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**185th ALLIED FORCE
THREAT GUIDE V1.1**

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This document provides a guide to the major air and ground threats you are likely to encounter when flying official TEs.

Note that the data is relevant to Allied Force and technical details may vary from published real world data.

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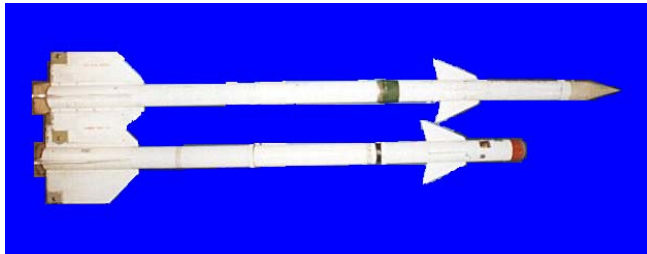
AIR-TO-AIR MISSILE THREATS

AA-2 ATOLL (R-13)



On 24 September 1958, the Chinese acquired an American AIM-9B Sidewinder missile that was fired from a Taiwanese F-86 Sabre but lodged in a Chinese MiG-17 without exploding. The missile was copied, and the product was the AA-2 Atoll (R-13). Two variants the AA-2 (IR) and the AA-2-2 (SARH) were produced. Like the AIM-9P, the AA-2 lacks the seeker sensitivity to detect the IR signature of targets in the

frontal aspect. This effectively limits the missile to rear aspect engagements only.



The missiles are also handicapped by background IR clutter. In look-down situations at low altitude it may not be possible to get a lock due to IR clutter from the ground. They are easily decoyed by the sun. It is not a good dog fighting

missiles firing in a turn in excess of 4g will sometime result in ballistic shots as the missile either gimbals out or the target line of sight (LOS) rate exceeds the tracking ability. Beam shots will seldom succeed due to the high LOS rate during end-game. Effective range is 1 - 1.5nm tail-on. The missile lacks any IRCCM and is very susceptible to flares.

The K-13 missile was also produced in China as the PL-2.

AA-2 Statistics

Guidance: IR / SARH

Eff. Range: WVR Rear: 1-1.5nm Front: SARH only 3.0 nm

Speed (mach): 2.5

CM Vulnerability: Flare - Very High

Avoidance: Flares + Break Turn

Characteristics: Low sensitivity seeker. Susceptible to CMDS. Low seeker LOS rates. IR not All Aspect. Low maneuverability.

Carried by: Mig-19, Mig-21PF/PFM/bis, Mig-17, Su-25, Shenyang J-5

AA-6 ACRID (R-40)



The AA-6 ACRID or R-40 was designed for use with the MiG-25 as a long range intercept missile, similar to the AIM-54 Phoenix. It is also fitted to the MiG-31 and SU-34.

The missile was produced in two variants: R-40R and R-40T. The R-40R is SARAH with a maximum range of over 30nm and the R-40T is IR with a range of approximately 19nm.

As the missile was primarily designed for shooting down aircraft such as bomber it is not particularly manoeuvrable and, especially, at longer range can be defeated by a combination of beaming and a break turn with chaff/flare.

The missile must be respected, however, due to its high speed (Mach 5+) and long range which can put the F-16 on the defensive long before you are in AIM-120 range.



Statistics

Guidance: IR / SARH

Eff. Range: BVR Rear: T- 15nm / R-8 nm Front: T-30nm / R-20nm

Speed (mach): 5+

CM Vulnerability: Flare - High Chaff - Med

Avoidance: Chaff/Flares + Break Turn/Beam

Characteristics: Datalink guided until seeker is in range. High speed (Mach 5+). Low IRCCM capability. Limited maneuverability.

Carried by: MiG-25, MiG-31, SU-34

AA-7 APEX (R-23/24)



In the mid-1960s the R-23 intermediate-range missile was developed for MiG-23 fighter jet aircraft. The missile was certified as a weapon for the MiG-23M in 1973. The R-23 comes in two variants: R-23R with radar guidance and R-23T with infrared guidance.



The later MiG-23ML and MiG-23MLD aircraft carry the R-24 missile, a modification of the R-23 with various improved characteristics, most importantly a 50 km rather than 35 km range. In its external appearance this missile is similar to the predecessor R-23. For actual use

it is available in two variants: R-24R and R-24T.



The AA-7 has not demonstrated strong combat performance. Syrian MiGs firing AA-7s failed to score a hit against the Israeli Air Force during the 1983 invasion of Lebanon. The missile's sole kill was a South African Mirage F1 when fired by an Angolan MiG-23.

The AA-7 can be defeated at longer range by beaming, with or without ECM and chaff. At closer range ECM, chaff/flares and a break turn might be necessary.

Statistics

Guidance: IR / SARH

Eff. Range:	Rear: 4-6 nm (R-23R/T)	Front: 10-15 nm (R-23R/T)
WVR/BVR	Rear: 10-15 nm (R-24R)	Front: 20-25 nm (R-24R)

Speed (mach): 3.0

CM Vulnerability: Flare - Very High Chaff - High

Avoidance: Chaff/Flares + Break Turn/ Weaving/ Dive and Climb / Beam

Characteristics: Low sensitivity seeker. Susceptible to CMDS. No IRCCM. Low seeker LOS rates. Low maneuverability. Loses speed rapidly in turns

Carried by: Mig-23

AA-8 APHID (R-60)



Toward the end of the 1960s work began on the first Russian missile designed for dogfighting, the AA-8 Aphid (R-60) and production began in 1973. It uses infrared self-guidance and with a high tracking rate was able to follow targets manoeuvring at up to 12g. The seeker also has a ± 20 degree gimbal limit, allowing shots farther off the aircraft's nose than earlier missiles.



To achieve this manoeuvrability the design traded size and range with the R-60 missile being unusually small, weighing half as much as the lightest Western missiles, with a correspondingly small warhead that requires the Aphid to get within a few feet of the target to have a good chance of causing serious damage.

The R-60 on attack aircraft such as the MiG-27, Su-24 or Su-25 serves as a self-defence missile and on fighter aircraft such as the MiG-23, MiG-25, and Su-15 it is occasionally used as a supplementary missile.

The AA-8 has not demonstrated strong combat performance. Syrian MiGs firing AA-8s failed to score against the Israeli Air Force during the 1982 invasion of Lebanon.

Statistics

Guidance: IR

Eff. Range: WVR Rear: 1.5 nm Front: 2.0 nm

Speed (mach): 2.0+

CM Vulnerability: Flare - Very High

Avoidance: 3-4 Flares + Break Turn

Characteristics: Low sensitivity seeker. Susceptible to CMDS. Rudimentary IRCCM.

Carried by: Mig-21bis, MiG-23, MiG-25, MiG-27, MiG-29, MiG-31, Su-25

AA-10A/B/C Alamo (R-27)



The AA-10 Alamo (R-27) medium-range missile is a component of the MiG-29, Su-27 and Su-30 armament. In its overall characteristics the R-27 is generally comparable to the AIM-7M Sparrow. The R-27 is capable of engaging targets in long-range and air-to-air combat. It supports the intercept of targets moving from different

directions against the background of the earth's and water's surface in any weather conditions.

The R-27 is designed according to a modular principle and is the base for a family of missiles equipped with various types of homing heads and propulsion systems. Several versions of this missile have been produced in Russia with infrared, semi-active and active radar guidance.

The first service version of the R-27 were the SARH R-27R (Alamo-A) and the IR R-27T (Alamo-B). Both versions use inertial guidance with data link command from the launching aircraft in the first phase of flight and under perfect conditions the Alamo A/B offers a head-on shot at 33 nm and a tail-aspect shot at 12 nm (against a bomber size target), making it a serious threat if ignored.

Development of the R-27 provided a missile with better range and tracking ability and these missiles became the SARH R27ER (AA-10C) and the IR R-27ET (Alamo D). With the Alamo C offering a range up to 59 nm under ideal conditions, it offers a first launch capability against the F-16/AMRAAM combination. The R-27 ET has a similar range, giving it extremely long legs for an IR missile. It achieves this by utilising the data-link and inertial guidance for the first phase of flight.

The Alamo is not a true dogfight missile, but can follow a target pulling up to 8G, making it good enough against anything except for a modern fighter operating at its maximum turn performance. It is capable of going around a plume of passive jamming, of being moved out of the main lobe of the platform's radar, and of approaching a low-flying target from above at a given angle.

At long range, the R-27 missile can be evaded by putting it on the beam and employing chaff/flare. At close range, a 9G turn into the missile will normally work.

Statistics

Guidance: SARH/IR

Eff. Range: BVR	A/B	Rear: 5-8 nm	Front: 10-15 nm
	C/D	Rear: 10-12 nm	Front: 25-30 nm

Speed (mach): 4.05

CM Vulnerability: Flare – Med/ Chaff - Med

Avoidance: 4-5 Flares/Chaff+Break Turn / Weaving / Dive and Climb / Beam

Characteristics: Good seeker sensitivity, Good IRCCM, above average manoeuvrability (but a 9G turn will defeat it). The C/D models have a longer range but lower manoeuvrability. Loses speed quickly in turns.

Carried by: MiG-29, Su-27, Su-30

AA-11 Archer (R-73)



The R-73 is Russia's best short range air-to-air missile and is used on the MiG-29S, MiG-29SM, MiG-21-93, and the SU-27/30/33/35/37 family. It combines exceptional manoeuvring ability with unprecedented seeker agility. When combined with the Helmet Mounted Sight (HMS), it allows engagement of targets at much larger angle off than a fighter armed with any other missile, including the AIM-9M.



The R-73 became operational in 1984 and is used for engaging modern fighters, including those executing up to 12g manoeuvres. It permits the platform to intercept a target from any direction, under any weather conditions, day or night, in the presence of natural interference and deliberate

jamming and realises the "fire and forget" principle. A powerful motor and sensitive seeker extend the range of the missile and allow it to outrange the Sidewinder and get in the first shot during a head-on engagement. In a neutral turning fight, the HMS/Archer combination gives pilots an earlier shot advantage, although one-on-one, a good pilot should be able to negate these advantages, particularly if they pick the entry into the fight carefully. In a furball, or when the fight is forced, the Archer can provide the enemy with a decisive advantage. The Mod1 variant extends gimbal limits to 45 degrees and the Mod2 to 60 degrees.

The Archer is less susceptible to flares and violent manoeuvres than any other IR missile, but 6-8 flares released in a 2 second burst and a break turn may defeat it.

Statistics

Guidance: IR

Eff. Range: WVR

Rear: 1.5-4 nm

Front: 5-10 nm

Speed (mach): 2.55

CM Vulnerability: Flare – Very low

Avoidance: 6-8 Flares/2 secs+Break Turn

Characteristics: Off boresight capability. High seeker LOS rate. High gimbal angle. Good IRCCM. High manoeuvrability (thrust vectoring). Avoid 2-circle fights.

Carried by: MiG-29, Su-27-Su-30, MiG-21-93

AA-12 Adder (R-77)



The most recent Russian medium-range air to air missile developed in Russia is the R-77 (AA-12 Adder or "Amraamski"). It can be fitted to a range of aircraft as shown at the bottom of the page.

It is an ARH missile with a HOJ capability that is similar to and in some respects superior to the American AIM-120 AMRAAM missile.



The AA-12 has a manoeuvring advantage by making better use of its available energy due to its aerodynamics and rear control assembly. It also has a slight range advantage but this may be negated because the AIM-120 has better ECCM characteristics and goes active at a longer range due to its superior seeker head.

The R-77 missile has an active radar finder and a maximum range of approximately 30 nm (further than the AMRAAM) and flies at four times the speed of sound. The missile's guidance is inertial with mid-course updates from the launch aircraft, followed by a terminal active radar phase from an acquisition range of about 8 nm.

The missile has good ECCM and is highly manoeuvrable making it difficult to defeat, especially at launch ranges less than 12-15 nm. Chaff and a 9G break turn may defeat the missile. The R-77M is an update version of the R-77 with 20% longer range and an active seeker range of around 12nm.

Statistics

Guidance: Inertial Command, Active Radar Homing with HOJ capability. Flies Lead Pursuit.

Eff. Range: BVR Rear: 10-15 nm Front: 18-30 nm

Speed (mach): 4.0

CM Vulnerability: Chaff – Very low

Avoidance: Chaff+Break Turn / Weaving / Dive and Climb / Beam

Characteristics: Range advantage over the AiM-120 but seeker range is 8-12 and supporting aircraft has to support the missile longer than the AiM-120. HOJ capability, High manoeuvrability, very dangerous.

Carried by: MiG-21-93, MiG-29S, MiG-29SM, MiG-33, Su-27SM, Su-30M, Su-30MKK, Su-32, Su-33SM, Su-35, Su-37.

AIM-120 AMRAAM



The AIM-120 AMRAAM (also known as the Slammer) is an advanced medium range air-to-air missile. It is the primary BVR weapon of choice for the United States Air Force, Navy and Marines as well as many other air forces across the globe.

It employs active, semi-active, and inertial navigational methods of

guidance to provide an autonomous launch and leave capability against single and multiple targets in all environments.

The AMRAAM flies up to Mach 4 and has a typical head-on engagement range of up to 25nm. In long-range engagements the AMRAAM heads for the target using inertial guidance and receives updated target information via data link from the launch aircraft. It transitions to a self-guiding terminal mode when the target is within range of its own radar, typically at around 12nm. The AIM-120 also has a "home-on-jam" guidance mode to counter electronic jamming. With its high closing speed, and excellent end-game manoeuvrability, this is a very difficult missile to avoid, especially when fired at shorter ranges, typically 12-15nm. Upon intercept an active-radar proximity fuse detonates the 18kg high-explosive warhead to destroy the target.

There are several different versions of the AIM-120 modelled within Allied Force. The standard B variant as described above, the C-4 model has clipped wings to allow for carriage in the F/A-22 and JSF weapons bays. It also has an updated guidance system with better ECCM capabilities and a larger warhead to improve the chance of a first shot kill against larger manoeuvrable targets such as the MiG-29 and Su-27 families. Finally it also changed the engine from a sustain/boost design to a pure boost. This slightly shortens the missiles overall range but allows the missile to get to its target quicker due to the increased acceleration. The C-5 model improved the range and had further ECCM upgrades. It is the most effective version within Allied Force.

Statistics

Guidance: Inertial with mid-course updates, active radar homing in terminal phase. Flies Lead Pursuit.

Eff. Range: BVR Rear: 3-12 nm Front: 5-25 nm

Speed (mach): 4.0

CM Vulnerability: Chaff – Very low

Avoidance: Chaff+Break Turn / Weaving / Dive and Climb / Beam

Characteristics: Slightly smaller range than the R-77 but seeker range is 12 nm and time of flight is shorter meaning the aircraft doesn't need to support the missile for as long. HOJ capability, High maneuverability especially at end-game when fired from less than 15nm makes this missile very dangerous.

Carried by: F-14D, F-15 (all variants), F-16 (all variants), F/A-18 (all variants), F-22A, EF-2000, Tornado ADV.

AIM-54



The Aim-54A Phoenix was designed to engage and destroy enemy bombers and cruise missiles well outside the range of the Carrier Battle Groups SAM umbrella and has an extremely long range of some 80nm against a head-on threat.

It was the world's first operational Active Radar Homing (ARH) missile and was specifically designed to be carried by the F-14. After launch the F-14's radar guides the missile to a distance of approximately 11 nm from the target where the missile active guidance radar takes over and homes in for the end-game.



The missile has an extremely large warhead that gives it an

effective blast range of up to 100ft, making up somewhat for its lack of manoeuvrability against 9g targets.

The AIM-54C features completely new digital guidance and control sections. The missile incorporates a programmable digital signal processor, and the autopilot now uses a strap-down inertial navigation system. One very important feature of the AIM-54C is its vastly improved ECCM capability. Improvements in the rocket motor increase speed and range, and the new target detection device improves fusing accuracy in high-clutter environments and for small and low-altitude targets.

The AIM-54 was officially retired from service in 2004 and the F-14 was retired in 2007. Both can still be used in Allied Force.

Statistics

Guidance: Semi-active radar homing mid-course, active radar homing in terminal phase. Flies Lead Pursuit.

Eff. Range: BVR Rear: 15-30+ nm Front: 20-80 nm

Speed (mach): 4.3

CM Vulnerability: Chaff – low

Avoidance: Chaff+Break Turn / Weaving / Dive and Climb / Beam

Characteristics: Extremely large missile designed to shoot down bombers but it is still extremely effective against fighters inside 50nm due to its high energy level during the end-game especially at target manoeuvring at up to 7g. A 9g turn should defeat the missile if executed correctly. Active seeker range is 11 nm.

Carried by: F-14 only.

Mica RF/IR



The Mica missile is manufactured by MBDA. It has four firing modes to deal with both long and short range shots.

Once fired, the Mica missile depends on the Inertial Navigation System target information, which can be updated from the launching aircraft via a datalink.

After launch, the MICA climbs to very high level where it's aerodynamic configuration minimises drag and significantly increases range.

The Mica missile features 2 seekers each with it's own ECCM and once inside 10nm, the terminal phase RF/IR seeker is fully responsible for target acquisition and interception.

The Mica also features high manoeuvrability due to thrust vector control and effective tail control surfaces. The Mica's 12kg blast fragmentation warhead detonates by proximity or direct impact.

Statistics

Guidance: Semi-active radar homing with course updates from the launch aircraft, active radar homing or infra-red in the terminal phase. Flies Lead Pursuit.

Eff. Range: BVR Rear: 3-10 nm Front: 5-20 nm

Speed (mach): 4

CM Vulnerability: Chaff/Flare – Very low

Avoidance: Chaff/Flare+Break Turn / Weaving / Dive and Climb / Beam

Characteristics: Modern missile available in RF and IR variants. It has extremely good ECCM capabilities and is especially lethal if fired head-on within 10-15nm due to the additional manoeuvrability provided by the thrust vector system.

Carried by: Mirage 2000-S and 2000-D.

AIRCRAFT THREATS

MiG-21F/MF/PF/PFM Fishbed (Chengdu J-7)



The MiG-21 is one of the most produced aircraft in the history of aviation. The earliest production model is the MiG-21F Fishbed C that was only armed with the IR R-13M (AA-2 Atoll).

The MiG-21 MF/PF/PFM Fishbed J/D/F were equipped with an early engine that gives it a lot less acceleration compared to the late model Mig-21bis and MiG-21-93. The aircraft

normally utilises ambush and slash-and-run tactics. The delta wing design results in very high drag in a turning fight and will rapidly bleed the energy from the aircraft, even in full afterburner. Against the F-16 it can easily be out-turned in a two circle fight (although it can out-turn an F-16 in Cat III mode) and the lower thrust to weight ratio puts it at a distinct disadvantage compared to the F-16 in a dogfight.

The RWR will only detect the F-16 at a range of approx 20 nm, making it very susceptible to long-range, high altitude BVR shots. The performance of the radar does not allow it to detect targets in look-down situations and look-up range is poor at 12-14 nm. The aircraft is not equipped with any jammers or CMDS. You are likely to find the Mig-21MF/PF/PFM equipped with R-13M/R (AA-2C and AA-2D) missiles. The lack of BVR weapons and all-aspect WVR missiles means this airplane is not much of a threat until it gets to the rear quarter.

The Chengdu J-7 is a Chinese built variant of the MiG-21PF/PFM Fishbed-F and is armed with the PL-2 or PL-7 missiles.

MiG-21bis



The Mig-21bis is an improved model featuring ground attack secondary capability, additional fuel capacity and an engine that provides over a third more thrust than the Fishbed F. This makes it more effective in the turning fight, although it can still be out turned by an F-16 in Cat I at corner airspeed. It may also be equipped with the more capable all aspect R-60 (AA-8) missile that makes the MiG-21bis a threat from the front quarter.

MiG-21-93 Fishbed



The MiG-21-93 is a derivative of the MiG-21bis. The upgrade is based on the Kopyo airborne radar and new weapons. It provides:

- Longer range air target detection and lock-on in look-up and look-down, carriage of the R-73 and R-77.
- air target detection and engagement range in action in the front hemisphere;
- track-while-scan mode with the capability of tracking up to 10 targets and engaging two of them;
- capability to battle successfully with forth-generation fighters

The advanced radar combined with the R-77 (AA-12 Adder) offer the MiG-21-93 a BVR and Home-on-Jam (HOJ) capability and the first shot over the F-16/AIM-120 combination. In the WVR arena the high off-boresight, manoeuvrability and range of the R-73 Mod 1 and 2 (AA-11 Archer) give the MiG-21-93 an advantage over the Aim-9M equipped Falcon and is equal to the Aim-9X.

The MiG-21-93 is a serious threat that should be taken as seriously as the most modern of fighters.

Statistics

Mig-21 Fishbed/ Chengdu J-7 III

Armament: AA-2C (MiG-21F), AA-2C/D (MiG-21MF/PF/PFM),
AA-8 (MiG-21bis, MiG-21-93), R-73 Mod 1 & 2 (93),
R-77 (MiG-21-93)

Engine power: Low T/W ratio (Medium for Bis and 93)

A-A Threat Type:	WVR	Rear Aspect (MiG-21 PF/PFM)
		Fwd Aspect (MiG-21bis)
	BVR & WVR	All-aspect (MiG-21-93)

Speed (top): Mach 1.8

Dogfight ability:	Vertical:	Very Low (PF/PFM), Low (Bis, 93)
	Horizontal:	Low-Med

A-A Tactics: Ambush / Slash + Run

RWR: < 20 nm (PF/PFM, Bis) <25nm (93)

Radar Range

Look Up: (12 - 14 nm) (20nm+ for MiG-21-93)

Look Down: None (15nm+ for MiG-21-93)

Burnthrough Look Up: 6nm (10nm+ for MiG-21-93)

Burnthrough Look down: 1nm (5nm+ for MiG-21-93)

CMDS / ECM: None

Primary Missions: Point defence CAP / Basic A-G

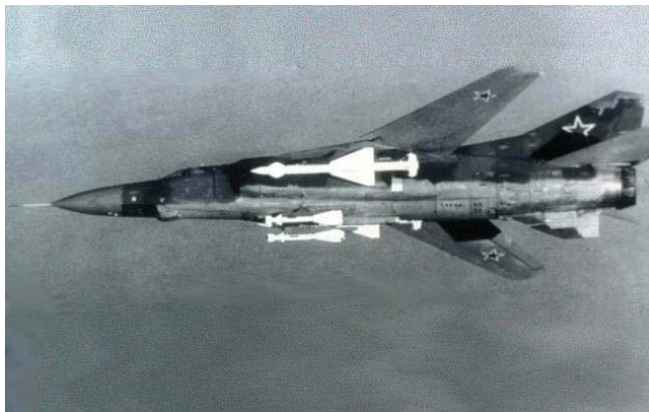
Characteristics: High drag in turning fight. RWR leaves it vulnerable to hi-alt, long-range BVR shots (except for MiG-21-93). Early variants are WVR only. Bis and 93 offer BVR capability. 93 carries R-73 and R-77.

MiG-23 Flogger



Designed as a point defence fighter with a secondary capability of ground attack, the MiG-23MF Flogger B and MiG-27 are fighter-bomber variations. The Flogger B is a standard interceptor. The MiG-23MLD Flogger K version was a modification of the MiG-23ML Flogger G and incorporated improved avionics, armament, and aerodynamic features. The MiG-23MLD is the most advanced version of the Flogger

and features a different identification-friend-or-foe system, a more advanced missile capability and a distinctive notch in the leading edge of the wing to improve flight characteristics.



The MiG-23 Flogger offers a powerful radar, an infrared search and track system, a selection of radar and infrared guided weapons and high top speed (Mach 2.35) to counter its adversaries. It entered service in 1971 as a successor to the MiG-21 and in addition to a more powerful engine also had a variable sweep wing.

The MiG-23 is a look-down shoot-down capable machine with BVR engagement capabilities. The airplane has tremendous acceleration ability, often matching the F-16. The High Lark radar is capable of look-down target acquisition, though the performance is not as good as the APG-68 on the F-16. Together with the R-23 (AA-7), the MiG-23 has a BVR capability of about 14 nm head-on. The onboard RWR is of similar performance to the 21PF/PFM, giving it a detection range of about 20-23 nm against the F-16. You should also be aware that the aircraft is equipped with anIRST, capable of passively detecting MIL power targets at up to 12 nm in the rear aspect. Though it may not give sufficiently accurate range information for BVR targeting, it does mean that the airplane is still capable of vectoring towards the target in an environment where heavy jamming prevents its own radar from detecting targets.

The acceleration ability of the MiG-23 gives it the ability to fight in the vertical plane, but as long as the F-16 is kept at the corner speed of between 350-420 knots, it should be able to out-turn the MiG-23 eventually (in Cat I). The MiG-23 is not a good close-in fight due to the relatively poor performance of the AA-8, but the ability to carry up to 6 missiles (2 AA-7 and 4 AA-8) does give it some degree of combat persistence.

The aircraft does not have CMDS for protection against IR and radar guided missiles (the MLD Flogger-K does) but the all-aspect BVR and WVR capability does mean the aircraft is a serious threat. If you detect the presence of a MiG-23 in the vicinity, you should pay attention to ensure you are not its intended target.

Statistics

Armament: AA-2, AA-7, AA-8

Engine power: High T/W ratio

A-A Threat Type: WVR – Limited BVR – Limited Front, Aspect IRST

Speed (top): Mach 2.35

Dogfight ability: Vertical: Med Horizontal: Med-High

RWR: 20-23 nm

A-A Tactics: Ambush / Slash + Run / Chase

Radar Range

Look Up: 35 nm

Look Down: 14 nm

BurnThrough Look Up: 10nm

BurnThrough Look Down: 5nm

CMDS / ECM: None

Primary Missions: Intercept / Fighter

Characteristics: Excellent acceleration. Has the ability to fight in the vertical. F16 can out turn Mig-23 at the F16's corner speed. Performance of AA-8 limits dogfighting capability.

MiG-25 Foxbat



The MiG-25P (Foxbat A) was originally designed as a high speed, high altitude interceptor. The unarmed reconnaissance version was the MiG-25R (Foxbat B).

The MiG-25 relies on its huge speed advantage and acceleration capabilities to fight. It can often out-run missiles fired against it, given sufficient notice of launch. Its high speed also confers an F- pole advantage by giving its missiles higher initial velocities.



The threat posed by the aircraft is BVR. The R-40 (AA-6) missiles can be launched from over 30 nm and the IR version is data link guided in the initial stage. The AA-6 will almost always out-range the AIM-120 due to the F-pole advantage and high speed. It is difficult for you to obtain a reasonable Pk with the AIM-120 against the MiG-25 at ranges in excess of 15 nm due to high speed and acceleration. You will need to defeat it using ECM to deny a missile shot and close for the kill.



For WVR engagements, the MiG-25 is equipped with the AA-8, however, the poor turning ability of the aircraft means that it will employ ambush slash-and-run tactics as it is not designed for the turning fight. The lack of CMDS and jammer mean the MiG-25 is vulnerable to most missiles if it is not able to out-run them.

Statistics

Armament: AA-6, AA-7, AA-8

Engine power: Very High T/W ratio

A-A Threat Type: BVR / WVR / Forward Aspect capable

Speed (top): Mach 2.8

Dogfight ability: Vertical: Good, Horizontal: Low-Med

RWR: 20+ nm

A-A Tactics: Ambush / Slash + Run

Radar Range

Look Up: 39nm

Look Down: 21.4nm

BurnThrough Look-up: 5nm

Burnthrough Look-down: 8nm.

CMDS / ECM: None

Primary Missions: Interceptor / Recon

Characteristics: Not a good turning fighter. Tremendous speed gives the Mig-25 an F-Pole advantage. Use ECM to deny the enemy a missile shot and close to within AIM-120 range.

MiG-29 Fulcrum-A/C/E



The MiG-29 Fulcrum-A entered service in 1983. In contrast to the primitive electronics of the MiG-25, the MiG-29 has a radar system comparable to Western aircraft and is an agile aircraft capable of manoeuvring in a dog-fight. The MiG-29G Fulcrum A variant are refitted German MiG-29 Fulcrum A with Western IFF and navigation systems and other changes to improve aircraft reliability.

The MiG-29 Fulcrum A is equipped with the Slotback look-down shoot-down

radar. The RWR system can detect the F-16 from 23-25nm away. A passive IRST is capable of detecting MIL power targets out to about 12nm in the rear quarter. The onboard defensive suite consists of CMDS only (ie no jammer).



It can be armed with the R-27R/T (AA-10 Alamo A/B), the R-60 (AA-8 Aphid) and R-73 Mod1 (AA-11 Archer). It also has a limited Air to Ground capability using unguided weapons and a built-in gun.

The radar is a handicap to the Fulcrum-A due to it's susceptibility to jamming and notching. You should use your ECM equipment to maximise your advantage in BVR, and engage the

MiG-29 from longer distance. The Fulcrum-A lacks ARH missile capability, so this is where the F-16, with the AIM-120, has the edge. The MiG-29/AA-10A does not give it a huge BVR range and ECM should prevent a shot until 12-15nm. Having an early AIM-120 shot will put the Mig-29 on the defensive, allowing you to deal with it at arms length and avoid a close fight.

The MiG-29S Fulcrum-C is considerably more capable at BVR than the MiG-29 Fulcrum-A. It has the Topaz radar which is better hardened against ECM and less susceptible to notching, an internal jammer, CMDS and can also the Alamo C/D, the R-77 and R-73 Mod 2. The SM variant features additional air-to-surface improvements and is equipped with precision guided weapons, such as Kh-29T(D) air-to-surface missiles and KAB-500KR TV-guided bombs, in combination with the upgraded weapon control system, the MiG-29SM is a true multi-role fighter. The MiG-29M/-33 "Fulcrum E" is an advanced multi-role variant, with a redesigned airframe, a fly-by-wire system, enhanced thrust, additional weapons load and extra fuel tanks. It is also known as the MiG-33.

The RWR will not show a difference between the Topaz and slotback radar and usage of the jammer will only prevent a shot out to 15-18nm away, putting it on almost an equal footing with the AIM-120 armed F-16. The A-pole advantage of the F-16 still holds and will allow you to break off and take evasive action earlier.

One way of distinguishing the MiG-29 variants is to use STT lock on the contact. If it breaks lock by jamming you are facing the MiG-29S/SM/M Fulcrum-C/E.

The MiG-29 has excellent slow speed handling qualities and is capable of a better turn rate and higher AOA performance than the F-16 below 250 knots. However, the F-16 is better above 400 knots, and you should aim to fight the MiG-29 at higher speeds.

In the WVR arena the MiG-29 is a very capable opponent with the Helmet mounted sight (HMS) and AA-11 combination. IRCM tactics can be used to deny the front quarter shot, but you should be aware that a shot can be taken up to 45 degrees off-boresight (60 degrees in MiG-29S/SM/M). Whenever possible you should avoid engaging the MiG-29 in a knife-fight as this is where it really shines. If you do, remember to keep your speed high, above 350 knots and whatever you do, avoid getting slow.

MiG-29 Statistics

Armament: MiG-29(G) Fulcrum-A AA-8, AA-10A/B, AA-11
MiG-29S/SM Fulcrum-C AA-8, AA-10A/B/C/D, AA-11, AA-12

Engine power: High T/W Ratio

A-A Threat Type: Med BVR (High BVR for Fulcrum-C/E) / High WVR

Speed (top): Mach 2.3

Dogfight ability: Vertical: High, Horizontal: Very High

RWR: 20+ nm

Radar Range

Look Up: MiG-29A/C 31 nm

Look Down: MiG-29A – 11 nm MiG-29C/E – 20 nm

BurnThrough Lookup: A – 13 nm C/E – 13 nm (15nm+ for AA-11 HOJ)

BurnThrough LookDown: A – 5 nm C/E – 9 nm (15 nm+ for AA-11 HOJ)

A-A Tactics: BVR shot, Knife fight

CMDS / ECM: CMDS and ECM on Fulcrum-C/E

Primary Missions: Air Superiority

Characteristics: HMS and AA-11 combo makes 2 circle dogfights very dangerous against a Mig-29. It has superior turn handling over the F16 below 400 kts. The Fulcrum-A Radar is susceptible to jamming and notching and ECM should prevent a shot until a range of 12-15 nm. The Fulcrum-C/E has a more power radar and carries the ARH AA-12 missile with a HOJ capability.

MiG-31 Foxhound



The MiG-31 Foxhound was designed to replace the MiG-25 Foxbat. It is an all weather long range interceptor with advanced digital electronics. It first flew in 1975 and the radar is capable of scanning over 120 nm forward and tracking 10 targets simultaneously as well as below and behind its own location.

The Foxhound carries the long range R-33 (AA-9) missiles and can engage 4 different targets simultaneously. It can also engage targets at a greater range than the F-14/Phoenix combination. The MiG-31 is equipped withIRST for emission free detection.

As with the MiG-25, the MiG-31 relies on its huge speed advantage and acceleration capabilities to fight. It can often out-run missiles fired against it, given sufficient notice of launch. Its high speed also confers an F- pole advantage by giving its missiles higher initial velocities.

The threat posed by the aircraft is primarily BVR. The R-33 (AA-9) missiles can be launched from over 50 nm and it can also carry the AA-6 and the AA-10. The AA-9 will always out-range the AIM-120 due to the F-pole advantage and high speed. It is difficult for you to obtain a reasonable Pk with the AIM-120 against the MiG-31 at ranges in excess of 15 nm due to high speed and acceleration. It is almost impossible to prevent a BVR shot as burn through will occur at over 20nm. The best tactic is to operate as a flight/element in order to allow an unengaged aircraft to close to within 12 nm and then use an AIM-120. Once the MiG-31 is defensive, it may be possible to chase it down for the kill, speed dependant.

For WVR engagements, the MiG-31 is equipped with the limited R-60 (AA-8) and the R-73 Mod1 (AA-11 Archer), which makes it extremely dangerous, however, the poor turning ability of the aircraft means that it will employ ambush slash-and-run tactics as it is not designed for the turning fight. It has CMDS and jammer.

MiG-31 Statistics

Armament: AA-6, AA-8, AA-9, AA-10, AA-11

Engine power: Very High T/W ratio

A-A Threat Type: High BVR / Medium WVR (but has passive IRST capability)

Speed (top): Mach 2.83

Dogfight ability: Vertical: High, Horizontal: Med

RWR: 25 nm

Radar Range

Look Up: 60+ nm

Look Down: 30+ nm

BurnThrough Look-up: 22+ nm

Burnthrough Look-down: 15+ nm.

A-A Tactics: High Alt, Long Range BVR, Ambush / Slash + Run WVR

CMDS / ECM: CMDS and ECM

Primary Mission: Interceptor

Characteristics: A dangerous aircraft, roughly equivalent to the F-14. Prefers to stay at high altitude to maximise range of its AA-9 missiles where it has a huge F-pole advantage. Radar has excellent chaff resistance. Not a great dogfighter due to its size and weight.

Sukhoi Su-27 Flanker/Su-33 Navel Flanker



The Su-27 is the Russian equivalent of the F-15. The original Su-27S Flanker-B entered service in 1984 while the Su-27UB Flanker C is the two-seat trainer version of the SU-27S. Designed primarily for the air superiority mission, the Flanker is equipped with up to 10 air-to-air missiles, 8 when wing-tip ECM pods are fitted, and a powerful radar.

The on-board radar has more power compared to the MiG-29 and is capable of detecting the F-16 at beyond 48nm. The radar will burn through jammers at ranges exceeding 22nm, allowing the SU-27 to take BVR shots beyond most AIM-120 engagement ranges. The RWR signature of the radar is also very similar to the MiG-29 A & C, making it difficult to distinguish between the three. On-board self-defence includes CMDS, RWR and wing-tip mounted ECM pods. The RWR can detect F-16 transmissions up to 23-25 nm away.



The threat posed by the SU-27 is primarily BVR. The radar is hardened against ECM and counter-measures, making chaff less useful. Together with the long-range AA-10C, this allows the SU-27S to strike at ranges beyond the F-16. Even when fired at the radar burn-through range of 22nm, the AA-10C will be closer to its Rmax2 range compared to other Western missiles. This means they will arrive at their target with a very high energy state and the huge acceleration capability of the Su-27 also confers it an F-pole and A-pole advantage over most other fighters.

When detecting a 29 RWR contact, you can never be sure which aircraft has you locked up. If it employs ECM you can be reasonably sure that it is either the MiG-29C or a Su-27S/UB. As such treat the contact as an SU-27 until you can verify otherwise. If you want to close in for an engagement, bear in mind that you may be unknowingly flying yourself into the AA-12 envelope.

WVR fighting the SU-27 is similar to an F-15. However the 4 AA-11 make it a dangerous close-quarters opponent. Slow speed handling characteristics are excellent but due to its heavy operating weight, the F-16 may be able to bring the nose around slightly faster than the SU-27, though the HMS/AA-11 will redress this somewhat.

At close quarters, stay out of the cone extending from its 10 o'clock position to its 2 o'clock position as this is the AA-11 launch envelope. As with the MiG-29, proper throttle management and IRCM tactics will help you deny an IR missile lock.

The Su-27SM is a mid-life update for the Su-27S. It is equipped with an upgraded fire control system, including an improved radar (shows a 30 instead of 29 on the RWR) with better air-to-air performance and an air-to-surface mode. The upgrade enables the use of the ARH R-77 (AA-12) medium range air-to-air missile and a wider selection of guided air-to-surface bombs and missiles. The aircraft's self-defence suite has also been upgraded.



The Su-33 Flanker D (Su-27K) is a carrier-based variant of the Flanker B that entered service in the Russian Navy in 1994. It is used in both night and day operations at sea and has additional small wings behind the cockpit that shorten take-off distance and improve manoeuvrability. While it is not assisted by a catapult, the Su-33

has a higher thrust to weight ratio and, due to better aerodynamics, generates more lift. The outer wings fold for more compact storage on the aircraft carrier and the undercarriage has been strengthened. To avoid tail scrape during landing and take-off the long tail cone on the land based versions was shortened. Armament is similar to the basic Su-27 Flanker-B, with 12 pylons and limited air-to-ground capability. The Su-33SM provides the aircraft with a similar upgrade package to the Su-27SM including a different radar (30 on RWR) and the ability to carry the AA-12.

Sukhoi Su-27/Su-33 Flanker Statistics

Armament: AA-10A/B/C/D
HMS+AA-11 Mod 1&2
AA-12 (Su-27SM & Su-33SM only)

Engine power: Very High T/W Ratio & outstanding acceleration.

A-A Threat Type: High BVR (Very high for SU-27SM & Su-33SM) / High WVR

Speed (top): Mach 2.35

Dogfight ability: Vertical: Very High, Horizontal: Very High

RWR: 23-25 nm

Radar Range

Look Up: 45 nm

Look Down: 30 nm

BurnThrough Lookup: 23 nm

BurnThrough Look down: 15 nm

A-A Tactics: First shot BVR, Knife fight

CMDS / ECM: CMDS and ECM Pods

Primary Missions: Air Superiority

Characteristics: A very dangerous aircraft. The SARH AA-10C and ARH AA-12 (Su-27SM & Su-33SM) allows the Su-27/Su-33 the first shot in BVR, though that advantage is somewhat nullified by the AA-12s longer support time. Outstanding acceleration and turn rate, combined with the HMS+AA-11 combination makes the Su-27/Su-33 a deadly dogfighter.

Sukhoi Su-30 Flanker



The Su-30 (originally known as the Su-27P) entered service with the Russian air forces in 1992 and is largely based on the Su-27UB two-seat trainer. It is a long-range precision-attack fighter that retains the interceptor duties of the Su-27 but the early SU-30 and SU-30K models are optimised for long-endurance missions of up to 10 hours. The aircraft are also fitted with a radiolocation system that can transmit the positions of 10 targets to four other fighters at the same time.



The Su-30M is a standard Su-30 with an added precision ground attack capability (similar to the F-15E Strike Eagle). It can carry twice the ordnance load of the Su-27 and a large variety of Air-to-Ground weapons on its 12 hardpoints. It also has the ability to carry the AA-12 air-to-air missile. The addition of canards makes it easy to distinguish from the Su-27 and Su-30.



The export model, the SU-30MK has been purchased by India (SU-30MKI) and China (Su-30MCK). This has 2D Thrust Vectoring Control that allows the engine exhaust nozzles to be directed up or down, giving the aircraft the capability to continue flying at very low speeds and high angles of attack. When TVC is combined with the HMS and AA-11 Mod 2, it makes the Su-30MK lethal in the dogfight and a two-circle fight should be avoided at all costs.

Sukhoi Su-30 Statistics

Armament: AA-10A/B/C/D
HMS+AA-11 Mod 1&2
AA-12 (Su-27M/MK only)

Engine power: Very High T/W Ratio & outstanding acceleration.
Su-30MK has TVC.

A-A Threat Type: High BVR (Very high for SU-30M/MK).
High WVR (Very high for SU-30MK due to TVC).

Speed (top): Mach 2.35

Dogfight ability: Vertical: Very High, Horizontal: Very High

RWR: 23-25 nm

Radar Range

Look Up: 45 nm

Look Down: 30 nm

BurnThrough Lookup: 23-25 nm

BurnThrough Look down: 15 nm

A-A Tactics: First shot BVR, Knife fight

CMDS / ECM: CMDS and ECM Pods

Primary Missions: Air Superiority/Strike/SEAD

Characteristics: A very dangerous aircraft. The SARH AA-10C and ARH AA-12 (Su-30M/MK) allows the Su-30 the first shot in BVR, though that advantage is somewhat nullified by the AA-12s longer support time. Although the SU-30 is not quite as manoeuvrable as the Su-27 Flanker B due to the additional weight, outstanding acceleration and turn rate, combined with the HMS+AA-11 combination still ensure the Su-30 is a dangerous dogfighter. The addition of TVC to the Su-30MK makes this a deadly dogfighter that should be avoided at all costs.

Su-32/34 Fullback (Platypus)



The Su-32 FN (also known as the Su-34 or Su-27IB) is a two seat strike variant of the Su-27 that first flew in 1990. It has been nicknamed the Strike Flanker or Platypus due to its unusual nose design but the official NATO designation is Fullback.

The Su-32 multi-role aircraft is designed to be operated from aircraft carriers and can fly maritime patrol, anti-ship attack, day/night all-weather precision strike against

small-size and moving targets, low level attack, and anti-submarine warfare missions engaging enemy aviation using short and medium range air-to-air missiles. In-flight refueling capability enables the Su-32 to perform longer range tactical attack missions typically carried out by Tu-22 Backfire medium-weight bombers. Its advanced architecture allows operations in severe clutter and jamming environments.



The aircraft has canards and a large flattened nose with sharp edges to reduce radar cross-section and can be operated from ships by utilising its TVC engines. It has a side-by-side cockpit layout and advanced radar with terrain-following and terrain-avoidance for low-level attack. The aircraft has a distinctive large "sting" in the rear which contains the radiolocation system, a radio electronic countermeasures system, and a fuel tank. It also features a rearward radar that monitors enemy fighter activity behind the aircraft, and as needed, can direct R-73 and R-77 missiles at targets. The Su-32 FN fighter-bomber is intended to replace Russian Su-17, Su-24, and the MiG-27.



As the Su-32/34 is primarily designed as a strike bomber, it is a less capable dogfighter than the Su-27SM. It is limited to +7G and has a lower thrust-to-weight ratio. Despite this, the AA-12 and power radars (capable of firing at target to the rear of the aircraft) provide the

aircraft with a very high BVR threat. The TVC engines and AA-11 combination still ensure it is a significant threat in the dogfight but the F-16 should be able to outturn the Su-32/34 in Cat I at corner.

Sukhoi Su-32/34 Statistics

Armament: AA-10A/B/C/D
HMS+AA-11 Mod 1&2
AA-12

Engine power: High T/W Ratio & good acceleration. Also has TVC.

A-A Threat Type: Very High BVR.
High WVR.

Speed (top): Mach 1.8

Dogfight ability: Vertical: Very High, Horizontal: High

RWR: 23-25 nm

Radar Range

Look Up: 45 nm

Look Down: 30 nm

BurnThrough Lookup: 23-25 nm

BurnThrough Look down: 15 nm

A-A Tactics: First shot BVR

CMDS / ECM: CMDS and ECM

Primary Missions: Strike Fighter

Characteristics: The SARH AA-10C and ARH AA-12 allows the Su-32/34 the first shot in BVR, though that advantage is somewhat nullified by the AA-12s longer support time. The SU-32/34 is not as manoeuvrable as the Su-27 Flanker B due to the additional weight, but excellent acceleration, TVC and the AA-11 ensures the Su-32/34 is a dangerous dogfighter.

Su-35/Su-37



The Su-35 is a single seat fighter based on the Su-27UB two-seat trainer and incorporates many of the improvements first seen on the Su-30 series in order to produce a true multi-capability fighter.

Changes from the Su-27 include canards, a greater fuel capacity, uprated engine with TVC and an in-flight re-fuelling system. The avionics have been upgraded,

including a new radar, digital fly-by-wire control system, a rear-radar for firing SARH missiles and a modern glass cockpit with HOTAS. It is also lighter due to the larger amount of composites and redesigned fuselage, and thus has an improved thrust to weight ratio.

The radar, allows the detection of aerial targets at a range up to 250 nm and ground targets at a distance up to 120 nm, the simultaneous tracking of up to 15 aerial targets and firing at 6 targets simultaneously. It is equipped with 14 air-to-air missiles, including all variants of the AA-10, the R-73 Mod 1 & 2 and the R-77. The aircraft can carry out a strike against ground and surface targets with missiles with television and remote command guidance, guided or unguided aerial bombs, cluster bomb units and rockets. There also is a built-in 30-mm cannon.

The improved radar and modern systems of the Su-35 make what was already an excellent fighter into an outstanding one that offers a decisive advantage in both the BVR and WVR arenas.



The Su-37 Super Flanker is a single-seat multi-role combat aircraft. It is a super-maneuvrable thrust vectoring derivative of the Su-35 and represents a new level of capability compared with the Su-27 and Su-35. It features an updated airframe containing a high proportion of carbon-fibre and Al-Li alloy and the engines are configured for thrust vector control. It has a variety of other innovative equipment such as the all-weather digital radar that can operate in air and ground modes simultaneously. The Su-37 is also equipped with a rearward facing radar in the tail stinger area of the fuselage. It has state of the art ECM in wing-tip pods, allowing improved survivability in electronic warfare environments.



The Su-37 can perform astounding manoeuvres and can literally flip its nose through 180 degrees in order to engage a target, before returning to the original direction of flight. It can achieve Alphas of over 135 degrees without stalling and can out-turn any aircraft in the world, with the possible exception of the F-22. Combined with the extremely powerful radar, the ability to engage multiple targets at the same time, a

rearward missile launch capability and modern cockpit with HOTAS, the Su-37 is the most formidable of Air-to-Air opponents.

Sukhoi Su-35/37 Statistics

Armament: AA-10A/B/C/D
HMS+AA-11 Mod 1&2
AA-12

Engine power: Very high T/W Ratio & excellent acceleration with TVC.

A-A Threat Type: Very High BVR.
Very High WVR (Su-35)
Outstanding WVR (Su-37)

Speed (top): Mach 2.3

Dogfight ability: Su-35 Vertical: Very High, Horizontal: Very High
Su-37 Vertical: Outstanding, Horizontal: Outstanding

RWR: 25-30 nm

Radar Range

Look Up: 60 nm

Look Down: 45 nm

BurnThrough Lookup: 35 nm

BurnThrough Look down: 25 nm

A-A Tactics: First shot BVR, Knife-fight

CMDS / ECM: CMDS and ECM pods

Primary Missions: Air-Superiority Fighter

Characteristics: The SARH AA-10C and ARH AA-12, powerful radar and outstanding acceleration allow the Su-35/37 the first shot in BVR, though that advantage is somewhat nullified by the AA-12s longer support time. The SU-35 is extremely manoeuvrable and the TVC and HMS+AA-11 make it an extremely dangerous dogfighter that is difficult to defeat. The Su-37 with higher thrust-to-weight ratio and better TVC is simply outstanding in the turning fight and 1v1, the F-16 is simply outclassed. Your best tactic (other than avoid them altogether) is to use multiple F-16s against each Su-37 in order to try and gain a shot but be aware of the rear firing missiles.

SU-25/39 Frogfoot



The Su-25 was designed primarily as a CAS and ground attacker aircraft in the same mould as the A-10. It is armed with one twin barrel 30mm gun and carries about 4,000 kg of air-to-ground weapons, including 57mm to 330mm rockets. There are two small outboard pylons for the AA-8 APHID.

The Su-39 (also known as the Su-25T or Su-25TM) is a Frogfoot variant. It is based on the Su-25UB two-seat trainer, with the rear seat and cockpit replaced with a fuel cell and extra avionics. The Su-39 carries the *Kopyo*-25 multi mode radar in a pod under the fuselage. Armament includes ground attack missiles such as the AT-16 *Vikhr*, anti-ship missiles, and the AA-8 and AA-11 Mod-1.

With no radar the Su-25 has no BVR capability and very limited WVR capability due to its limited manoeuvrability and poor A2A missiles. The Su-39 is equipped with the AA-11 ARCHER Mod-1, which offers it a high-off boresight capability WVR and needs to be respected.

Su-25/39 Statistics

Armament:	Su-25	Gun, AA-8
	Su-39	Gun, AA-8, AA-11 Mod-1

Engine power: Low T/W Ratio

A-A Threat Type: Nil BVR / Low WVR (Su-25) Medium WVR (SU-39)

Speed (top): Mach 0.8

Dogfight ability: Vertical: Very Low, Horizontal: Low-Medium

RWR: Su-39 <20 nm

Radar Range

Look Up: Su-25 No radar Su-39 <40nm

Look Down: Su-39 <20 nm

BurnThrough Lookup: Su-39 <25nm

BurnThrough LookDown: Su-39 <15 nm

A-A Tactics: Avoids engagements by getting low and fast.

CMDS / ECM: CMDS/Jammer

Primary Missions: CAS, Ground Attack

Characteristics: You are very unlikely to find yourself being attacked by the Su-25 or Su-39. They will generally do everything then can to avoid A2A engagements and will only react in self-defence. The best tactic to use is to pick them off from BVR. If you get to WVR then you should quickly be able to get to the rear of the aircraft for a Sidewinder shot but the AA-11 Mod 1 carried by the Su-37 needs to be respect so stay out of it's WEZ.

Antonov An-24



The Antonov An-24 is a 44-seat twin turboprop transport manufactured in Ukraine by the Antonov Design Bureau. It was first flown in 1960 and over 1,000 examples were built with 880 still in service worldwide.

The design of the aircraft was optimised for operating from rough strips and unprepared airports in remote locations. The high-wing layout protects engines and blades from debris, and the power-to-weight ratio is higher than that of many comparable aircraft. The machine is rugged and does not require sophisticated ground equipment for maintenance.

China's Xian Aircraft Manufacturing Company makes copies of the An-24 as the Yunshuji Y-7. Production continues in China, though production in Ukraine was shut down in 1978.

Antonov An-124



The Antonov An-124 Condor is the largest aircraft ever mass produced, and was, until the advent of the An-225, the largest aircraft in production. Physically, the An-124 is similar to the American Lockheed C-5 Galaxy but is slightly larger. An-124s have been used to carry a wide variety of oversized cargoes and up to 150 tonnes of cargo can be carried in a military

An-124: it can also carry 88 passengers in an upper deck behind the cockpit. Due to limited pressurization in the fuselage, it seldom carries paratroopers.

AIR DEFENCE SYSTEM THREATS

SA-2 GUIDELINE



The SA-2 GUIDELINE is a medium to high altitude surface-to-air missile system. This two-stage missile has a large solid propellant booster stage fitted with four very large delta fins.

The guidance system at an SA-2 site can handle only one target at a time, but can direct three missiles against a target simultaneously. Additional missiles can be fired against the same target after one or more missiles of the

first salvo have completed their run.

The warhead weighs 195 kg (130 kg of which is high explosive) with proximity, contact and command fusing available. At medium and low altitudes the kill radius is about 65 meters and the blast radius for severe damage is 100-120 meters. The maximum blast radius against a high altitude target is approximately 250 meters, due to the rarefied atmosphere. The weapon has an accuracy of 75 meters with the large blast radius compensating for system inaccuracies.

The standard deployment pattern of a battalion site consists of six semi-fixed launchers, the Fan Song-B Fire Control Radar, 2x ZPU-2 AA artillery and 6 support trucks. Destroying the Fan Song-B will disable the entire system.

SA-2 Statistics

Site: Static

Guidance: Fan Song-B (Command)

Min/Max Range: 3nm/20nm (12nm Jammer on)

Min/Max Height: 2000ft/73000ft+

Max Velocity: 4.0-4.5

Manoeuvrability: Low

Chaff Vulnerability: High

Avoidance: Break Turn (6-7g)+Chaff/Beam/Below 2,000ft/Destroy FCR

SEAD: HARM+Cluster Bombs+Use ECM

Characteristics: Minimal chaff resistance, site consists of 6 launchers surrounding "Fan Song-B" FCR. Destroying Fan Song-B neutralizes SA-2 site.

SA-3 GOA



The SA-3 GOA surface-to-air missile was designed to fill the gap created by the limits of the SA-2 and target low altitude intruders. Targeting is managed by the Battalion's LOW BLOW trailer-mounted fire control radar. The SA-3 has a range of 11nm and its large control surfaces means it has some manoeuvrability but modern fighters should have no problem out manoeuvring the missile given enough warning and SA-3 engagement times

can be as little as 15 seconds for an experienced crew.

The standard deployment pattern of a battalion site consists of four semi-fixed launchers, the Low Blow Fire Control Radar, 2x ZPU-2 AA artillery and 6 support trucks. Destroying the Low Blow will disable the entire system.

SA-3 Statistics

Site: Static

Guidance: Low Blow (Command)

Min/Max Range: 2nm/11nm (8nm Jammer on)

Min/Max Height: 100ft/44000ft

Max Velocity: 3.0+

Manoeuvrability: Low

Chaff Vulnerability: High

Avoidance: Break Turn (6-7g)+Chaff/Beam/Destroy FCR

SEAD: HARM+Cluster Bombs~Use ECM

Characteristics: Low Blow is vulnerable to chaff. Site consists of 4 launchers and 1 Low Blow Control Radar. Destroying Low Blow neutralizes SA-3 site.

SA-4 GANEF



The SA-4 GANEF is a medium to high altitude surface-to-air missile system.

The huge missile is launched by four solid booster rockets mounted externally on the body. The missile is armed 300 meters from the launcher. After launch the boosters fall away after about 15 seconds and the missile continue to accelerate to Mach 4.



Targets are initially detected by the LONG TRACK radar mounted on a lengthened version of the heavy artillery tractor with a large van body added, and is also used for the SA-6 SAM. This system passes data to the SA-4 GANEF battery and a single missile is launched and guided to the target by the guidance beam with a semi-active terminal homing phase for the final stage. Maximum range is 19nm.

The standard deployment pattern of a battalion site consists of 3 SA-4 launchers, 1x Long Track radar, 1x BMP-CMD, 2x support trucks and 2x SA-7 and 3x ZPU-2 for low-level air defence. Destroying the Long Track will disable the entire system.

SA-4 Statistics

Site: Mobile

Guidance: initial – Command Terminal - SARH

Min/Max Range: 2nm/19nm

Min/Max Height: 15000ft/60000ft

Max Velocity: Mach 4.0

Manoeuvrability: Low

Chaff Vulnerability: Medium

Avoidance: Break Turn (6-7g)+Chaff/Beam/Destroy FCR

SEAD: HARM+Cluster Bombs~Use ECM

Characteristics: Long Track is somewhat vulnerable to chaff. Site consists of 3 launchers and 1 Long Track FCR. High speed of missile makes it difficult to outrun so use chaff and break turns. Destroying Long Track neutralizes SA-4 site.

SA-5 GAMMON



The SA-5 GAMMON surface-to-air missile is a strategic SAM designed to engage targets at medium to high altitudes. It is a long range SAM that can engage targets at 50 miles away. To achieve this range, the missile has four jettisonable, wrap around solid propellant boosters. The missile is guided by the Command radar and also has an active seeker head on the missile itself. This is activated as the missile closes on the target. The

missile uses the tracking data supplied by the Command radar and its own seeker head to complete the intercept. The warhead is 215 kg (474 lb) of high explosive triggered by proximity or command signal.

Each Battalion has 6 single-rail missile launchers, a Barlock-B search radar and 9 support vehicles. Destroying the Barlock-B will disable the entire system but any missiles in the air when the FCR is destroyed may still track due to their ARH capability.

The limited manoeuvrability and high minimum engagement height mean the SA-5 presents no significant threat to the modern fighter but it is often used to drive aircraft low enough to be engaged by MANPADS and AAA. For heavier aircraft like tankers the SA-5 is a real threat.

SA-5 Statistics

Site: Static

Guidance: Initial – Barlock-B (Command) Terminal - ARH

Min/Max Range: 3nm/55nm (40nm+ Jammer on)

Min/Max Height: 6000ft/85000ft

Max Velocity: 4.0

Manoeuvrability: Very Low

Chaff Vulnerability: High

Avoidance: Break Turn (5-6g)+Chaff/Beam/Jamming/Destroy radar

SEAD: HARM+Cluster Bombs~Use ECM.

Characteristics: Terminal ARH vulnerable to jamming and chaff. Ineffective against fighters. Minimal threat vs SEAD strikes even after being fired upon. Site consists of 6 launchers and 1 Barlock-B target acquisition radar. Best SEAD tactic is jammer on, Angles 25+ and launch HARM from 20-25nm. The large smoke trail makes the missile very easy to acquire.

SA-6 GAINFUL



The SA-6 GAINFUL system is a mobile, radar guided SAM system. The missile is a two stage, low-altitude SAM that uses radio command guidance with semi-active radar terminal homing. It was designed to destroy aircraft, missiles, cruise missiles and assault helicopters at low to medium altitudes.

Each battery has a Straight Flush FCR and six launchers, all on armoured carrier chassis. It is supported by two ACRV anti-aircraft vehicles and two support vehicles. The system can guide three missiles to one target at any given time but is limited to firing at a single target.

The SA-6 has a range of 2 to 11 nm and can engage targets from 550 up to 36000 feet. The system is extremely vulnerable to a HARM attack due to it's short range and single Straight Flush FCR, which if destroyed will shut down the entire battery but being a mobile system, it can still surprise aircraft by switching on at short range. The best defence against a missile launch is to beam and use an 8-9g break-turn with chaff but even this is not guaranteed to cause a miss as the high speed of the SA-6 (up to Mach 2.8) makes them difficult to defeat kinetically.

A high threat missile system, the SA-6 is resistant to chaff and is difficult to beat with a break-turn. The system should be destroyed from range using the HARM but any missiles in the air when the FCR is destroyed may still track due to their SARH capability.

SA-6 Statistics

Site: Mobile

Guidance: Initial – Straight Flush (Command) Terminal - SARH

Min/Max Range: 2nm/11nm (10nm+ Jammer on)

Min/Max Height: 550ft/36000ft

Max Velocity: 2.8

Manoeuvrability: Medium

Chaff Vulnerability: Medium

Avoidance: Sustained 8-9g turns+Chaff/Beam/Retain High Airspeed//Destroy FCR

SEAD: HARM+Cluster Bombs~Standoff attack with AGM-65 and ECM.

Characteristics: Missile uses lead pursuit course. Medium chaff resistance. Hard to defeat kinematically. Site consists of 6x launchers and Straight Flush FCR.

SA-7 GRAIL



The SA-7 GRAIL is man-portable, shoulder-fired, low-altitude SAM system with a high explosive warhead and passive infrared homing guidance. The SA-7 was the first generation of Soviet man portable surface-to-air missiles. Although classed as "fire and forget" types, the missiles were easily overcome by solar heat and, when used in hilly terrain, by heat from the ground.

The SA-7 has a minimum range of 250ft and a maximum range of 2nm. The kill zone is between 50ft and 7000ft with a speed of about Mach 1.7. It is a tail-chase missile system, and its effectiveness depends on its ability to lock onto the heat source of low-flying fixed- and rotary-wing aircraft targets. The missile is extremely vulnerable to flares but due to the lack of a launch warning its most potent weapon is surprise if you don't keep your eyes open.

SA-7 Statistics

Site: MANPAD

Guidance: IR

Min/Max Range: 0.3nm/3nm

Min/Max Height: 50ft/7000ft

Max Velocity: 1.7

Manoeuvrability: Medium

Flare Vulnerability: High

Avoidance: Break Turn 8-9g turn+Flares/Stay above 7000ft/Regularly dispense flares when in SA-7 envelope.

SEAD: Cluster Bombs with Medium altitude delivery.

Characteristics: Often carried by infantry units. Poor seeker sensitivity gives it little resistance to CMDS, background IR clutter and the sun. It can be outrun by very fast aircraft.

SA-8 GECKO



The SA-8 GECKO is a single-stage, solid-fuel, short-range, low-altitude, all-weather SAM system. It is a quad missile launch system intended to replace less mobile towed anti-aircraft guns.

Each launch vehicle has its own radar system, making it a stand-alone system. A target can be engaged with 1 or 2 missiles.

Maximum speed is Mach 2.4, minimum altitude is 100ft and maximum effective altitude is 15000 ft. Minimum engagement range is 1nm and the maximum range is 5 nm.

The warhead of the missile is fitted with proximity and contact fuses, and the 19 kilogram warhead's lethal radius at low altitude is about 15ft.



The LAND ROLL conical-scan fire control radar has a 360° traverse.

In Allied Force the SA-8 can only be found grouped with a BTR 70 HQ, with 4x SA-8 vehicles.

SA-8 Statistics

Site: Mobile

Guidance: Command

Min/Max Range: 100ft/5nm

Min/Max Height: 100ft/15000ft

Max Velocity: Mach 1.6

Manoeuvrability: Medium

Chaff Vulnerability: Medium

Avoidance: Sustained 8-9g turns+Chaff/Beam/Retain High Airspeed//Destroy each unit.

SEAD: HARM+Cluster Bombs~Standoff attack with AGM-65 and ECM.

Characteristics: Missile uses lead pursuit course. Medium chaff resistance. Can be defeated kinematically. Site consists of 4x launchers, each needs to be destroyed separately.

SA-9 GASKIN



The SA-9 GASKIN is a short-range, low-altitude self-propelled SAM-carrying system based on the BRDM-2 chassis. The vehicle carries quadruple SA-9 SAM launchers on a revolving mount. The missiles are usually fired in pairs against each target to increase the kill probability, with an interval between rounds of about five seconds.

The 30 kilogram Mach 1.5 *Strela-1* missile carries an HE-fragmentation warhead and proximity fuse with a lethal radius of 5 meters and damage radius of 7.6 meters. The minimum range is 250ft and the maximum range is 4nm within altitude limits of 50 to 15000ft. When engaging a head-on target the system has a considerably reduced range. The missile is extremely vulnerable to flares but due to the lack of a launch warning its most potent weapon is surprise if you don't keep your eyes open.

SA-9 Statistics

Site: Mobile SHORAD

Guidance: IR

Min/Max Range: 0.3nm/4nm

Min/Max Height: 50ft/15000ft

Max Velocity: 1.8

Manoeuvrability: Medium-High

Flare Vulnerability: High

Avoidance: Break Turn 8-9g turns+Flares/Regularly dispense flares when in SA-9 envelope.

SEAD: AGM-65/DTOS Cluster Bombs.

Characteristics: Has no IRCCM capability so is very vulnerable to flares and background IR clutter. No radar system so no RWR warning. Integrated targeting and launcher vehicle. Used as part of larger units such as a Motor Rifle Battalion.

SA-10 GRUMBLE



The SA-10 Grumble surface-to-air missile system is similar to the US patriot system in terms of role and capability. It offers significant advantages over older strategic surface-to-air missile systems, including multi target handling together with a capability against low altitude targets (less than 200ft).

The SA-10A launch complex consists of the FLAP LID multi-function phased-array engagement radar, 3 SA-10 mobile launchers, SA-7 and ZPU-2 assets for low-level defence and KraZ T 255B support trucks. The SA-N-6 naval version is fitted to the Russian carrier group.

Missile guidance is of the Track-Via-Missile (TVM) type with the FLAP LID guidance radar capable of engaging up to 6 targets simultaneously, with two missiles per locked target to ensure a high kill probability. The system has a range from 2nm to 55nm and can engage targets from 100ft up to more than 60,000ft.

Due to the TVM radar you do not get any missile launch warning on the RWR, therefore if you are within 55 nm of an SA-10 you MUST assume that there is a missile inbound to you and take evasive action.

Missiles are very difficult to spot and have a low smoke signature so you should offset your heading by a few degrees from the threat to make them easier to spot. They also often come from a higher trajectory.

The missiles are very difficult to defeat kinematically and the best defence is normally to get as low as you can and use chaff to break the launcher lock.

SA-10 Statistics

Site: Mobile Long Range AD

Guidance: Initial – Command Terminal - Track-via-Missile

Min/Max Range: 2nm/55nm

Min/Max Height: 100ft/60000ft

Max Velocity: Mach 7

Manoeuvrability: High

Chaff Vulnerability: Very Low

Avoidance: Break Turn 8-9g +Chaff

SEAD: Long range, high altitude HARM or very low (100ft) cluster bomb to knock out Flap Lid FCR.

Characteristics: Has good ECCM and due to it's high speed, lack of RWR warning and low visual signature is very difficult defeat kinematically. Best option is to get very low (100ft) inside an SA-10 umbrella.

SA-11 GAINFUL



The SA-11 Gadfly is a medium-range, semi-active, radar-guided missile system used as air defence against fighters and cruise missiles.

The SA-11 missile launcher is mounted on a tracked chassis and is an updated design of the SA-6, over which it offers significant improvements such as engaging up to 6 targets simultaneously from different directions and at different altitudes.

Maximum range is 22 miles from 100ft to 48000ft. It is extremely deadly and each unit has its own radar so you will need to knock out all units to remove the threat. Due to the short range and there short launch warning times, the missiles can be extremely difficult to pick up visually.

The SA-11's Fire Dome radar provides improved resistance to ECCM and improved tracking abilities.

In Allied Force each battalion of SA-11 consists of 6 launchers each with their own FCR, 2x ACRV Command vehicles, 2x SA-14 and 2 support trucks. The best advice is to avoid this system if possible as due to its short range it is only a threat if your target is inside the engage umbrella. If you have to engage it then at least a 4 ship SEAD Strike will be required to neutralise all six launchers. Stay high and fast to maximise the HARM range and launch at 15 nm then turn immediately away.

SA-11 Statistics

Site: Mobile AD

Guidance: Initial – Command Terminal - SARH

Min/Max Range: 0.5nm/22nm

Min/Max Height: 50ft/48000ft

Max Velocity: Mach 4.0

Manoeuvrability: High

Chaff Vulnerability: Low

Avoidance: Break Turn 8-9g + Chaff/Notch/Stay out of engagement envelope/Regularly dispense flares when in SA-14 envelope.

SEAD: HARM from outside engagement umbrella, otherwise from low cluster bomb attack (high risk).

Characteristics: Low chaff resistance. Very hard to defeat kinematically. Site consists of 6x launchers each with their own FCR.

SA-13 GOPHER



The Sa-13 Gopher was designed as a replacement for the SA-9 Gaskin and is a short-range, low altitude SAM system.

It is fitted with an improved all-aspect IR seeker unit that ensures good IR decoy counter-countermeasures discrimination and optimum use against low altitude targets in adverse weather conditions. The estimated minimum range of the SA-13 is 500ft and the maximum effective range is 4nm with altitude engagement limits of 50ft to 14,000ft.

Each SA-13 vehicle incorporates the range-only SNAP SHOT radar which provides the operator the targets range to the system to prevent wastage of missiles outside the effective range of the system. This means the SA-13 may show up on the RWR system

but pilot should not get confused, the missiles are IR only.

SA-13 Statistics

Site: Mobile SHORAD

Guidance: IR

Min/Max Range: 0.3nm/4nm

Min/Max Height: 50ft/14000ft

Max Velocity: 2.0

Manoeuvrability: High

Flare Vulnerability: Medium

Avoidance: Break Turn 8-9g turn+Flares (4+)/regularly dispense flares when in SA-13 envelope (look for tall-tale RWR symbol).

SEAD: AGM-65/DTOS Cluster Bombs/HARM may be effective against ranging radar.

Characteristics: All aspect capability. Decent IRCCM and background IR clutter rejection capabilities. Hard to defeat kinematically. Integrated ranging radar and launch vehicle. Normally found only as part of larger units such as a Motor Rifle Battalion or HQ units in Allied Force.

SA-14 GREMLIN



The SA-14 GREMLIN is a portable missile system that is the successor to the SA-7 GRAIL. It offers improved counter-countermeasures, increased range and increased flight altitude. It was developed for destroying low flying aircraft and helicopters. The missile has an all-aspect capability. The warhead of the SA-14 was nearly doubled in weight over the small warhead of the SA-7. The SA-14 has a maximum range of 4nm and

a maximum altitude of 15000 feet.

SA-14 Statistics

Site: MANPAD

Guidance: IR

Min/Max Range: 0.3nm/4nm

Min/Max Height: 50ft/14000ft

Max Velocity: 1.8

Manoeuvrability: Medium

Flare Vulnerability: Medium

Avoidance: Break Turn 8-9g turn+Flares/Stay out of engagement envelope/Regularly dispense flares when in SA-14 envelope.

SEAD: Cluster Bombs with medium altitude delivery.

Characteristics: All aspect capability. Decent IRCCM and background IR clutter rejection capabilities. Hard to defeat kinematically. Can be outrun by fast aircraft in tail-on aspect. More dangerous than SA-7.

SA-15 Gauntlet



The SA-15 GAUNTLET low-to-medium altitude SAM system is capable of engaging aircraft and helicopters. Although an autonomous system it can be interfaced into an integrated air defence network.

In Allied Force, 2x SA-15 can be found with the HQ BMP –CMD battalion. The SA-15 has the capability to automatically track and destroy 2 targets simultaneously in any weather

and at any time of the day.

The single stage solid propellant missile has a maximum speed of Mach 2.8 and is fitted with a 15 kg HE-fragmentation warhead detonated by a proximity fusing system. The cold launch ejection system propels the missile upwards to a height of 18-20 meters, whereupon thruster jets ignite and turn the weapon to the target bearing. The main sustainer rocket motor then ignites and the missile is command guided to the intercept point where the proximity fuse is triggered. Effective range limits are from 1nm to 22nm with target altitude limits being between 50 and 20000 ft. The maximum manoeuvring load factor limit on the weapon is 30 g.

SA-15 Statistics

Site: Mobile AD

Guidance: Command

Min/Max Range: 1nm/22nm

Min/Max Height: 50ft/20000ft

Max Velocity: Mach 2.8

Manoeuvrability: Very High

Chaff Vulnerability: Very Low

Avoidance: Break Turn 8-9g + Chaff/Notch/Stay out of engagement envelope/Regularly dispense flares when in SA-14 envelope.

SEAD: HARM from outside engagement umbrella, otherwise stay away as this threat is lethal.

Characteristics: High chaff resistance combined with highly manoeuvrable missile make the SA-15 very hard to defeat kinematically. Site consists of 2x launchers each with their own FCR.

SA-17 GRIZZLY



The SA-17 Grizzly is actually an improved version of the SA-11 Gadfly. It uses the same launch vehicle chassis, and overall has a similar configuration to the SA-11.

The SA-17 can fire against up to six targets flying simultaneously from different directions and at different altitudes.

Maximum range is 17 miles from 100ft to 48000ft. It is extremely deadly and each unit as it's own radar so you will need to knock out all units to remove the threat. Due to the short range and

there short launch warning times, the missiles can be extremely difficult to pick up visually.

In Allied Force each battalion of SA-17 consists of 6 launchers, each with their own FCR. The best advice is to avoid this system if possible as due to it's short range it is only a threat if your target is inside the engage umbrella. If you have to engage it then at least a 4 ship SEAD Strike will be required to neutralise all six launchers. Stay high and fast to maximise the HARM range and launch at 15 nm then turn immediately away. The naval version of the SA-17 is the SA-N-12 and is installed on Russian aircraft carriers.

SA-17 Statistics

Site: Mobile AD

Guidance: Initial – Command Terminal - SARH

Min/Max Range: 0.5nm/17nm

Min/Max Height: 50ft/48000ft

Max Velocity: Mach 4.0

Manoeuvrability: High

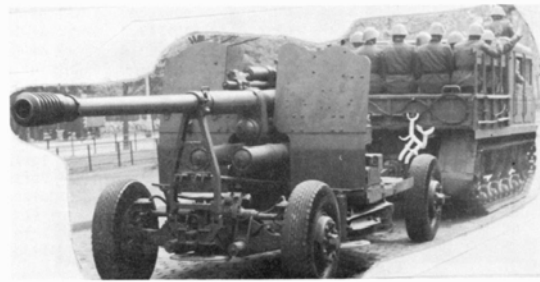
Chaff Vulnerability: Low

Avoidance: Break Turn 8-9g + Chaff/Notch/Stay out of engagement envelope/Regularly dispense flares when in SA-14 envelope.

SEAD: HARM from outside engagement umbrella, otherwise from low cluster bomb attack (high risk).

Characteristics: Low chaff resistance. Very hard to defeat kinematically. Site consists of 6x launchers each with their own FCR.

KS-19 AAA BATTALION



100 mm AA gun KS-19

a much higher rate of fire and utilise optical tracking down to ground level. When combined these weapons provide a defence from ground level up to 30,000ft for five miles around the units.

The KS-19 AAA Battalion consists of 4x KS-19 100mm gun, 4x KS-12 85mm gun and 4x S-60 57mm gun. This provide a dense wall of flak from 2000ft up to 30000ft and a range of up to 5nm. They can be used optically or slaved to the Firecan radar for better accuracy. In addition these AAA Battalion utilise 2x ZU-23 23mm and 2x ZPU-2 14.5mm AAA. These provide

It is best to stay out of the limited range of this unit but if you do get caught then a high speed and vertically jinking provides the best defence. Destroying the Fire Can radar with a HARM will also reduce the accuracy of the flak.

ZSU-57-2



The ZSU-57-2 is a lightly armoured, self propelled AAA vehicle armed with two 57 mm cannons. The ZSU-57-2 is of limited use. It has an open turret that provides virtually no protection for the gun crew, can only perform during the day in good weather and only has optical targeting. It has a maximum range of 2.5nm and an altitude of 15,000ft.

ZSU-23-4



The ZSU-23-4 is a Self-Propelled Anti-Aircraft Gun. Using its integrated radar, it is capable of acquiring, tracking and engaging low-flying aircraft (as well as mobile ground targets while either in place or on the move). The armament consists of four 23mm cannon with a range of 2nm and a maximum engagement altitude of 7,000ft.

Two ZSU-23-4s and two ZSU-57-2 are assigned to protect Tank Battalions and three of each are assigned to HQ Battalions. The high rate of fire and high accuracy provide by the radar controlled ZSU-23-4 make this weapon extremely lethal and it should be avoided at all costs by staying out of range. The HARM can be used to target the radar on the ZSU-23-4.