**Idea:**

Replacement of copper cables, connectors and penetrations in spacecraft for weight release.

The use of graphene is the material chosen for the following reasons:

• High thermal conductivity.

• High electrical conductivity.

• High elasticity (deformable).

• High hardness (resistance to being scratched).

• High resistance. Graphene is approximately 200 times stronger than steel, similar to diamond resistance, but is much lighter.

• It is more flexible than carbon fiber but just as light.

• Ionizing radiation does not affect you.

• It has a low Joule effect (heating when conducting electrons).

• For the same task, graphene consumes less electricity than silicon.

• A resistance 200 times higher than steel has been measured.

• Its density is barely 2.26g / cm3 (even lighter than aluminum).

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**Features:**

For this case we decided to take as reference the Space Shuttle that stopped working in 2011. They had 370 km of internal cables, which represented approximately 4,500 kg. With graphene this would be reduced to just 1,140kg.

Representative 3.36tn of weight release, available for activation in payload.

This is achieved by making "gutters" on the walls of the spaceships, with an insulator inside, there are the cables, and then seal them with another insulator above. Being as a result a cable anchored within the walls, but perfectly functional towards all the devices of the ship.

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**Problems**

The main problem encountered so far is the cost. In our investigation we found that we have managed to produce graphene in an order close to usd $ 30 / kg. Although it is far from usd $ 5.7 / kg of copper. We take as a reference that the price could be around $ 24 / kg within the next 5 years.

Taking as reference the previous data, and a cost of launching to the space of approximately usd $ 1,500 per kg. The 3,360kg would mean a savings of usd $ 4,950,000. Or in a complementary perspective, it could be 3.36tn of extra payload to be launched.

In turn, the cost of graphene, for the same 370km of wiring, same of usd $ 27,336,000, against about $ 6,730,500 with copper.

Therefore, if we divide the cost of graphene, on the savings produced in payload thanks to the release of weight, and thanks to the reuse of rockets that is currently done, in just 6 flights the expense was saved.

All this without considering the space and weight that will be released by not using supports or connectors for the structure.

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**Validation**

We seek to find the difference in thickness and weight in a graphene cable, with respect to one of copper, so that both transmit the same amount of electric current.

First as an important fact we have the diameter of the copper of 25 mm = 0.025 m and the length of the cable that is for the two equals is 370 km = 370000 m

Then look for the relationship between length and diameter.

With the diameter we take out the radio, with the radio we have the cross-sectional area of ​​the cable (different for each wire)

A = 𝞹. r2 being r = ⌀2

replacing r in the Area equation we get:

A = 𝞹4.⌀2

The resistance of a conductor cable is proportional to its length and inversely proportional to its cross-sectional area.

R = ρ LA

where ρ is a constant of proportionality called resistivity of the conductive material.

ρgrafeno = 1.00 ｘ10-8 (ᘯ.m)

ρcobre = 1.71 ｘ10-8 (ᘯ.m)

The resistance for copper and graphene is supposed to be the same, that is, its functionality must remain the same even if the cable thickness changes.

Rg = Rc

ρg⌀g2 = ρc⌀c2

⌀𝘨 = ρgρc.⌀c

⌀c = 0.025m

⌀𝘨 = 0.01911m

Vc = Ac. L = 181.62 m3

Vg = Ag. L = 106.12m3

We conclude that with graphene cables we obtained approximately a volume reduction of 75,497m3.

and since I'm leaving you the weight

graphene density = 2260 kg / m3

copper density = 8960 Kg / m3

weight = density Volume 9.8 N / Kg

graphene weight = 2,3504 .106N

copper weight = 15,947 .106N

Mass = density Volume and gives in Kg

check the weight difference, a difference of 13,596,106Kg