance to high temperatures, but also because it is malleable, allowing reliefs on it.

Then the case is made of graphene, another material resistant to high temperatures and lightweight. Graphen protects also from magnetic radiation.

***Launch period***

In order to try to avoid gravitational interferences made by Jupiter and Mars, and also the Trojan asteroids and Hilda asteroids family we have to choose the right launch period.

***Message***

The main idea is to give basic information to explain humanity.

Audiovisual system will give explanations about:

* Instructions to start the system
* Earth position
* Atmosphere’s chemical components
* Decimal system
* Unit of measure
* Art and music related to historical periods
* Information about humans’ daily life

***References***

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