WEAPON INTEGRATIONS ON HIGH SPEED CRAFT - RWS

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CMN NAVAL
THE HOME OF NAVAL EXCELLENCE

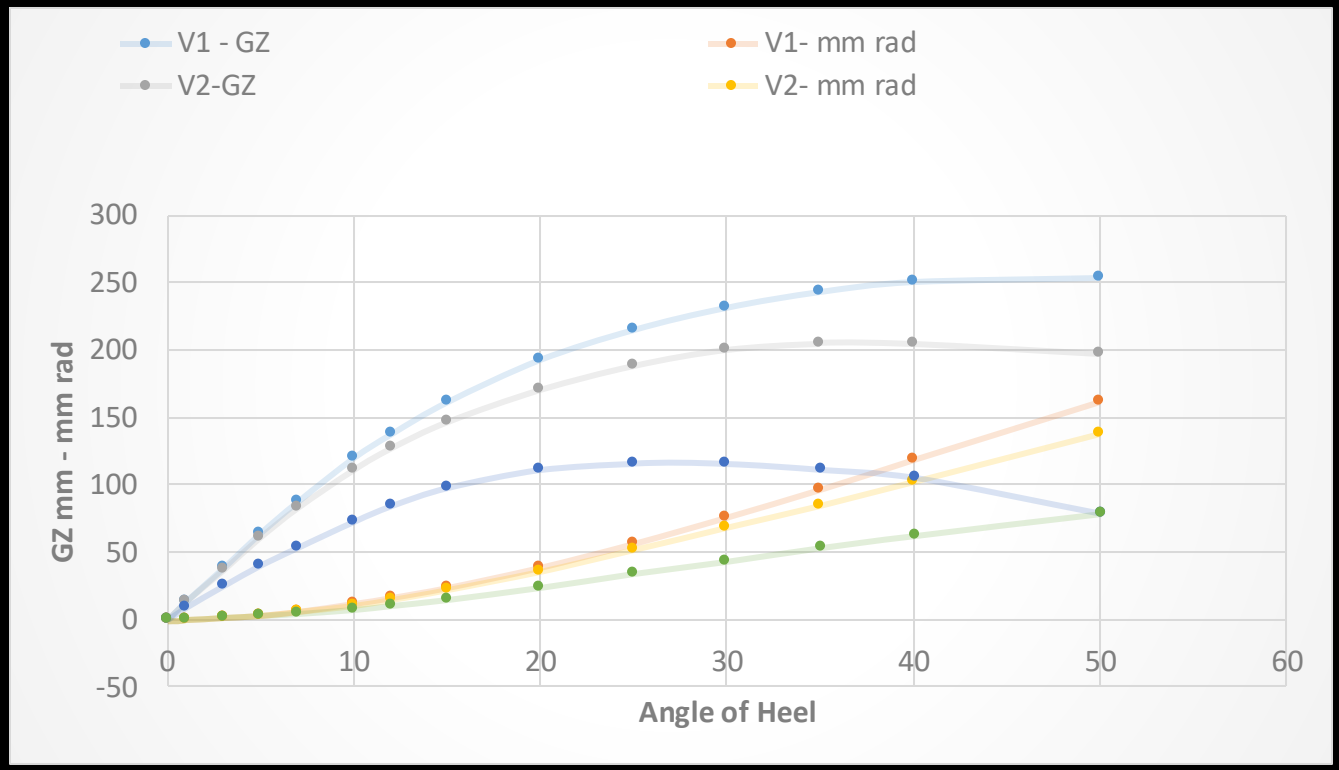


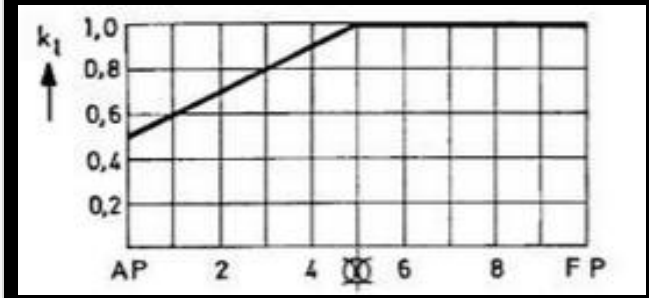



- VESSEL ADAPTION
  - STABILITY
  - PERFORMANCE
  - STRUCTURE
  - LAYOUT
  - ADVANCED
- SYSTEM INTEGRATION CONSIDERATIONS

WEAPONS INTEGRATIONS ON HIGHSPEED CRAFT

STABILITY STUDY – WEIGHT CONSIDERATIONS





ESTIMATE FULL WEIGHT PACKAGE INSTALLED WITH STRUCTURE, MOUNTS, AMMO, HOT BARRELS, AND SPARES

PREFERRED NEW LOCATION OF MASS RELATIVE TO VESSEL MOVEMENT ACCELERATIONS

VERIFY NEW CGS AND ENSURE STABILITY CRITERIA ARE MET

PERFORMANCE – SPEED AND HANDELING

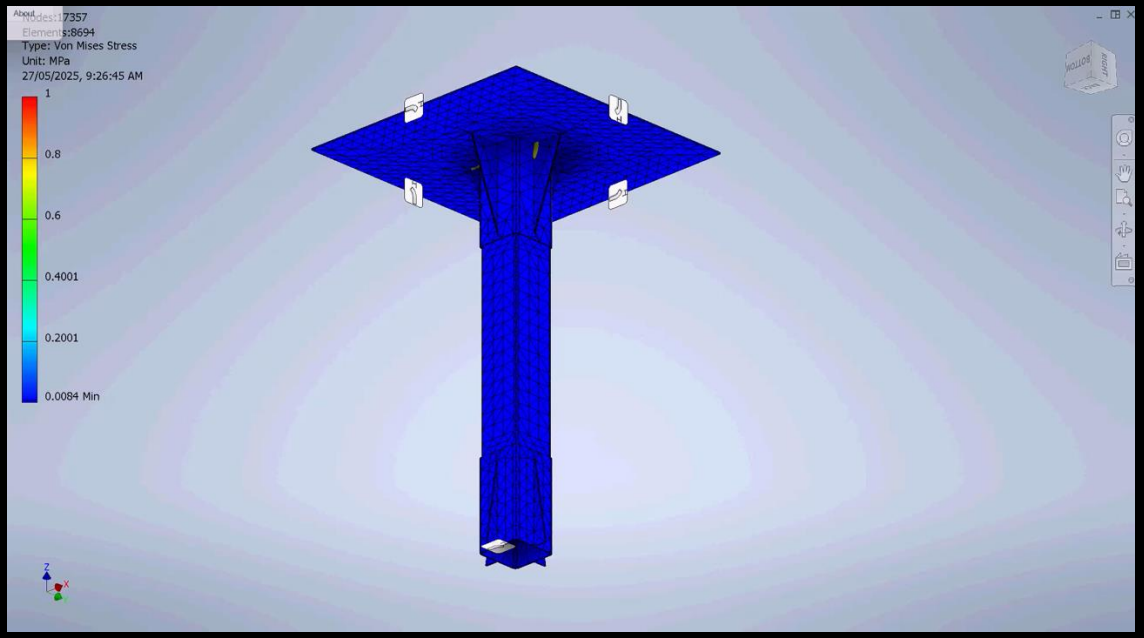
COMPARE VESSEL RESISTANCE AND PLANING/TRIM ATTRIBUTES WITH AND WITHOUT WEAPONS INSTALLATION, WHAT ARE THE DELTAS?

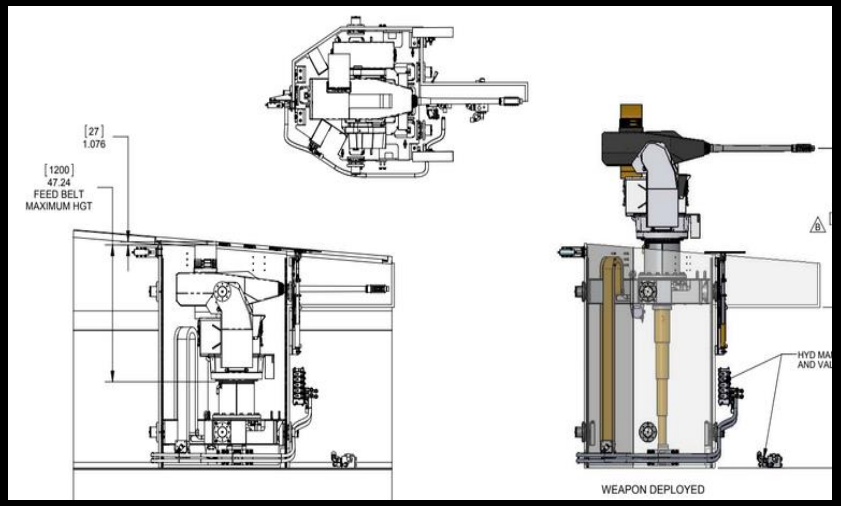
EFFECTIVE POWER/TORQUE SUFFICENT ACROSS THE SPEED RANGE?

EFFECT OF VCG ON HANDELING AND ROLL PERIOD?

EFFECT OF LONGITUDINAL MASS EQUILIBRIUM IN WAVES AT SPEED?

STRUCTURE





VERIFY STIFFNESS REQUIREMENTS FOR SYSTEM

DETERMINE RECOILS LOADS, FULL WEIGHT OF INSTALLATION, MAX ALLOWABLE ACCELERATIONS, FATIGUE CYCLES AND FOS

DESIGN STRUCTURE BLENDING INTO AS MUCH OF THE VESSELS NATURAL SCANTLINGS AS POSSIBLE – CFRP?

RUN ANALYSIS AND DETERMINE IF DEFORMATIONS ARE WITHIN REQUIRMENTS – CHECK NATURAL FREQUENCIES

BOLTING SYSTEMS FOR SIMPLE REMOVAL AND MAINTENANCE

ACCESS TO HARDWARE

LAYOUT AND ADVANCED SOLUTIONS

CREW COME FIRST LISTEN TO THEM

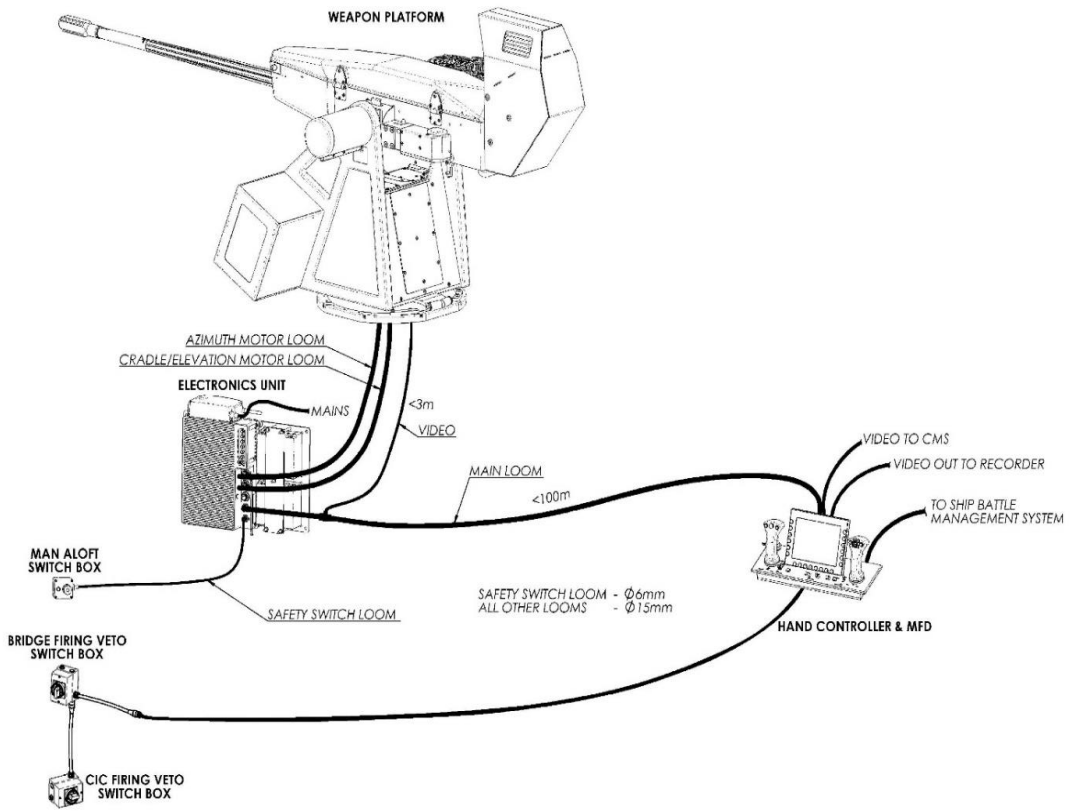
KNOW THE LIMITATION OF OPERATION – HSIG – SPEED – EFFECTIVE RANGE – EFFECTIVE DESIGNATION

SSM INSTALLTIONS – FIRING LIMITATIONS

RETRACTABLE TURRET SYSTEMS BENEFITS

A Typical Weapon System Installation

- Weapon System Platform
- Electronic Units
- System Control Unit
- Safety Interlocks
- System Harnesses



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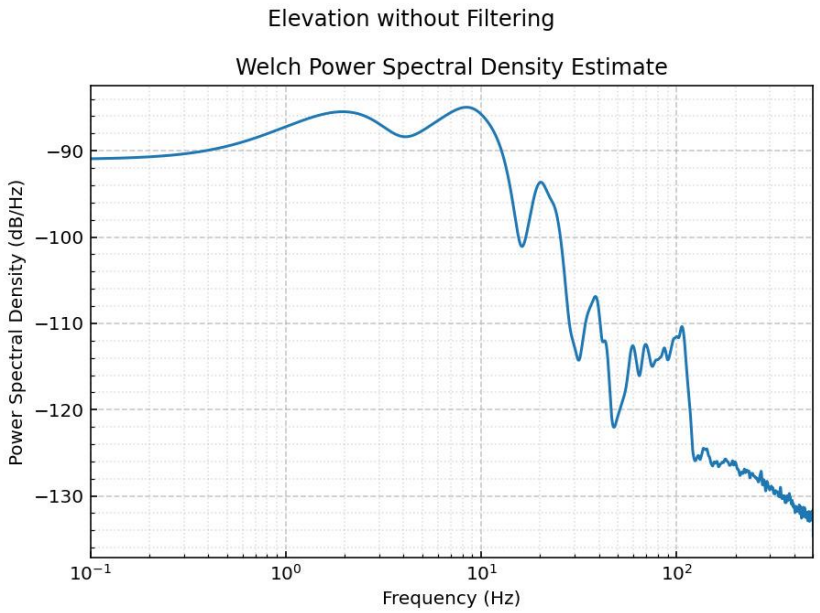
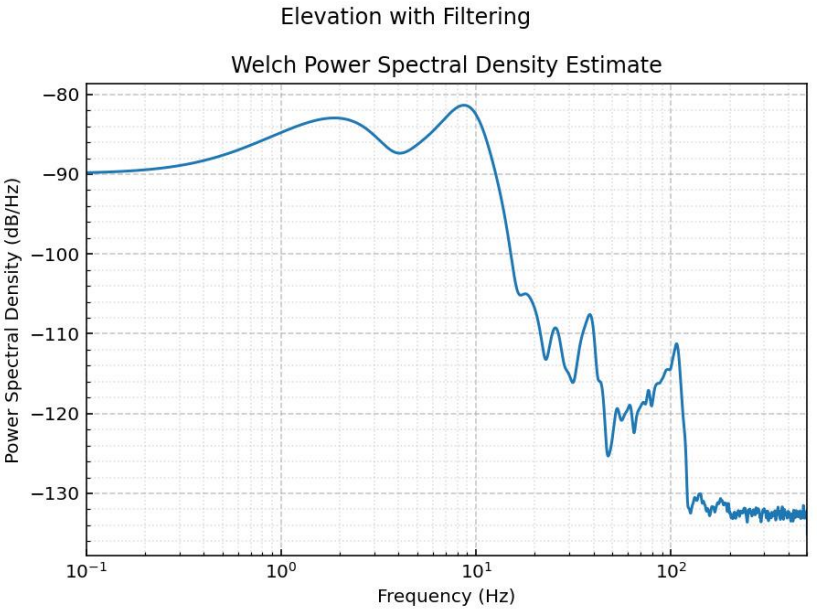
Weapon System Placement

- Platform Mounting Interface
- Movement and Firing Angles
- Muzzle Flash/Blast Effects
- Cartridge and Link Ejection
- User Envelope

Platform Structure and Mounting Interface

- Platform/Mount resonance frequency should be above system control bandwidth.
- Flatness and stiffness are critical to ensure proper weapon alignment and prevent long-term mechanical degradation.





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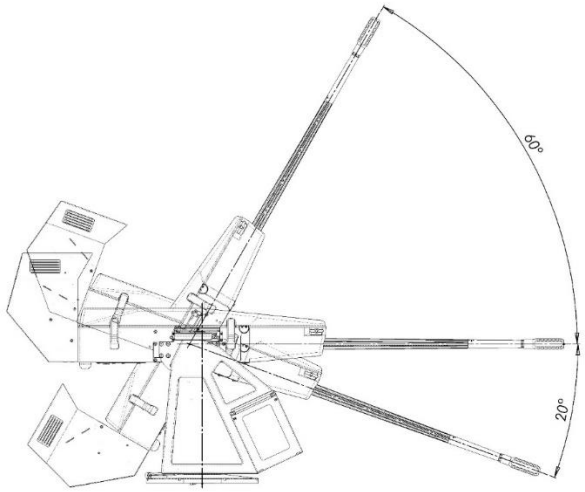
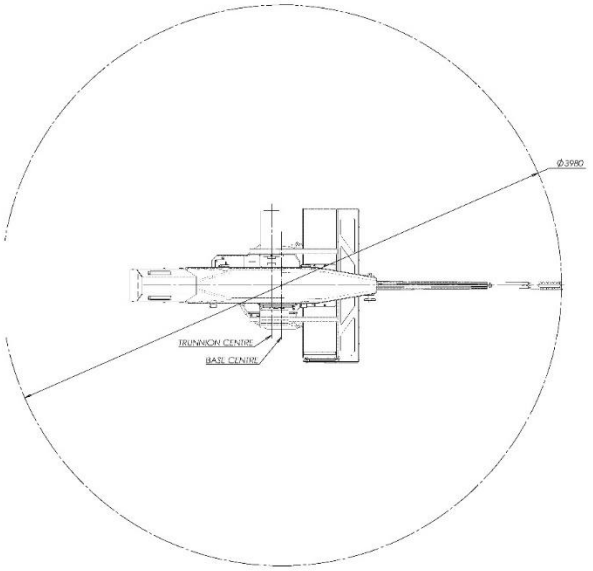
Movement and Firing Angles

- The weapon must not be able to traverse into the vessel's own structure.
- No-go and No-fire zones
- Hardstops and Softstops

Elevation Angles



Traverse Angles and Operating Circle



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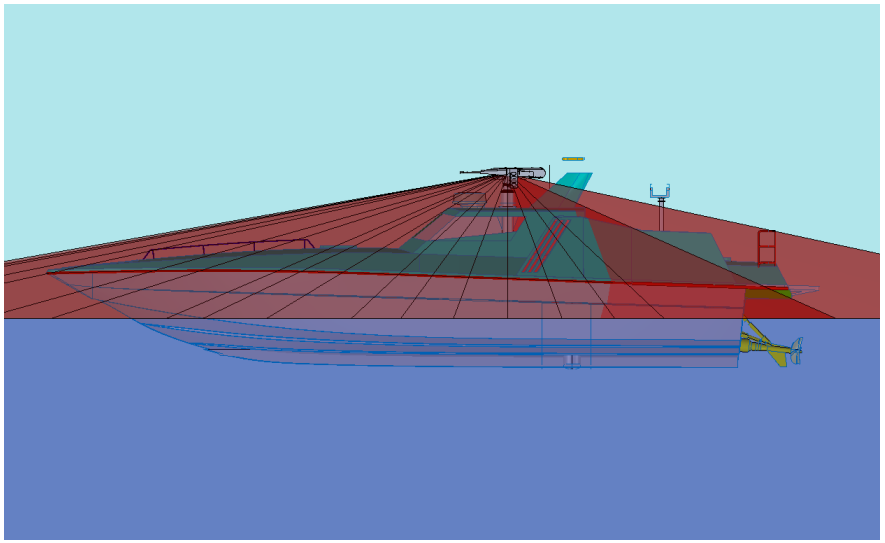
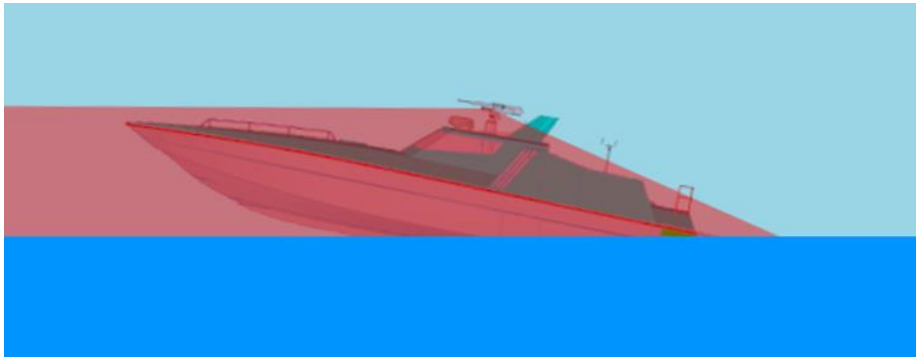
Firing Angles

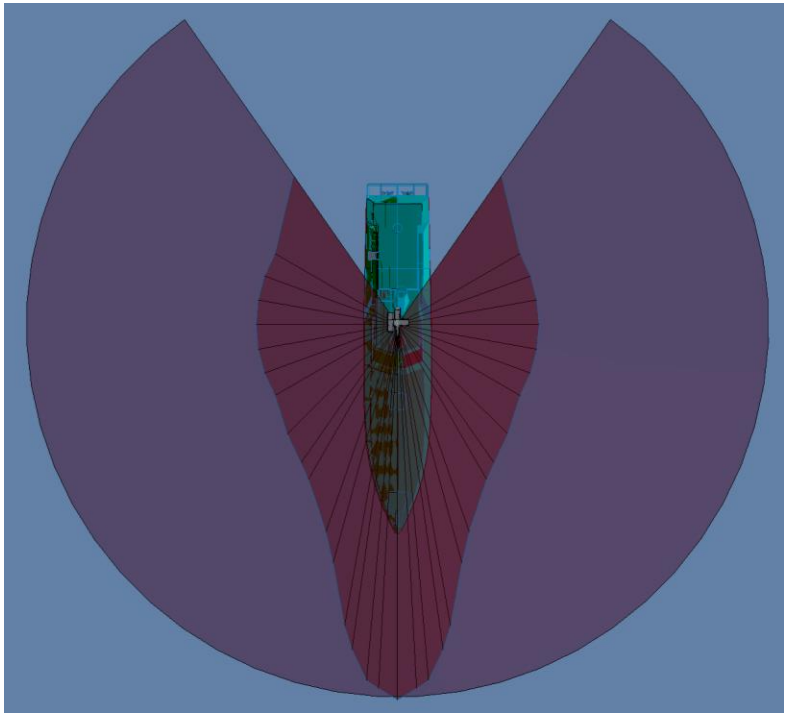
- The weapon must never be aimed at any part of the vessel's structure.
- A mechanical hard stop is implemented to physically enforce this limitation.
- Soft stops are implemented to limit entering the hard stop region.
- Mounting height directly impacts the system's minimum achievable elevation angle.



Minimum Achievable Elevation Angle

- The higher the minimum elevation angle, the farther from the vessel the weapon must engage surface targets, creating a close-range dead zone that cannot be covered.
- A high minimum elevation angle can be problematic, as even slight vessel pitch or roll in rough seas may lift the barrel above surface targets, preventing effective engagement.





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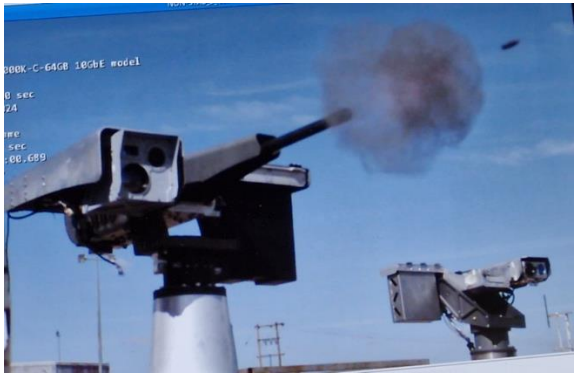
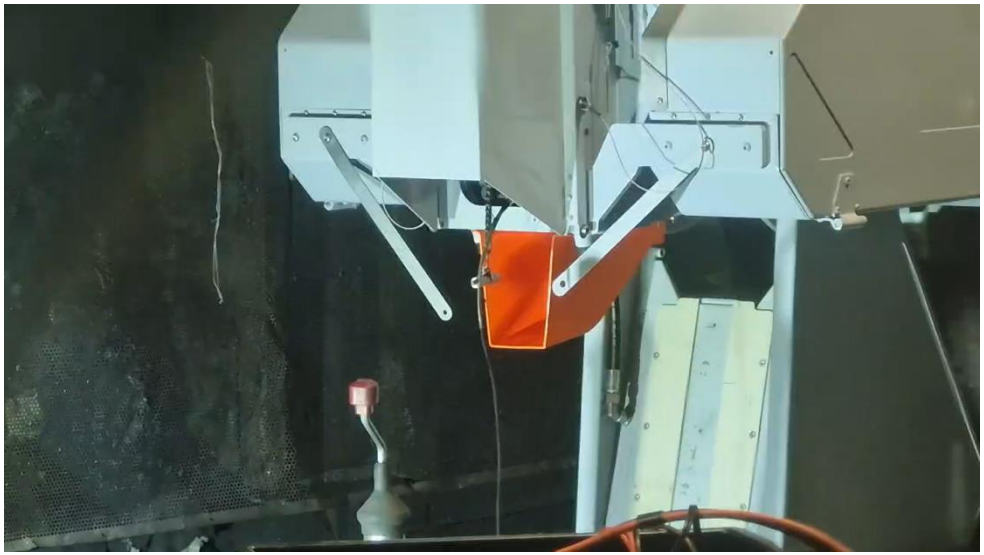
Muzzle Flash/Blast

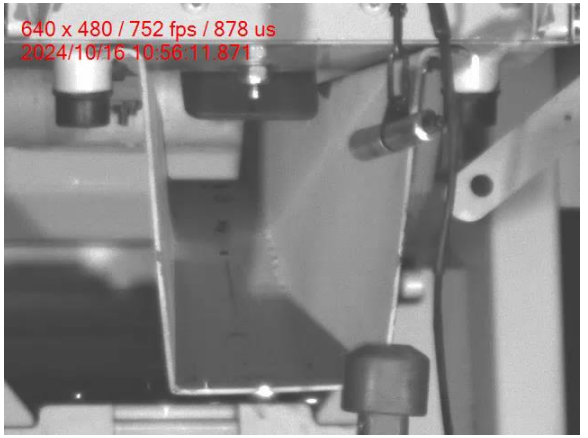
- Muzzle blast can damage nearby sensors such as EO/IR systems, radar, or antennas through heat and pressure exposure.
- Degrading of surrounding structures, especially lightweight materials, over time.
- To mitigate this, designers use shielding, spacing, or blast deflectors to protect critical components.



Cartridge and Link Ejection

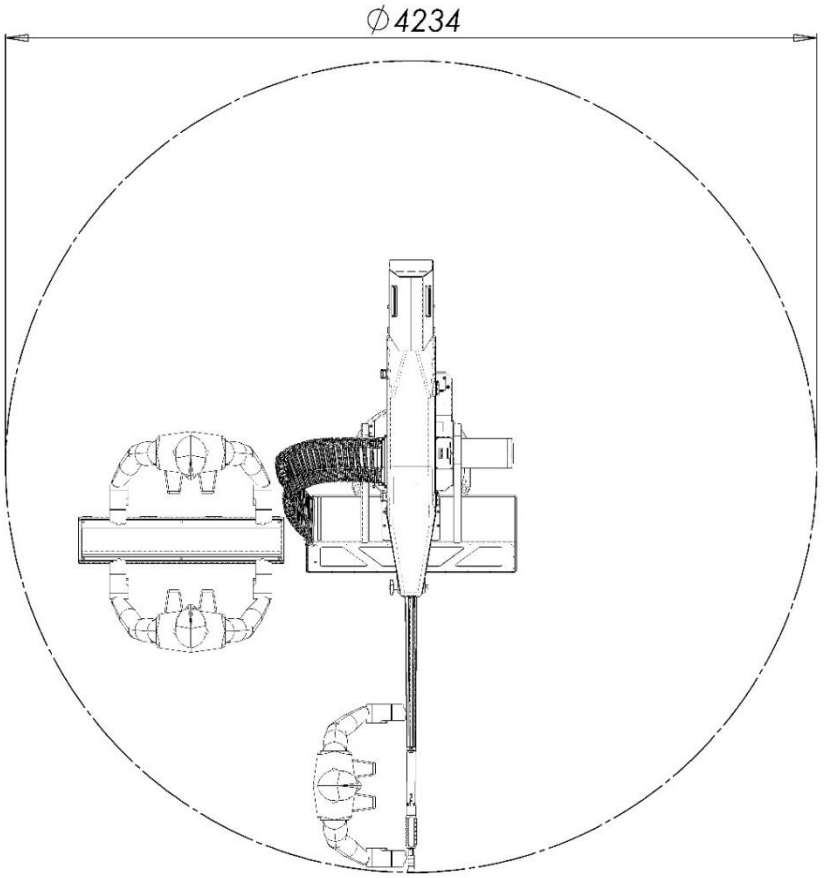
- Spent cartridges or links may be forcefully ejected, posing a risk to crew, sensors, or nearby equipment if not properly managed.
- Ejection trajectories must be considered in placement design to ensure safe clearance and avoid interference with deck-mounted systems.





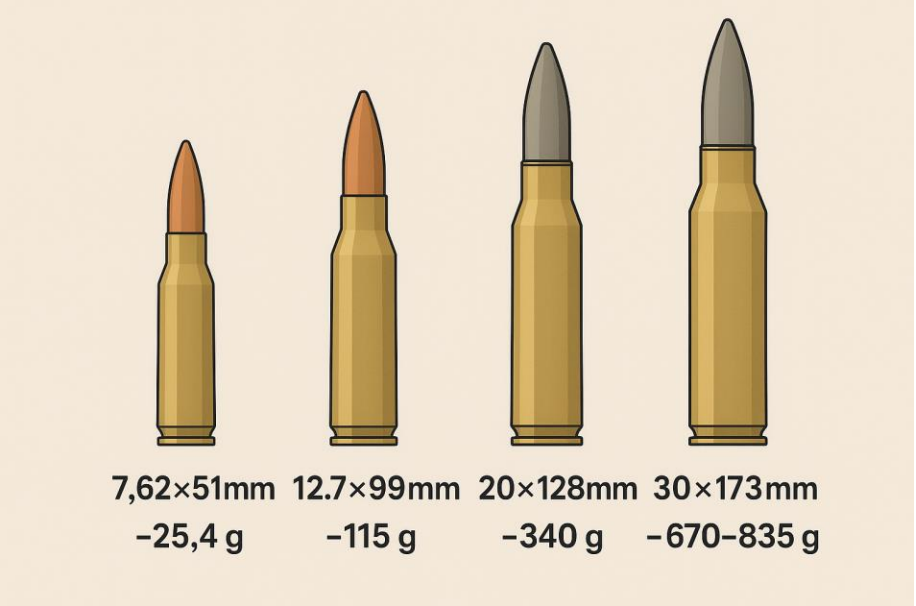
User Envelope

- Crew must be able to install, reload, boresight, and maintain the weapon system efficiently. Some of these actions have to be executed while operational.
- Ammunition handling needs to be considered.



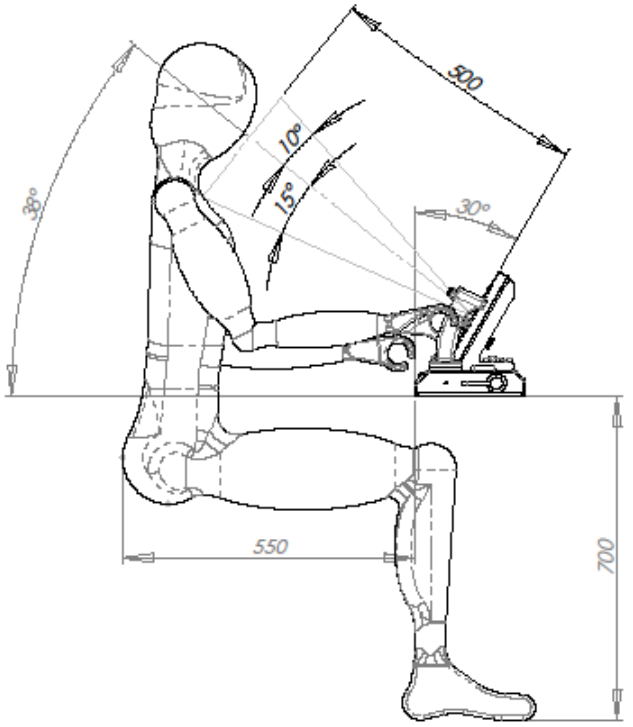
Ammunition Handling

- Heavy ammunition might require assisted handling mechanisms or optimized storage placement to reduce crew strain.
- Can reloading be executed under motion.



System Control Unit Placement

- The HMI should support the full engagement loop, allowing for quick target identification, operator decision-making, and confirmation of neutralization.
- Control units must be placed in accessible locations, such as the bridge or crew stations, especially in the absence of a central combat management system.
- Placement should provide good visibility and support coordination between the commander, gunner, and other crew members.



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Electrical Considerations

- All electrical units, including the battery and control systems, must share a common ground to ensure signal integrity and prevent malfunction.
- A poor grounding strategy can lead to noise, unstable operation, or even equipment damage during power fluctuations or EMI events.

Conclusion

- Weapon system integration on naval platforms is a multidisciplinary challenge — it's not just about mounting a gun.
- From structural dynamics and firing angles to crew interaction and electrical grounding, every design choice affects performance, safety, and mission success.
- Precision in integration is the foundation of operational dominance.