DIRECTING ENERGY V/S PGM –A CHEAPER APPROACH TO DESTROY STRATEGIC TARGETS

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All over the world, military planners have been using a large number of weapons to destroy a particular strategic target. To blow a bridge of some length, the number of missiles/rockets/ bombs are calculated and based on these figures the number of fighters which would deliver them is calculated. The number of fighters in turn helps to calculate the escorts, the photo recce and other aircraft in the formation. Overall, it is a huge effort which is required just to destroy a strategic target across the border.

Instead of counting the number of weapons required to destroy a target, have we ever thought in terms of the energy required to destroy a target based on its material composition? Let's elaborate this further. Every target is made of some material. As per elementary physics, every material has a density, melting point, vaporisation point, Heat capacity, Heat of fusion and Heat of vaporisation. If we analyse these thermal properties as per the chart given below, we can calculate the amount of heat required for either melting or vaporizing a particular target made out of any of these materials.

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Material	Density(gm/cm^3)	Melting Point (^{0}C)	Vaporization (^{0}C)	Heat capacity (J/gm^{0}C)	Heat Of Fusion (J/gm)	Heat of Vaporization (J/gm)
Aluminium	2.7	660	2500	0.9	400	11000
Copper	8.96	1100	2600	0.38	210	4700
Magnesium	1.74	650	1100	1.0	370	5300
Iron	7.0	1500	3000	0.46	250	6300
Titanium	4.5	1700	37000	0.52	320	8500

Let us clarify this point by taking an example. Assume that we have to destroy a bridge in enemy territory, made of aluminium struts and pillars. To melt the aluminium, the energy required is given by a simple relationship i.e. $E=m\,C(T_m-T_i)$, where E is the energy required, m is the mass of the object ,C is the Heat capacity and T_m And T_i are the melting temperature and initial temperature(taken to be close to the ambient temperature) respectively. To melt a strut of the bridge weighing say a ton (1000kg), 13kg of ATF is sufficient. The same effect can be achieved perhaps even more efficiently with a burst of High Energy Laser with Fluence value of 10^4 from an invisible source. Various methods to deliver these can be explored separately. The objective here is to deliver the measured energy so that the target can be destroyed. Instead of using a formation package of numerous aircrafts, if a single prepositioned source can deliver this energy, it will definitely prove to be more cost effective. The air effort thus rendered surplus (notionally) can then be deployed for some other role.

The point which needs to be emphasised here, is that if we start calculating the required energy to destroy a target rather than the number of rockets /missiles, it will prove to be more economical. The use of kinetic energy weapons proves to be inefficient as far as the ratio between energy dissipated to damage of target is concerned. On the other hand, a precisely directed energy to a small specific area in a pre-calculated quantity will create more effective results. The future of weapon technology is justified in pursuing the development of directed energy weapons for this reason, the world over. The initial cost of development for such a system is high but because of the enormous advantage that it will offer in future, this cost is thoroughly justified.

For the sake of convenience let us assume the mass of the bridge to be 1 ton (1000 kg or 1000000 gm), the melting temperature of Aluminium is 660.3 ^{0}C and ambient temperature is 28 ^{0}C. The heat required to melt it will be 568800000 Joules. The specific heat capacity of ATF is 42.8 X 10^6 Joule / kg. The amount ATF required to melt the Structure of the bridge will be 13.28 Kg (568.8X 10^6/42.8 X10^6) only.

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