

FSCAI is an experiment in using the facilities of Microsoft ESP-based civilian flight simulator programs (FSX, FSX-SE, and Prepar3D) to provide a deep, rich, realistic combat environment.

The first version of FSCAI was quite simple and involved providing the ability to define weapons parameters and to "attach" any of those weapons to any ground-based SimObject in the simulated world so that SimObject could target and potentially damage the user aircraft. The set of weapons encompassed small arms, light AA with tracers, heavy AA with Flak, and guided ground-to-air missiles. This version was solely for a single player.

The second release updated the program to include multiplayer support, which involved the expansion of the AI provided to the ground SimObjects to be able to target, and damage or destroy other AI aircraft as well as the user airplane.

This third major release is a dramatic expansion that adds new features to address some of the weaknesses of the original design as well as much, much more.

FSCAI has always had a much more ambitious goal than simply to allow ground targets to shoot back at aircraft that attack them. That goal is to potentially provide every SimObject in the FS world with the ability to know who their enemies are and to attack or defend against them, on the air, land and sea; and against any other air, land or sea target or targets. And furthermore to use those AI capabilities to assist other friendly SimObjects in an organized and realistic way, as well as to assist the user aircraft.

These are deeper explanations of the major new features of the upcoming FSCAI:

## **1. Team Concept**

One of the most bedeviling problems of FSCAI is how each AI object can know who are its friends and who are its enemies. This version contains a fairly elaborate system to define what we call "teams", with each team having a user-assigned name. Each SimObject can then be assigned to any of the teams based on a set of rules in an "era configuration file". (Not every SimObject has to be on a "team", any that are not are considered "neutral" and will not attack or be attacked by the active teams of AI. If any neutral objects are damaged by the user that's considered "collateral damage".)

Here's how it works:

There's a configuration file named "Eras.cfg" and it contains a list of user-defined "eras". Each "era" is actually just a name of an "Era Configuration File" which contains the rules for assigning teams to each SimObject in the world for that "era".

There are three ways in which an object can be assigned to a team:

- By the use of airport ICAO templates. Each SimObject will likely be approximately near an airport in the sim world. The airport ICAO codes are largely assigned with consistent naming schemes based on countries and regions. Thus it's possible to assign teams based on the ICAO of the nearest airport to each SimObject. For example, in the FSX@War Pack 1 based on the conflicts in Libya in 2011, it's possible to assign all Libyan airports to team "Libya" with the

wildcard ICAO specifier "HL\*\*\*". Thus any aircraft parked at any airport with an ICAO starting with HL will be assigned to "Libya". Also any ground based SimObjects can likewise be assigned based on proximity to an airport. In fact, this scheme does have drawbacks and in practice is more complex; for example in the same FSX@War pack 1, the target sites are defined as "airports" with codes like RL01 or RL33 so it's also necessary to assign a template "RL\*\*\*" to team Libya too. Likewise the NATO team can be assigned based on templates like "LI\*\*\*" for all Italian airports, etc.

- By the use of the "ATC\_MODEL" parameter each mobile SimObject can be defined with in its simulator configuration file. Each aircraft is usually assigned an ATC\_MODEL in its aircraft.cfg by the developer, and this includes AI aircraft. The original purpose of these models is so that the built-in ATC can use the proper verbal description for example any aircraft with a model of "MIG21" will be called "Mig twenty-one" by the MS ATC voices. We can use this model code to assign aircraft to teams. In the 2011 conflict "MIG21" would be team Libya, whereas "MIRAGE" or "A10" or "RAFELE" would be team NATO. Assignments based on model override ones based on airports, if there is a conflict.
- Explicit assignment in the definition of objects included in a Mission. The "Mission" system is described below.

Once teams are assigned at the start of any FSCAI session, the AI will follow some simple and logical rules. They will assist (or ignore) other objects on their own team. They will attack (depending on the Rules of Engagement) other objects assigned to a team not theirs. And they will ignore any object not assigned to a team, unless attacked by it.

## **II. Weaponized Aircraft.**

This version now allows weapons to be attached to AI aircraft as well as ground objects. That's a simple thing to say but it opens up a vast world of possibilities.

When aircraft are on the ground they are considered inactive. But once airborne they follow the same engagement rules as ground objects. They will attack any other SimObject not neutral and not on their team. This includes (but is certainly not limited to) the user aircraft. It also includes ground targets. AI can use air-to-air weapons (including of course missiles) against enemy aircraft, and they can use air-to-ground weapons against ground targets; including guns, rockets, bombs, and missiles. Of course, any ground targets attacked will shoot back if they can.

This applies not only to aircraft assigned in a mission script, but to any airborne aircraft in the simulated world, including those flying on a flight plan. If they detect an enemy (including you the user pilot) they will likely attack. They will assist those on their own team - also including you as the user pilot.

The only thing remaining to make FSCAI a comprehensive combat simulation is ground targets engaging one another, and that will be coming in a later release.

Weapons are assigned to aircraft based on the "ATC\_MODEL". Currently there is only one fixed loadout able to be defined per aircraft type (we later plan to add multiple load-outs). However that can

contain multiple weapons which are listed in priority order. For example, the atc\_model=A10 is assigned the following weapon set in the default configuration:

AIM9M-4,AGM65D-6,MK82-12,LAU68-4,GAU8.

The rules are that the first weapon listed is the primary air-to-air weapon, the second is the primary air-to-ground weapon, and all others are listed in the order of their employment. In this case, in an air-to-air engagement the A10 AI would first use up to 4 AIM-9M missiles, and when they are expended, would use the GAU8 (which is defined as primarily an air-to-ground weapon but can be used against airborne targets). Against ground targets the Warthog would first use up its six Maverick missiles, then drop up to 12 MK-82 bombs (in pairs) then when they are gone use rockets and when they are gone, the GAU8 gun. (Why not put the GAU8 first? Because it has 1174 rounds of ammo and if listed before rockets and bombs the latter would likely never be used. The AI pilot doesn't select his weapon based on what's "appropriate" but strictly on the order list in the Vehicle definition. Only when one is used up will the next be selected.)

### **III. Wingmen.**

Having granted AI capability to aircraft, it's also possible for you as the user craft (and thus the Primary Hero (or Goat) of the simulated environment) to call on up to three other copies of the aircraft you are flying to fly along with you as "wingmen". Wingmen can be created both in the air and on the ground. If created before you take off, they will defer to you and wait until you take off, then they will likewise take off and then join up with you in a formation.

Wingmen are created by cloning the user aircraft. This can be a problem, because not all simulations make good AI aircraft. We are considering ways to address this problem, such as "substitutions" configuration.

You and your wingman or wingmen are considered a "flight". You are the leader. The others will fly along with you (poorly) in a predefined formation, which you can change. They do not follow the same rules of engagement as other AI aircraft, friend or foe - they will not attack anyone else unless you order them to. Orders you can give to your flight include:

- Change Formation.
- Engage Bandit
- Engage Air Defenses
- Engage Ground Targets
- Cover Me
- Rejoin Formation (cancel current orders)
- Return to Base.

You should understand that in this first experimental version of FSCAI air combat your wingmen (like all AI pilots) are only minimally competent. And that might be generous. There are a few things they do well, such as detecting and engaging ground targets. However they are very shaky at formation flying and total rookies at dogfighting. In short they see like eagles but can't fly very well. But they are definitely better than nothing!

#### **IV. You can use the AI weapons.**

A major focus of development has been the ability to use air-to-air and air-to-ground weapons. In testing these it was very useful to be able to use them from the user aircraft. We decided to leave this testing capability in the program for you to use. If you are flying a simulated aircraft that has an "atc\_model" that is weaponized in the FSCAI configuration files then you can use the same weapons as any AI pilot flying that model, without having to configure or change anything on the aircraft!

This capability gives those without a weapons add-on program the ability to shoot at other SimObjects, as well as potentially arming any aircraft you may have with weapons even if not configured for the weapons add-on you have.

This feature comes with many limitations. Because there is no explicit configuration of these weapons beyond the list in the Vehicle definition, your load-outs are limited to what's listed there. There is no visual depiction of the weapons on the aircraft (but they do work!). The weapons have no weight.

You access these AI weapons via a simple set of function keys (which are default but can be user-changed).

- Shift-F9: ARM the weapons systems. Unless they are armed they can't be used. A second press will toggle this. Also, on the ground, arming the weapons will reload all of them.
- Shift-F7: Cycle the Gun-type weapons. If you have more than one the next in the priority chain will become active, and they will wrap around if you're on the last one.
- Shift-F8: Cycle the Stores-type weapons. If you have more than one the next in the priority chain will become active, and they will wrap around if you're on the last one. Stores are the weapons that typically hang from wings like bombs and missiles.
- Shift-F5: Query. Show the currently selected weapons and their ammo status, and show any currently selected guided weapon target if there is one.
- Shift-F6: Reject the current target and select another one, if available. Cycling either stores weapons or the arm-disarmed function will clear the reject list.

These are exactly the same weapons and work the same way as the weapons the AI aircraft use against you or each other.

#### **V. Missions**

To provide structure and many capabilities to your combat experiences with FSCAI, we have incorporated the "Assignments" system from FSCaptain as a native part of FSCAI, with a few extensions specific to FSCAI like the ability to assign units to teams or give explicit skill levels to AI SimObjects.

Missions are written in scripting language named "ASL" that was developed for FSCaptain

assignments (ASL stands for Assignment Scripting Language of course.) This language allows simple missions to be defined in a set of four statements. Additional statements allow the placement and intelligent animation of SimObjects.

Missions are obtained by placing your aircraft at an airport that has missions written for it. They can be of several different types:

- Pickup or Delivery missions.
- Air Drop missions.
- Recon or Survey type missions
- Combat missions

Missions can be written for combat-capable aircraft and involve shooting at targets, or non-combat aircraft that can act in logistics or reconnaissance type roles. “Non-combat” in our context doesn't mean there is no risk of being shot at, it means your intention is not to attack anything directly. Combat missions are not available to non-combat aircraft, but non-combat missions can be executed by combat-capable if they meet all the other criteria such as size.

How do we define “combat-capable”? This is done by keying on the `atc_model` in the `aircraft.cfg`. There is a list of models that we consider “combat-capable” in the configuration file “`Combat.cfg`”. We know that at this early stage not every aircraft type is listed there. You can edit and easily add entries to this file if needed to weaponize (or use the weapons with) something that we don't already have listed.

You can write your own missions. We have clear, solid plans for a visual missions editor to allow you to construct these missions (including the placement and animation of ground, sea, or air SimObjects) but this is not done yet. You will need to handle the scripting language on your own if you want to do this. We recommend cutting and pasting from existing missions and changing the details. That's what I do to make the missions provided with this release.

Missions have specific goals and are scored and logged to make up a career which you can look at by using the 'Your Log' button on the FSCAI user interface.