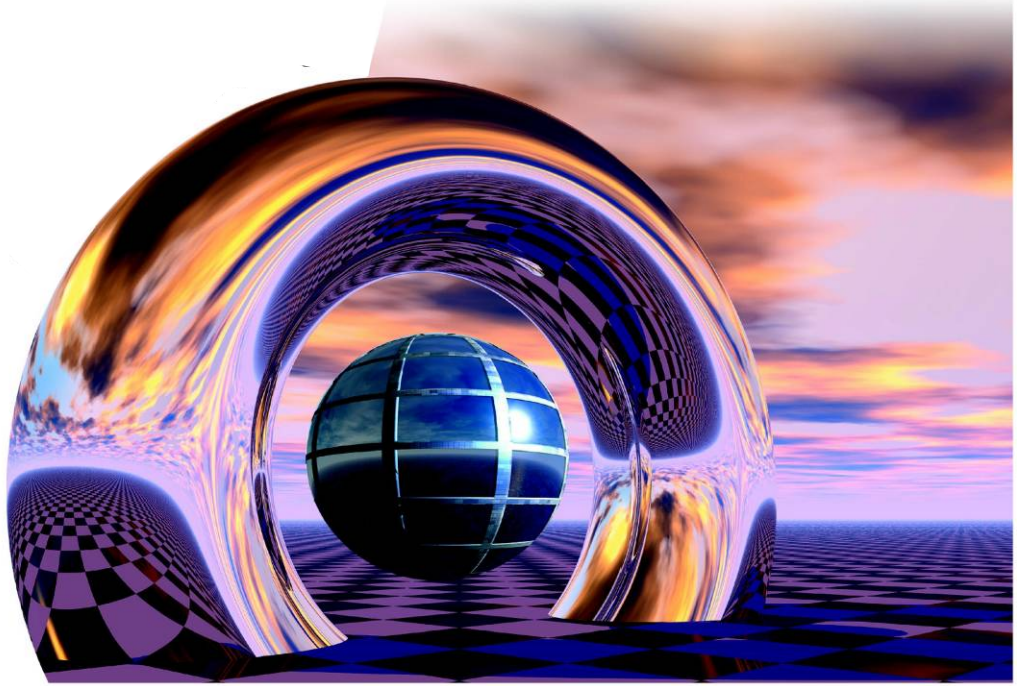
Combustion Light Gas Gun

CLGG



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Not Your Father's Light Gas Gun

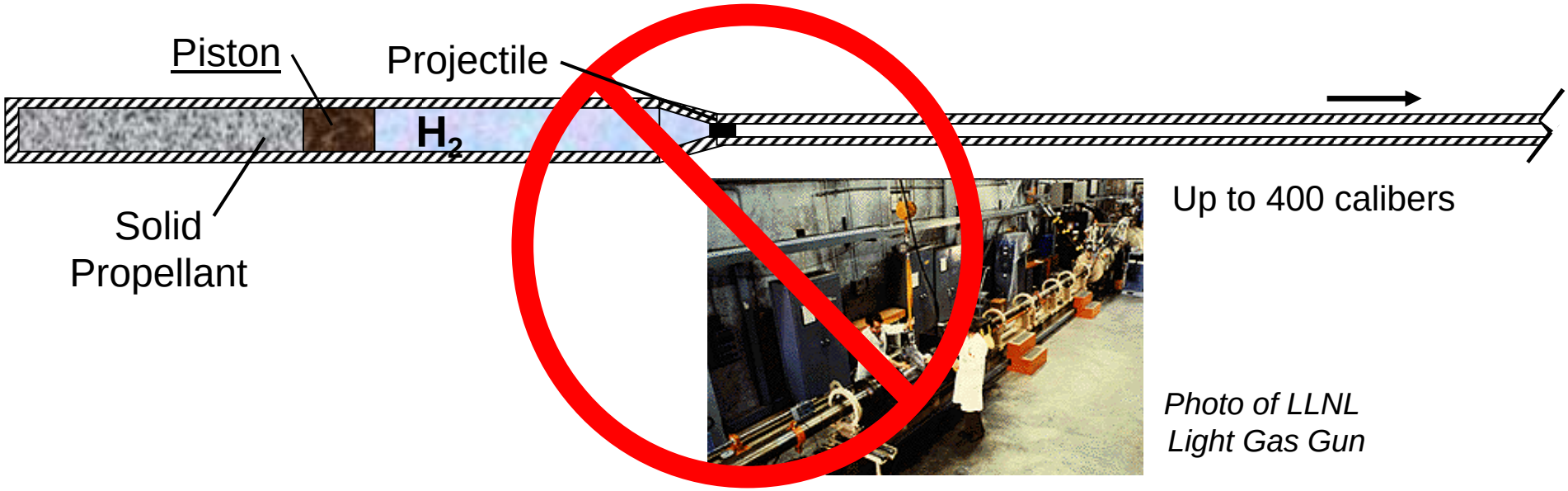
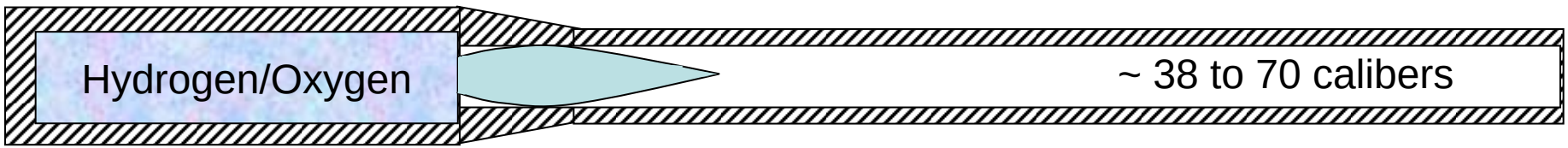


Photo of LLNL Light Gas Gun

Combustion Light Gas Gun



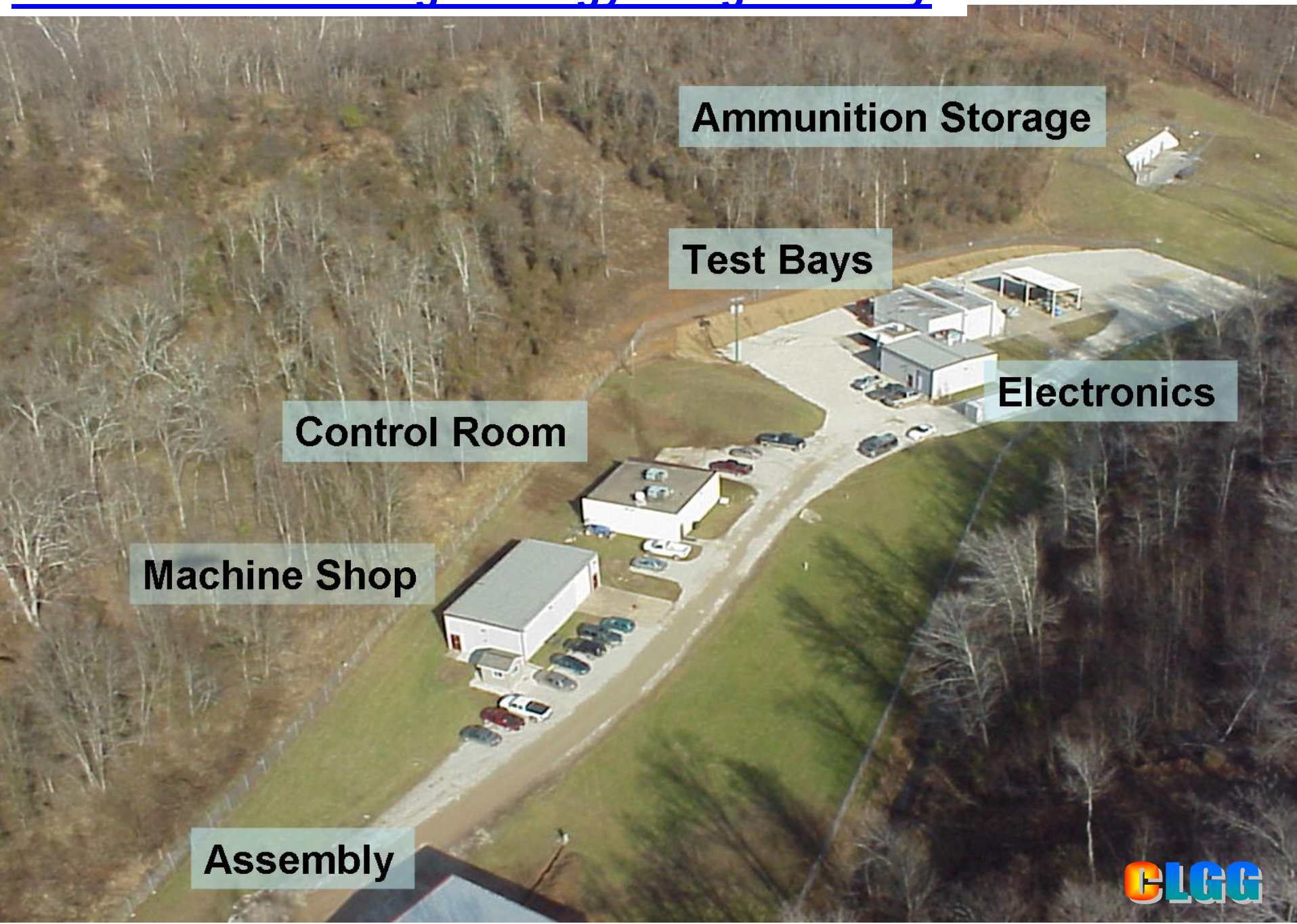
"The lighter propellant gases chase the projectile down-bore more efficiently!"

CLGG Benefits

- High velocity even with moderate tube lengths
- Infinite zoning
- Relatively low flame temperatures (long tube life)
- Lower operating pressures (lighter tubes)
- Lower acceleration on projectile
- Ability to produce propellant onsite
- Commonality of propellant across platforms

CLGG

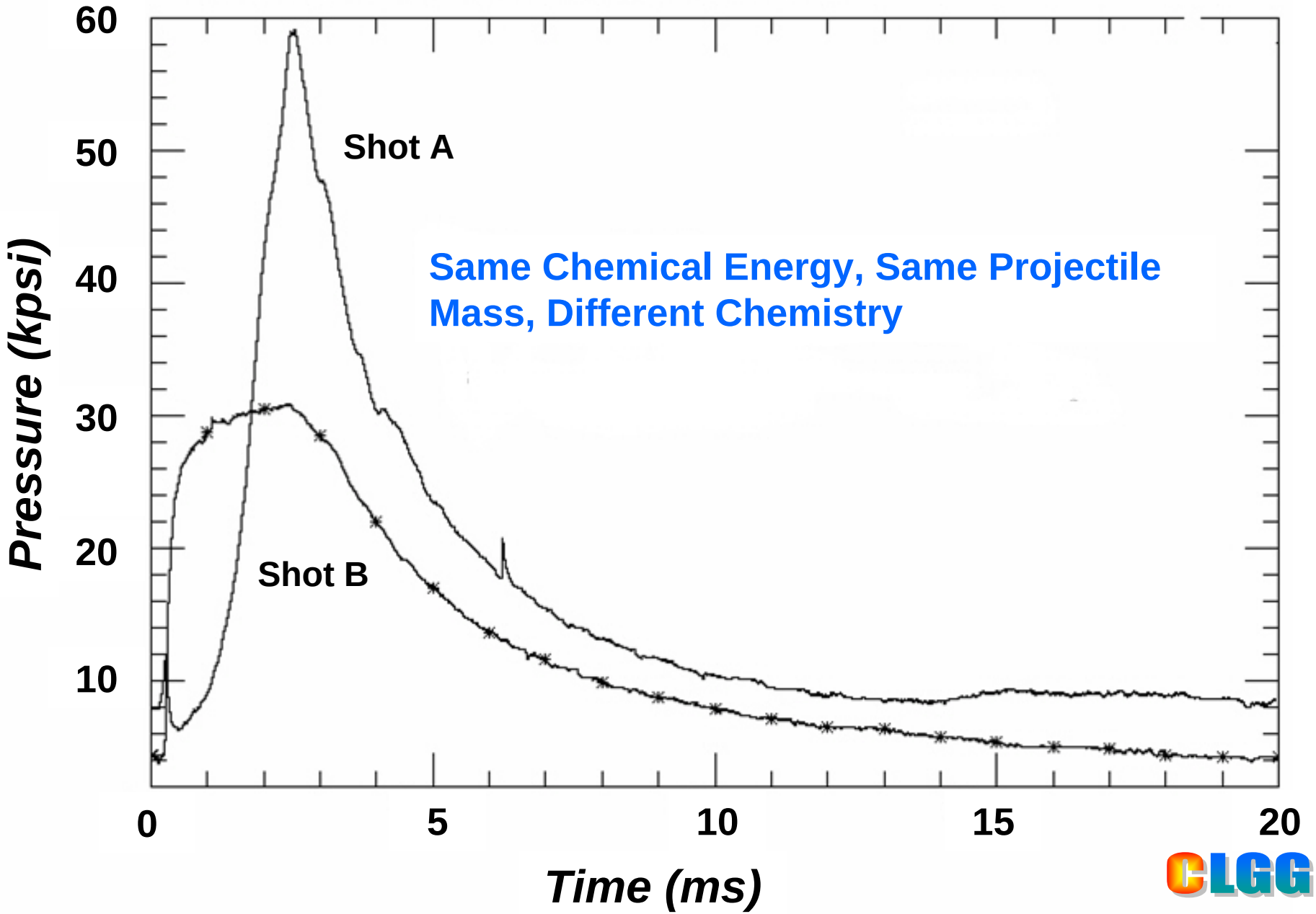
UTRON 300 Acre High Energy Range Facility



CLGG Development

- CLGG technology has been under development for 15 years.
- This 45mm has been operational for 8 years
- Autoloader added to 45mm recently

Combustion Control – Pressure Shape



45mm Performance

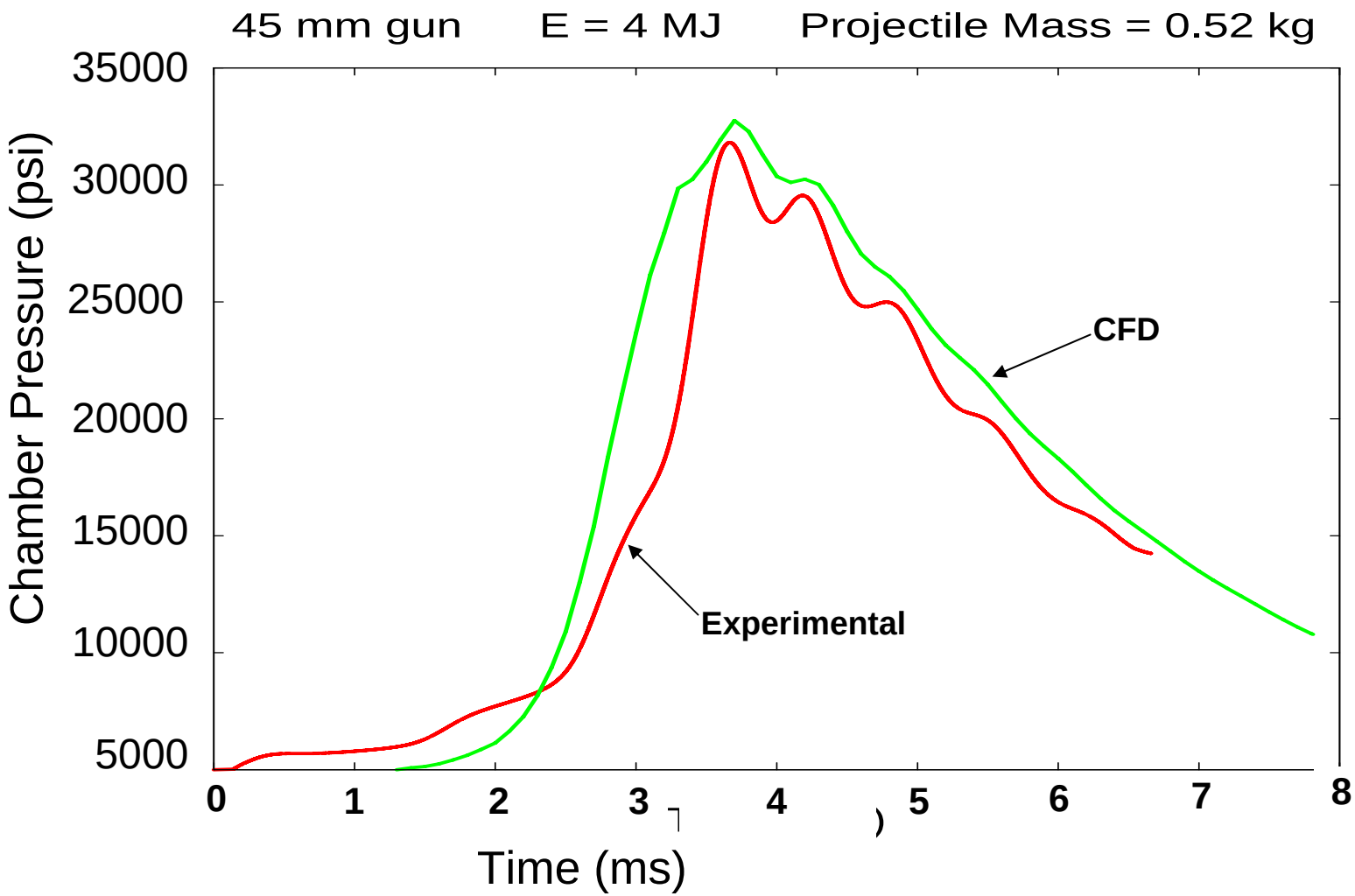
45-mm Experiments	
Mass kg	Velocity m/s
0.200	2810
0.544	2100
1.100	1700
3.365	878

Demonstrated performance gains for a broad range of projectile masses

155 mm CLGG

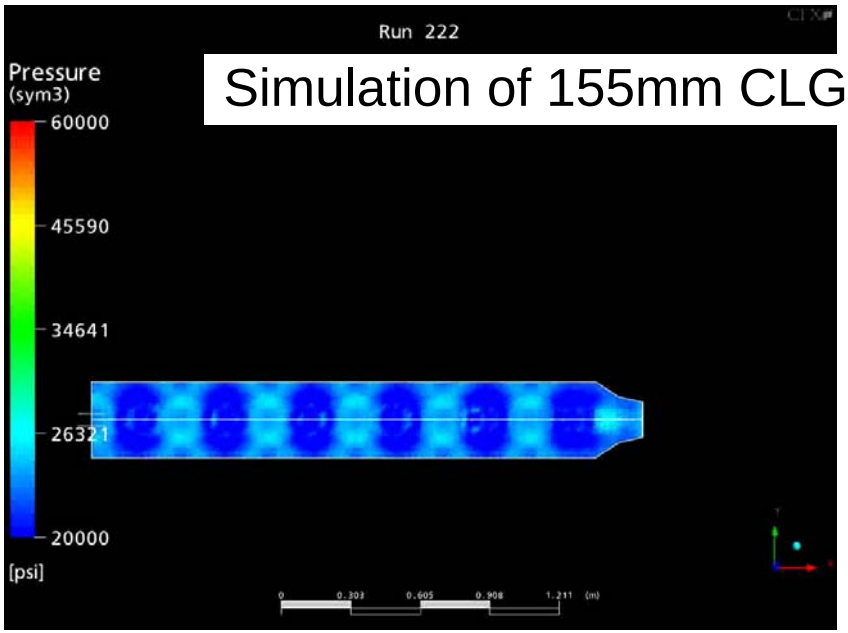
5 shots with up to 17 MJ muzzle energy to date,
A fraction of its capability, tests are ongoing

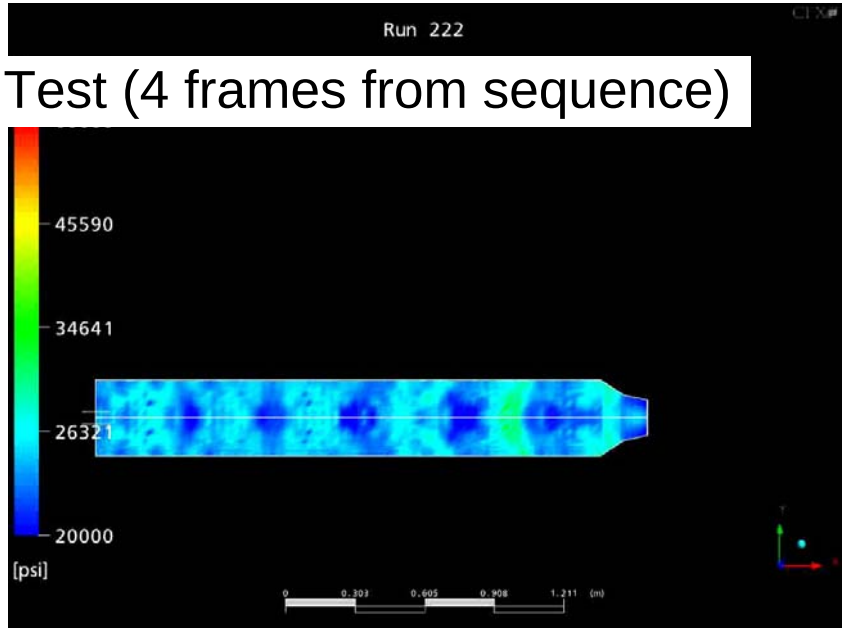
Computational Fluid Dynamics (CFD) Benchmarking

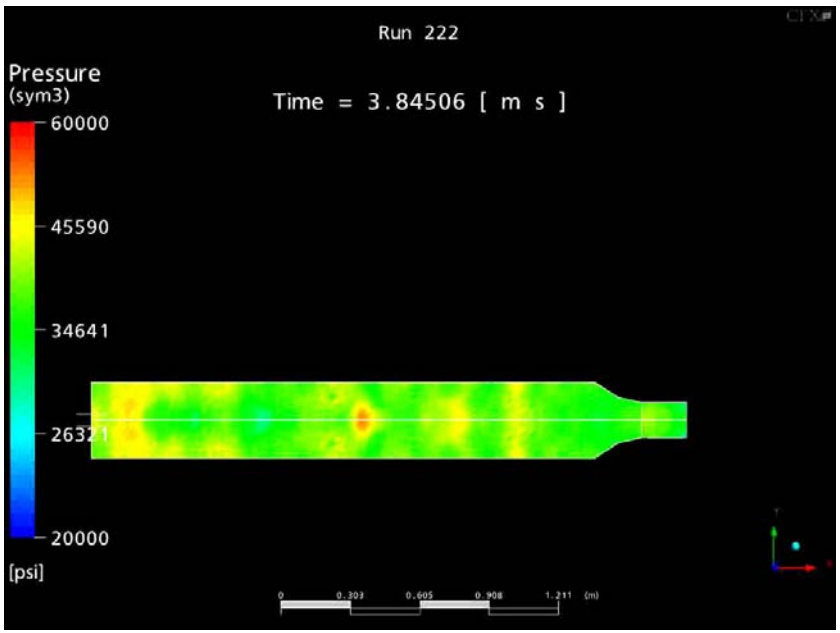


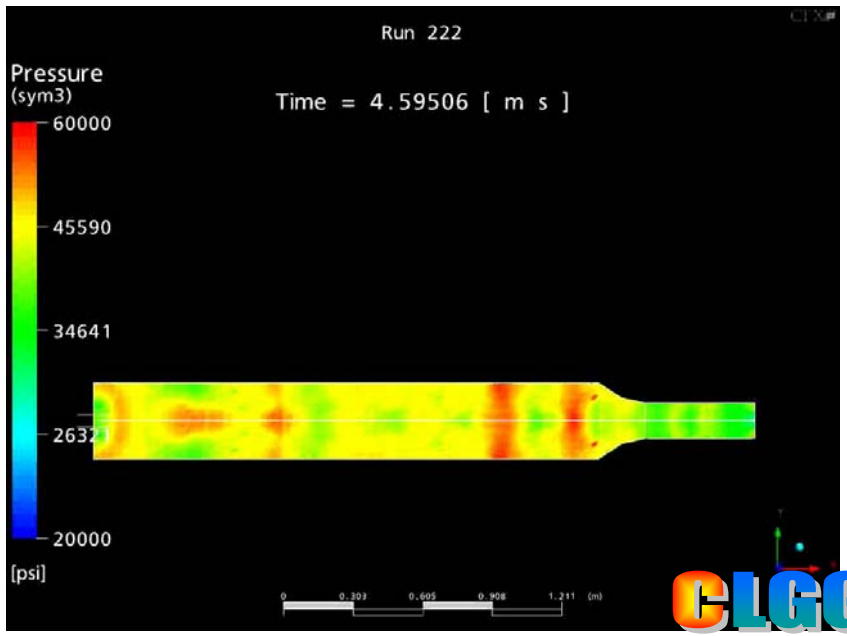
Computational Fluid Dynamics

Simulation of 155mm CLGG Test (4 frames from sequence)

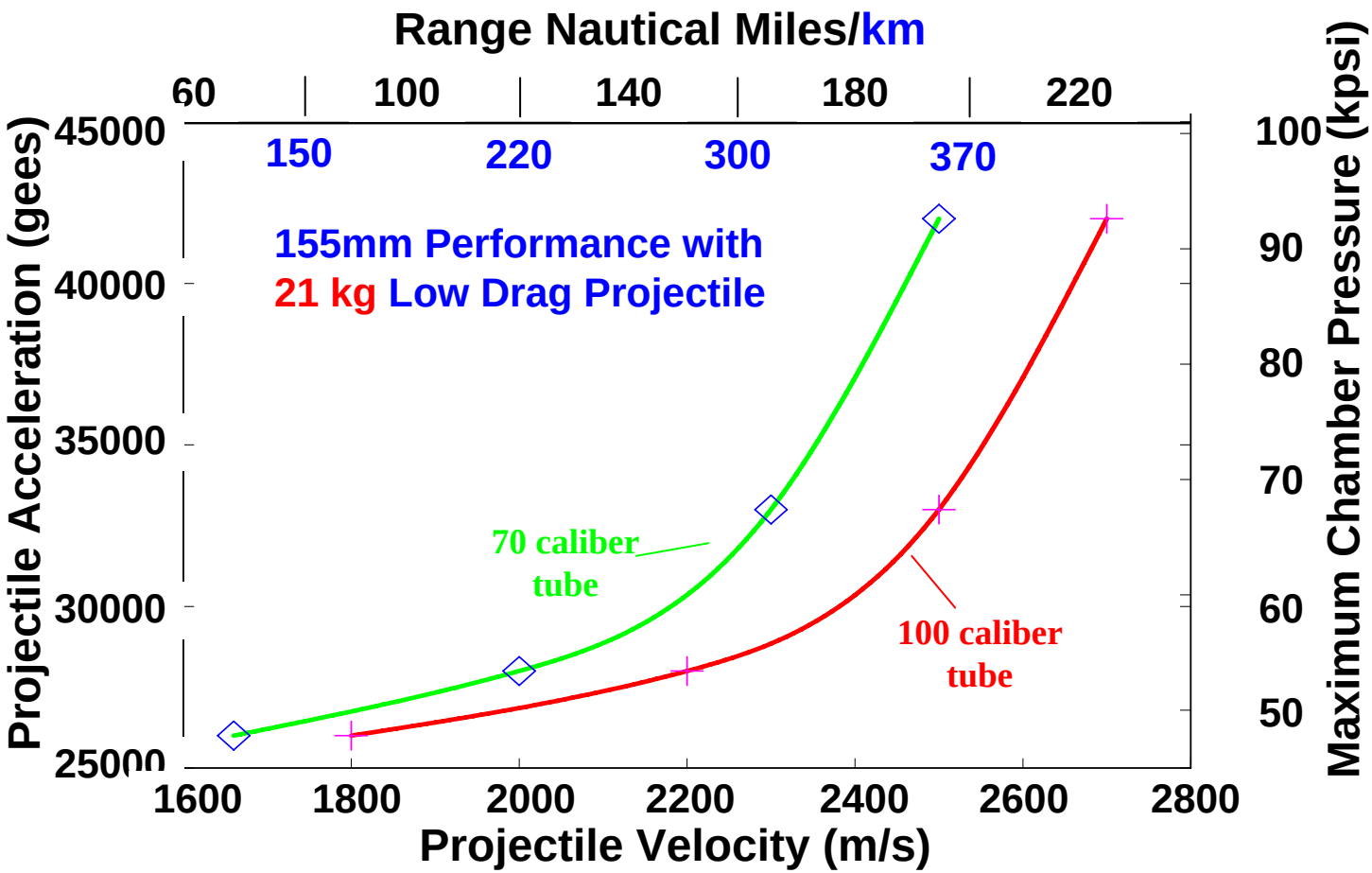






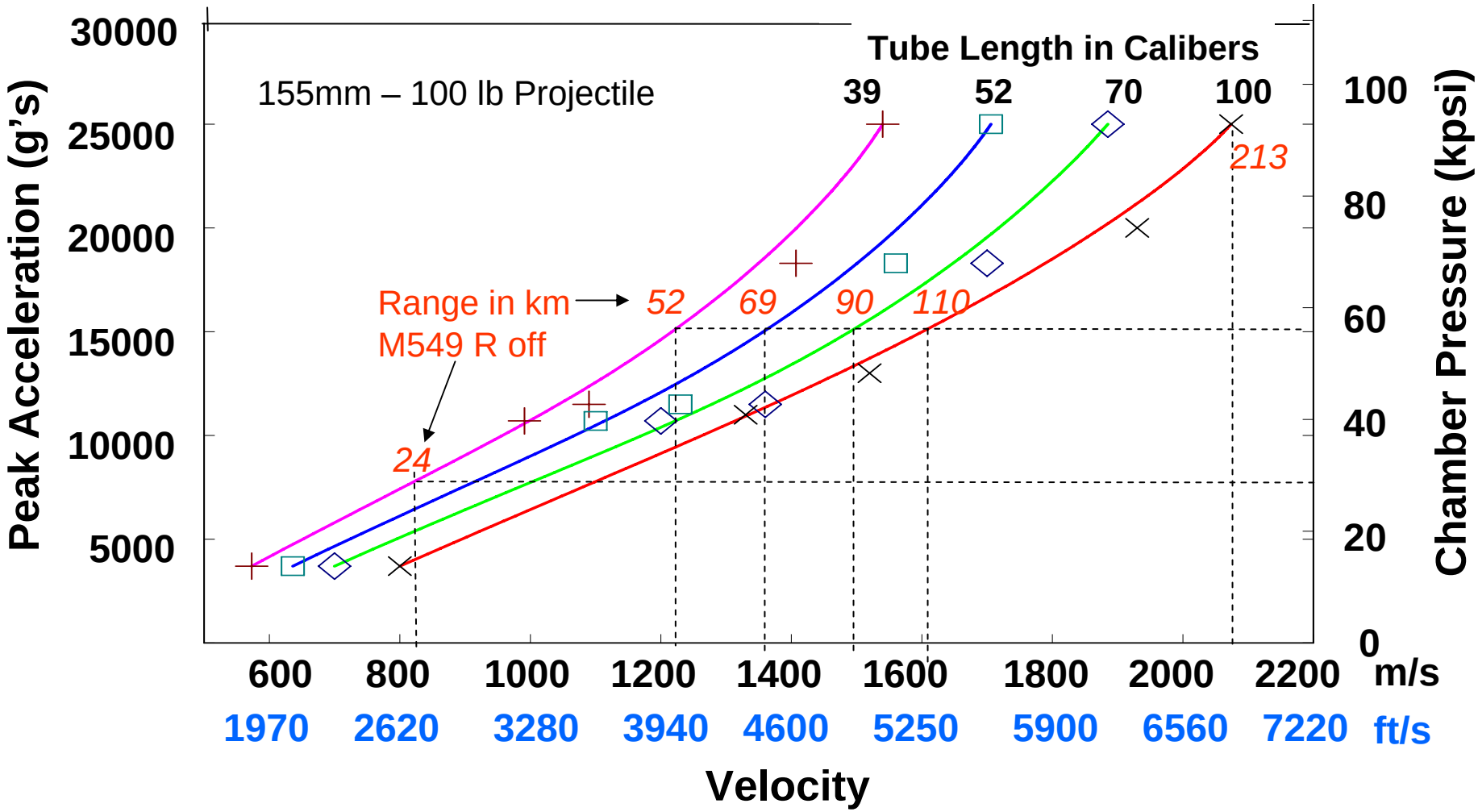


Long Range Shore Support Predictions



Notional Long Range Projectile – Navy Barrage Round

Extreme Range Artillery Predictions with 45 kg Projectile



Performance Example

- CLGG Range 200 + km
- Conventional Gun Range 30 km

Large Circle – Footprint of Single CLGG Gun

Small Circle - Footprint of Conventional Solid Propellant

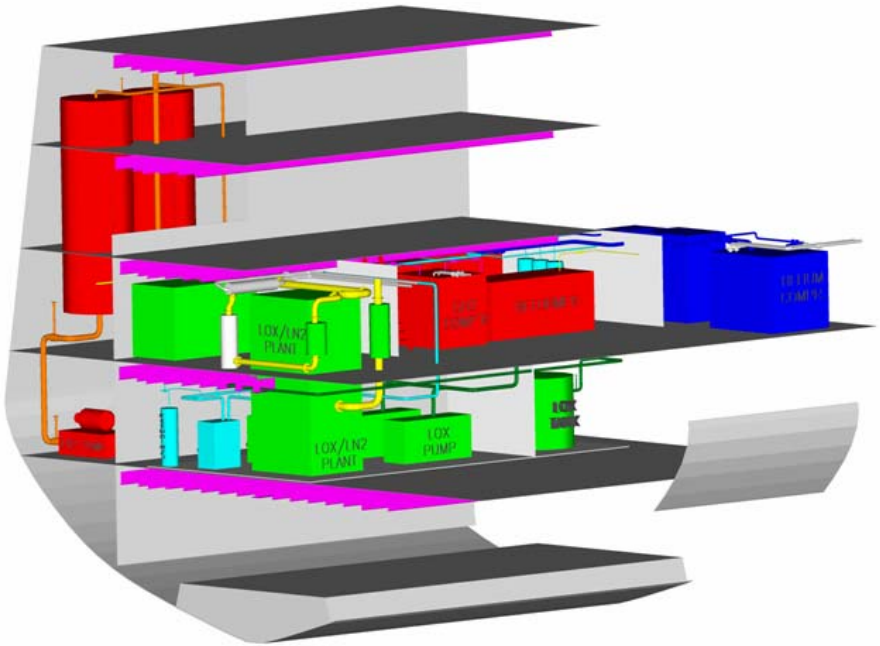
It would take ~ 50 conventional guns to cover the area of one CLGG

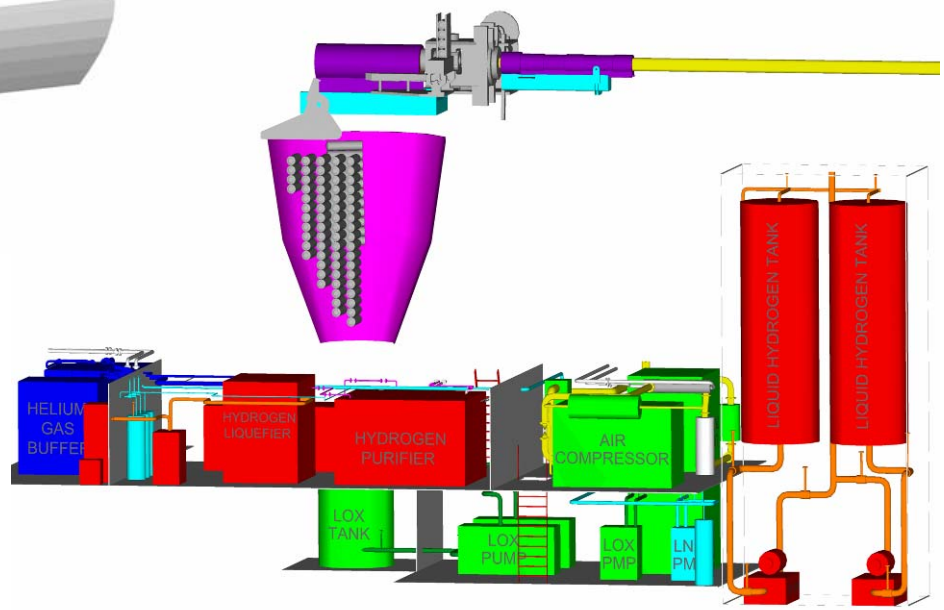
Propellant Production

CLGG technology offers the potential for propellant production as needed to meet mission requirements, on board ship or in the battle space.

- Hydrogen can be reformed from many feed stocks
  - Diesel Reforming (e.g. Navy Fuel Cell Program)
  - Natural gas
  - Electrolysis
- Oxygen can be manufactured in a number of ways.
  - By product from hydrogen production
  - Cryogenic liquefaction
  - Air membrane reactor
- Storage
  - Gas
  - Cryogenics

Notional Ship with CLGG Gun and Propellant Production Equipment Installed



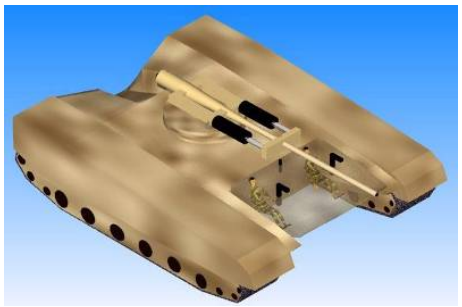


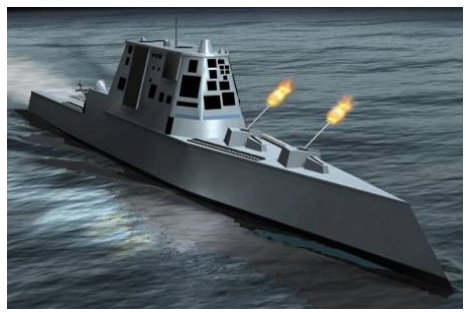
Machinery is commercially available

CLGG

CLGG Applications

- ***Long to Extreme Range Artillery (Navy & Army)***
- ***Light Weight Direct Fire***
- ***Ship and Land Based Missile Defense***
- ***Other***





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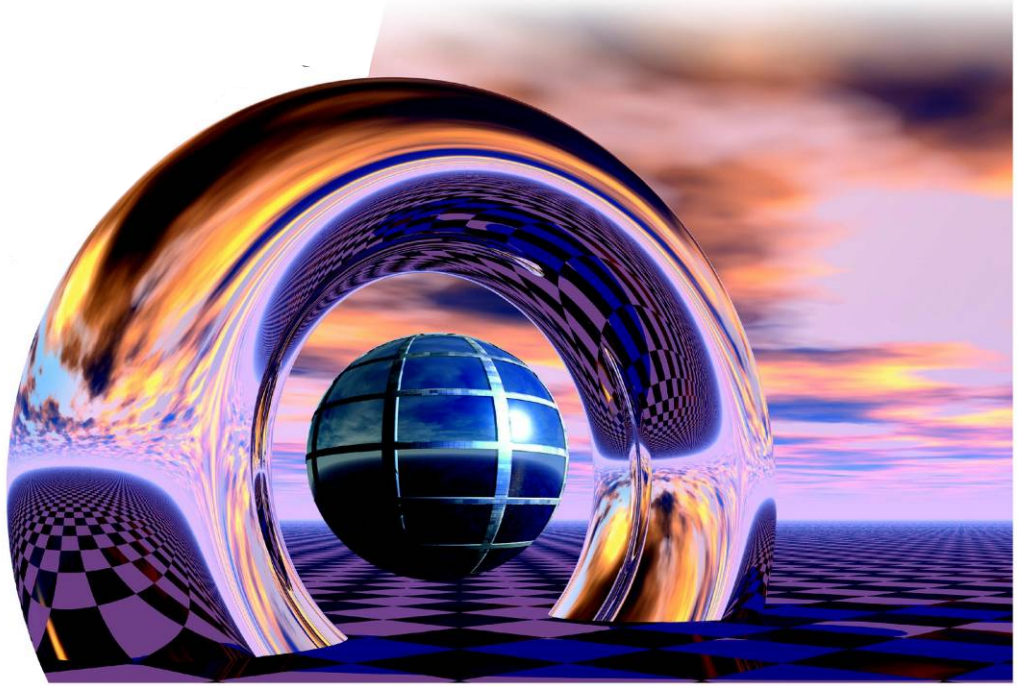

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