

# *Fire Support Weapon Systems*

Understanding the War in Ukraine

Session #4

## *Indirect Fire (Definitions)*

- **fires** — The effects of lethal or nonlethal weapons. (JP 3-09)
- **fire support** — Fires that directly support land, maritime, amphibious, and special operations forces to engage enemy forces, combat formations, and facilities in pursuit of tactical and operational objectives. See also fires. (JP3-09.3)
- **indirect fire** — Fire delivered on a target that is not itself used as a point of aim for the weapons or the director.

# Tanks and Field Artillery

## Direct and indirect fire



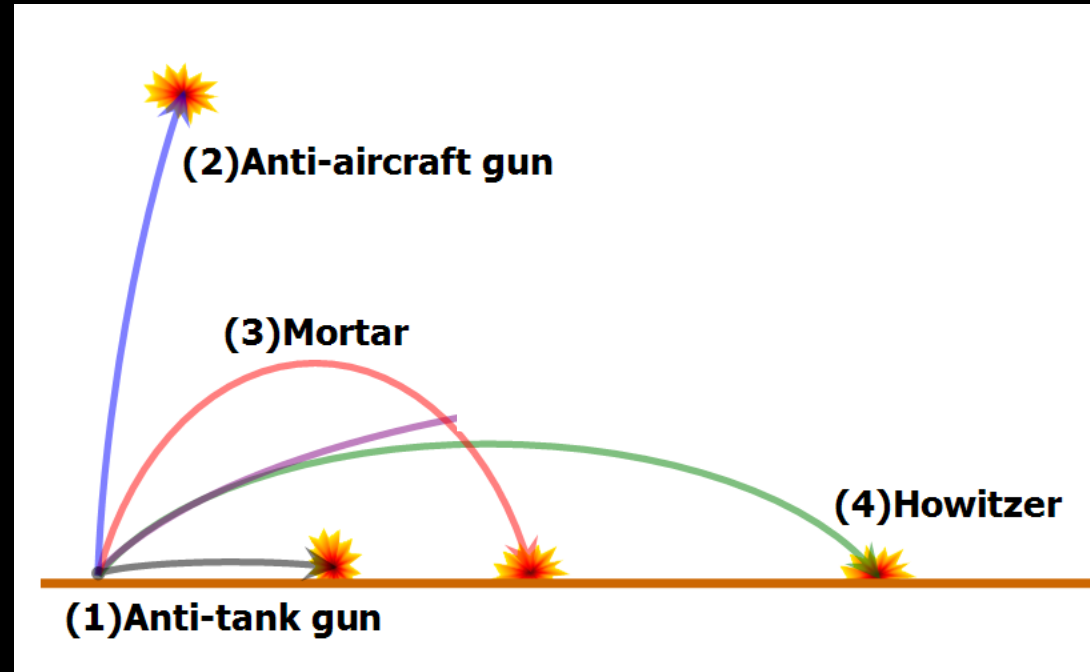
US Army photograph

<https://breakingdefense.com/2023/02/evolving-plans-ukraines-m1-abrams-tanks-could-come-from-us-stockpiles-official-says/>

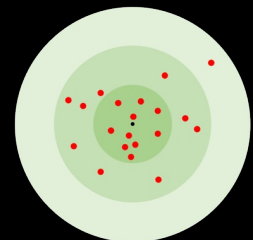
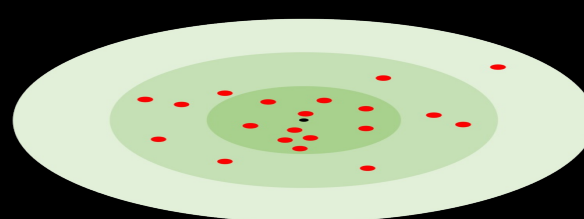


US Army photograph

[https://www.army.mil/article/476/army\\_fields\\_its\\_first\\_light\\_weight\\_howitzer](https://www.army.mil/article/476/army_fields_its_first_light_weight_howitzer)



<https://www.wikiwand.com/simple/Trajectory>



# *Requirements for Accurate Predicted Fire*

## **Accurate:**

1. Target location and size
2. Firing unit location
3. Weapon and ammunition information
4. Meteorological information
5. Computational procedures



# How Does Indirect Fire Work?

## Artillery Call for Fire Process

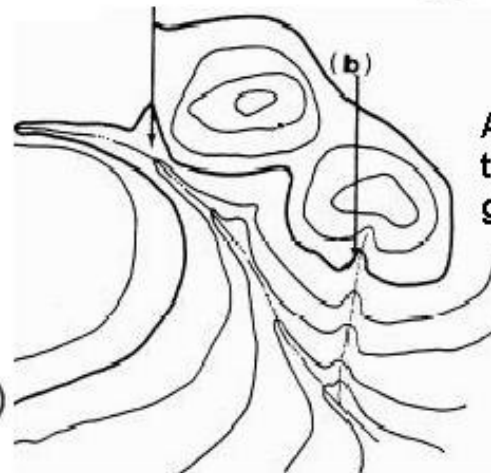
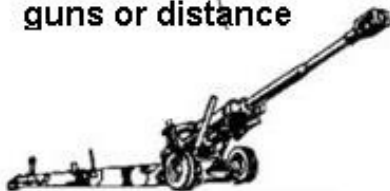
Forward Observer (FO)  
calls for and adjust fire  
on enemy



Fire Direction Center  
(FDC) computes firing  
data (range, trajectory  
and shell/fuse info) to  
pass to gun line's gun(s)



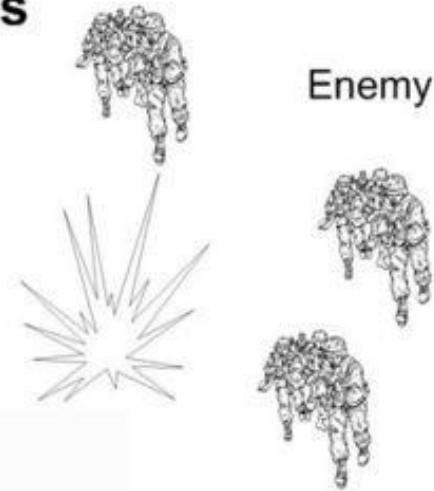
Target usually can not be directly seen  
by soldiers manning the guns because  
of terrain masking the view from the  
guns or distance



A hill masks the  
target from the  
guns but not the FO

Gun line gun(s) fire the  
mission. FO observes  
the effects, continues to  
adjusts fall of shot until  
"End of Mission" (EOM)

FDC's parent unit's  
(FDC) monitors the  
mission and intervenes  
as needed



Enemy

# *Cannon Artillery*

Types of howitzers:

Self-propelled



Towed





UNCLASSIFIED

Printed and distributed in 1981

GTA 30-3-23 SEPTEMBER 1981  
Headquarters, Department of the Army  
DISTRIBUTION: US Army Training Aids Centers.

# SOVIET BIG 7



ZSU-23/4

## ARMORED ANTI-AIRCRAFT WEAPON

FOUR 23mm AA GUNS ON A COMMON MOUNTING.  
FOUR GUNS FIRE TOGETHER FOR MAXIMUM VOLUME OF FIRE.  
EMPLOYED AS LOW-LEVEL AA TROOP PROTECTION.



MI-24 HIND-D GUNSHIP

A POTENT WEAPONS SYSTEM THAT POSES A  
SIGNIFICANT THREAT IN ANY TACTICAL  
SITUATION.

ARMAMENT:  
1 NOSE MACHINE GUN  
4 SWATTER ANTITANK MISSILES  
4 PODS (EACH WITH THIRTY-TWO  
57mm ROCKETS)



BMP

## AMPHIBIOUS ARMORED INFANTRY COMBAT VEHICLE

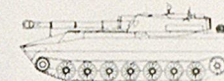
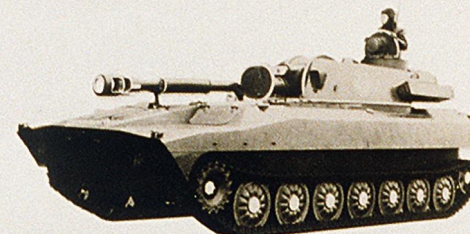
MOBILITY, FIREPOWER AND TROOP PROTECTION EXCELLENT BY U. S. STANDARDS.

ARMAMENT:  
73mm SMOOTHBORE GUN AND AN ANTITANK MISSILE.  
CARRIES CREW OF 3 AND 8 INFANTRYMEN.



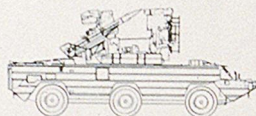
T-72 TANK

REPORTED TO BE THE SUCCESSOR TO THE T-62 TANK.  
HIGHLY MOBILE WITH IMPROVED ARMOR PROTECTION.



122MM SP GUN  
M-1974

REPORTED TO BE THE REPLACEMENT FOR  
THE 122mm TOWED HOWITZER D-30.  
HIGHLY MOBILE AND AMPHIBIOUS.

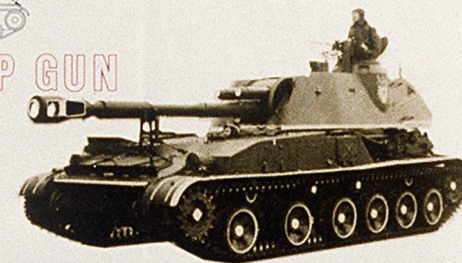


SA-8 GECKO  
SURFACE-TO-AIR MISSILE

FOUR SA-8 MISSILES ARE CARRIED ON A THREE-AXLE  
AMPHIBIOUS VEHICLE.  
THE ENTIRE SYSTEM, FIRE CONTROL RADAR AND  
MISSILE LAUNCHER, IS MOUNTED ON ONE VEHICLE.  
THE SA-8 MISSILE'S RANGE IS 10-15 km.



152MM SP GUN  
M-1973



REPORTED TO BE THE REPLACEMENT FOR TOWED 152mm GUN HOWITZER.  
HIGHLY MOBILE.



# Russian Cannon Artillery Systems

2A65 "Msta-B" towed, 152mm howitzer



Mil.ru, [https://en.wikipedia.org/wiki/152\\_mm\\_howitzer\\_2A65\\_Msta-B](https://en.wikipedia.org/wiki/152_mm_howitzer_2A65_Msta-B)

2S7M Malka self-propelled, 203mm gun



Business Insider, Rostec Press Office\TASS via Getty Images

2S19 Msta 152mm self-propelled howitzer



Vitaly V. Kuzmin - [vitalykuzmin.net](https://vitalykuzmin.net), [https://en.wikipedia.org/wiki/2S19\\_Msta](https://en.wikipedia.org/wiki/2S19_Msta)

2A18 (D-30) 122mm towed howitzer



Mil.ru, [https://en.wikipedia.org/wiki/122\\_mm\\_howitzer\\_2A18\\_%28D-30%29](https://en.wikipedia.org/wiki/122_mm_howitzer_2A18_%28D-30%29)





# *NATO Allies Cannon Artillery Systems*

US M109, 155mm, SP



French CEASAR, 155mm, SP



U.S. Army photo by Markus Rauchenberger

German Panzerhaubitze 2000, 155mm, SP



UK/US M777, 155mm, Towed





# 2S22 Bohdana (155mm, SP)





# *Ammunition Expenditure*

- 155mm ammunition: 6,000 to 8,000 rounds per day = approx. 24 to 32 semi trailer loads
- Pallet of 155mm projectiles (144 x 96 lbs each) with dunnage weighs about 15,000 lbs, (estimate another 8,000—10,000 lbs for fuzes and propellant charges)
- MLRS Rocket pod: 5,236 pounds (Jeep Grand Cherokee with 3 adult passengers)



# Counter-Battery Fire

Artillery-locating radar

1L219M Zoopark-1M



via Armada International

1L271 Aistyonok



Via Nagorno Karabach Observer

Photo provided by from Almaz Antey

AN/TPQ-36 Firefinder



Ukraine Military Pages





# Russian Multiple-Launch Rocket Launchers

BM-21 Grad



TOS-1 Buratino



Kirill Borisenko

SMERCH



Vitaly V. Kuzmin





# M270 Multiple Launch Rocket System MLRS



Non-nuclear capable  
Bradley Infantry Fighting Vehicle chassis, 26 tons  
3-man crew  
12 rockets (19.9 miles) or 2 ATACMS missiles (up to 186 miles)  
Rocket pod weighs 5,200 lbs





# *M142 High Mobility Artillery Rocket System*

## *HIMARS*

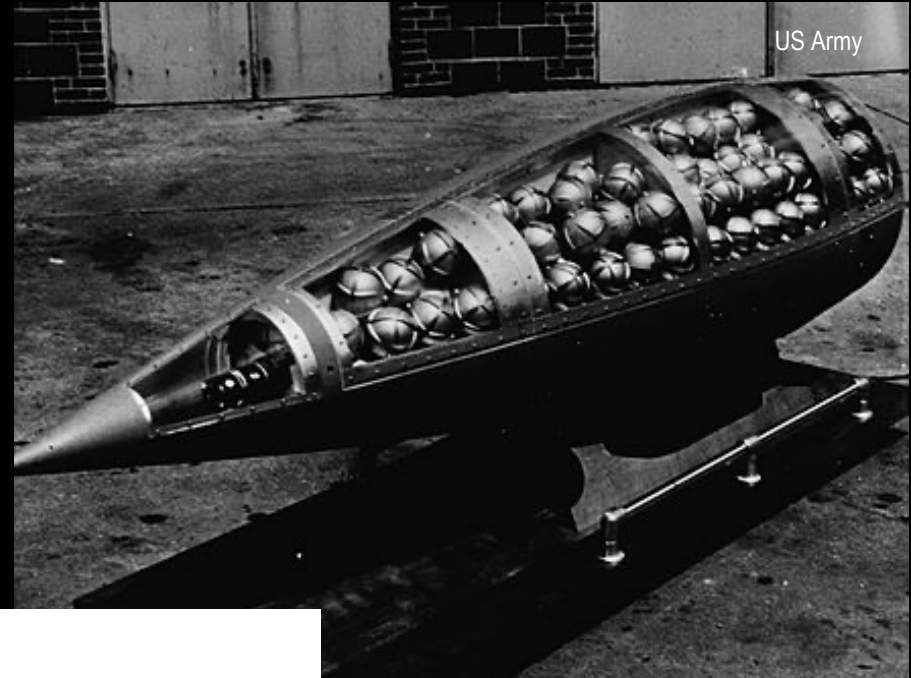


MLRS ammunition, but only one pod  
17 tons fully loaded  
Same 3-man crew

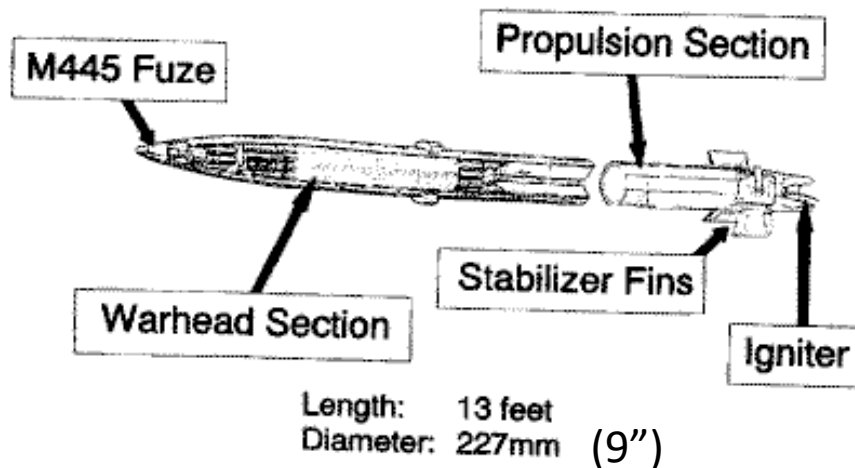
# Cluster Munitions



Problem:  
dud rate

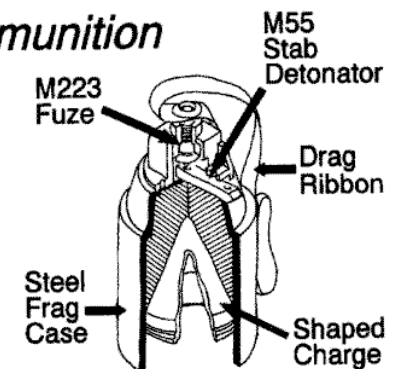


## M26 Rocket



## M77 Submunition (DPICM)

Height: 81mm  
Diameter: 38mm



MLRS "steel rain"  
(Desert Storm)



# *What Cluster Munitions Look Like*







# 9K720 Iskander Short-Range Ballistic Missile (SS-26 Stone)





# Close-in Air Defense Weapons

ZSU-23-4 (Shilka)



Sgt. Ryan Ward, U.S. Marine Corps

Pantsyr (SA-22 Greyhound)







# *FIM-92 Stinger Surface-to-Air Missile*



30th Konstanty Ostrogski Brigade's anti-air battalion in the vicinity of Bakhmut.



# 2K12 Kub (SA-6 Gainful)



1S91 (Straightflush)



- Med-range, surface-to-air missile
- 1967—present, several improved versions
- Radar-homing
- 15 mile range, 20,000'

# *S-400 Surface-to-Air Missile (SA-21 Growler)*



[https://en.wikipedia.org/wiki/S-400\\_missile\\_system](https://en.wikipedia.org/wiki/S-400_missile_system)



Youtube, <https://www.youtube.com/watch?v=ebVXwUI0azI>





# *US Patriot Surface-to-Air Missile*





# *Counter-drone truck*







# *KH-55 and KH-101 Air-launched Cruise Missiles*

KH-55 (AS-15 Kent)



Eurasian Times

Military-Today.com

KH-101 / KH-102



Missile Defense Advocacy





# 3M-54 Kalibr (family of missiles) (SS-N-27 Sizzler)



Sea-launched – either ship or submarine







# *Kh-47M2 Kinzhal (Killjoy) hypersonic cruise missile*





# Storm Shadow



SCALP-EG "Système de Croisière Autonome à Longue Portée – Emploi Général";  
English: "Long Range Autonomous Cruise Missile System – General Purpose"

## Storm Shadow Cruise Missile







# *Russian FAB-500 bomb*



Upper left: [https://en.wikipedia.org/wiki/FAB-500#/media/File:FAB-500\\_M62\\_aerial\\_bomb\\_in\\_Park\\_Patriot\\_01.jpg](https://en.wikipedia.org/wiki/FAB-500#/media/File:FAB-500_M62_aerial_bomb_in_Park_Patriot_01.jpg)

Lower right: <https://newspaper.pressherald.com/html5/reader/production/default.aspx?pubname=&pubid=7197fe86-8d61-4e68-b9e9-94d7dbb2ffb5>



# Drones





# *Tupolev Tu-141 Reconnaissance Drone*





# Iranian-made Shahed-136 Drone



Defence Express, Getty Images via BBC



Washington Post

# *Chinese-made Mugin-5 Drone*



# *UJ-22 Airborne*

## UNMANNED AIRCRAFT SYSTEMS SOLUTIONS







# Baykar Bayraktar TB2 Drone





# *MQ-9 Reaper / Predator B*







# *RQ-4 Global Hawk*



# Generations of Fighter Aircraft

Fighter aircraft are fixed-wing military aircraft designed primarily for air-to-air combat. In military conflict, the role of fighter aircraft is to establish air superiority of the battlespace.

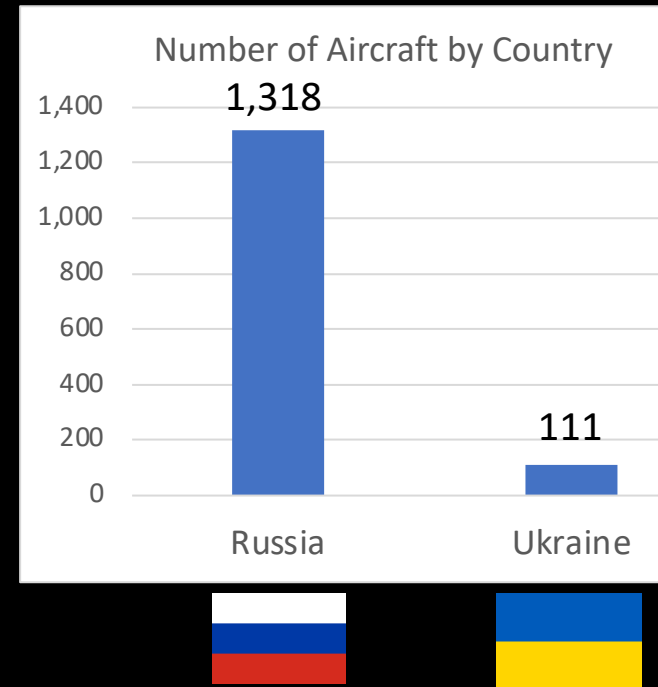
Gen	In Svc	Description	Examples	
1	1943-1955	<ul style="list-style-type: none"> <li>Transonic (250-760 mph)</li> <li>Conventional armed, missiles, radar</li> </ul>	P-80 F-86	MiG-9 MiG-15
2	1953-1970	<ul style="list-style-type: none"> <li>Supersonic</li> <li>Radar, air-to-air missiles</li> </ul>	F-100 F-104	MiG-19 <b>Su-24</b> MiG-21 <b>Su-25</b>
3	1960-1970	<ul style="list-style-type: none"> <li>Multipurpose fighter-bombers</li> </ul>	F-4	MiG-23
4	1970-2000	<ul style="list-style-type: none"> <li>Supersonic, multi-role</li> <li>High efficiency, high maneuverability</li> </ul>	F-14 F-15 F-16	<b>MiG-29</b> <b>Su-27</b> MiG-31
4.5	1990-2000	<ul style="list-style-type: none"> <li>Enhanced capabilities, advanced avionics</li> <li>Limited stealth</li> </ul>	F/A-18 (Eurofighter Typhoon)	Su-30 Su-34 MiG-35 Su-35
5	2000-present	<ul style="list-style-type: none"> <li>Advanced, integrated avionics</li> <li>Low observable stealth</li> </ul>	F-22 F-35 (FA-50)	Su-57

UNOFFICIAL – For discussion purposes only



# Numbers of Russian & Ukrainian Fighters

Model	NATO name	Enter Svc	Gen	Type	Russia	Ukraine
Su-24	Fencer	1975	2	Attack	273	12
MiG-31	Foxhound	1981	4	Interceptor	129	0
Su-25	Frogfoot	1981	2	Attack	192	16
MiG-29	Fulcrum	1982	4	Fighter	240	51
Su-27	Flanker	1985	4	Fighter	101	32
Su-34	Fullback	2006	4.5	Multirole	147	0
Su-30	Flanker-H	2012	4.5	Multirole	110	0
Su-35	Fulcrum-E	2013	4.5	Multirole	110	0
MiG-35	Fulcrum-F	2019	4.5	Multirole	6	0
Su-57	Felon	2020	5	Multirole	10	0



**Fighter** – primarily air-to-air combat

**Interceptor** – defensive interception of attacking aircraft (bombers or reconnaissance)

**Multirole** – air-to-air, air support, aerial bombing, reconnaissance, electronic warfare, and suppression of air defense

**Attack** – primary purpose of attacking targets on the ground in proximity to troops



# Russian & Ukrainian Fighter Aircraft

Su-24 (Fencer)



Alexander Mishin via Wikipedia

Su-25 (Frogfoot)



UKRINFORM (Ukrainian multimedia platform for broadcasting)

Su-27 (Flanker)



Wikipedia

MiG-29 (Fulcrum)



Defensenews





# Other Key Russian Warplanes

MiG-31K (Foxhound) Interceptor



Capable of launching  
Kinzhal hypersonic  
missile

Soldat.pro

Su-35 (Fulcrum-E) Multirole



Anna Zvereva from Tallinn, Estonia



Tu-22M3 (Backfire) Bomber Ministry of Defense of the Russian Federation



# *F-16 (Fighting Falcon)*

Entered Service: 1976, over 4,500 built, 25 users

Type: Gen 4, multirole, single-seat

Speed: Cruise at Mach 2.05 (1,353 mph)

Range: ~2,000 miles (58,000' ceiling)





# Ukraine Air Force Bases





# *Russian Helicopters*

Mi-24 (Hind) Helicopter Gunship



Ka-50 (Hokum A) Attack Helicopter



Mi-8 (Hip) Transport Helicopter







# *Ukrainian Navy Patrol Boats*

