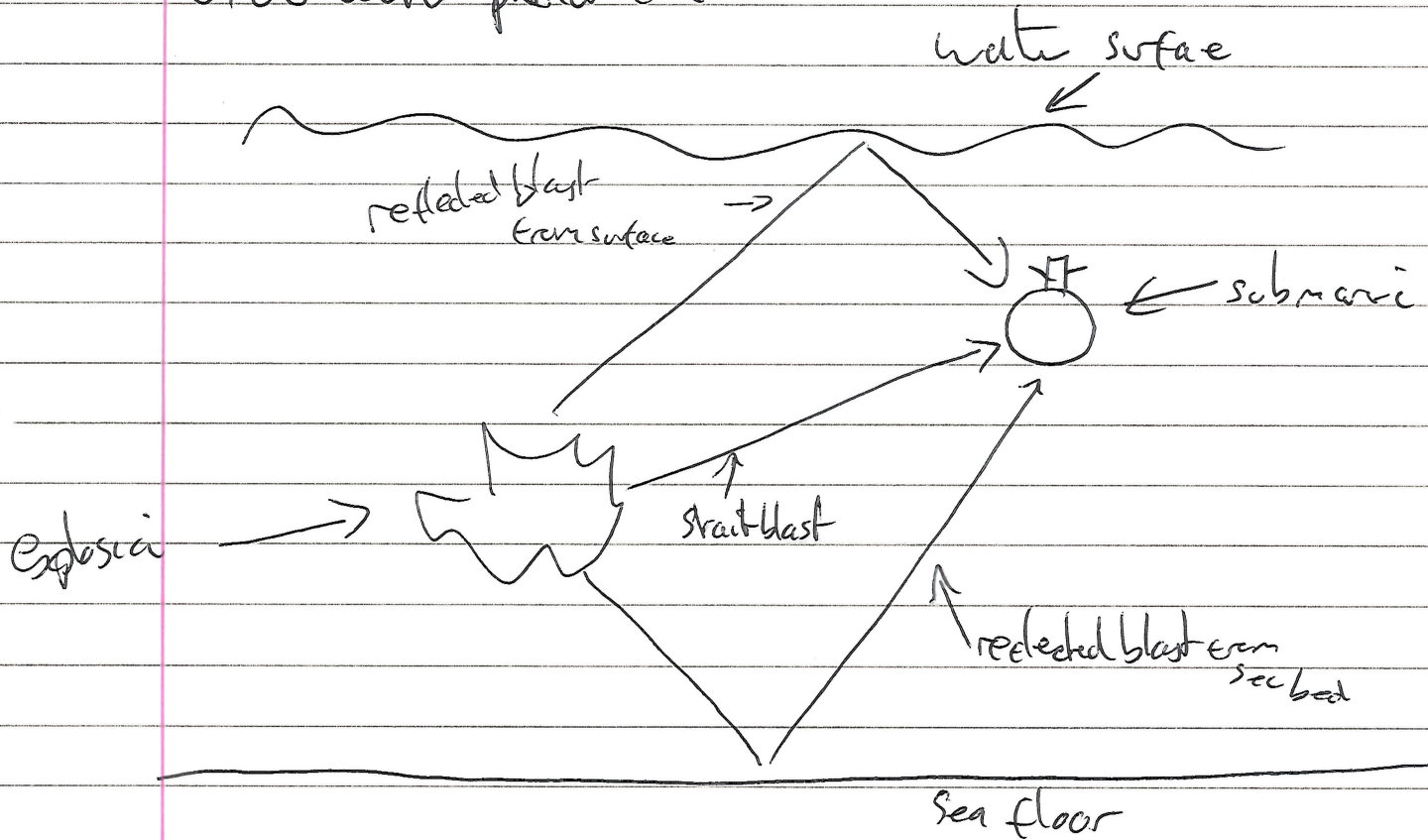
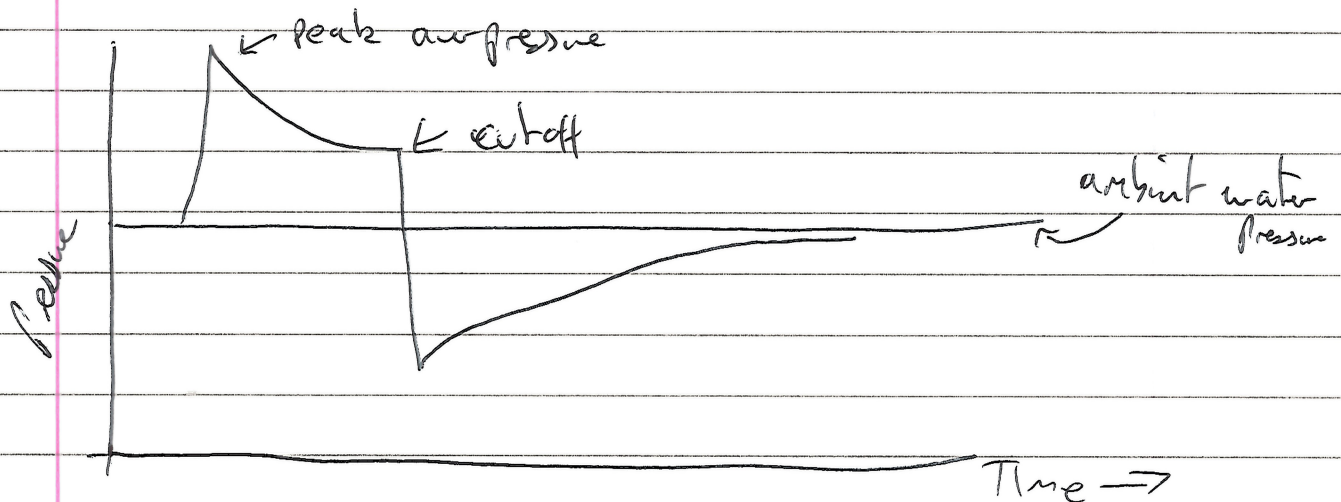


B1

Underwater phenomena



A submarine shallow in water can be hit by 3 blast waves if a munition functions, direct blast and also reflected blast from the surface and from the sea bed



B1 The other phenomena is the bubble. Water is not very compressive. As the gases from the explosion go outward, they are held by the water creating a bubble. The bubble expands until the force of the water is great, then the bubble contracts. The oscillation of expansion and contraction continues until the bubble reaches the surface. This bubble is what is used to lift a ship out of the sea, break its keel, then pull it back into the void.

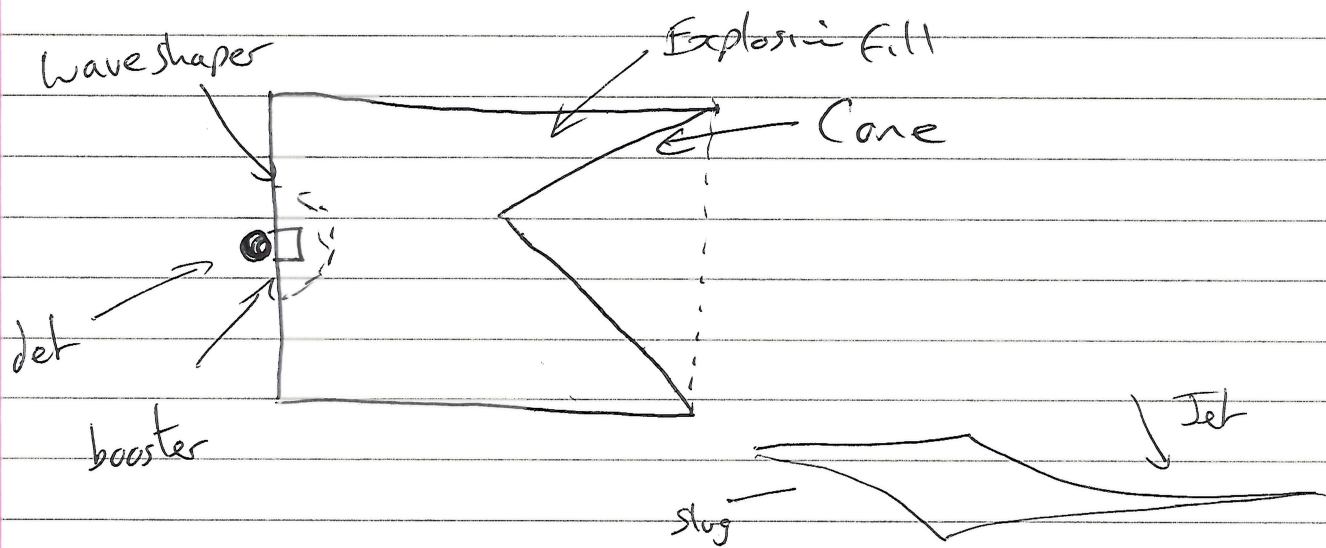
Advantages of blast/frag warheads are that they are relatively cheap and easy to manufacture, with omnidirectional blast they are effective internally.

Disadvantages are that ~~they~~ their effects can become less effective with distance from target, and altitude. They do increase collateral damage, and externally their omnidirectional blast can be quite wasteful.

B2 Two forms of directed energy warhead are shaped charge and HESH.

A shaped charge uses a cone of material, generally copper. An explosive fill behind the cone is ignited. The detonation compresses the cone which produces a high velocity metal jet forward.

B2



The cone must be symmetrical for most efficient shaped jet. This will also make the jet straight.

The Explosive fill must be high velocity, HMX is a good material. Torpex has been used extensively in the past. CL20 has a higher V_{oD} making it a good candidate, however its sensitivity to shock may rule it out as a main charge fill.

The angle of the cone is important, ~~between~~ between 40 and 90° is common, but is determined by application. The cone material is also dependent on application, Aluminium cones are best for concrete targets.

It is important that the warhead does not spin. This will not allow the jet to form correctly.

The explosive must be able to readily detonate at the correct stand off from the target, this will allow the jet to form correctly. Stand off can be anything from 2 to 8 x the diameter of the cone. The distance between the detonator and the start of the cone, the head height, must be sufficient to allow the explosive to have reached sustained detonation to allow the cone to develop. It is also essential that an explosive with minimal divergence is used. This is so that when the shock wave hits the cone, it is evenly

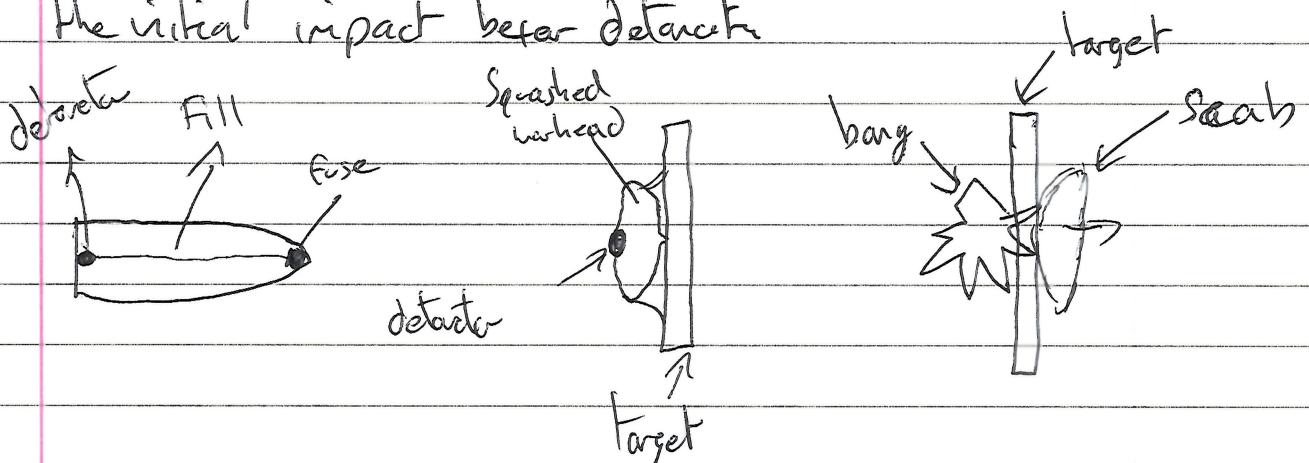
B2 directed round the cone. If a material with poor divergence is used then a wave shaper may be used in the explosive fill to bring the wave back into a useful (flat) shape.

An explosively formed projectile is very similar to a shaped charge. Using a much flatter cone, rather than a jet + slug, a ~~slug~~ ^{fragment} or bullet will be produced.

Another directed energy warhead is a HESH round. High explosive squash head.

This artillery / tank round is designed to hit the target, squash up, then detonate. It does not make a hole, the blast forces a 'scab' of material on the other side of the target to be blown off, neutralising anyone on the other side.

The explosive must be insensitive and malleable enough to take the initial impact before detonating.



The munition must be in good contact with the target, therefore the fuse at the front will trigger a delay timer allowing the warhead to squash onto the surface. The detonator is at the

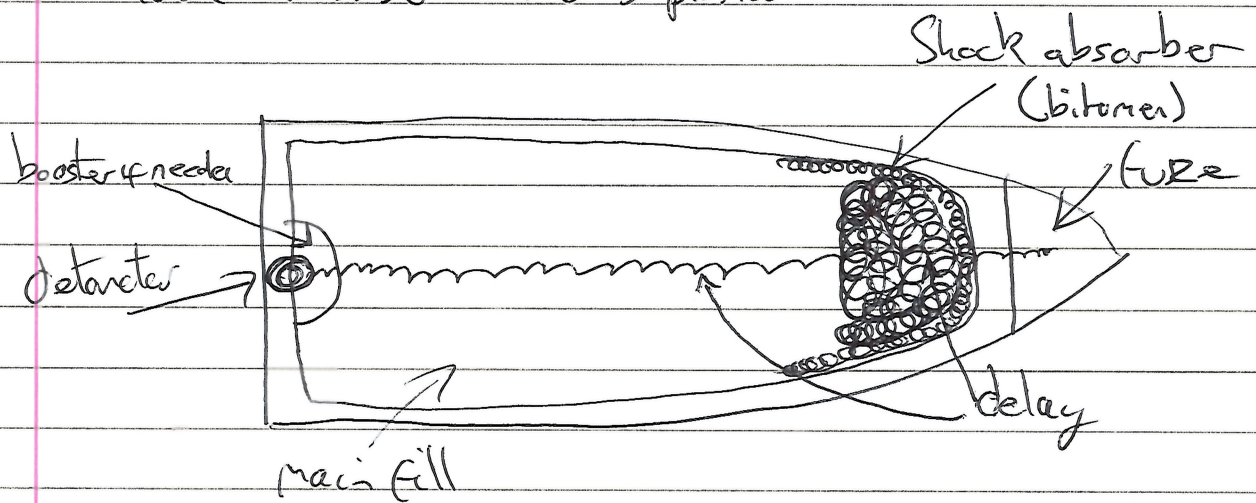
Steve James 1870370

P10

B2

rear of the warhead so that detonation will not occur until good contact is made. The detonation wave will be flowing forward into the target allowing the seal to be made.

It may be found that a cushioning pad of rubber or bitumen (or another soft material) is placed at the front of the warhead, between explosive fill and case. This will act as a shock absorber to the explosion.



Explosive such as HMX or CL20 will not be suitable as they are too shock sensitive. RDX/TNT mix may be a suitable explosive for this, or RDX mixed with wax to be made more.

Alternate design

