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PULSAR KINETIC IMPACT TECHNOLOGIES & DESIGN

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Why "*PULSAR"*?

The *Pulsar* kinetic Impact technology (Pulsar, 2025), would allow humanity to literally sleep through the menace of a comet or asteroid which posed a threat to Earth. The Pulsar motor is designed to harness nuclear plasma technologies through a Direct Fusion Drive (DFD). The DFD is a revolutionary steady state fusion propulsion concept, based on a compact fusion reactor. It will provide power of the order of units of MW, providing both thrust of the order of 10−101N with specific impulses between 10,000 – 15,000 seconds and auxiliary power to the space system *(https://pulsarfusion.com/products-development/sunbird-fusion-propulsion/, Wikipedia (2025, https://en.m.wikipedia.org/wiki/Pulsar_Fusion).*

If in any event a near earth object, whether an asteroid, comet, were to pose a potential risk to life on Earth, one of the most important key factors to survival is mitigation. With mitigation comes response, and with that response comes speed, how fast can we arrive to the object to mitigate the threat to life on Earth. That's where *Pulsar* comes in. With *Pulsar* you can travel at 800.000 km per hour *(Wikipedia (2025, https://en.m.wikipedia.org/wiki/Pulsar_Fusion)*.

Let me explain what this means with an example. Planet Jupiter is 833,79 million km away from Earth. In a hypothetical scenario, an asteroid with aphelion at the Jupiter distance is heading for Earth. By coincidence, the planet Earth is at the closest point to Jupiter. Using the most advanced rocket traveling at a speed of roughly 35420 km per hour, the mitigation would take 980 days to reach the asteroid at its current location. And 490 days if the asteroid were traveling at the same speed towards the Earth, approximately.

However, when we introduce the *Pulsar* DFD rocket speed into the equation, the mitigation time would be 43 days, and that's all the way to the location of the object near Jupiter. That's an amazing 2279% faster than any rocket used currently.

The question is then, why is mitigation so important? Let's say that we need more than one attempt to mitigate the object, either due to the failure of the first attempt, or because the first attempt did not deflect the object enough for it to completely avoid the collision with Earth. Since the asteroid is moving slowly near its aphelion, many more attempts. The 2279% faster speed is not an assumption, it is a real option.

Seconding the mitigation speed, is the effect of the chosen mitigation technique. Let's first assume that we are using the *Hyper Velocity Impact Vehicle*, HVIV, that has an impactor on the top, which detaches from the main body of the impactor and impacts the object creating a crater. This will be followed by the main body loaded with a nuclear bomb, which then enters the crater and detonates inside it. Once again, using this method we can deliver much more nuclear power to mitigate the object, considering that we would have so many more attempts.

So, let's assume that the first attempt contains 350 million mega tons of power, and that we could launch 12 attempts. Then we could have launched a total of 4.2 gigatons of nuclear power. That's far more than what would be possible with a conventional rocket.

Now let's look at the real meat and potatoes of mitigation, *Kinetic Impact Technologies.* The system must be designed to eliminate the high risk of accidental nuclear detonation on the launch pad. If the kinetic impactor is designed correctly, it would be capable of an impact hammer function. This function acts like an additional amount of impact force after the initial impact. The design is like a cylinder with a free-floating ring, very thick and most likely over 150,000 pounds. The main cylinder is made up of multiple pieces, if need be, with a total weight between 300,000-650,000 pounds (135000 to 29250 kg). And the tip or nose of the cylinder would be designed like the nose of a Boeing 747. On impact the nose allows for the complete transfer of energy into the object and then the cylinder impacts the back side of the nose adding between 25-40% more impact power. This design allows for greater impact with less launch payload.

Now let's get into the math of a paper published by NASA (NASA, 2025). The paper proposes the following problem: *"Suppose a cylindrical asteroid 10 km in height x 10 km in diameter impacted the earth at 30,000 mph. Calculate the energy dissipated, in megatons of TNT".* The Solution is as follows:

Let the density of the asteroid, ρ, be five times the density of water, i.e., ρ = 5000 kg/m^3. Then, the mass of the asteroid is (5000 kg/m^3) x π (5000 m)^2 x (10,000 m) = 4 x 10^{15} kg and the kinetic energy, traveling at 30,000 mph (= 1.3411 x 10^4 m/sec) is (1/2) x (4 x 10^{15} kg) x (1.3411 x 10^4 m/sec)^2 = 3.529 x 10^{23} joule. Now, one megaton of TNT delivers 4.2 x 10^{15} joule, so that the required energy in megatons of TNT is 8.434 x 10^7 megatons or around 84 million megatons.

We can measure this quantity in units of Hiroshimas, where 1 Hiro = 15000 Tons of TNT. Then equivalent energy would be = 8.434 x 10^7 Hiros *("Next Asteroid Impact". Amazon.com).*

Here we will replace the instance in the NASA paper with our kinetic impactor hitting the same Asteroid that would have killed the dinosaur's. Using the dimensions of the Asteroid from the NASA paper to determine the amount of energy released in megatons from a collision between two objects, traveling towards each other in space. We use the kinetic energy formula (KE) of an object given by $E = \frac{1}{2}mv^2$. In this scenario, we have two objects, (a) an iron block weighing 650,000 pounds traveling at 500,000 mph, and (b) the asteroid mentioned in the NASA paper with a mass of 4×10^{15} kg traveling at 30,000 mph. We convert all units to IS units (kg and m/s) to ensure consistency in our calculations.

Step 1: The mass of the iron block in kilograms is 650,000 lbs. × 0.453592 kg/lb. = 294,838.5 kg. The velocity is converted from miles per hour (mph) to meters per second (m/s). For the iron block the calculation is: 500,000 mph × 0.44704 m/s/mph = 223,693.6 m/s, and for the asteroid is 30,000 mph × 0.44704 m/s/mph = 13,411.2 m/s.

To calculate the kinetic energy for both objects using their respective masses and velocities we will assume that the collision is frontal. In that way the two velocities add up and the total kinetic energy is KE = (1/2) (m1+m2) $(v1+v2)^2$.

The result is KE = 9.99×10^{25} Joules. The KE of the asteroid dominates however the effect of the force from the massive release of energy completely diverts the asteroid from its path to impact the Earth. One megaton is 4×10^{15}. Thus, the KE in megatons is 2.5×10^{10} megatons = 2.5×10^{7} Kilo-Tons = 1667 Hiros.

Now we can see why kinetic impact technologies are far greater than the high risk of nuclear weapons. And clearly yield much, much higher impact energies. Even if all the countries in the world combined in an effort to build the largest nuclear bomb(s) ever built, we still would not reach that level of power. And clearly with a single *PULSAR* launch we would not only mitigate the object but would eliminate any potential threat entirely. And this calculation was conducted using 650,000 pounds. When using smaller weight between 500-1000 lbs. we still get astronomical results that essentially would when struck several times deflect a planet killer asteroid.

We have already seen the results of kinetic impact technologies in the "DART" mission which demonstrated that just a small space craft weighing a little more than 1300 lbs. can offset the orbit of a small moon. And now we have the *PULSAR* fusion rocket which is setting on the horizon. This technique yields more power than a nuclear weapon. Thus satisfying the "Two Punch Defense" recommended by Iowa State Universities Bong Wie *"https://www.news.iastate.edu/news/iowa-state-engineers-developing-ideas-technologies-save-earth asteroids#:~:text=A%20two%2Dpunch%20defense,would%20blast%20the%20asteroid%20apart".*

Now is the time to make the upgrade to our capabilities, not just as a scientific community but as the people of the world, to protect the future of humanity against any potential unknown future threat that could possibly destroy all life on Earth. It's not just about our generation, it's also about the generations to come.