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LS-Principles of OME ACDA 5010

Page 1 of 9

SECTION A

1 Combustion - Release of energy, Relatively slow less than 400 mm/s minimal pressure change, Propagates through Thermal Conductivity + Permeating hot gasses

Deflagration - fast release of energy with similar mechanisms to combustion but greater than 400 mm/s and less than 2000 mm/s high gas + flame output with noticeable pressure change

Detonation - very fast release of energy propagated by supersonic shockwave greater than 2000 mm/s high pressure output

2. Transition mechanism of Deflagration to detonation

Explosive in path of Deflagration Combustion zone becomes compressed by thermal expansion pressure wave builds in front of combustion zone and initiates Explosive as a shock front

Jordan Timberlake 1810310

L5- Principles of OME ACDA 5010

Page 2 of 9

3 Design changes that alter the effect of munition

Casing - Casing Geometry can alter munition output i.e. Thickness thinner case will provide greater Blast effect or machined thicker case may produce natural or Prescribed Fragmentation

- casing material will alter output i.e. more Ductile will Provide larger fragments

Explosive - Quantity higher Amount of explosive in a relative munition size will provide greater Blast characteristics

- Brisance (shattering effect) a higher Brisance explosive will aid in Disrupting the case to provide either more significant shockfront with a thinwalled casing or higher fragment Velocity to a machined or thicker casing

Jordan Timberlake 1810310

L5 - Principles of OME ACDA5010

Page 3 of 9

- 4 Primary explosives have a lower activation energy and output of energy, generally used as an initiator for larger mass of Secondary type explosive.

Secondary Explosives generally provide the main output of a munition they are harder to initiate having higher Activation Energy but have a larger amount of explosive power and a greater Power index.

Where a primary explosive output does not meet the input 'Activation' energy of a secondary explosive a Booster type explosive will be implemented to bridge the gap and give a smooth Detonation Path.

- 5 Propellant grains sometimes will be perforated with additional holes; this is to allow better propagation through hot gas permeation given that the surface area is increased meaning that thermal conductivity is spread over a larger area creating a faster reaction rate.

Jordan Timberlake 1810310

LS Principles of OME ACDA5010

Page 4 of 9

- 6 Particle Sizing in A pyrotechnic mixture will mean that the propagation rate of Reaction will change: Smaller particles will likely result in a faster Burn Rate this is due to thermal Conductivity over a larger surface Area meaning hot permeating Gasses will be able to Proliferate through the Composition more easily AND the smaller Particle will be Consumed faster. The larger Particle may initiate but will take longer to be fully Consumed.

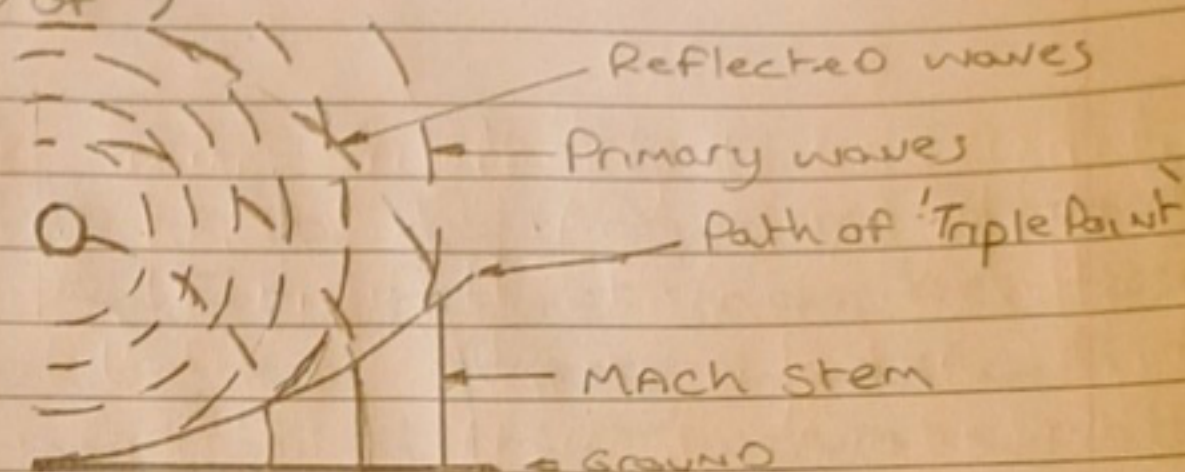
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L5-Principles of ONE ACDA 5010

Page 5 of 9

Section B

1



When Detonating a Blast type warhead IN AIR there are some Behaviors that can be observed when the height of Burst is greater than $10m \cdot kg^{-3}$

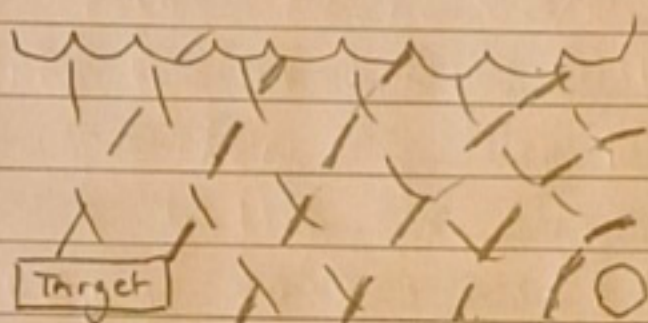
Primary waves are formed and are Reflected off the ground, these Reflected waves Propagate upwards and start to converge with the Primary waves due to conservation of energy the waves Energy combines to create a higher force being projected outward this is known as the path of Triple Point wherein Primary, Reflected and Mach stem waves can route their origin. The elevating path of Triple Point is moving faster than the Primary + Reflected waves creating an Almost 'flat' wave front intended to impact the Target this is a phenomena called the Mach stem

Jordan Timberlake 1810310
L5-Principles of OME ACDA 5010
Page 6 of 9

Section B

1
continued

following a Sub Aquatic Detonation a similar process can be observed wherein the primary waves will reflect outward until the waters surface is hit then additional reflected waves will propagate toward the target



In Addition to this the Resultant Gas Bubble will be compressed by the surrounding water until it over compresses then will expand, over expand and start to compress. this oscillation will continue until the Bubble Breaches the surface. it is this effect that causes the damage to the Target its Pressurised structure is fatigued until a Rupture or tear is formed and the Target rendered inoperable.

Jordan Timberlake 1810310
L5-Principles of ONE ACDA5010
Page 7 of 9

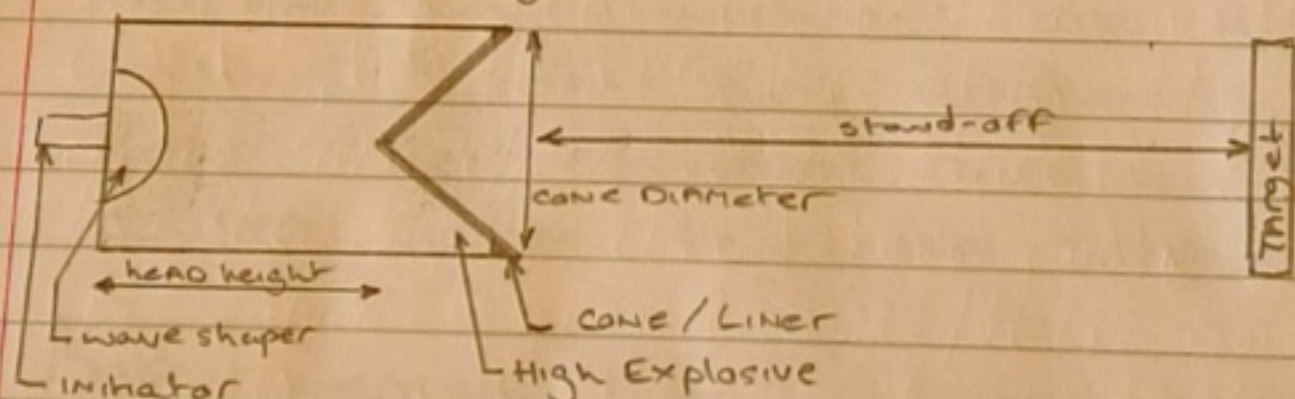
Section B

1
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Blast / Fragmentation warheads detonated in Air have many Advantages such as they are omnidirectional, cheap and simple to create (Relatively) and internally are very effective. However, the omnidirectional Blast could be seen as a disadvantage
1) Collateral Risk is high or perhaps wasteful + inefficient use of energy. The main disadvantage of Blast / Fragmentation warheads is their constrained by Proximity to the Target + Altitude can effect their operation due to density of the air.

2 Directed Energy Warheads

Shaped charge



The shaped charge must be initiated at a stand-off from its target to allow time for a jet to be formed. the jet is explosively accelerated molten metal intended to cause deep penetration into

Jordan Timberlake 1810310
LS - Principles of ONE ACDA 5010
Page 8 of 9

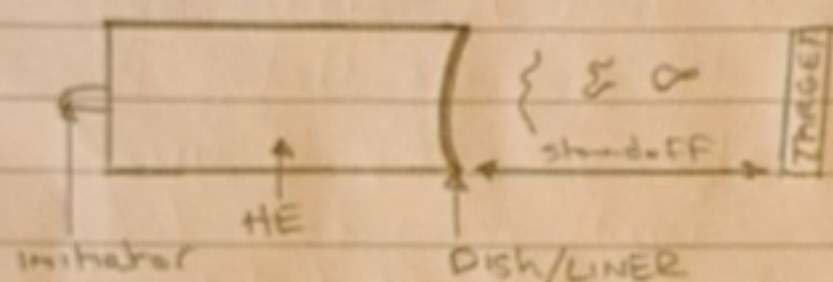
Section B

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Armour + Significant Damage to other Targets
standoff is Relative to the size and shape
of the round and the molten Jet will be
consumed by erosion of the Target Material

Explosively Formed Projectile (EFP)



An EFP works in a similar fashion to a shaped charge in that it uses Explosive force to launch metal at a target. again it relies on an Adequate standoff to enable formation of the Projectile in its optimum shape

Directed Energy warheads are a complex weapons system. Both mentioned here will require Tight engineering tolerances + complex delivery systems to enable correct function

Both require Axially Initiated, Uniform density / composite charges to impact a Symmetrical Liner (Cone or Dish) both are Negatively affected by Rotation and have A range of operation for the warhead to deliver the desired

Jordan Timberlake 1810310
L5 Principles of OME ACDA 5010
Page 9 of 9

Section B

2
Continued

effect. If Detonation occurs out of the maximum standoff in the case of the shaped charge the Jet will no longer be in the Right form with sufficient energy to penetrate as designed & with the EFP it will still work But Likely lose too much energy to deliver its Required effect.

If Axial Initiation or homogeneous Filling is not achieved this could mean Propagation of A Skewed or malformed Jet or Projectile. In some cases either effect may not be formed At all Resulting in Fragmentation