Weapon Systems & Technology Directorate

Change in view point: Application of the Dual Recoil System to Light Weight Towed Artillery

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Role of Artillery

- Support maneuver elements
  - Provide timely, accurate and effective fires
  - Both in direct and general support
- Tube artillery has a place with rocket/missile and mortar systems
  - Range capability
  - Accuracy
  - Responsiveness

System Limiting Factors

- Strategic Mobility
  - Limited assets
  - Competition for space
- Tactical Mobility
  - C-130
  - Helicopter performance
  - Prime mover performance

Current Light Cannon Artillery M119A2 105mm Towed Howitzer

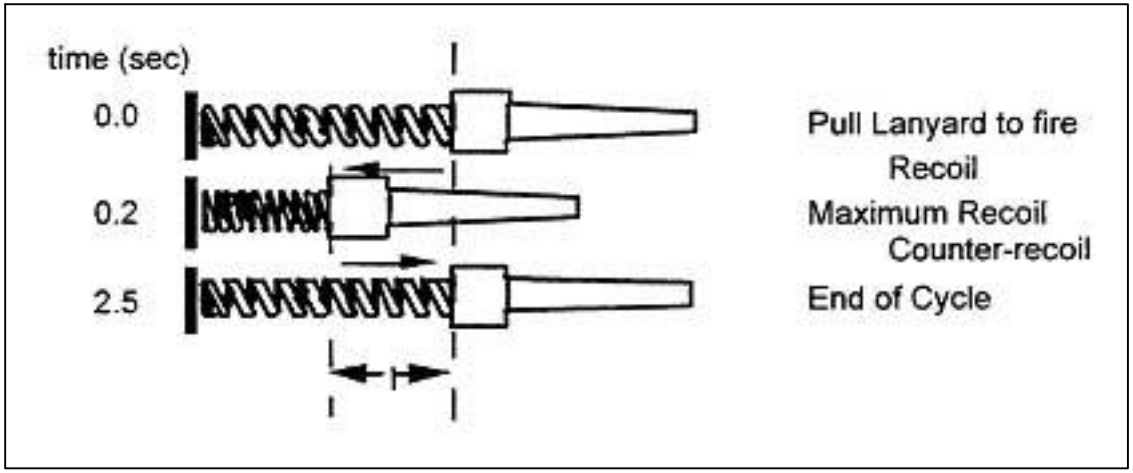
- Max Range/Precision (M913)
  - 19.5 km / 32 m CEP
  - 20 km / 35 m CEP (Battlefield Emergency)
- Weight - 4270 lb
- Prime Mover – M1097 HMMWV

Weapon Weight Reduction

- Limited by recoil reaction
- Recoil reaction reduction dependant upon system utilized
- Structural Life

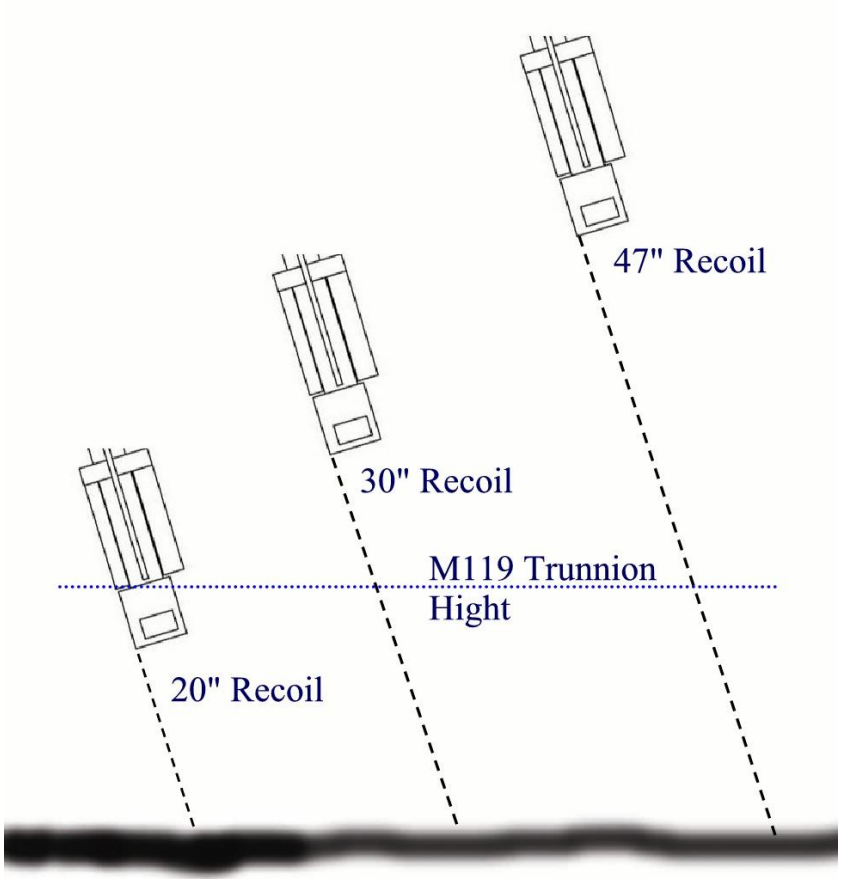
Fire-In-Battery
Single Recoil System

For a given weapon impulse and recoiling mass, the weapon load is inversely proportional to the recoiling mass and the distance it is allowed to translate.

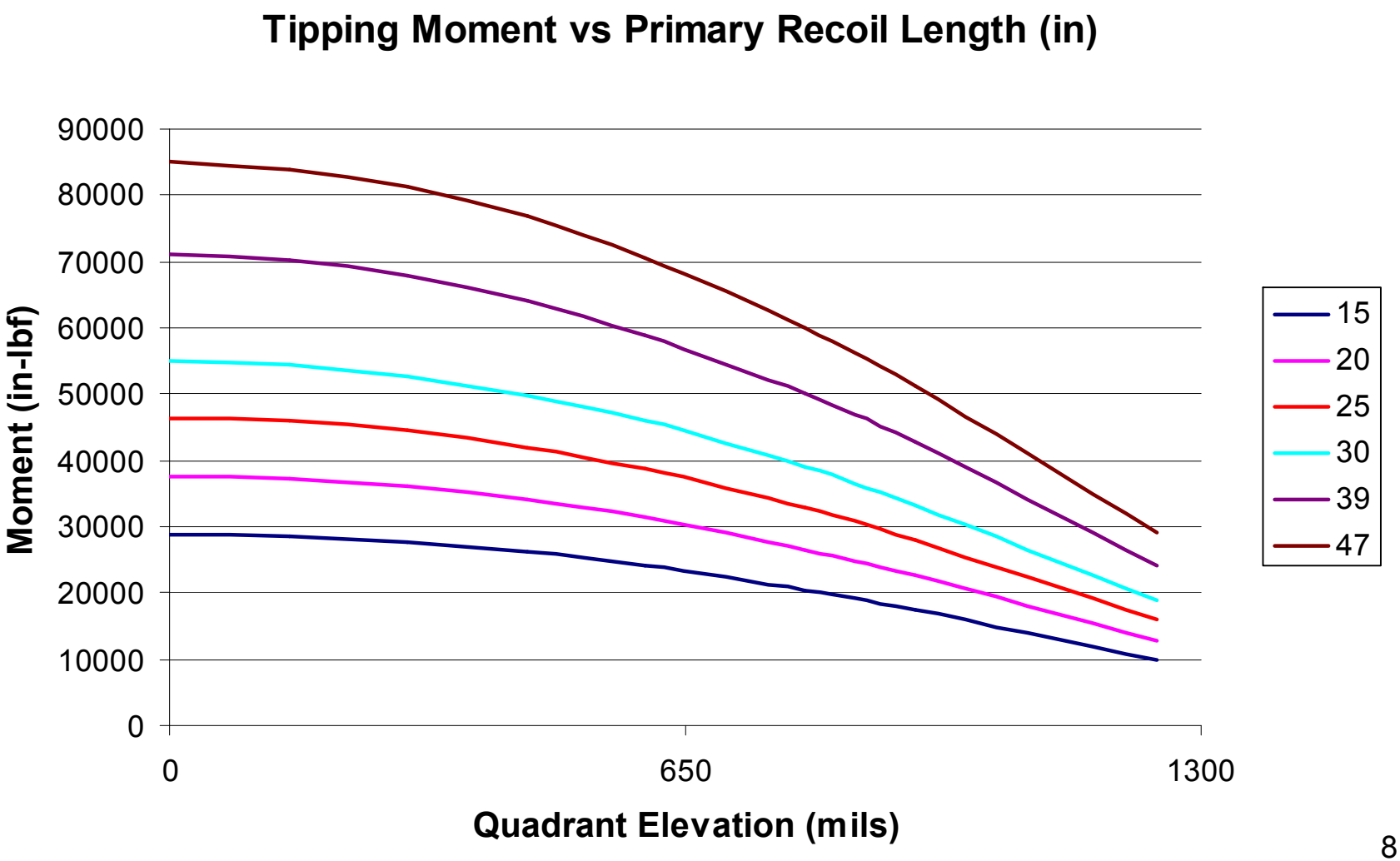


Implications of Increasing Recoil Distance

- Tipping center of gravity shifts
- Recoil mechanism and cradle structure increases
- Loading more difficult complicated
- Recoil cycle time impacted

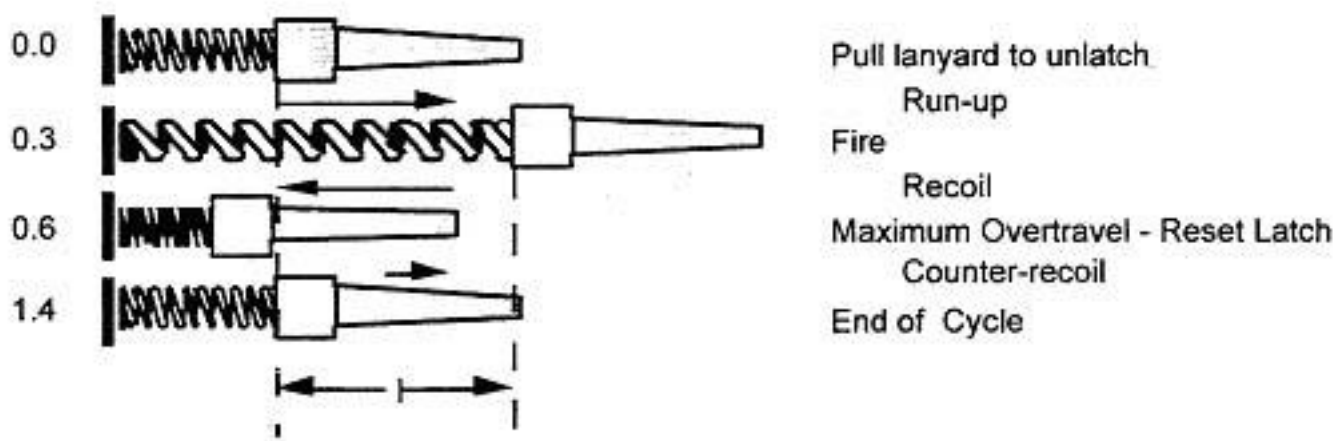


Implications of Increasing Recoil Distance



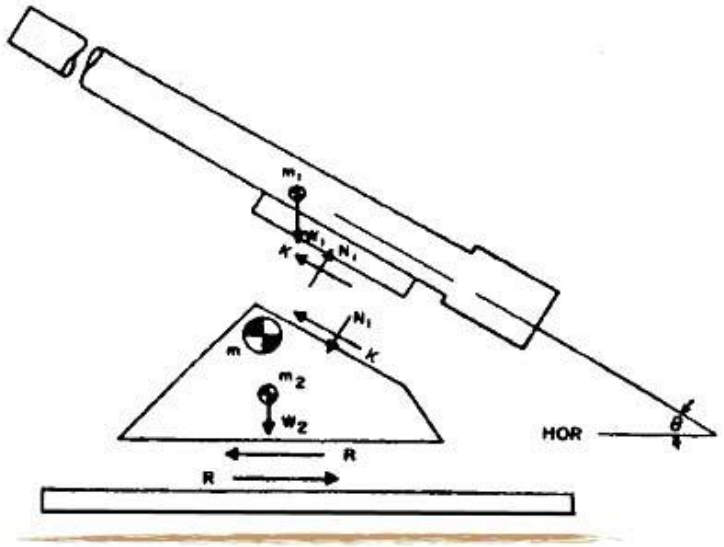
Fire-Out-of-Battery Single Recoil System

- Recoil impulse partially countered by inducing forward momentum prior to weapon firing
- Performance affected by temperature, forward velocity, and position along orifice control



Fire-In-Battery
Dual Recoil System

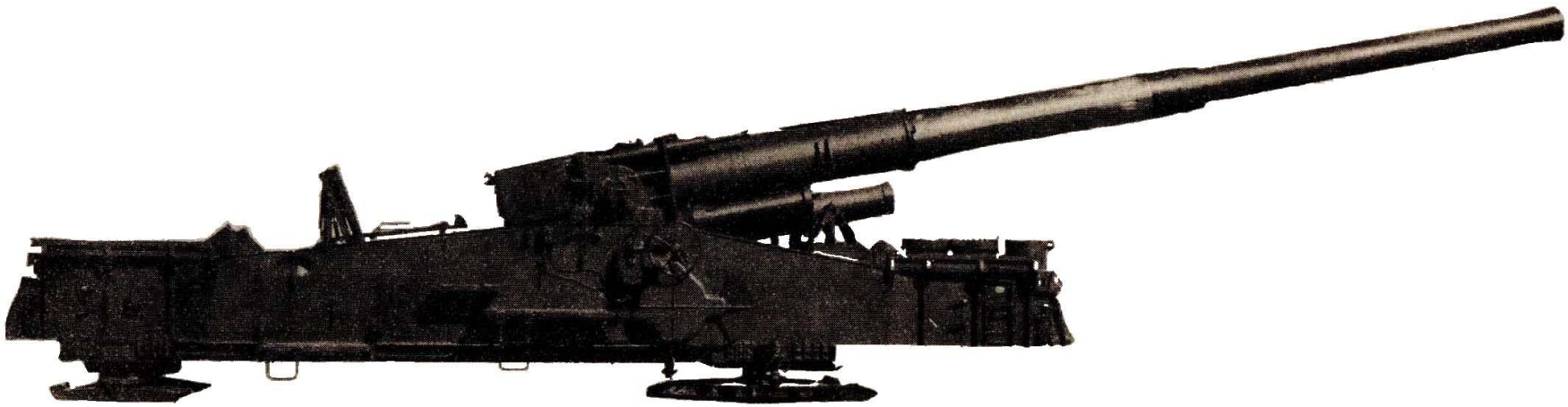
Recoil system between cannon and cradle and recoil mechanism between the top and bottom carriages



Dual Recoil Historical Application

- Very heavy artillery systems from World War I into the 1950's
  - Railway guns
  - Very heavy mobile siege guns and howitzers
- Dual recoil system required to handle:
  - Huge recoil forces (projectile weights/ranges)
  - Within reasonable physical and logistic limits

US M59 280mm Towed Gun



System Weight – 47 tons

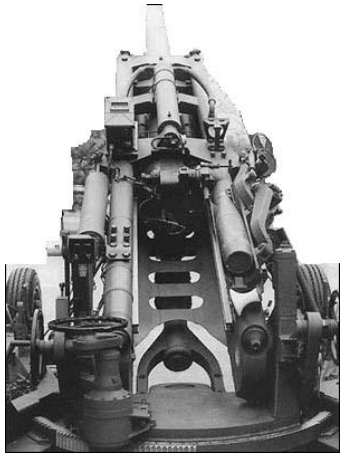
Projectile Weight – 550 lb.

Charge Weight – 150 lb.

Range – 27 km

Recent Weight Reduction Efforts Towed Cannon Artillery

- M777 155mm Towed Howitzer
  - Increased recoil length of single recoil FIB
  - Titanium

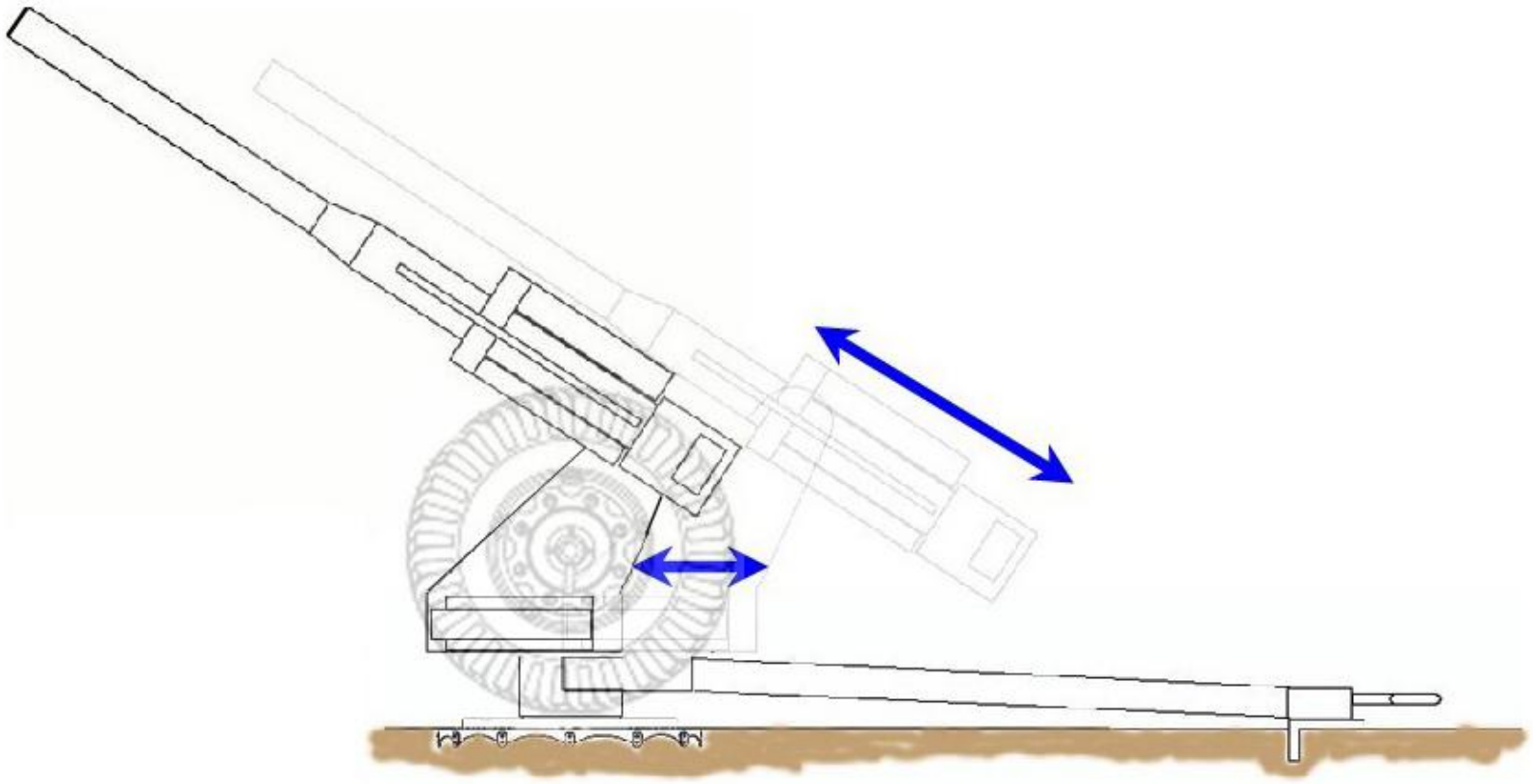


- Giat LG1 Mk II 105mm Towed Howitzer

Draft Requirements for Forcible Entry Weapon (FEW)

Criterion	Threshold	Objective
Weight	3,300 lbs	3,000 lbs
Max. Range	19.5 km with M913	20 km with CCF/BB 21 km without CCF
Rate-of-Fire	8	10
Shift Fire Azimuth	6400 mils	6400 mils
Emplacement/Displacement	60 sec.	30 sec.

Concept System Utilizing Dual Recoil System



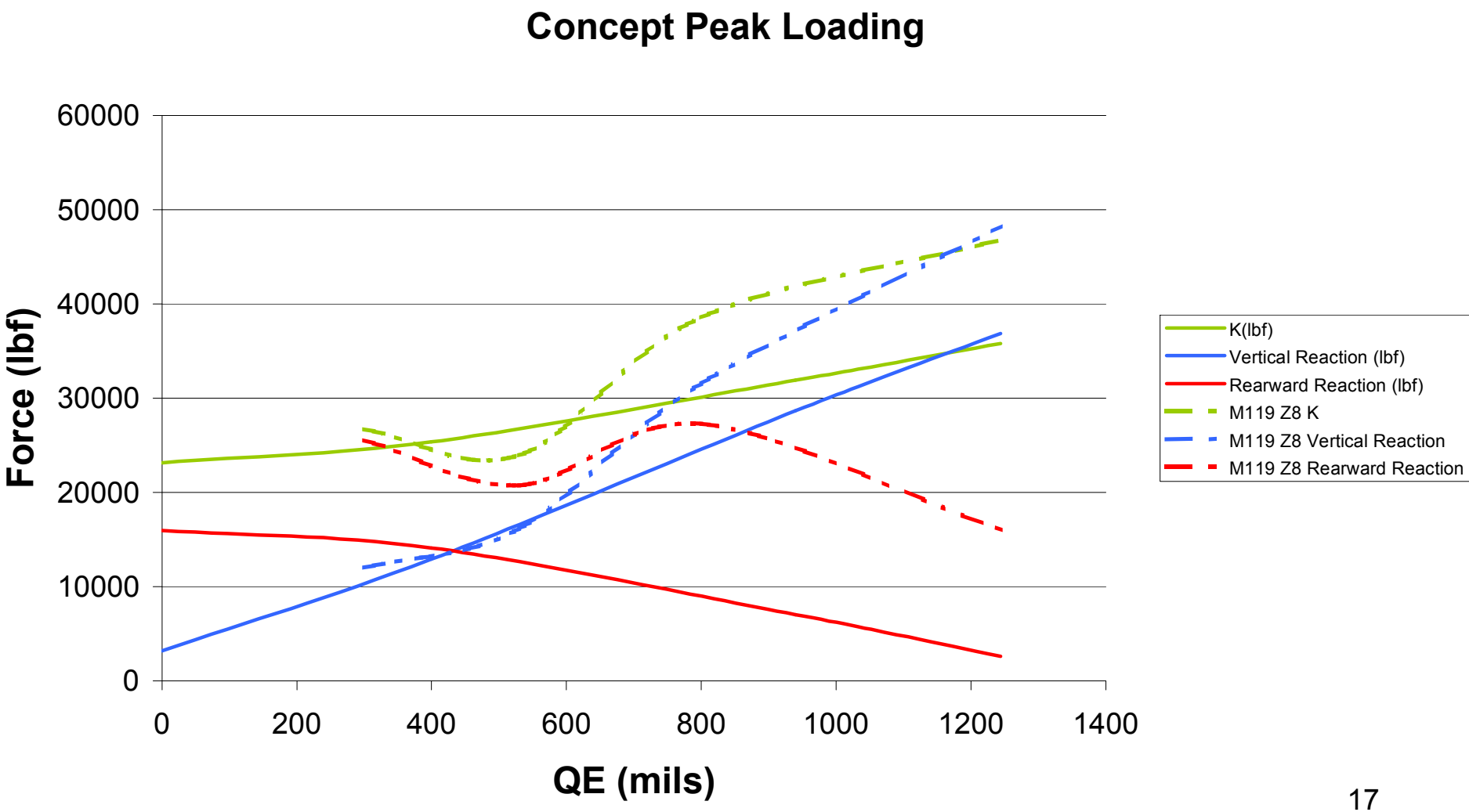
Concept System Characteristics

- Weight
  - Recoiling (primary) - 1710 lb.
  - Recoiling (secondary) - 915 lb.
  - System – 3230 lb.
- Max. rate of fire

  10 rounds per minute

- Ammunition – All compatible with M119A2 howitzer
- Range
  - M760 Ballistic-14.5km
  - M913 RAP Ballistic-21km
  - M913 RAP CCF-20km
- Recoil cycle time – 2.3 seconds

Concept System Dual Recoil



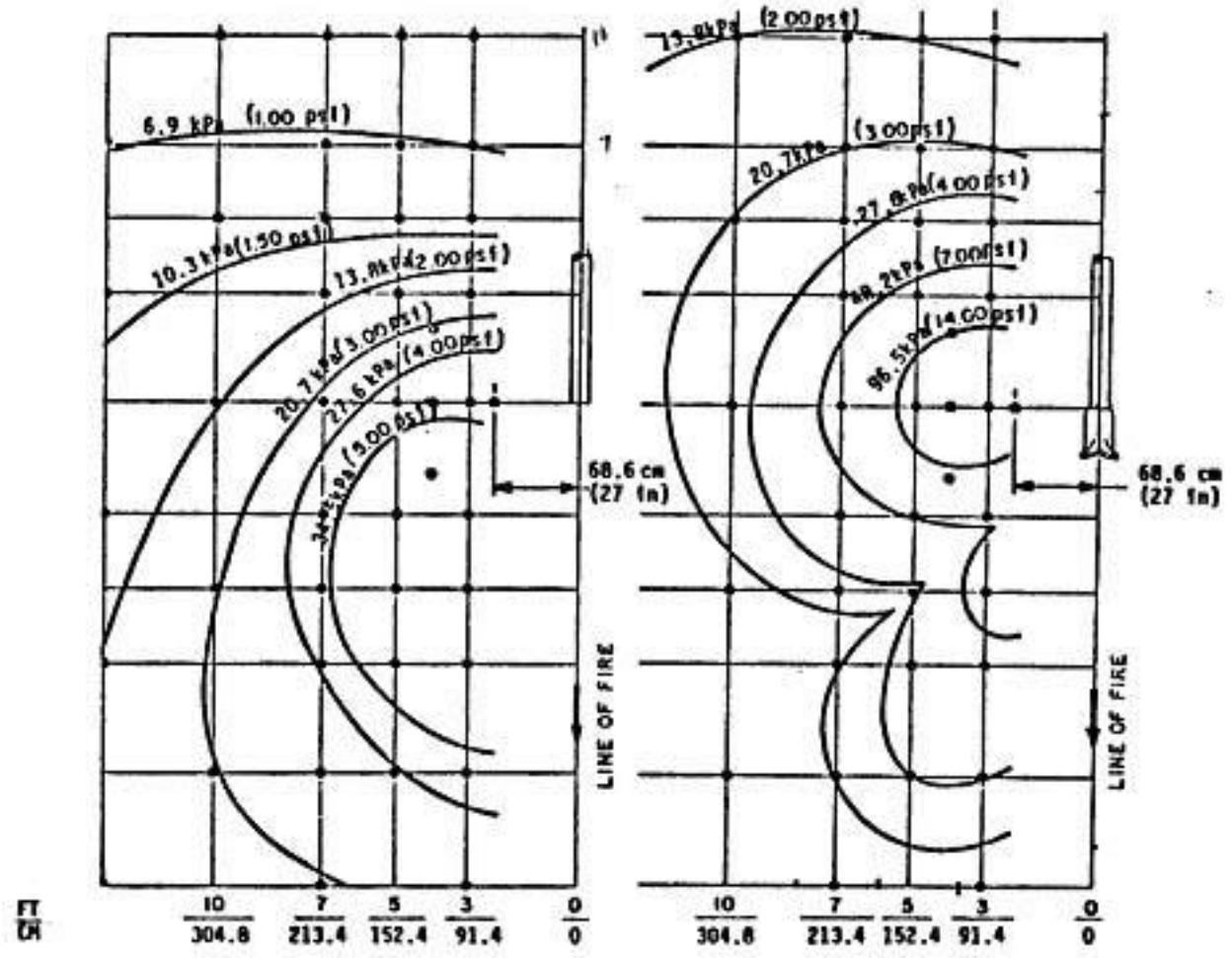
Dual Concept Compared to M119A2 Howitzer

Parameter	Concept	M119A2
System Weight (lb)	3230	4270
Max. Range - M760 (km)	14.5	14
Max. Range – M913 (km)	21	19.5
Max. Rate of Fire (rounds per minute)	10	8
Trail Configuration	Split	Wish bone
Muzzle Brake	None	Single Baffle, Med.
Peak Recoil Load, Primary @ 800 mils (lbf)	30000	38600
Peak Lateral Ground Reaction Load @ 0 mils (lbf)	16000	(22100 est.)

Dual Concept Compared to M119A2 Howitzer

Blast Overpressure

Dual Concept



M119A2