

George Goddard 1810319

Section A

- 1 Combustion is when something burns with a great change in pressure. Deflagration is a rapid combustion with release of flames and hot gases. Detonation propagates rapidly by means of a shock wave through the material.
High explosive detonation is where the wave is supersonic.
- 2 If an explosive is burning and the rate of propagation accelerates to the speed of sound in the material it will become a detonation. This is the deflagration to detonation transition.

George Goddard 1810319

Section A

- 3 Design Changes that can affect the effectiveness of an artillery Shell are:
- Explosive fill, the explosive used can be changed for a more/less powerful explosive depending on the desired effect.
 - Case material - the case can be manufactured from different materials, a ductile material or a brittle material would give different effects.
 - The case can be scored to cause the case to fragment into pre cut fragments. ~~the~~ A profiled liner can also be used to encourage fragmentation.

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Section A

- 4 Primary explosives are very sensitive and only require a small amount of energy to initiate them. An example of a primary explosive is Lead azide or Lead styphnate.

Secondary explosives are less sensitive than primary explosives. They require more energy to initiate them and are therefore safer. Because of their safety properties they are used as main fill explosives. TNT and RDX are examples of secondary explosives.

A booster is used in an initiation chain to detonate the secondary explosive. Where the booster is a primary explosive it is easily initiated which sets off the secondary explosive.

George Goddard 1810319

Section A

5 The addition of holes to propellant grains increases the surface area. This increased surface area increases the burning rate. The surface area will increase as the propellant burns. The rate of gas production decreases slower therefore giving a longer burn.

6 If larger particles of fuel are used they will have a small surface area, and be of a lower power than smaller particles. If smaller particles are used they will produce a greater effect as they will have a larger surface area.

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Figure 1

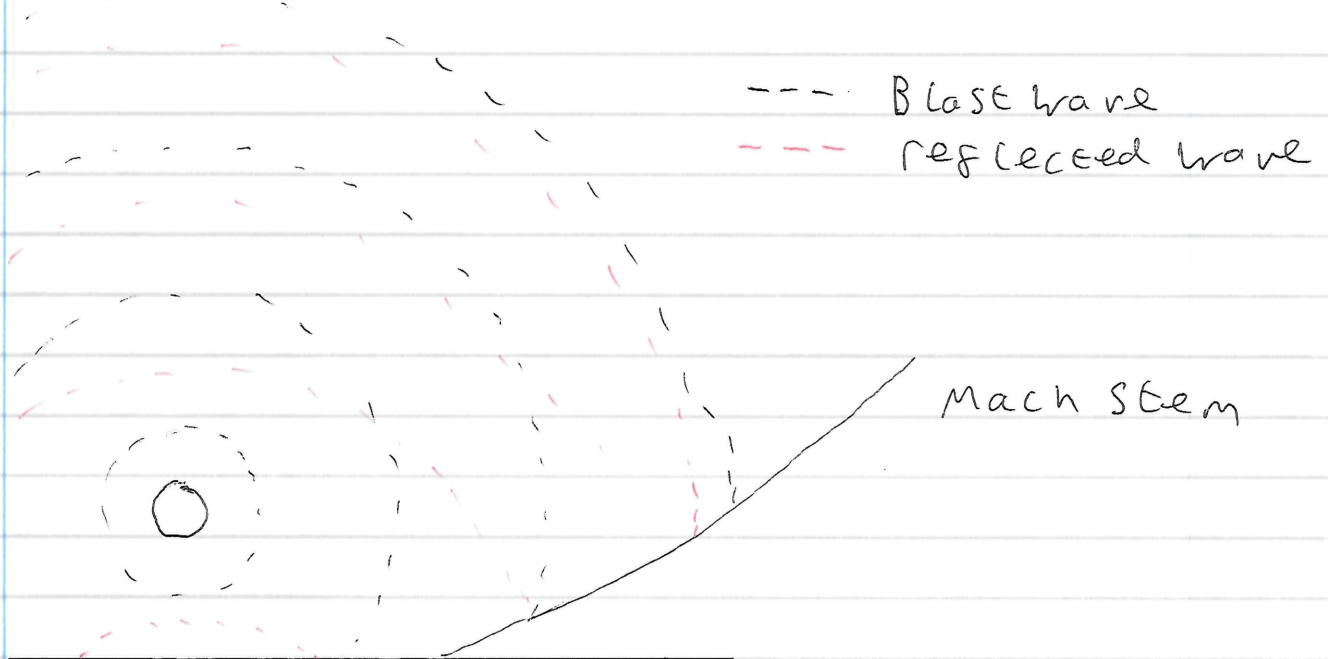
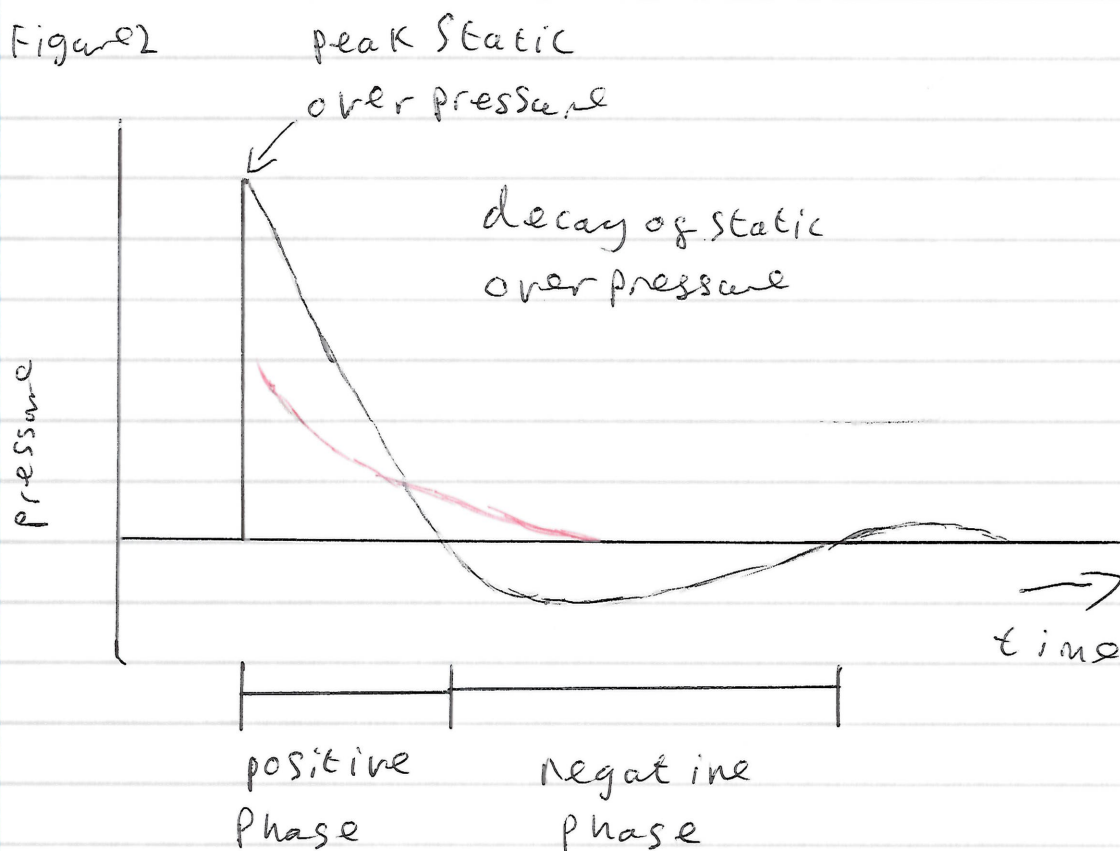


Figure 2



— Dynamic pressure
— Static over pressure

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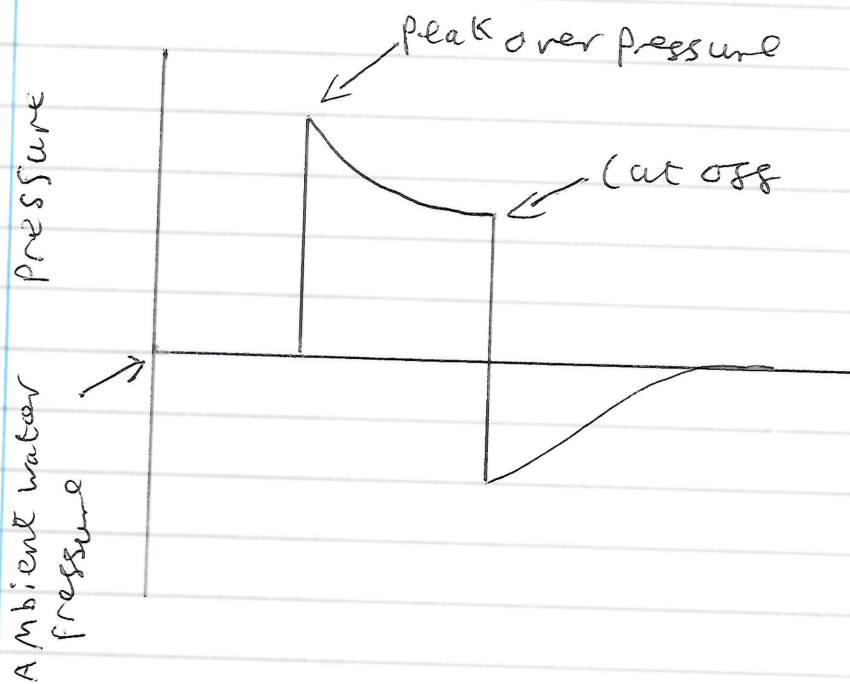
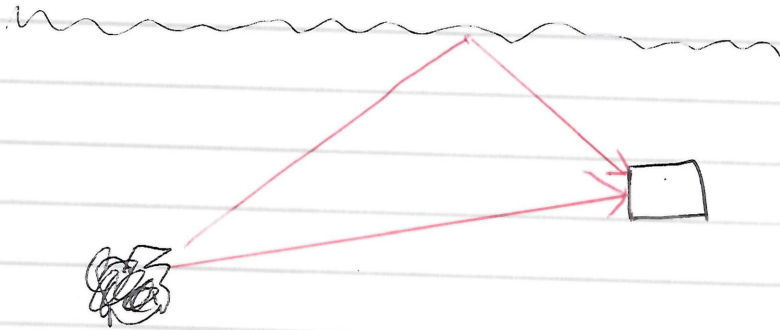
Section B

Figure 1 Shows a blast war head detonating above ground in air. It Shows the initial blast waves and the ~~the~~ reflected wave that has reflected off the ground. The Mach Stem is shown as a black line. The Mach Stem wave is twice as powerful as the initial blast wave. This is because the reflected waves are travelling faster than the initial blast wave. The reflected and blast waves merge to form the Mach stem.

Figure 2 shows the Dynamic and Static over pressure. Peak static over pressure is at detonation, with the pressure decaying. The negative ~~ture~~ phase is where the ambient pressure drops below zero.

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Section B

Figure 3



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Section B

1 Figure 3 shows the effect on an underwater target. The initial base wave will travel and hit the target. The target will then be struck a second time by the reflected wave. The reflected wave will have reached the surface and reflected back down towards the target. A gaseous bubble will expand and contract, oscillating for several cycles.

Blaze/fragmentation warheads - advantages

- good against soft targets
- cheap to manufacture
- omnidirectional - effective in confined spaces

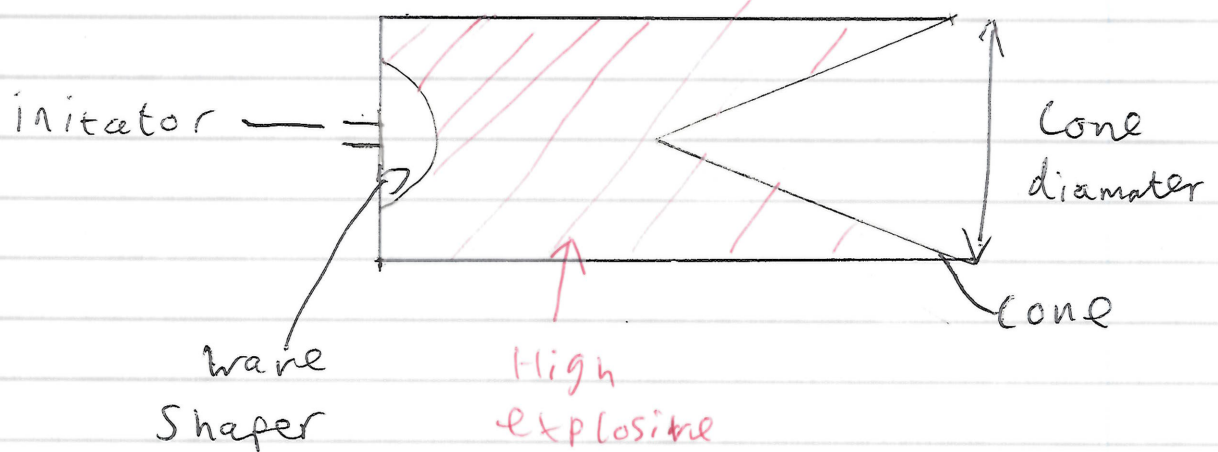
Disadvantages -

- sensitive to distance and altitude
- increased collateral damage
- wasteful; omnidirectional not effective in large open areas.

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Section B

2 Shaped Charge

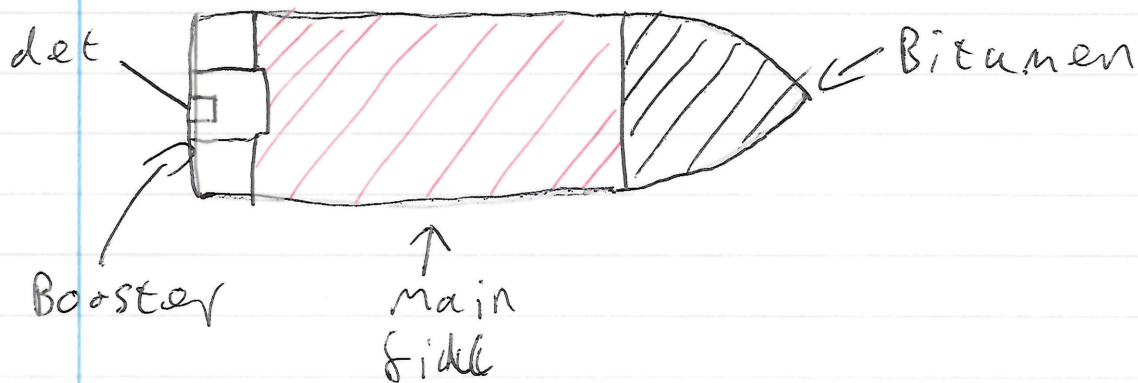


Shaped Charges are used to penetrate armour and other targets. They work by forming a jet that penetrates the target. The jet is formed by the high explosive behind the cone detonating with a flat wave that squirts the cone out. The charge must detonate a specified distance from the target to allow the jet to form. This is typically 2-6 cone diameters from the target. If this distance is not correct the jet won't form. The charge must not be rotating when it detonates. The HE fill must be uniform in density and composition.

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Section B

2 High explosive Squash head HESH



HESH rounds are designed to squash onto the target before detonation. The shock wave is transmitted into the target causing spalling on the inside of the target. The bitumen is used to cushion the round and absorb the initial impact allowing the HE to squash before detonation. The case must be strong enough to survive launch but ductile enough to control the squash of the explosive on impact. The fill needs to be insensitive to the initial squash therefore RDX/wax is a good fill. The explosive fill must be uniform with no gaps.

