

CoSAIR Game Manual

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1 Overview

This document describes the rules of the game used in CoSAIR¹, the "Complex Strategy AI Research Project", which aims to investigate and explore Strategy Game AI in complex settings. The game contains all elements necessary in order to be classified as a complex, hardly analysable strategy game, such as multiple players, hidden information, large situation and decision spaces, and so on. The rules are mostly fixed and static, allowing for a maximum of comparability in research.

In the game setting, multiple *nations* populate an area in space, the *map*, and compete against each other for winning or for a good ranking. Nations possess *planets*, which are a nation's main resource, and *fleets*, which are used for attacking and defending.

The game passes in a series of turns with simultaneous moves. An average game takes about 500 turns to finish. In games with multiple human players the turn length is set to either an hour or a minute and passes in real-time. In games with only one human player, turns pass under user control and games with bots only are simulated with maximum processing speed.

2 Map

The map is always quadratic, consisting of m times m squares, whereas m depends on the number of participating nations n as shown in table 1.

There are no fixed ends, the map possesses a so-called "donut"-topology, in which you reach the left most square when moving to the right from the right most square.

¹<http://www.cosair.org>

n	m	$m * m$	$m * m / n$
2	4	16	8
3	5	25	8.3
4	6	36	9
5	7	49	9.8
6	7	49	8.2
7	8	64	9.1
8	8	64	8
9	9	81	9
10	9	81	8.1
11	10	100	9.1

Table 1: Map sizes depending on the number of nations in the game

The map contains nothing but a number of planets, where one planet is exclusively located in exactly one square. Movement always happens from planet to planet and the duration is calculated upon the euclidian distance of the two planets. Moving one distance unit takes 5 turns.

3 Nations

A nation is controlled by a player and competes against all other nations. Each nation starts with one planet and can get new planets later on by peaceful but costly colonisation of new planets, or by risky attacks on other nations. Each nation must possess one planet in order to continue existing, as soon as it loses its last planet, it is exterminated from the game.

In a new game, every nation gets assigned a color by random and his nation is named accordingly, e.g. "The Red". The first planet is named "Red Prime" in this example. The first planet starts with

a population of 3 million and a stationed fleet with 2 cruisers.

4 Planets

4.1 Characteristics

A planet is always controlled by a nation. It contains a growing population, produces items and possesses a number of buildings. Newly colonised planets start with 1 million people and grow by 12k each turn, up to the maximum population limit of 4 million.

Each full million of people generates 5 production points (PP), which are used to sequentially produce items off a given list. Items are ships or planet infrastructure. The production value of a planet depends on multiple factors in the game, but is guaranteed to be always at least 1.

4.2 Buildings

Every building available to a nation through a technology may be built once on each planet (80PP), and the the building effects benefit this planet. A building costs maintenance in form of one gold unit per turn.

4.3 States

A number of states can affect a planet:

- **Unrest:** By agents or invasions, unrest can start on a planet. In the state of unrest, the population growth is lowered by 6k and the production is lowered by 2PP per full million of population. Unrest ends by a chance of 10% per turn.
- **Production Jam:** By agents or invasions, production can be jammed on a planet, i.e. no items are built in this time, all production points are lost. Jam ends by a chance of 20% per turn, respectively 10% if unrest is going on.
- **Rushing Production:** On every planet, you can choose to buy one production point for every full million of population by activating *production rush*. This costs one gold unit per turn for each production point acquired in this way.

4.4 Colonisations

To colonise a new planet, you need an existing planet with a ready colonyship and at least 2 million of population. Then you can start a new colonisation from this planet at the cost of $n^2 * 25$ gold, where n is the number of planets you currently own or that will be colonised shortly. You must send one or more cruisers stationed at the planet as an escort with the colonisation. You are only allowed to start 9 colonisations during a game.

A colonisation takes 1 million population from the planet and settles them to a new one. The new planet will appear by random in a neighbored square of an existing planet from your nation. A colonisation takes 15 turns to finish. The planets of a nation are automatically named in the order of their colonisation, e.g. from "Red Two" over "Red Three" up to "Red Ten".

5 Trade

5.1 Trade Points

Each nation receives a number of *trade points* from two sources, population and *trade routes* to foreign planets. In the total population of a nation, every full 500k of people give one trade point. A trade route can be maintained to every planet controlled by a foreign nation, as long as there exists a *freighter* (50PP) to serve it.

5.2 Tax Rate

According to the *tax rate* of a nation, which can be set from 20 to 80% in steps of 10%, trade points are transformed into gold and research points according to the tax rate, whereas gold is always rounded up and research points are always rounded down. Gold is needed for various maintenance tasks and colonisations, while research points are used to research new technologies.

5.3 Gold Balance

A nation can expense as many gold units as it wants to, but the balance is a critical aspect in the game. There is an interest rate of 1 gold unit per 200 gold units. You receive this interest for every surplus of

full 200 gold units and you pay it for every begun deficit of 200 gold units.

For every full 400 gold of deficit, your planets suffer -1PP/mio. This represents the economic difficulties in such a situation.

6 Fleets

6.1 Ships

Fleets consist of two sorts of ships, *cruisers* (50PP) and *transports* (50PP). Cruisers are the universal offensive and defensive unit in the game. A cruiser possesses three defense points and two offense points for space battles. Transports are only needed when invading other planets, they conduct the ground combat against the planet's militia after the space battle has been won.

6.2 Maintenance

Cruisers, transports and active freighters require maintenance in form of one *command point* per ship. The number of command points of a nation depend on its population, every full 200k of population provides one command point. Ships which are not maintained by command points require gold for maintaining them, whereas one unit of gold replaces five missing command points.

6.3 Battles

Whenever a fleet arrives at a planet which is controlled by another nation, a battle in two phases takes place.

The first phase is the space battle, where the cruisers fight against each other. The fleet with the majority of combat points wins the space battle and annihilates the opposing fleet. It takes losses relative to the opposing fleet's combat points.

If the attacker has won space combat, the second phase takes place, ground combat. In this phase, the transports of the attacking fleet invade the planet and fight its militia. In order to win, the attacker needs one transport for each started million of population of the planet. The required transports are lost.

If the attacker wins the ground combat, he has conquered the planet and takes over the control, in

any other case, the attack has failed, eventual remaining ships of the attacker fly back to the nearest own planet.

7 Espionage

7.1 Agents

Each nation can possess a number of *agents*, who can be sent on *missions* to other nations or who can support *counterespionage* while they are available. An agent needs 10 turns to recruit, and only one agent at a time can be recruited. You are only allowed to recruit 26 agents during one game. Agents are automatically named by the alphabet in the order of their recruitment, e.g. from "Red Alpha" over "Red Bravo" up to "Red Zulu".

Each agent costs one gold unit support per turn. An agent has a certain rank, representing his skills. An agent starts with a rank of 1 and can advance up to a rank of 5. This rank determines the success chances on missions and the strength in counterespionage.

7.2 Missions

An available agent can be sent on a mission to a planet controlled by an opposing nation. It takes the normal flight time to arrive at the planet. There he tries to execute his mission and then he flies back to the nearest own planet.

The available missions are the following, ordered by increasing risk:

- **Gather Planet Information:** This gives you information about the current state of the planet. Information includes population, buildings, the sum of stationed ships, and the presence of mines. Risk: 15%.
- **Gather Nation Information:** This gives you information about the current state of the nation. Information includes gold assets, technologies, the number of active freighters and the sum of ranks of all active agents. Risk: 30%.
- **Sabotage Production:** This inflicts a production jam on the planet. Risk: 45%.

- **Incite Unrest:** This causes unrest to reign over the planet. Risk: 60%.
- **Hijack Freighter:** This gives you a freighter from the targeted nation. Risk: 75%.

The more risky the mission is, the more likely the agent is to fail, but also the higher is the chance to advance one rank in case of success.

7.3 Counterespionage

All available agents perform counterespionage work, which defends a nation's planets from opposing nation's agents. The counterespionage strength depends on the sum of all incorporated agent's ranks relative to the number of planets they have to protect. If there are no agents performing counterespionage, every opponent mission will succeed, but the higher the counterespionage strength is, the likelier these mission will fail.

In such a case, the attacking agent is discovered, and chance determines whether he can flee or gets caught. The higher his rank, the higher are his chances to flee. An agent at rank 5 always succeeds to flee. A caught agent is immediately exterminated. In case of discovery, a randomly chosen agent of the counterespionage group has the chance to advance one rank.

8 Technologies

A nation can freely choose to research one technology at a time. The first one requires 200 research points to complete, each following one requires 200 additional research points.

The following technologies can be chosen:

- **Autofabrication:** Enables factories on planets, which give +1PP for every full million of population on the planet.
- **Biomodelling:** Enables biospheres on planets, which house an additional million of population above the limit of 4 million.
- **Armoured Cruiser:** Increases the defensive combat value of all cruisers by 1.
- **Conscript Army:** Enables barracks on planets, which turn its militia into a regular army.

When defending the planet, the attackers needs twice as many transports to be successful. Additionally, barracks lower the production cost for transports on the planet by 20% and double the chance for unrest to end.

- **Space Mines:** Enables the production of pairs of mines (40PP) on the planet, which act as an additional defensive protection. Mines and attacking cruisers are assigned at each other one-to-one, and the mine has a 60% chance to destroy the cruiser before space battle.
- **Fusion Drive:** Accelerates all flights of the nation (fleets, agents, colonisations) by 25%. Thus the flight time per distance unit is lowered from 5 to 4 turns.
- **Assault Cruiser:** Increases the offensive combat value of all cruisers by 1.
- **Security Network:** Triples the counterespionage strength of a nation.
- **Modern Medicine:** Enables medicenters on planets, which increase population growth by 6k.
- **Orbital Engineering:** Enables starbases on planets, which increases the defensive combat value of all cruisers in the fleet positioned at this planet by one. Additionally, it lowers the production cost of cruisers and freighters on the planet by 10%.

If a nation succeeds to research all the available technologies, the tax rate is fixed at 100% and research has ended for this nation.

9 End

The game ends as soon as the number one ranked nation possesses at least twice the potential of the number two ranked nation. This end criteria indicates a major superiority and prohibits unnecessary annihilation phases in the end of a game.