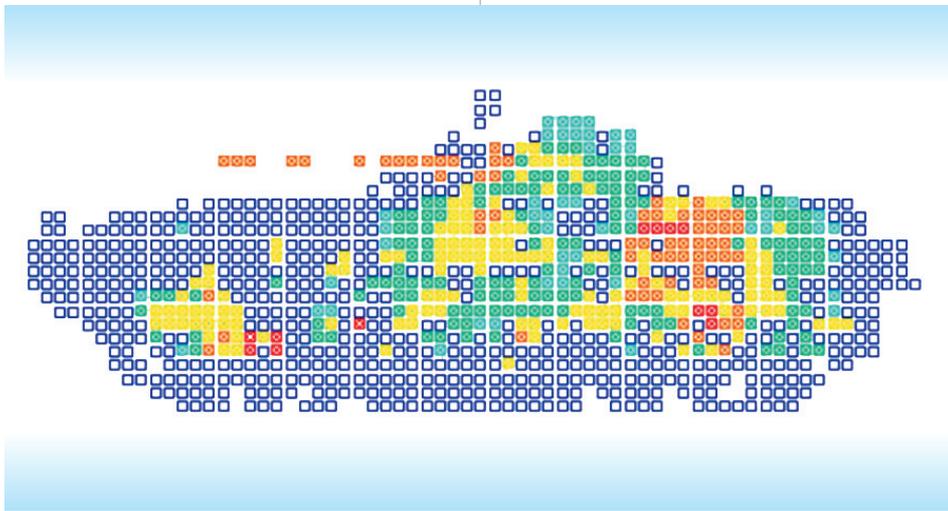


### Lethality assessment

Ammunition data can be both in-house generated or customer-supplied. TNO operates several specialised lethality assessment models to accurately predict the inflicted damage on a broad range of targets. If required, we add aspects like gunner error, ballistic dispersion, firing doctrine and deployment issues. Typically, this yields 'probability of kill' predictions.

### Lethality optimisation

TNO is also frequently asked to analyse proposed design reviews. We assist in optimisation of ammunition against specific targets or armour configurations. A typical outcome is the maximum number of 'stowed kills', given a fixed number of rounds carried.



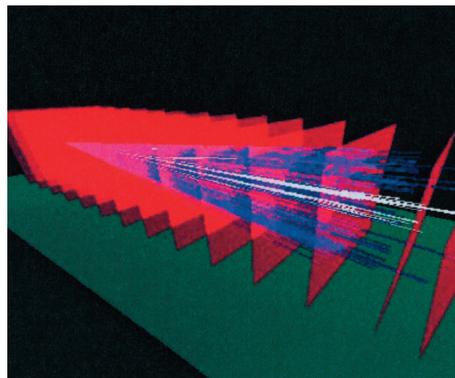
### Project examples

Among others, TNO already successfully completed assignments on the following subjects.

- Lethality of TOW-2A/2B warheads.
- System performance of 155 mm smart artillery rounds.
- Comparison of 40 mm grenade launcher against 7,62 mm machine gun.
- Lethality of 30 mm and 35 mm ammunition family.
- Comparison of 20 mm PGU-28 with 20 mm FAP.
- Payload co-design of 27 mm FRAP.
- Characterisation of 120 mm HE.
- Optimisation of medium calibre ABM.



Photo OCP



### TNO Defence, Security and Safety

'TNO Defence, Security and Safety' is the title under which TNO operates as a strategic partner for the Dutch Ministry of Defence and makes innovative contributions to enhancing the security of the Netherlands both at home and abroad. We also use our accumulated knowledge for foreign governments and for defence-related industries.

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Product and services

# Lethality of ammunition and warheads



TNO has a vast experience in assessing weapon system effectiveness of guns and missiles. Our main customer is the Netherlands Ministry of Defence. Over the years, we have supported the procurement and upgrading of new ammunition and weapon systems. Nowadays, our expertise is also available for other government agencies and the defence industry.

## Context

At present, armed forces worldwide find more and innovative ways to protect their assets. The engagement window for well-protected targets is small. Only a limited amount of fired ammunition actually hits the target. So, it is essential to yield a maximum

damaging effect but at the same time there is a need for cost-effectiveness. To find such solutions TNO operates state-of-the art test facilities and computer models for a broad range of ammunition effects in land- sea- and air targets; both material and personnel.

## Ammunition characterisation

With our in-house developed computer models we are able to predict the effects of a particular type of ammunition. Moreover, changes to the ammunition can easily be modelled to quickly assess the improvement in terminal ballistic effectiveness of a particular change. With this approach you can avoid extensive (costly) test and increase your flexibility. For the remaining experiments, TNO exploits a fully instrumented indoor test facility for determining projectile stability, break-up, penetration and behind armour effects. This saves time and money and increases flexibility.