=X51=

Modern Air Combat Introduction Manual

=X51= WAZZERBOSH

Version 1.0

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Introduction

Traditionally, X51 is a WWII-era combat squadron. With our recent, and fast moving excursion into modern air combat with DCS: World, this guide serves as a basic reference manual in order to get those who have recently gone from props and guns to turbines and missiles up to speed on terminology, common aircraft systems, weapons and tactics.

Common systems found in modern Jets (mid — late 20th century) are covered in this manual, but with a main focus on those that are relevant to DCS: World

This guide does not go into detail about combat tactics or detailed system operation. It is purely meant as a general overview.

Comms Brevity and Glossary

With new weapons and tactics comes new terminology… a lot of new terminology. Only those that you may not have encountered in pre-jet era combat are included here, and only the most commonly used terms.

Aspect (hot, cold or flanking)	Referring to the aspect of another aircraft relative to you. **Hot:** Flying towards you **Cold:** Flying away from you **Flanking:** Heading perpendicular to you
AWACS	Airborne Warning and Control System. Usually a multi-engined aircraft equipped with a radar system that gives allied units information on other aircrafts' positions and aspects (see: **BRA**) relative to you or a fixed reference point (see: **Bullseye**)
Anchor	To hold at current position. E.g fly an orbit or racetrack pattern around a fixed position
Angels	Altitude, in thousands of feet. E.g 15,000ft is angels 15
Bandit	An enemy aircraft
Bingo	Minimum fuel level to safely return to friendly airfield/carrier
Bittersweet	AKA: Blue on blue. Friendly aircraft being fired upon by another friendly
Bogey	An aircraft that has not yet been identified as friend or foe
Bogey Dope	Requesting position and aspect information of a target. A "Bogey Dope" is usually requested to an AWACS or ground radar network. (See also: **BRA**)
BRA	Bearing, range, altitude. May also include aspect (BRAA). Example: *Pilot (to AWACS): "Request bogey dope"* *AWACS: "BRAA: 150 for 55 at angels 12. Hot."* (Bearing 150 degrees, 55 nautical miles away at 12,000 ft and their nose pointed towards you)
Buddy Spike	Means a friendly radar has locked onto you. Is often called out in response to "**raygun**" to let a friendly know they have just locked a friendly
Bullseye	A fixed reference point on the map that can be used for declaring positions relative to. E.g. *"Bandit is 10 miles east of bullseye"*
BVR	Beyond Visual Range. Usually referring to combat at ranges greater than 10 nautical miles
CAP	Combat Air Patrol. A role fulfilled by aircraft fitted for air to air combat. Usually supporting nearby ground, CAS or logistics operations by protecting them from hostile enemy aircraft.

CAS	Close Air Support. Role fulfilled by ground attack aircraft. Often to support local friendly ground units
Chaff	Material deployed by an aircraft to defend against radar guided missiles
Cherubs	Like **Angles**, but for hundreds of feet. 500ft = 5 cherubs
Cloak	Turn off exterior aircraft lights
Cranking	Turning away from an enemy aircraft while keeping them at the **gimbal limit** of your radar
ECM	Electronic Countermeasures. E.g. Jamming an enemy radar via radar signals
EW/EWAR	Electronic Warfare. E.g. use of radar jamming
Eyeball	Visual contact of target
Faded	Contact has disappeared from radar
Feet Dry	Over land. E.g "Enemy is feet dry." Or "I am feet dry"
Feet Wet	As above but for over water
Fence In/Out	Set up for combat. E.g. Turn on master arm, weapons selected, exterior lights off…
Flare	Flares deployed by an aircraft to defend against infrared (IR) homing missiles
Firewall	Go full throttle (see also, and not to be confused with: **Military/Mil Power**)
Fox	Firing a missile. Precedes a number that designates the type of missile being fired, E.g. "Fox 1", "Fox 2", or "Fox 3"). See weapons section for more detail
GCI	Ground Control Intercept. Casually, often used synonymously with AWACS in DCS multiplayer, and often refers to a player in the "GCI slot" who can give BRA calls for targets
Gimbal Limit	The point at which a radar or targeting camera/laser has reached the limit of its gimbals (rotation limit) and will not be able to track beyond that point
IFF	Identification Friend or Foe. Identifying, either visually or via transponders, whether an aircraft is friendly or not
Mad Dog	Called when a fully active radar (fox 3) missile is launched with its seeker turned on. Will track and intercept the first radar contact it finds
Magnum	Called when an anti-radiation missile is launched (a missile that homes in on radars)
Merge	When a friendly and hostile aircraft "meet"
Military/Mil Power	100% throttle, without engaging afterburner
Mud Spike	Being locked by a ground radar
Music	Radar jamming signals. E.g. *"enemy has music on"* (enemy is jamming your radar). "*Music on"* (declaring you are turning on your radar jammer)

Nails	Declaring that you are picking up the search signal of an enemy radar, but it has not locked you.
Naked	Target is not showing up on your **RWR**
Padlocked	Declaring that you cannot take eyes off the target, or you will lose visual on them
Pickle	Bomb release
Pitbull	Missile has gone fully active (turned on its on-board radar)
Raygun	Declaring that you have locked up an unknown target. If a friendly sees that you have locked them, they will respond with "**buddyspike**", letting them know they have locked a friendly
Rifle	Air to ground missile launch
RWR	Radar Warning Receiver. An instrument in the aircraft that detects the incident radiation from radars
SAM	Surface-to-Air Missile (referring to the ground unit or the missile itself)
Shack	Enemy ground unit is hit
Spike	RWR is showing a radar lock. (**Mud Spike** refers specifically to a radar lock from a ground unit)
Splash	Enemy air target is hit
Trashed	Missile defeated and is no longer a threat. (Lost lock, lost energy or defeated by countermeasures)
Winchester	Out of ammunition/payload

Being familiar with the above brevity codes and knowing how ATC, GCI and AWACS calls work will make it much easier to communicate on the "hardcore" DCS combat servers over SRS, and is required knowledge for inter-squadron events. Radio calls do not have to be realistic or "to standard" they just need to be understandable, i.e it must be clear who is making the call, who the call is for and the information relayed briefly and clearly. A radio call to someone else to relay information has the structure:

<*callsign of receiver***>**, **<***callsign of transmitter***>**, **<***information***>.**

Brief replies that answer a question or confirm that the information was received can include:

"Copy" or *"Roger"* – The previous message was received and understood. (In reality certain services and operations distinguish between copy and roger but here they are used interchangeably)

"Wilco" – Same as "copy" and "roger" but states that you will carry out the request/order of the previous message

"Affirm" or *"Affirmative"*- The positive answer to a question (yes).

"Negative"- Opposite of affirm (no).

"Unable"- The order/request cannot be performed.

Examples:

A player with callsign Uzi 1-1 and his wingman in F-18s let traffic at Maykhop airport know that they are about to take off on runway 04:

UZI 1-1: *"Maykhop traffic, Uzi 1-1, two ship of F-18s taking off runway zero four"*

AWACS with callsign "Wizard" tells pilot Uzi 1-1 that they have an enemy aircraft approaching them from 40 nautical miles away, at bearing 275 and at 22,000 ft:

WIZARD: *"Uzi 1-1, Wizard. Bandit BRAA 275 for 40 at angels 22. Hot."*

Uzi 1-1 lets Wizard know that they have killed the enemy, but have used all their weapons and are returning to base. Wizard then gives them a heading to fly to return to base.

UZI -1-1: *"Wizard, Uzi 1-1 splash bandit. Winchester and RTB."*

WIZARD: *"Uzi 1-1, roger. Fly 095 for 50."*

UZI 1-1: *"Uzi 1-1 wilco."*

Systems

The airframes of DCS have many specialised and often unique sytems, so this section will concentrate on only those that are common to most aircraft, or one needs to understand in order to defeat it.

Radar

There are numerous types of air-to-air radars, but the most common employ the doppler effect to extract targets from the radar reflections (returns).

Similar to how you can tell if a police car is coming towards you or driving away based on the siren's pitch, the doppler radar sends out radiation and determines the existence of a target and its velocity from the frequency of the signals that are reflected back. This allows it to distinguish a moving aircraft from the statonary ground, for example.

However, this also means that the radar is susceptible to *notching.* When the relative velocity between your aircraft and the target is too small, the doppler shift is either too little for the radar to effectively see it, or the target's relative velocity to you is too similar to your relative velocity to the ground and the enemy aircraft cannot be distinguished from the ground returns.

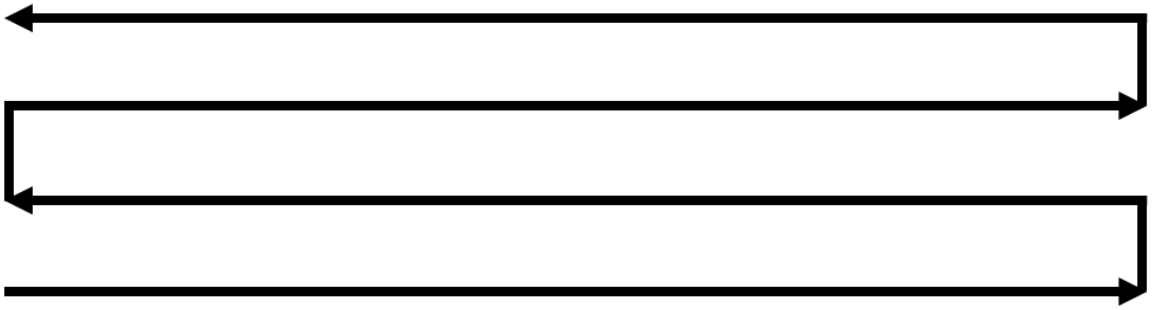
If your target is flying below you and towards you, the radar is going to receive returns from both the target and the ground behind the target. However, the relative velocity between yourself and the target is much greater than the relative velocity between yourself and the ground. The returns from the target will therefore be much higher pitched compared to the ground returns, and is easily distinguishable.

Take the same situation where the target is instead flanking perpendicular to you (*beaming*) and despite their high speed, from your radar's perspective they are not moving relative to the ground and cannot be distinguished from it.

Radar guided missiles such as the AIM-120 also use doppler radars in their seekers. Such missiles can be defeated by flyng perpendicular to their nose and notching their radars. Keep in mind that for fully-active radar guided missiles, one must notch the missile. For semi-active radar guided missiles, one must notch the enemy aircraft.

Scanning patterns

Most radars scan in horizontal lines in a continuous zig-zag pattern. That means when it sweeps left → right, it then scans slightly below (or above) the previous sweep when it then scans right → left. This can explain why a target might fade between successive sweeps, as on the return sweep it is not scanning in the same place, and may now be scanning below the target. Usually, one can adjust how many scan lines the radar performs. Decreasing the number of scan lines will mean it will repeat the full scan more frequently, but have a narrower vertical coverage.



A four scan-line sweep pattern where the radar is pointing into the page.

Many modern radars also allow the operator to modify the angle of elevation and azimuth, as well as the azimuth scan range. In practice, these variables relate to the following effects:

Number of scan lines: vertical thickness of scan

Azimuth range: horizontal thickness of scan

Elevation: vertical angle of scan

Azimuth: horizontal angle of scan

Keep in mind that despite a target being visible continuously on the scope, a full scan may take several seconds, with the radar sweeping over the target and receiving a return for only a fraction of a second of that sweep. Restricting the scan by changing the azimuthal range and scan lines will increase the frequency at which the full scan is completed, giving you a better time resolution of that area, but leaves you blind to everything outside of this restricted range.

Track While Scan (TWS)

TWS is a locking mode where the radar does not fixate on a single target, but instead continues its scanning pattern while keeping track of the locked target. This will not give the target any indication that you have them locked, and you will appear as only a scanning target on their RWR. It also does not blind you to other aircraft within the scanning pattern. However, you will likely receive less detailed information on the target and they are more prone to fading.

Single Target Track (STT)

Conversely, STT locks the radar beam onto the target. You get continuous and detailed information on bearing and speed, but the enemy will receive a hard lock warning on their RWR and you will be blind to any other target.

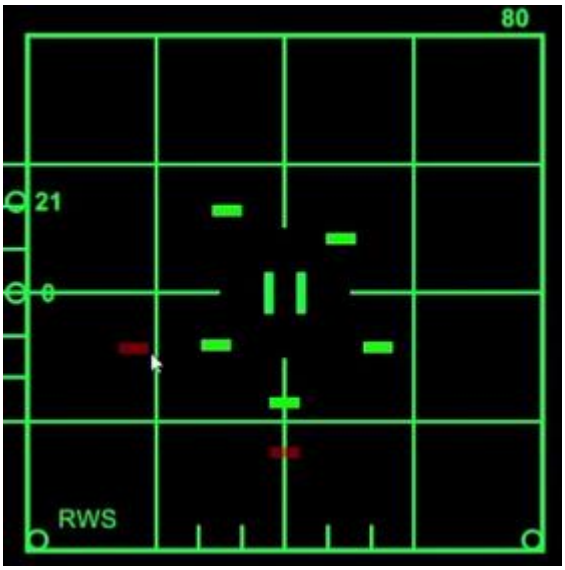
Displays

The radar information can be displayed in numerous ways, but the most common in DCS are the *Plan-Position Indicator* and *B-scope.*

The PPI display shows a top-down view of the area the radar is scanning. The “y” axis represents distance from the radome, which is situated at the bottom center of the display. The angle to the target (*azimuth*) is represented as one would expect in a top-down view of the situation, i.e. the azimuth of the target in space is the same as the angle from the bottom center of the radar display.

Mirage 2000C radar display in PPI mode. Source: kriegsimulation.blogspot.com

Instead, the B-scope displays azimuth on the “x” axis. This means the distance along the x-axis the target appears on the display is related to the azimuth. If you take an imaginary vertical line from the top to the bottom of the display, which represents distance to the target, anything along that line is at the same angle off your nose irrespective of their distance from you.



F-15 B-scope display

Radar Warning Receiver

The RWR is a series of sensors mounted to the aircraft that detect incoming radar signals. Modern versions can identify the radar type based on the emissions, therefore classifying the contact as a particular air unit, ground unit or radar guided missile. It can also tell you whether it is just a search signal or a hard lock.

The RWR will therefore only display information on units actively emitting radiation. It is worthy to assume that if you can see something on your RWR, it can also see you.

Likewise, if you have your radar on, you will appear on the RWRs of all aircraft that your radar beam intercepts, even if their current aspect and position is obscuring them from appearing as a target on your radar.

Often, both you and your wingmen might report being "spiked" (locked) by the same target simultaneously. In reality, only one of you is locked, but the RWR infers this from the incoming radar signal being continuous rather than a sweeping scan. Therefore, it will appear to anyone within that continuous beam of the enemy radar as if they are being locked.

Symbology and operation of RWRs differ greatly between aircraft, so that won't be covered in detail here and it's crucial to learn what the symbols and sounds of your aircraft's RWR mean, and to understand its limitations.

Radar Jamming

Jamming, or ECM allows you to disrupt an enemy's radar by overpowering it with noise, or returning similar signals to their radar in order to confuse it. This can be used in BVR to close the distance between yourself and a target while minimizing their chances of receiving a valid return and achieving a lock. Be aware that jamming can also make you more noticeable.

Although jamming may inhibit the enemy's ability to gain a lock, some radars will display the bearing from which the jamming signal is coming from – giving them a rough idea of where you are long before you would appear on their scope anyway. Some radars will also attempt to isolate and burn through the jamming, and some missiles can be launched in "home on jam (HOJ)" mode where they will lock and attack the jamming signal. Achieving a kill with a HOJ missile is unlikely due to the large distances in which it is applicable, and the missiles are therefore less effective.

In summary, jamming is situation dependent and how effective it is depends largely on the enemy aircraft.

Countermeasures

Flare and chaff are used to defend against enemy missiles. Flares can distract IR missiles by creating a heat source behind your aircraft that is hopefully more attractive than your own heat. Chaff is material dispensed behind your aircraft to produce a radar return to break the lock of an enemy aircraft or missile.

Flare and chaff are much more effective when released together in bunches as their concentration in a small area will create a larger source of infrared energy, or larger radar return. They are also more effective when released before conducting a manoeuvre. This separates yourself from the cluster of

countermeasures. Combining these two techniques will increase the chances that the enemy missile will attack the countermeasures rather than you.

As well as making the countermeasures appear more attractive to the enemy missile, you will want to make yourself less attractive. For instance, if defending against an IR seeker - shut down you afterburner. Against radar homing – notch the radar and chaff along the beam.

ELINT

A specialised system available on a couple of aircraft in DCS. ELINT is normally available as a pod that attaches to the aircraft and behaves like an RWR that is recording everything including position. The data is analysed after the flight and allows the aircraft to scout around enemy SAMs, gathering signal data to identify the unit types and triangulate their positions.

IFF

Identifying whether a contact is friendly or hostile is crucial in avoiding friendly fire incidents. If an aircraft is fitted with a radar, it will almost certainly be fitted with an IFF interrogation system. Be sure to use it constantly to identify locked targets. Also, make sure that your IFF transponder is powered up and working to avoid friendly fire coming your way. If a multiplayer server has a human controlled AWACS/GCI, you can ask them to identify the target off your nose with the brevity code "**DECLARE**".

Missiles do not have any form of IFF system. They will attack whatever you shoot it at, whether friendly, hostile or neutral.

Be aware that some friendly aircraft may not have IFF transponders. (Sometimes tankers and AWACS will not respond to an IFF interrogate).

If there is any doubt as to whether the target is hostile, **do not shoot.**

Air to Air Weapons

Air-to-Air (A2A) missiles are categorized into three types based on how they home in on the target. These are Semi-Active Radar Homing (SARH) missiles, designated Fox 1; Infrared (IR) homing missiles (Fox 2); and fully Active Radar Homing (ARH) missiles (Fox 3).

Semi-Active Radar Homing Missiles

SARH missiles, known as Fox Ones, are guided onto the target by the aircraft's radar. Usually a full STT lock is required to fire SARH missiles and that lock must be maintained until the missile has impacted. If the lock is lost while the missile is in flight, it will no longer be able to track. However, some aircraft have a "FLOOD" mode which is used in the event of a lost lock. In FLOOD mode, the missile can be guided towards the target by keeping it within a circle on the HUD.

Enemies will receive at least a lock warning when SARH missiles are used, as they require a lock from the aircraft's radar. They are usually short-medium range missiles and can be defended against by either out manoeuvring the missile, using chaff and defeating the enemy aircraft's radar via notching.

SARH missiles in DCS include:

BLUEFOR	***REDFOR***
AIM-7	*R-23R*
SUPER-530D	*R-27R*
	R-27ER

Infrared Homing Missiles

IR missiles (Fox Twos) have passive seekers. This means a launch cannot be detected by an RWR. In most aircraft, no warning will be received if an IR missile has been launched against them. (The exceptions are the A-10 and Mirage, which can detect the heat flash of an igniting rocket motor. This system only gives a warning that a missile in the vicinity has been launched, but does not know who it has been launched against.)

IR missiles are usually short-range and highly manoeuvrable and can be defended against by out-manoeuvring and use of flares.

Some aircraft allow the seeker to be guided by either a head mounted display (HMD) or the aircraft's radar. This will point the seeker in the desired direction, increasing the chances of a lock.

IR missiles can be distracted by any heat source including the sun and nearby enemy and friendly aircraft. Make sure the seeker is locked on the desired target before launching it off the rail. As they can be launched with the radar completely off, special care must be taken to properly IFF the target.

IR missiles in DCS include:

BLUEFOR	REDFOR
AIM-7	*R-23T*
SUPER-530D	*R-27T*
	R-27ET
	R-60
	R-73

Active Radar Homing missiles

ARH missiles (Fox Threes) have their own doppler radar in the nose that it uses for homing. They are usually medium-long range missiles that can be used in BVR combat.

They first require a lock from the aircraft radar before firing. After firing they are guided towards the target in the same way a SARH missile is, then after a short period of time, (or if the aircraft radar lock is broken before then) they switch on their own radar and begin homing independently. This is known as “going pitbull”.

An ARH missile that is launched without first achieving a lock is known as a “mad dog”. It is as dangerous as the name suggests as it will home in on and attack the first target it sees… not recommended.

Care must be taken when firing ARH missiles when there are friendly aircraft in the vicinity. If there are any other aircraft close to the target, it is not guaranteed that the missile will track the same target your aircraft’s radar has locked when it goes pitbull. If the enemy notches your aircraft’s radar, or is destroyed while it is still in SARH mode, it can force the missile to go pitbull on whatever it sees in front of it. That might very well be the friendly that just destroyed the enemy you had locked.

Like SARH missiles, ARH can be defeated by out-manoeuvring it, chaff and notching. In this case, you must notch the missile and not the enemy aircraft.

As the missile’s seeker is a radar, it will trigger an RWR alarm when it goes pitbull.

ARH missiles in DCS include:

BLUEFOR	REDFOR
AIM-120	*R-77*

Future Topics

Future volumes will individually cover A2A offensive and defensive techniques, ground threats and SAM defensive tactics. Some of these are included in the resources below:

Resources

This is a list of useful online resources to learn more about system operation and tactics.

TAW interactive F-15 radar	A 3D simulation of the F-15 radar system. A great tool to see exactly what's happening when you operate the radar
Hoggit DCS Wiki	One of the best resources for general unit and weapons information and guides for new players
Growling Sidewinder (YouTube)	Includes a great collection of tutorial videos for basic and advanced fighter manoeuvres
Mudspike's F-15 combat guide	A well written combat guide for beginners in the F-15
Chuck's guides for DCS	Chuck's guides are invaluable reference material for DCS modules. He has summarised the systems and operation of every DCS aircraft module into easy to read pdf slides.

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