MCC GAIA v1.0

# Greater Artificial Intelligence Awareness

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# Introduction

# GAIA stands for Greater Artificial Intelligence. Ever since I typed my first 2 lines of MCC code it has been going through my mind. What if the AI did…? Why isn’t this….? …..These and a zillion other questions have haunted me for too long. GAIA is my answer to most of these questions. So, now you know my personal motivation, let’s move on to the system itself. This document tries to focus on the intent of GAIA and the design decisions that have been made. I won't try to explain how all of the code works, but after reading this document you should have a clear understanding of what GAIA stands for, what choices she makes and how she operates.

# Goal

GAIA can best be seen as a higher level lead organization that is tasked to make all groups work towards (a) common goal(s). GAIA does not improve and tries not to influence the behavior at group level.

So what is it that GAIA wants? The main goal of GAIA is to defend territory. To do that she makes sure that:

1. All assets are used intelligently. Know your units, what can they do, what are their weaknesses.
2. Responses to threat are in proportion. Do not send more troops then needed, but also make sure it is enough to deal with the opposing threat.
3. Understand the priorities. The closer a threat is to the center of the territory (zone), the higher the priority.

In future versions of GAIA goals will be expanded and might even grow to fully commanding offensive battles.

# Requirements

# GAIA is in the first place created and designed as ‘the new engine’ of MCC (Mission Control Centre). For more info see the BIS forums. MCC makes use of UPS, UPSMON, BIS Patrol etc. Although all of them deliver great functionality, they were not created with the intention to be used by MCC. It is exactly the other way around. As we (Shay Gman and I) had, and have, great goals in mind for MCC, the idea was born to build our own AI ‘engine’. This is where I took off and for that am back on my original project MCC. So with what did I take off?

# GAIA should outperform UPSMON as the currently used ‘engines’. Not for the sake of beating them but for the fact that we want to expand the AI numbers and their behavior. If you want that, you need good performance.

# GAIA should be setup in such a way that it initially can be a simple ‘replacement’ for the existing ‘engines’. This is the reason why GAIA initially supports the commands ‘DEFEND’, ‘ATTACK’ and ‘FORTIFY’, just like UPSMON and UPS do. (see details later).

# GAIA should be created such that it is capable of operating all units created by BIS and the community, in a smart way. No more vehicles without guns in the attack!! (Except for Shay and Spirit)

# GAIA should be setup in such a way that expansion of AI behavior can be handled easily.

# CYCLES

GAIA commands all troops by cycling through organized phases. After she finishes all phases, one cycle is complete. From a very high level view it can be divided into two phases : Intelligence and Orders. The end of the cycle is celebrated by a well-deserved waiting time and then it starts all over again.

The key phases of a cycle are:

1. Gather Intelligence
2. Update Alarm Levels
3. Classify and Identify
4. Define Conflict Area’s
5. Issue Orders

Let’s go through one cycle just briefly, so you get the idea behind it.

# Gather Intelligence

In the ‘Gather Intelligence’ phase GAIA gathers information on the whereabouts of her own and the enemy’s troops.

For her own troops she notes where they are, where they have been and where they are going. This information is used to optimize the patrols. It is not necessary for forces to patrol a certain area if a friendly force has recently been there or is planning to go there.

Apart from her own forces, GAIA takes note of all enemy units seen by her forces (including friendly forces not under the control of GAIA). For each target she notes where and when the enemy was last perceived to have been seen. Confirmed kills are scratched from her list without any remorse. Based on the last time an enemy was seen it is categorized in either Targets or Spots. Spots are outdated (i.e. not seen for a while) Targets. Spots are used for patrolling (making sure it is clear), while Targets need immediate response and are used for attacks. A Target becomes a Spot by simple staying unseen by GAIA forces until a certain time has expired.

A Spot can be cleared (by a patrol checking out the location of the Spot) or by the fact that too much time has passed and the Spot is dropped from her list (and forgotten).

So Targets can be scratched from the Target list in the following ways:

1. The target is killed.
2. The Target is lost and becomes a Spot.

Spots disappear from the Spot list in one of the following ways:

1. The enemy unit is seen by GAIA forces and the enemy unit becomes a Target once again.
2. GAIA forces have been at the location of the Spot and seen noone. We call that active clearing.
3. GAIA forces fail to actively clear and the Spot simple becomes outdated (too much time has passed by). The Spot is scratched from the list and forgotten.

# Update Alarm Levels

Every group under GAIA control operates in a certain area. We will call these areas zones. During this phase GAIA starts to check if each zone still has active forces. If a Zone contains no more forces then GAIA forgets all about this zone. Put another way: GAIA produces a list of active zones and considers zones without forces as lost.

Secondly GAIA checks the alarm level of each zone. The levels are Green (No enemy seen), Orange (Enemy’s close), Red (enemy in the zone). These alarm levels affect the behavior of all the groups that are operating in that zone. Green means, all is ok and the groups are moving around “SAFE”. Red means the highest alert and they move “FULL” speed and AWARE. Combat status is never given. Combat status is defined by the group itself. As soon as it gets into active contact with the enemy it moves itself into Combat Status (BIS default behavior). The combat status excludes it from most orders GAIA can give (but not all!).

Target

A threat is inside zone one. The alarm rises to status Red.

Target

A threat is seen near the zone. The alarm rises to status Orange.

Zone one is happy. No threats are near, the zone is in status Green.

**Overlapping Zones.**

A zone can overlap another zone (a big zone containing another zone). GAIA calls these overlapped zones Child Zones and the one overlapping the child is called the Parent Zone. Child zones are affected by Parent zones. If the Parent Zone becomes Orange (targets close), then the Child also becomes Orange. Red status can only be achieved when there is a target inside the zone, so a Child zone will as a maximum go to status Orange, based on the status of the Parent zone.

Both Zones green and happy.

Threat near zone 1. Zone 1 goes Orange.

Zone 2 is a child of 1. It inherits the zone status of 1.

Target

Threat moves into 1 and 1 goes status red. 2 Stays orange, no target is inside 2.

Target

Target

# Classify and Value

During this phase GAIA evaluates the size of her forces and what they are capable of. Every group will be analyzed and for each group she notes the following information:

* Class
* Speed
* Points
* Portfolio
* Cargo Space

Let’s take a closer look at what these value mean, as they are vital for the decisions GAIA makes.

## Class

A class is a conclusion we draw from analyzing the units in a group. Some examples will help: If we have 10 normal infantry then GAIA will classify this group as Infantry. If it contains 5 recon units then it will be classified as ‘Recon Infantry’. So far these are straight forward examples. Let’s say a group contains 5 infantry and 1 Hunter with 2 cargo spaces; this group will be classified as ‘Motorized Infantry’.

So why do we need that class anyway? Orders to Recon Infantry are different than orders to artillery units. So when a group is identified as a particular class, it makes it clear what orders can be given to that group by GAIA. Those orders are stored in the so called 'Portfolio'.

The classes that are currently automatically detected and supported are: Infantry, Recon Infantry, Anti Air, Car, Motorized Recon, Motorized Infantry, Tank, Mechanized Infantry, Artillery, Helicopter, Ship, Support, Static Gun, Submarine, Unknown.

The “unknown” means that a combination of units is found that GAIA does not recognize as a certain class. An example would be 2 helicopters and a tank in a single group. It will still be able to give it orders, but it will be very cautious and very unexciting. I would not advise using this sort of group, but it’s not up to me, it is up to the mission maker (our most firm MCC belief).

As GAIA moves to release 1.0 candidate, I am sure I will have forgotten some class combinations. Also the list is not complete; that I am aware off. Snipers for example. This is where the famous words come in: “in a future release!” 

So I hear you think. A Car? Isn’t that rather small, too little to tell what it can do? Yes, it is. What about if we also check whether that car has a mounted gun and if it holds cargo for transportation?

## Portfolio

As has been said, the portfolio is a set of orders a certain group can execute. The portfolio is based on the class and its specific details. Let’s sum up the possible orders with a brief description of what they do.

|  |  |
| --- | --- |
| Do Clear | Group moves to the nearest Spot and checks the area. If nothing seen, the Spot is cleared from GAIA’s Spot List (see ). |
| Do Patrol | Group patrols the zone he is operating in. |
| Do Attack | Group moves (possible flanking) to the given Conflict Area (CA). (see tbfi) |
| Do Hide | Group moves to a position in the zone he is operating in that preferable holds forest or other stuff he can seek cover behind. |
| Do Park | Group moves to a random road position and stands still on the side of the road. |
| Do Mortar | Group moves to a position from where it will be servicing mortar support. |
| Do Artillery | Group moves to a position from where it will be servicing artillery support. |
| Do Transport | Is a combination order. One group moves to a position on the road and waits for the other group to pick them up. The group is then transported to the closest road location of where it needs to be. From there they go their own ways. (See transportation system in the Orders Phase). |
| Do Cas | Group moves, lands and wait at its designated landing spot, from where it will wait for Close Air Support requests. |
| Do Support | Group will move to a (preferred road) location in the zone, park its car just off the road and wait for service requests. (Medic, Repair, Fuel etc). |
| Do Guard | Group will move to a designated position and stand guard. |

So how is this all handed out to the group? The following table will shine some light on that. The condition means: does this group have any special requirement before its gets an order added to its portfolio. If, for example, a unit does not hold the ´DoAttack order´, then it will not attack during Order Phase of GAIA.

|  |  |  |
| --- | --- | --- |
| Class | Condition | Order Portfolio |
| Infantry | - | Do Clear |
|  | - | Do Attack |
|  | - | Do Patrol |
| Recon Infantry | - | Do Clear |
|  | - | Do Attack |
|  | - | Do Patrol |
| Anti Air | - | Do Hide |
| Car | No Guns + Has Cargo | Do Transport |
|  | Has Guns | Do Attack |
|  | Has Guns | Do Patrol |
| Motorized Recon | - | Do Patrol |
|  | - | Do Attack |
| Tank | - | Do Hide |
|  | Guns | Do Attack |
| Mechanized Infantry | - | Do Patrol |
|  | - | Do Attack |
| Artillery | - | Do Hide |
|  | - | Do Artillery |
| Helicopter | - | Do Patrol |
|  | No Guns + Space | Do Transport |
|  | Has Guns | Do CAS |
| Ship | - | Do Patrol |
|  | Has Guns | Do Attack |
|  |  | Do Clear (water positions!) |
| Support | - | Do Hide |
|  | - | Do Support |
| Static Gun | - | Do Guard |
| Submarine | - | Do Patrol |
| Unknown | - | Do Patrol |
|  | Has Guns or contains infantry or holds Recon | Do Clear |
|  | Has Guns or contains infantry or holds Recon | Do Attack |

## Speed

The value for speed indicates how fast a group can move. GAIA recognizes ‘Slow', 'Normal' and 'Fast’. Foot mobiles are considered Slow, vehicles are considered Normal and air units are considered Fast. The group can however contain different unit types in which case the slowest unit determines the speed.

Example: 5 infantry, 1 Hunter with 2 cargo slots. The vehicle is Normal, the infantry is Slow and there is only space for 2 out of 5 infantry in the cargo. The group is considered Slow.

Example: 6 infantry, 1 M113 with 8 cargo slots. The vehicle is Normal and the infantry is Slow. Since all infantry can fit in the vehicle, the group speed is Medium.

So why do we need that speed indication? The speed of the group affects its reaction range. Said in another way: the faster the group is, the further it can travel for attack orders. So foot mobiles are more limited in range to respond to attacks then air units (with exceptions, but that is for later).

# Points

Points indicate the threat value of a group of units. That can be either friendly or enemy groups. Points are used to see how much of a response we need to eliminate a threat. GAIA will almost always try to top the enemy points by at least 2 times before commencing an attack.

Examples:

Based on the number of troops we can calculate the point value that is used in the battle system. 6 Infantry = 12 points, plus 1 mechanized armored vehicle makes it a total of 37 points. GAIA calculates the points for vehicles based on a base value of 20 and then 5 points for each turret/gun.

Let’s take a look at the current point table:

|  |  |
| --- | --- |
| Class | Points |
| Infantry | 2 |
| Car | 5 |
| Tank (\*) | 10 |
| Artillery | 5 |
| Helicopter (\*) | 20 |
| Ship (\*) | 10 |
| Recon Infantry | 3 |
| Support | 1 |
| Static Gun | 4 |
| Submarine (\*) | 0 |
| AA (\*) | 5 |
| (\*) = For each gun add | 5 |

Clarification for the (\*): When we have a Hunter (car) it is worth 5 points. If we hold that same hunter and mount a heavy machine gun on top of it we add 5 points. That would make 10 points total.

Why does GAIA need to check on that every round?

Within the GAIA system each class holds a so called Portfolio. This basically means that it becomes clear what sort of activity can be executed by this class. This sounds more vague then it has to be so, let’s get some example going here.

*Example 1:*  
A group contains 6 infantry and a transport vehicle with crew. The classification system checks this and, based on the conditions in GAIA, concludes that this is a Mechanized Infantry. The portfolio of Mechanized infantry is: DoAttack, DoPatrol and DoClear. This means that the group can be used during attacks, can actively patrol and is able to clear Spots (see above). Also the preference for its terrain is attached to the class. In this case it would be roads and open areas.

Based on the number of troops we can calculate its point value, that is used in the battle system. 6 Infantry = 12 points, plus 1 mechanized armored vehicle makes it a total of 37 points. GAIA calculates the points for vehicles based on a base value of 20 and then 5 points for each turret/gun.

Example 2:

A group contains one car, has no guns and holds 2 empty cargo s. This ‘group’ is identified as Car, but because of its content (no guns) it holds the following portfolio: DoTransport, DoHide and DoPark. This basicly means that the car is available for 2 man groups for transportation request, will try to hide during combat and ‘Parks’ the car somewhere aside the road waiting for transportation requests. As you see the car has no DoAttack. The battle system will for that reason not send the unit into attack. The points for this care