

May 15, 2020

Master of Orion II: Battle at Antares - version 1.50.18



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Introduction

This unofficial 1.50 fan patch provides an updated DOS version of Master of Orion II: Battle at Antares (MOO2). It fixes most known crashes, stalls and network synchronization errors, as well as an abundance of interface and game rule bugs.

The **interface** has been improved with a 6th ship design slot, enhanced build queue management, new keyboard shortcuts, and slower mouse scrolling speed in combat, making it usable again.

The patch introduces **configuration files** that allow customization of the interface and extensive modding. Config files are plain text files and can be viewed and edited with any plain text editor (like Notepad on Windows). The 1.50 distribution comes with several mods and with MOO2 Launcher, which makes it easy to select a mod before running the game. After installation MOO2 Launcher defaults to the mod 1.50 improved.

Network multiplayer setup has been improved. The host broadcasts settings to clients automatically, eliminating the need for all parties to use the same set of command line switches or enable the same mod (except for lbx files). With the built-in mapgen, running the separate mapgen program which requires restarting the game is no longer needed.

This manual and its addendum MANUAL_150.XLS contain detailed descriptions of features, fixes and modding options. PARAMETERS.CFG provides an overview of all config parameters along with a brief description for each one. CHANGELOG_150.TXT contains an overview of changes for each patch version.

This unofficial fan patch is not supported by a company or anyone at all.

USE IT AT YOUR OWN RISK



New Feature Highlights of the 1.50 Patch

Random Number of Opponents

It's now possible to start a new game with a random number of AI opponents. In single player games 1-7 AI's are added, and in multiplayer games 0-6 AI's are added.

Build Queue Management

Build queues can now be auto filled by loading one of 11 configurable lists, drastically reducing micromanagement. The lists are bound to keys **Q** and **0-9**. They can be used in the Build screen and in the Colonies screen. Used in the Colonies screen, a list's contents is loaded to the queue of the highlighted colony, or to all build queues in combination with the SHIFT key. Default lists are:

- Q** merge buildings
- 0** clear the queue
- 1** append ship design 1
- 2** append ship design 2
- 3** append ship design 3
- 4** append ship design 4
- 5** append ship design 5
- 6** append ship design 6
- 7** prepend freighter
- 8** prepend spy
- 9** append housing



Section [Build Queue Management](#) describes syntax and usage in detail.

Revert Buy Action

A buy action can now be reverted by pressing the BUY button in the Colony screen, Build screen or Colonies screen. The amount of BC paid will be returned and added production removed.



6th Ship Design Slot

A 6th slot for custom design has been added.

Play with Auto Designed Ships

ALT-AD auto updates all six ship design slots with AI designs. The first slot is always a scout ship. On Pre-warp, Average and Post-warp tech starts, the other 5 design slots are frigate to titan class until doom star construction technology is known, then they become destroyer to doom star class. On Advanced tech starts, design slots 2 - 6 are always destroyer to doom star class.

Compatibility

Saves

Starting from patch 1.50.3, the game appends extra data to the save. So in general newer versions can load older saves but older 1.50 versions cannot load newer saves. 1.50.2 and earlier versions (including classic) will load any save but ignore the extra data, which can result in glitches.

Game version	Save file format version	Comments
1.31, 1.40, 1.50.0-2	0 (classic)	Can load all formats, but in saves from 1.50.6+ food will appear doubled. Some versions will also have incorrect ship speed. In saves from 1.50.18+ all freighted pop information will be lost.
1.50.3-5	1	Can load formats 0-1.
1.50.6-9	2	Can load formats 0-2.
1.50.10+	3	Can load formats 0-3, but loading 1.50.18+ saves in 1.50.10-1.50.17 will cause loss of all freighted pop information.

If you want to use a save editor, Corion2 version 1.1 or higher is recommended because older Corion2 versions discard 1.50's extra data. Other save editors might not support the new save file format.

Config

All major versions of 1.50 introduce new or renamed config parameters and can drop old ones. Because of this, config files for different versions are incompatible, so in general, after updating the game you also have to download updated versions of the mods you use. Some simpler configs might work in a new version but any complete config will almost certainly fail to load. This situation stands as long as the patch is in active development.

Network Multiplayer

Executables with different major versions are incompatible in network multiplayer and will not allow you to start a game between them. Executables with the same major version are compatible over network, so 1.50.x.y is always compatible with 1.50.x or 1.50.x.z. It is recommended however that all players use the exact same version.

*You have downloaded the zip file, this manual on your screen, and a manic gleam in your eyes.
What do you do now?*

Installation

MOO2 DOS version 1.31 or higher is required to install the 1.50 fan patch. English, French, German, Italian and Spanish languages are supported. Installation of the patch does not break your current MOO2 installation. No original files are overwritten. You can still use your original shortcuts to start an unaltered version 1.31 or 1.40 game.

Updating with MOO2 Launcher

1. Unzip the package anywhere (outside the /150 directory if you have it) and on
 - a. **Windows** run "install-win32.exe".
 - b. **Linux** open a terminal inside unzipped directory and run ./install-linux.
 - c. **Mac OS X** right click install-macosx and choose open.
2. You will be presented with a patch installation prompt: Specify MOO2 and DOSBox locations and press Install. GOG and Steam distros should be auto-detected. On **Mac OS X** locate and specify path to "Boxer Standalone" binary instead of DOSBox.
3. After reporting success MOO2 Launcher will switch to normal mode, from where you can run the game. Press Launch! and confirm that the version number in the bottom right corner of MOO2's Title screen is 1.50.x.

On subsequent runs the MOO2 Launcher won't prompt installation, and allows the game to start right away. Use the desktop shortcut created during installation to start it.

Updating Manually

The MOO2 Launcher runs on recent Windows, Linux and Mac OS X systems. Still it may happen that on your system it doesn't work. In that case you can install the patch manually.

1. Find in the 1.50 package the directory named "patch". Copy all its files into your MOO2 directory. The MOO2 directory is the one that contains ORION2.EXE, it's location may vary depending on OS and distribution. If you already have a version of 1.50 installed then choose to overwrite files.
2. Update your DOSBox config files to run ORION150.EXE instead of ORION2.EXE.
3. Run the game and confirm that the version number in the bottom right corner of MOO2's Title screen is 1.50.x.

To change enabled mods without MOO2 Launcher, edit file 150/ENABLE.CFG [manually](#).

Installation FAQ

MOO2 Launcher runs but fails to install patch with 'permission denied' error.

This happens if the destination is write-protected, for example for CD version installed to Program Files. Make MOO2 directory accessible or move the game to an accessible location like C:\GAMES\MOO2. In some cases you can workaround the issue by running MOO2 Launcher as administrator, but you'll have to do it every time you run it, so that's not recommended. This problem doesn't affect Steam and GOG packages even though Steam installs to Program Files.

MOO2 Launcher runs but fails to install patch with 'Error creating backup'.

This can happen when there is an instance of Windows Explorer open that has focus on a directory or file inside the MOO2 game directory. Close The Explorer window.

DOSBox crashes immediately after starting.

Try setting output to 'surface'.

Game doesn't start, complains about absence of info.lbx, credits.lbx and diplomse.lbx.

This happens when the game is installed from an original CD-rom. **To fix it, copy all files from CD to e.g. C:\GAMES\MOO2, remove read-only attribute from all files, then install patch 1.31, then install patch 1.50 via MOO2 Launcher.** The order of actions is important, install 1.31 after you copied the files from cd-rom. Do not put the game to Program Files, or you will need to run MOO2 Launcher as administrator every time.

Music plays, but no sound effects.

You need to make the file sound.lbx writable. On windows right click it -> properties -> remove read-only checkbox.

Game interface lags, sound is crackling.

May happen on Ubuntu with opengl output. Try overlay.

How to edit DOSBox options not accessible via MOO2 Launcher?

Edit file 150/dosbox.conf in the game directory. Note that the settings in this file override MOO2 Launcher settings, so if you e.g. force resolution there, changing it in MOO2 Launcher will no longer work.

I want the game to run in 16:9 (16:10, 4:3, etc.) mode.

The game was designed for 4:3 monitors. In windowed mode you can only have that. In full screen your monitor handles whether to stretch to maximum resolution, explore its OSD to figure out how to do it. Note that you'll never have a true 16:9 picture, the game uses a fixed resolution and everything will look stretched in 16:9.

Build Queue Management

Overview

Build queues can now be auto filled by loading one of 11 configurable build lists, drastically reducing micromanagement. A build list is a plain text file containing a list of buildable items and can be viewed and edited with any plain text editor (like Notepad on Windows). Build lists can also contain commands which affect how the queue is updated.



The lists are bound to keys **Q** and **0-9**, the corresponding files being BUILD.CFG, BUILD0.CFG, ..., BUILD9.CFG. Keys can be used in the Build screen and in the Colonies screen. Used in the Colonies screen, the list's contents will be loaded to all build queues, or in combination with the SHIFT key to only the highlighted colony's queue. Default lists are:

Q	BUILD.CFG	merge buildings
0	BUILD0.CFG	clear the queue
1	BUILD1.CFG	append ship design 1
2	BUILD2.CFG	append ship design 2
3	BUILD3.CFG	append ship design 3
4	BUILD4.CFG	append ship design 4
5	BUILD5.CFG	append ship design 5
6	BUILD6.CFG	append ship design 6
7	BUILD7.CFG	prepend freighter
8	BUILD8.CFG	prepend spy
9	BUILD9.CFG	append housing

BUILD.CFG (**Q**) contains a reasonably ordered list buildings and is set to merge by default. This should suffice for colony buildup in casual games against the AI.

Syntax

The portion of a line starting with # is a comment and is ignored, blank lines are also ignored. Otherwise a build list is just a list of items separated by spaces or newlines.

Each buildable item is either:

- a product
- a mode
- a command

Products are:

- buildings: any building name like [automated_factory](#) or [hydroponic_farm](#). The correct spelling can be made from in-game English name by lowercasing and inserting _ instead of spaces. If you aren't sure how to spell the name refer to the default BUILD.CFG which contains a full list of building names.
- landers: [colony_ship](#), [outpost_ship](#), [transport](#).
- custom ships: [design1](#), ..., [design6](#).
- droids: [android_farmer](#), [android_worker](#), [android_scientist](#).
- special products: [spy](#), [freighter_fleet](#), [trade_goods](#), [housing](#), [repeat](#).

Modes affect how products are inserted. Modes are:

- [append](#) -- items are inserted at the end of the queue unless the queue is full. This mode is the default if you haven't specified a mode.
- [prepend](#) -- items are inserted at the beginning of the queue unless the queue is full.
- [merge](#) -- items from the list already present in the queue will be rearranged in build list order. This mode is intended for inserting newly-researched buildings with proper priority.

Commands are:

clear	clear the queue apart from bought prod and ships being refitted
clear_refits	delete from the queue ships being refitted, except bought ones
unbuy	unbuy the current product if it's bought
buy75%	buy a current product if it's at least 3/4 built
buy50%	buy a current product if it's at least 1/2 built
buy10%	buy a current product if it's at least 1/10 built
buy	buy a current product regardless of build progress.
stop	stop reading the file and apply the list, ignoring all text after 'stop'

Examples

Append a transport to the queue:

```
transport
```

Or, which is the same:

```
append
transport
```

Insert a spy and a freighter in the beginning of queue (but not if bought prod is present):

```
prepend
spy
freighter_fleet
```

Remove everything from queue apart from bought prod and refits and add two androids workers:

```
clear
android_worker
android_worker
```

Scrap absolutely everything in queue and build design 6 repeatedly:

```
unbuy
clear
clear_refits
design6
repeat
```

Insert research lab on every planet where automated factory is already built and insert both otherwise:

```
merge
automated_factory
research_lab
```

You can do a few special tricks using merge mode. The idea behind it is that merge changes only those slots, the products from which are on the list. So you can clear or buy only specific products. For example to remove only hydroponic farms and food replicators from the queue:

```
merge
hydroponic_farm
food_replicator
clear
```

And to buy only automated factory:

```
merge
automated_factory
buy
```


Interface Changes

Auto Save

In Singleplayer, the game now autosaves each turn before combats instead of every four turns, the same way it already did for Multiplayer in classic. In addition, a batch file 'watch-save10.bat' is shipped with the patch that creates a copy of SAVE10.GAM each time it changes. Instructions on how to use the .bat are included within the file itself (open it in Notepad or any other plain text editor).

Default Settings

Upon a fresh install or after deletion of the file 150.SET, new default settings are:

New Game menu - Tactical Combat is ON;
Game Settings menu - [Ship Initiative](#) is ON;
Tactical Combat Options menu - Legal Moves is ON.

Improvements

Faster Screen Updates

Screen switches (fade-ins and fade-outs) are faster in 1.50 than in classic.

Title Screen

The name of the current mod is now shown in the lower right hand corner of the Title screen. There are different manifestations possible. By default it reads '1.50.x improved', indicating you will be playing the 1.50.x patch with 1.50 improved rules. (More on the mod 1.50 improved later in this manual.)



New Game Screen

New artwork¹ has been added to the New Game screen for the settings Cluster Galaxy, Random Opponents and Post-warp Civilization.



Select Race Screen

The button for the Darloks has been redrawn², correcting the name:



Enemy Moves

The option Enemy Moves in the Game / Setting menu now functions, when enabled showing red destination lines of all enemy fleets within scanning range, including those that are not travelling towards one of the player's systems.

Colony Screen

In addition to the remaining turns till completion, the stored production value (including bought production) and total production cost of the item is now displayed in the status box of the colony's current construction project:



Classic



Version 1.50

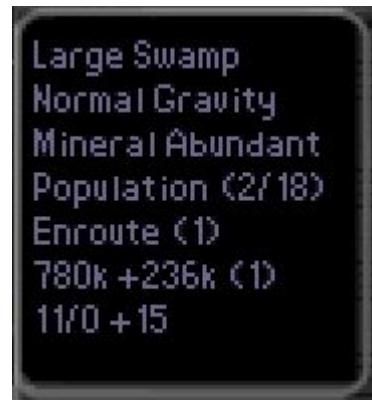
¹ In addition, the picture for seven opponents has been redrawn, centering the 7.

² In addition, "Psilons" has been centered on its button and misc. pixel artifacts cleaned up.

Colonies Screen

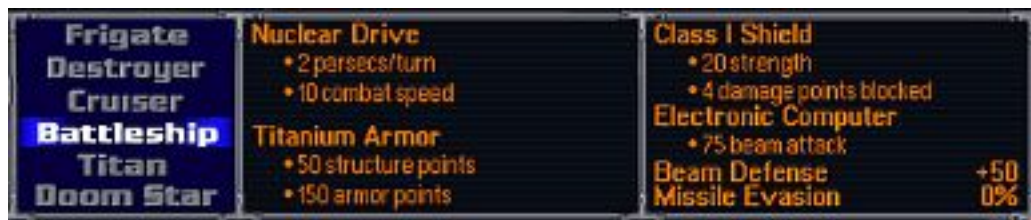
Extra info about population and production is now displayed in the Colony Info Summary window.

The new line Enroute (x), indicates how many population units are inbound to the colony. Pop growth value (+236k in this example) has been extended with the pop round off value present on the colony (here 780k) and how many population units will be added from growth next turn (here 1). The last line contains production stats in the form of stored production value (including bought production) over total production cost of the item, plus the amount of current production on the colony.



Automatics (Design Dock)

In the Ship Design Dock, the Automatics are the two boxes that list all of the ship essentials - engine, armor, shield and computer. In 1.50, the beam attack value includes the Battle Scanner bonus if present in the design, in the same way that Augmented Engines, Reinforced Hull, Heavy Armor and Hard Shields are shown since classic. In addition, Augmented Engines is no longer counted double in the Beam Defense value.



Above screenshot shows stats of a Battleship fully loaded with weapons & specials, including Augmented Engines (5>10 combat speed), Heavy Armor (50>150 armor points), Hard Shields (1>4 damage points blocked) and Battle Scanner (25>75 beam attack). In classic, this example would display 25 beam attack and an incorrect +75 beam defense.

Tech Breakthrough Turn Counter

The turn counter is now more precise overall, for example it shows 1 turn instead of 2 when the chance for breakthrough is 100%.



Next Turn Reports

The order in which you get reports or actions at the beginning of the turn has been changed, providing a more logical sequence:

Version 1.40	Version 1.50
GNN	GNN
	Technology Stolen
Research Breakthrough	Research Breakthrough
Evolutionary Mutation	Evolutionary Mutation
Hire Officer	Explore Star
Colonization	Colonization
Explore Star	Hire Officer
Officer Level Report	Officer Level Report
Technology Stolen	
Diplomacy Screen	Diplomacy Screen

- If you have a tech steal and a tech breakthrough in the same turn, you are now informed by your spy before you are brought to the Technology Select screen.
- Exploration happens before Colonization. When scouting two new systems in the same turn, you see them both before you are given the option to colonize a system.
- The option to Hire an officer now happens after Exploration, preventing the case of not being able to accept a Marooned Hero because you have just hired your 4th leader in that same turn!

Leader Screen Hire Window

In classic, the only time the technology that a leader brings is mentioned is on initial offering if you have sufficient cash to hire the leader. Now, the technology is also shown if you have insufficient money as well as upon clicking Hire in the Leaders screen.



Leader Screen Hire Window2

The second window for initial leader offerings shown on Tutor and Easy levels, is now only displayed on the Tutor difficulty level.

Leader Experience Points

Leader experience is now shown in the Leaders screen.

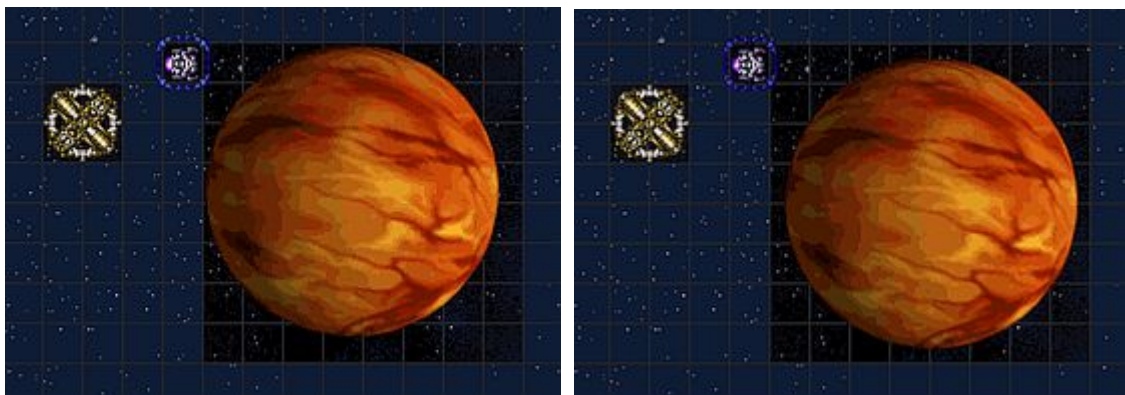


Cutscenes Sound

The sound for cutscenes is on if either Music or Sound Fx is on, rather than only when Music is on. Note that this sound for cutscenes is always at maximum volume, no matter the in-game volume levels.

Centered Planets

In tactical combat, planets are now drawn centered in the bombing area.



Planets Screen

The presence of a leader with the Galactic Lore skill caused all planets that have not yet been visited to be tagged in the Planets screen as 'no enemy presence', including ones with monsters. As a result, you could unknowingly send a colony or outpost ship to such worlds without warning, causing the destruction of said ships. This issue has been fixed in 1.50 by changing the 'no enemy presence' filter to show only planets that have actually been visited.

Annihilated Empires Shown on Graph

Empires that are annihilated are no longer removed from the History Graph but remain visible there.

Bug Fixes

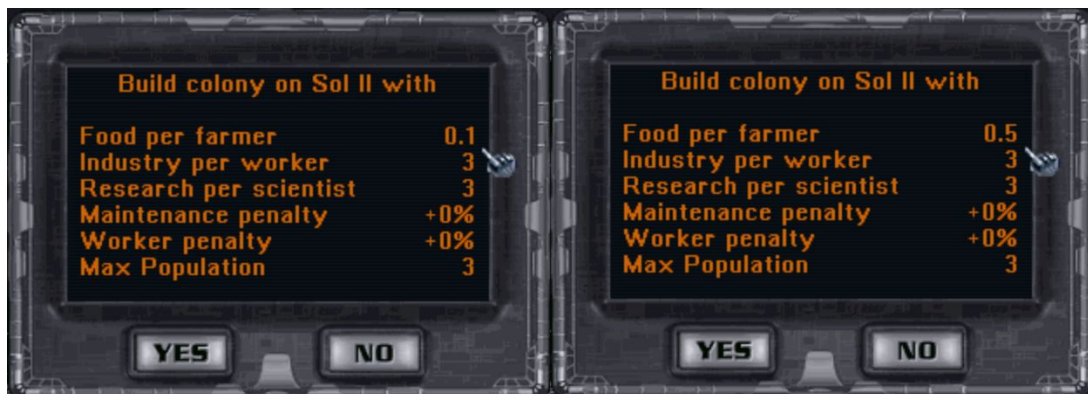
Billions of Colony Ships Bug

Corrected the display of colony ship count for 2 or more ships in the star system pop-up.



Incorrect Display of Fractional Racial Food Bonus

A .5 food value is displayed correctly now upon left-clicking on a planet in the System overview (the small box in the Colony screen) as well as in the New Colony dialog:



Missing Tolerant Maintenance Penalty

For tolerant races, the correct building maintenance penalty for Toxic, Radiated and Barren planets is now shown in the Build Colony and Colony Info pop-ups (Statistics Boxes).

Colorless Brown Stars on Minimaps

Colonized brown stars are no longer displayed as uninhabited on minimaps.

Planets Screen Gravity Penalty

Low-G planets now show “-25% prod” for a Heavy-G race, instead of “-50% prod”.

Stealth Detection Spoils

Fixed 3 detection giveaways of stealth ships:

- Star System popup: In the fleet summary tooltip.
- Fleets screen: In the summary below the galaxy map.

- Fleets screen: When scrolling in via <> with either filter off, seemingly empty fleets would appear suggesting the presence of filtered ships (normally empty fleets are skipped).

Fleets Screen Scrollbar Position Bug

The scrollbar is now drawn on top instead of centered when switching fleets.

Ship Officers Screen Missing Scroll Bar

A scrollbar for the Fleet Grid in the Ship Officers screen is now shown.

Navigator Skill Display Bug *

Corrected the displayed speed bonus in the navigator skill text. The ordinary skill gives a +2 speed bonus for level 5 leaders, and the improved (*) skill gives this +2 speed bonus for level 4 leaders.

AI Ground Troops Bonus Omission

During ground invasion, the AI troops bonus/penalty was listed but not added to the sum. This has been fixed. Note that the bonus did already apply to actual combat resolve. The fix was also applied in the Colony View screen (seen for AI's via [ALT-X](#)).

Commando Leader Omission

A colony leader with the Commando skill is now listed in the Ground Invasion screen and in the military statistics pop-up in the Colony screen. In the pop-up, the bonus is also added to the combat bonus total for each ground unit type:



Artifacts On-click Bonus Bug

Fixed the bug that made it possible to generate additional research points at Artifacts and Orion planets, by clicking on the science production icons and seeing the production breakdown. These additional RPs were real and affected the empire total, despite not being included in empire total RP count shown on the Main Screen.

Build Queue Bugs

All known build queue bugs have been fixed. This should put an end to the infamous repeat build cheat (at least we hope so).

- It is no longer possible to swap a repeated bought product by swapping with its repeat. This form of repeat build cheat was partially fixed in the 1.40 fan patch.
- Swapping repeated products will no longer result in a product loss. Example: queue is "spy, repeat, scout, repeat", selecting spy then clicking scout used to result in only spy being left in the queue. In 1.50 the queue becomes "scout, repeat, spy, repeat".
- It is no longer possible to get double repeat by moving repeated products around. Example: queue is "scout, repeat, spitfire, repeat, spy, repeat", selecting scout then clicking spitfire used to result in "scout, spy, repeat, repeat". In 1.50 scout and spitfire just swap: "spitfire, repeat, scout, repeat, spy, repeat"
- It is no longer possible to swap products under repeat. Example: queue is "autolab, spy, repeat", then swapping autolab and spy in classic would produce "spy, autolab, repeat". In 1.50 the queue becomes "spy, repeat, autolab".
- It is no longer possible to select a top product, buy it using B shortcut and then swap it with another item. Buying removes selections now.
- Canceling repeat+android no longer results in a bare repeat. In previous versions, if you repeat build androids on a planet that has no more room and then choose "no" when notified that there may be no room, the androids will disappear from the build queue, leaving a bare "Repeat", all by itself. Adding a new product to this bare repeat causes the game to freeze.

Colony Base Button Disappearance

The Colony Base button in the Build screen is only present if there is at least one colonizable planet present in that system, that is not yet covered by a Colony Base building already in the queue. Previously the Colony Base button was not updated in time because of a bug, so sometimes clicking on Colony Base button resulted in adding an item just below it (usually a freighter). Calculation of the amount of colonizable planets was also buggy because it considered outposts belonging to other players colonizable, which could result in scrapping of a built base.

Visual Fixups for Ships

In the Ship Info pop-up, the racial missile defense bonus is no longer halved (overmap) and the Trans-Dimensional (TD) bonus is added to the drive speed value (overmap and in combat). Driveless TD ships have their speed stats displayed properly. Unused, but misleadingly displayed values for marines and hit points of internal systems on a Combat Planet, lander ships and strategic ships have been removed. Combat speed for strategic and lander ships and unused defense values for lander ships are now displayed as zero. Also, info for the active ship in combat should now be displayed more properly in the status bar (during retreats etc).

Visual Fixup for Strategic Ships

Strategic ships have no separate armor points, only structure points. Both values used to be displayed however, and damage was subtracted from the structure



number while armor upgrades were counted in the armor number. Thus, a Zortrium armored frigate that sustained 12 damage, displayed a negative structure value together with healthy armor. Strategic ship hit points are now correctly displayed as the structure number and armor is displayed as 0.

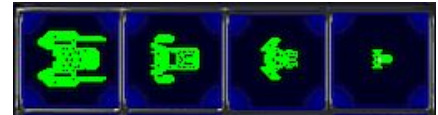
Ship shields in Strategic combat have no shield arc's strength, and act as planetary shields, only reducing damage by some value. This value is now properly shown instead of arc strength value. BD value of strategic ships display is now more accurate (previously the Tactical BD was shown instead, but note that the new value does not include possible bonuses from defense specials installed on a ship).

Strategic Doom Star Bug

Fixed strategic doom star being designed incorrectly as if it was tactical. Apart from incorrect armament displayed it had incorrect and possibly lower cost. This did not affect combat outcome, because in strategic mode ships are correctly redesigned for every combat.

Green Ships Bug

In the Fleets screen, opponents' ships will no longer color bright green when no player owned ships are present.



Star System Pop-up Broken Palette

Fixed the bug that sometimes caused part of the color palette of Star System pop-ups to change to bright green.

Hotseat Mouse Right-Click Block

Fixed the right-click mouse button block after loading a pre-battle autosave in hotseat. Loading such pre-combat autosave caused mouse right clicks to not work properly for some actions, most noticeably for turning ships.



Disabled Weapon Slots Color

Fixed the bug that erroneously led to displaying a turned off weapon slot as yellow instead of red in case the weapons in the slot had no shots left. Note that a reddened weapon (besides Spatial Compressor) does not automatically fire at incoming missiles anymore, except during the 'Seeking Missiles' phase at the end of each combat round.

Correct Damage Blocked Displayed for a Planet

Planet shields work in a slightly confusing way in tactical combat. Depending on the presence of defensive buildings on a planet, regular ship class shields can be added or not,

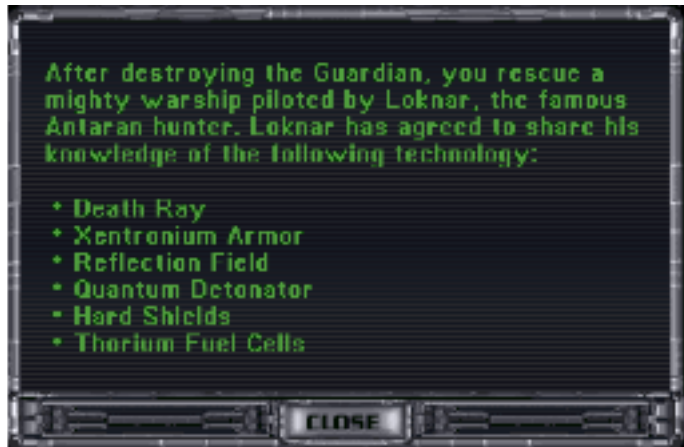
while game info misleadingly claims they are always added. This is now fixed, the ordinary shield bonus is no longer displayed when there are no ground defenses.

For example a planet has a Radiation shield, no defensive buildings, and its owner possesses the Class X shield tech. Displayed value would be 15 damage blocked, while only 5 would be actually blocked. 1.50 properly displays 5 damage blocked in this case.

Missing Loknar's Technologies

The two random technologies that Loknar brings (introduced in MOO2 version 1.3) in addition to the Death Ray and the three random Xenon techs are now also displayed.

Note that these two techs are chosen randomly, which could result in a selection of one or both techs already in your possession. In such a case the technology is not listed and you will not receive another tech instead.



Note also that this selection is made before the Xenon techs are chosen and in the rare case where the Death Ray is one of Loknar techs, you will not receive another Xenon tech instead of the default Death Ray technology.

Hotseat GNN

Now all hotseat players should get a GNN report about a planet attacked by a monster.

Evolutionary Mutation Screen Bug *

Fixed a bug that incorrectly prevented spending Mutation picks in some fields, due to incorrect cost calculation in case a negative pick was selected in the preceding field. For example, it did not allow to take +50 Attack when you already had +20 Ship Attack and -20 Ship Defense.

Race Info

- The Race Statistics subscreen under INFO, displays a maximum of 11 racial traits in classic. For races with more traits, the traits exceeding 11 are not displayed. In 1.50 the font automatically scales to accommodate up to 20 traits. A reduced font size is used for 12-13 traits and a minimal size for more than 13 traits.
- $+\frac{1}{2}$ and $-\frac{1}{2}$ food and money bonuses are now displayed correctly both in the race summary of the Race Selection screen and in the Race Statistics subscreen.

Tech Review

Corrected the placement of several sections and technologies in the Tech Review subscreen of the Info screen.



Keyboard Shortcuts

(blue = 1.50 hotkey changes or additions)

Any Screen

PageUp Speed up all in-game animation (maximum +3).

PageDown Slow down all in-game animation (minimum -3).

Main Screen / Galaxy Map

F1	Cycle forward through fleets
F2	Cycle backward through fleets
F3	Unknown
F4	Change all relocations to a given system
F5	Go to next colonized system (opens system window)
F6	Go to previous colonized system (opens system window)
F9	Find distance between two stars
F10	Quick Save
+	Zoom in
-	Zoom out

c	Colonies screen
p	Planets screen
f	Fleets screen
l	Leaders screen
r	Races screen
i	Info screen
t	Next Turn

ALT-F1	End of turn summary on/off
ALT-F2	End of turn wait on/off
ALT-F3	Enemy moves on/off
ALT-F4	Auto-select ships on/off
ALT-F5	Animations on/off
ALT-F6	Auto-select colony on/off
ALT-F7	Show relocation lines on/off
ALT-F8	Show GNN reports on/off
ALT-F9	Load game
ALT-F10	Save game
ALT-Q	Quit without saving

Colonies Screen

n	Sort colony list by Name
p	Sort colony list by Population
f	Sort colony list by Food
i	Sort colony list by Industry
s	Sort colony list by Science

r	Sort colony list by Production
b	Sort colony list by BC
c	Goto Colony screen of first colony in the list
q	Load BUILD.CFG on selected colony (+SHIFT for all colonies)
0	Load BUILD0.CFG on selected colony (+SHIFT for all colonies)
...	
9	Load BUILD9.CFG on selected colony (+SHIFT for all colonies)
SPACE	RETURN button
ESC	Escapes to Main Screen

Fleets Overview Screen

,	Go to previous fleet
.	Go to next fleet
F5	Change all relocations to a new system

Colony Screen

a	Turn on AUTOBUILD
b	BUY or UNBUY an item
c	CHANGE, go to the Build screen
.	Go to previous colony
,	Go to next colony
SPACE	RETURN button
ESC	Escapes to previous screen

Build Screen (Construction Orders Screen)

q	Load BUILD.CFG into queue
0	Load BUILD0.CFG into queue
...	
9	Load BUILD9.CFG into queue
b	BUY or UNBUY an item
e	REPEAT BUILD button
r	REFIT button
,	Go to previous colony
.	Go to next colony
ALT-AD	Runs Autodesign.
SPACE	OK button
ESC	Escapes to previous screen without saving changes.

Design Dock: Select Weapon System and Select Special System Screens

-	Scroll Up
+	Scroll Down
ESC	Escapes to Ship Design Overview without saving changes.

Battle Map (Tactical Combat)

a	Auto Combat. Click anywhere to turn it off.
b	Board
c	Center on active ship
d	Done
o	Options
r	Retreat
s	Scan
t	End your turn, acts like Done for all your ships.
w	Wait
z	Super-fast resolution mode (vs AI only). Click anywhere to turn it off.

Orbital Combat Selection Window

b	Bombard
h	Hold
a	Drop All
i	Invade
m	Mind Control

Cheats / Testing

The cheat reporting code has been fixed. A cheat warning is now always issued on the next turn after cheating and the warning cannot be lost anymore.

Cheats described below work in the Main screen, unless specified otherwise.

ALT +

eee	Extracts current config to EXTRACT.CFG (Main screen, Build screen and on the Battle Map during combat)
re	Reloads ORION2.CFG (single player game only) (Main screen, Build screen and on the Battle Map during combat)
ale	Previously disabled leader cheat. Pop-up allows you to select a leader id. That leader will offer to join the next turn.
allai	Turns all players to AIs, including yourself. Note that if End Of Turn Wait is off, turns will pass automatically and continue endlessly, even when there is only 1 player left in the game.
crunch	Finishes the current building project of a colony when used in the Colony screen. Used in the Build screen, it adds 32000 stored production, enabling the completion of successive build projects in 1 turn each.
einstein	Grants your empire knowledge of every application in every field of research, except for the Hyper-Advanced fields.
iseeall	Toggles Omniscience on and off. Note that if this cheat is toggled on when Evolutionary Mutation is researched, 3 picks are subtracted for the cost of Omniscience, leaving only 1 pick for mutating the race.
menlo	Finishes your current research project. Now adds 1000k instead of 10k and is tunable with menlo_research_points.
moola	Adds 1000 BCs to your imperial treasury.
scor	Reports current score (Note the removed 'E' from SCORE)
toggle	Toggles availability of all buildings in the Build screen on and off. Even those not researched.
x	Cycles between all players, except annihilated ones (SP games only).
lua	Toggles universal context for main screen scripts.

Critical Bugs

General

“Mark Block Stack Size Exceeded” Crash

Fixed the game crashing with this message when repeatedly entering and exiting Race Report in the Races screen. This happened due to an accumulating memory leak, so the problem was more likely to occur in long games.

Star System Pop-up Freeze

Fixed the game sometimes freezing when displaying a system pop-up. In rare cases it could display corrupted animation of rotating planets.

Random Sounds Crash

Fixed the game crashing on random sounds that could occur when pressing F keys in for example the fleet window, system window or colony view screen.

AI Food Balancing Freeze

Fixed the game freezing when an AI without Fungi tech gets stuck optimizing pop for food on a liberated and blockaded non-food planet in case the previous owner has Fungi.

Serendipity Event Freeze

Fixed the game freezing when no tech field is selected and the serendipity event occurs.

Driveless Trans-Dimensional Ship Bugs

Trans-Dimensional races can fly ships without a drive. Several bugs made use of such ships problematic:

- Such ships were immobile in combat despite the TD combat speed bonus.
- Such ships were placed directly underneath a defending satellite.
- Such ships were rotating as if being a satellite.
- If you won combat with such ships, the game would crash.
- If you scan (right-click) such a ship outside combat the game would crash.

All these bugs have been fixed in 1.50 and driveless ships are fully playable now.

Fighters Resolve on Top-left Corner Beam_SFX Crash

Fixed a rare crash in animation when fighters strike from a certain direction around the top-left corner of the target ship.

Ship Internal Damage Crash

Fixed a division by zero crash that happened when damaging internals of a ship with no systems left and a drive with 1 hit point remaining.

Raid Report Crash

The game no longer crashes when the raid report is too long.

Map Edge Retreat Crash

The game no longer crashes if the attacker retreats a frigate from the left edge of the battle map.

Networked Multiplayer

Techfield Desync Bug

Multiplayer combat will no longer desync when a player gets a new combat-related tech on the turn of battle. This can happen after research breakthrough, tech steal or tech capture during another battle on the same turn. Example: a tech field completion in Physics provides a new miniaturization level for the beam weapon used on a Satellite. Sometimes this information was passed only to one player resulting in a different satellite design observed by the two players. This could cause the course of combat to diverge between players, leading to an eventual stall or crash.

Evolutionary Mutation Desync Bug

Multiplayer combat will no longer desync when a player has Mutation applied on the turn of battle. This bug resulted in relatively little discrepancy for Single or Hotseat games; new picks acquired already came into effect during the combat cycle prior to the actual next turn. For Network games this was likely to cause desync and stall in combat requiring crashing and reloading the game. This bug is similar to the one described above.

Zero Marines Raid Desync Bug

Network games will no longer desync because of a boarding action with zero marines, resulting in a stall of combat. This situation could occur either by deliberately raiding with 0 marines or, more importantly, when a Damper Field's effect was reducing the boarding party to 0. Both actions are legal and cause no harm to the defender. Note that boarding with 0 marines still counts as one boarding action for the ship in that turn.

Shuttle Capture when Rotating Desync Bug

When playing network multiplayer, the game will no longer desync when a ship rotating in place (manual rotate with right click) is captured by telepathic Assault Shuttles.

Shuttle Capture of Last Ship Mid-Flight Stall

When playing network multiplayer, the game will no longer stall if the last ship was captured mid-flight by Assault Shuttles.

“Monster Bug”

Battles involving identical monsters fighting different players on the same turn will now resolve properly. Previously one of the battles could sometimes be “rolled back” restoring the monster and/or ships lost.

Dismissed Leaders Desync Bug

When a leader is dismissed he/she/it gets a level up. Sometimes this information was not synchronized and the leader could stay on the previous level. Leaders will now always acquire +1 level in a network game.

Gameplay Changes

Galaxy Generation



Cluster Galaxies

The Cluster Galaxy that was introduced in version 1.40, now works for multiplayer.

Wormhole to Orion Bug

Wormholes are no longer connected to the Orion system.

Black Hole Issues

Mapgen prevents Black Holes from appearing in Nebulae by replacing any such Black Hole with a normal star. This was done in a buggy way and regardless of mapgen tables such star had 1 planet or, if it became the star of a homeworld, the minimum set number of planets. Also, the star color was chosen with a simple random roll from all star colors (instead of from mapgen star class tables) and in case this process failed, the star became red. This is all fixed, the new star is now generated fully in accordance with mapgen tables.

Closest Star Issues

Mapgen ensures that there is a closest star to each home system with at least 1 colonizable planet and if this star did not have planets, it used to turn that star (or black hole) red, delete all satellites (asteroids and gas giants) and add two planets to the system. These deleted satellites were however not deleted from the planets array, causing them to become orphaned with no link to a star. The red star color especially stood out in non-red unicolor galaxies, e.g. when using the Orange2 map mod. All these issues have been fixed.

Runaway Homeworlds Bug

The maximum number of satellites that may be present on any map size is 250. If more are generated, a process of trimming reduces the number of satellites until there are 250 left. This happens for example when playing GoodMap4 and GoodMap5 map mods. This trimming process was buggy:

- It could lead to home colonies migrating to another planet.

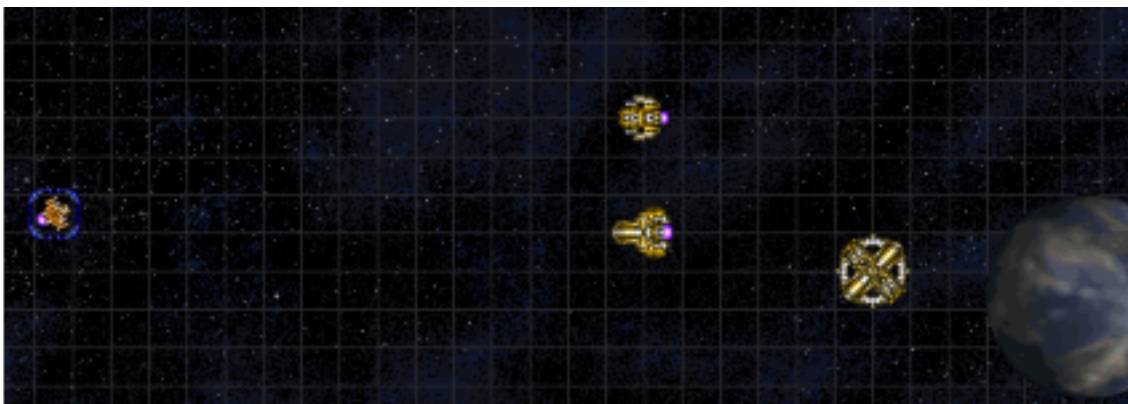
- Such migrated colonies could still be accessed by clicking both on actual home planet and on intended home terran planet in home system.
- With certain settings, trimming could create uncolonizable planets.
- Trimming could stall on certain galaxies with lots of asteroids or gas giants.

All these bugs have been fixed.

Number of Planets in Home Systems

The intention in classic was to have minimum 3 planets in the home systems, but due to a bug this did not work and home systems with only the home world (1 planet) or with 2 planets could be generated. With the introduction of the [/planets](#) switch in 1.40, the minimum was set to 2. Starting 1.50.9, this minimum is set to 3.

Tactical Combat



Always be brave.

Waking up Fleets

For a fleet that arrives at a system that has enemy presence, a pop-up will appear, asking if you want to attack. For fleets that already hover in an enemy system such pop-up does not happen every turn: they are asleep. Such fleets are awoken when circumstances change causing the Select Combat pop-up to appear, for example when another fleet arrives or a star base is built. This mechanic did not work properly for a newly built Fighter Garrison and Artemis System Net. Now, completion of those will also wake up fleets. On the other hand, completion of planetary shields will no longer wake up ships. In addition, fleets will wake up when a satellite, ground defense building or Artemis is destroyed. This especially reduces micromanagement when a player is using spies to attempt sabotage, eliminating the need to click 'Engage Enemy Forces' each turn to ensure engaging the enemy exactly the turn when a defense is destroyed.

Colony Beam Attack Bonus Bug

Fixed a bug that caused the defending fleet at a colony without a combat satellite or at an outpost to get Battlestation's +10 Beam Attack bonus.

Ship Initiative

Ship initiative is a classic feature introduced in version 1.31 intended to make combat more balanced. If enabled, all ships of both players act in the same and every combat round, and move in order of their initiative, from the highest to the lowest. Instead of using the classic formula

$$\text{trunc}[\text{beam_attack} / 10] + \text{speed}$$

ship initiative is now calculated as

$$\text{beam_attack} + \text{speed} * 10$$

so +5 attack is not lost due to rounding.

Naturally, in classic, ships could frequently be tied by initiative in which case they acted in semi-random order. In the 1.50 patch, ships are strictly ordered by the following comparisons:

1. By ship initiative, ship with greater initiative acts first.
2. By crew level, ship with higher crew level acts first.
3. If both ships are combat-only ships (defensive Antarans, satellites, ground defenses), then they are compared by combat ship ID, the ship with the higher ID acts first (planet acts last with ID 0).
4. If one of the ships is combat-only and the other is not, the combat-only ship acts first.
5. By crew experience, ship with greater crew experience acts first.
6. By overmap ship ID. Ship with lower ID acts first (having lower ID generally means the ship is older).

Turn Structure and Time Warp Facilitator Bugs

Note that all information in this section applies only to [ship initiative](#) mode.

The original combat turn structure contained a number of bugs and inconsistencies, mostly related to Time Warp Facilitator:

- The mere presence of a TWF ship used to affect all non-TWF ships, for example making a satellite rotate twice or phasing cloak counters deplete twice as fast for non-TWF ships.
- Non-TWF ships used to perform defensive fire during the TWF turn.
- Plasma Web and BHG effects used to apply only once every 2 turns for TWF ships.
- TWF ship's repair and shields recharge used to happen once every 2 turns.
- Missiles fired in TWF turn used to stop frozen until the next turn.
- Cloak and FMR states change was applying prior to other end-of-turn effects, and for all ships during TWF turn.
- Retreat used to happen before all ships could perform DF properly, making it safer to retreat for some ships. This is not related to TWF.

All these problems have been fixed in 1.50 by changing the turn structure. TWF turn is a full-scale turn now, and non-TWF ships are skipping most steps of it. The table below summarizes these changes. It lists all actions for different turn phases and which ships are subjected to them. All actions in the table are prepended with a single letter code:

A - Action applied to all ships.

T - Action applied to TWF ships only.

M - Action applied to missiles.

Actions colored **red** are the ones removed or changed by 1.50, **green** are those added by 1.50, actions not colored are the same in 1.40 and 1.50.

	Classic	1.50
Before ordinary turn	A Refresh combat stats M Replenish missiles' moves A Retreat or recharge ships ^2 A Rotate Satellite	A Refresh combat stats M Replenish missiles' moves A Recharge ships ^1 A Retreat A Rotate Satellite
Ordinary turn	A Move ships, fire	A Move ships, fire
Between ordinary and TWF turns	A Lose Absorber's charge M Move missiles A Update cloaks T Recharge FMR & HyperX A Apply plasma web & BHG T Retreat or recharge ships A Rotate satellite	(A Absorber keeps charge) M Move missiles T Apply plasma web & BHG T Recharge shields T Update cloaks T Recharge FMR & HyperX T Repair T Refresh combat stats T Recharge ships T Retreat T Rotate satellite
TWF turn	T Move ships, fire	T Move ships, fire
After TWF turn	A Lose Absorber's charge A Update cloaks A Recharge FMR & HyperX A Recharge shields A Repair	(A Absorber keeps charge) M Move missiles A Apply plasma web & BHG A Recharge shields A Update cloaks A Recharge FMR & HyperX A Repair

^1 Recharge ships -- recharge ships' weapons and replenish move points.

^2 Retreat or recharge ships -- only present in classic game. For each ship either a retreat or recharge is performed. This causes some ships to not yet be recharged when retreats happen, and thus defensive fire from those ships cannot be triggered by retreat U-turn.

Finally, note that

- TWF ship will now die twice as fast as non-TWF ship from BHG.
- Defensive fire on non-TWF ships will no longer happen in TWF turn, but anti-missile fire (Pd, AM-Rockets and Spatial Compressor) against incoming missiles/fighters still will.

- Energy Absorber's original dissipation rule was designed for non-[initiative](#) combat and had a number of problems otherwise. The Absorber now always keeps its stored energy if ship initiative is on.

Defensive Fire

Defensive Fire is a special ability of regular mount beams, intended to give an inactive player some defensive means during the active player's move. Sadly in combat with [ship initiative](#) enabled the whole mechanic was plagued with bugs, which rendered it inconsistent and incomprehensible. All problems have been fixed in 1.50, however because the whole mechanics was so severely bugged for all the years, and it was impossible to improve on it while keeping the "original feel" in combat, we have turned DF off by default for initiative games with the parameter [defensive_fire](#). With initiative off, DF is always on as it was in classic. More details can be found in section [Defensive Fire](#).

Mid Flight Update of Ship Coordinates

Ship movement in combat can trigger defensive fire, and on-impact anti-missile fire. In classic, in some cases a ship's initial coordinates are used for intermediate calculations. Both defensive fire and anti-missile fire are affected by this, the range to target is calculated from a ship's initial coordinates. An example: you order a ship to fly from point A to point B. Somewhere in between in point C the ship is impacted by a missile volley. Pd and Spatial Compressors should fire automatically at this point. But since the range to missile is calculated from point A and missile is currently at point C, Spatial Compressor will consider missile out of range and will not fire. Likewise if distance AC is more than Pd range, then Pd weapons will not fire. Ship coordinates are now updated during flight, so both anti-missile fire and defensive fire calculate range correctly. In addition, several small bugs that could affect Spatial anti-missile fire have also been fixed.

Destroyed Weapons

Ships now lose shots right after a weapon is destroyed. The game does not store states for individual weapons in slot, so a shot is only lost if a number of weapons remaining functional is lower than the number of shots. E.g. if you have a slot with 10 phasors, with remaining 8 shots, and 1 phasor is broken, you'll still have 8 shots. Then if 5 more phasors get broken you will be left with 4 functioning phasors so shots will be decreased to 4.

Indestructible Specials Bug

If damage inflicted on a special system was equal to its hit points, the special kept functionality but it became impossible to damage it further. Such specials were effectively acting as regular indestructible ones (reinforced hull, battle pods, etc). This bug has been fixed and to keep the original feel, +1 HP has been added to all specials.

Ship Repair Bugs

- Fixed the bug that prevented weapons from being repaired during or after the combat by engineers, cybernetic races or automated repair units. Weapons will now return to actual working status.

- A repaired shield generator will now recharge the shield. Previously the repaired generator was unable to regenerate shield strength until the end of combat, applying damage reduction only.
- Repaired special system will resume operation. In classic if special was completely broken it could never function until the end of combat.
- Repaired warp dissipator will now prevent retreats ordered on previous turn.
- In classic game immobile ship's drive is always repaired to minimum mobile state after each combat (in case you don't possess any repair tech, device or ability). Due to a bug this mechanics sometimes repaired a few hit points less than required for mobility. This is fixed in 1.50.

Immobilization

Fixed the discrepancy between the immobile label (which is intended to indicate if it's possible to board the ship) and the actual ability to board after trapping a ship with a Black Hole Generator or Tractor Beam. Previously a ship just affected by BHG was not marked immobile while it was possible to board it and a ship released from BHG or Tractor beam kept the immobile marking while no longer being boardable.

Boarding

- The attacker's marine bonus is now displayed on raid actions.
- Crew experience now also affects capture actions. Previously it only improved raid actions. This change affects Assault Shuttles too (Shuttles have the same crew level as the launching carrier).
- Raiding an enemy ship can now destroy all systems on it. Previously you could never destroy the last system on a ship by raiding it.
- Fixed the inability to destroy by raid ship engine that has 1 HP left.
- The raid results pop-up no longer reports damaged specials as destroyed, nor reports a misleading number of hits anymore (like 2 Warp Dissipators destroyed).
- A ship in stasis can no longer be boarded.
- A phasing cloak cloaked ship can no longer be boarded.
- Optionally boarding a ship / boarding from a ship trapped in a black hole can be forbidden.
- Ordinary and Transporters boarding ranges can be set in squares in Config.
- Optionally the amount of marines on a ship cannot exceed a given ship's maximum. By default it is possible to overload it during a capture action.
- The damage a successful raiding marine does, can be set in Config.
- The maximum number of items a successful raiding marine can destroy can be set in Config.

Done and Wait States Cleared on Capture

Telepathic races are able to control captured ships in combat. In classic (and only when ship initiative is on), a captured ship could not be controlled on the turn of capture if its original owner had already pressed 'done' for it. In 1.50 telepathic races always can control captured ships on the turn of capture. 'Wait' state is also cleared on capture when [ship_initiative](#) is set to 2. This allows the capturer to decide whether to wait.

Fighters Point Blank Bug

In classic, all 4 types of fighter crafts will strike immediately when fired point blank, except when fired left-to-right. This patch fixes it and fighters now strike immediately at point blank regardless of attack direction.



Fighters Chasing Unrelated Ships Bug

Fighters no longer chase unrelated ships, won't highlight when an unrelated ship is moving, and will highlight when targeting current ship indirectly (i.e. when targeting something that targets current ship directly or indirectly). Previously only fighters targeting current ship directly would be highlighted.

Fighters Chasing Missiles

Previously fighters were unable to chase not moving missiles at the end of turn, effectively skipping a turn. This is fixed in 1.50.

Fighter Bays Destroyed by Returning Squadron

Partially destroyed fighter squadrons that have returned to the mothership no longer cause permanent destruction of weapon bays.

Helmsman and Ordnance Bonus for Fighters

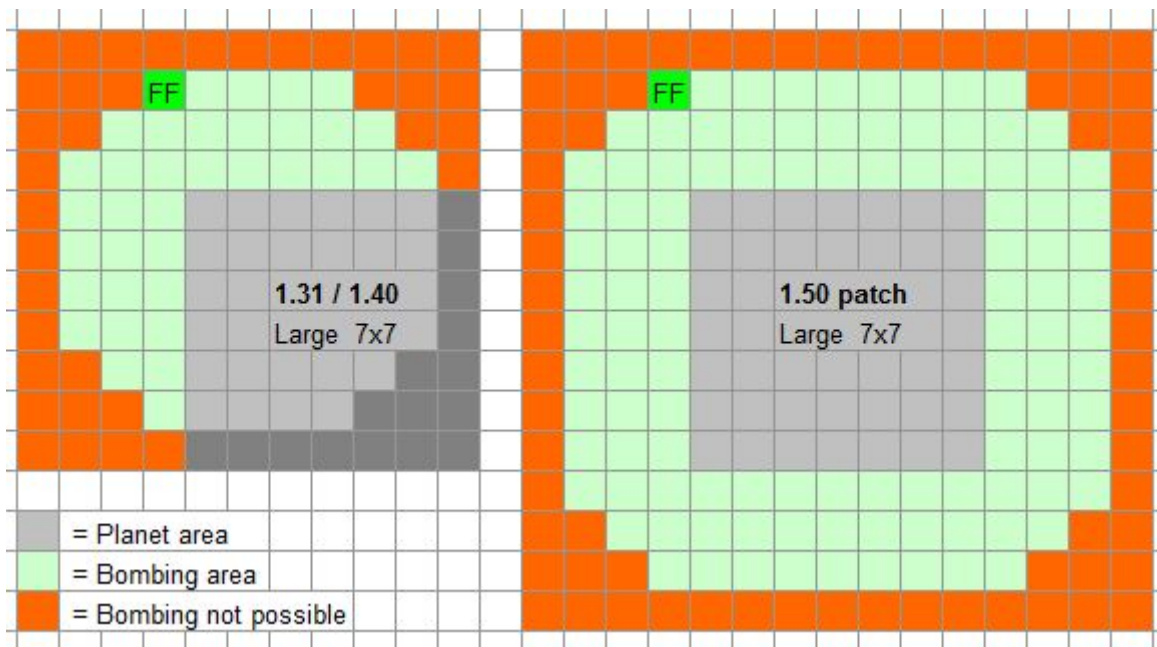
Helmsman and Ordnance bonuses now apply to all fighters (beams and bombs). In classic, fighters are the only weapons not to benefit from Ordnance (even Energy Absorber fire benefits from it). Note that the Weaponry bonus already applies to fighters in classic.

Missile Alerts Bugs

- Missile alert will now be triggered by manual rotations. Previously in place rotation had been simply ignored in warning calculations, so ship never got a timely stop in case of incoming missiles.
- The cost of a ship movement that would trigger a missile warning will now be calculated properly. The way the classic game calculated it could result in any of the following:
 - move cost being calculated incorrectly,
 - issuing a false missile warning,
 - failing to issue a missile warning,
 - turning ship to face east instead of the ordered direction.
- In classic, a ship stopped by a missile alert could trigger interceptor movements without moving itself. The alert would prevent the ship from moving but interceptors targeting the ship's targeters would move. This is no longer possible.
- Possible fake missile alert lingering from the previous ship is fixed.

Symmetric Bombing

Fixed the bug that did not allow bombing on the south and east sides of medium, large and huge planets. Bombing is now symmetric, and the distance from which a planet can be bombarded is the same from each side, regardless of its size.



Ground Installation +1 Hits Bug *

Due to a calculation error in Tactical Combat, ground installations were not destroyed until the damage dealt to them strictly exceeded their total hit points, in effect giving them +1 HP.

Civilian Structures +1 Hits Bug

Due to a calculation error in Tactical Combat, civilian structures were not destroyed until the damage dealt to them strictly exceeded their total hit points, in effect giving them +1 HP.

Bombardment Can Destroy Capitol

Bombardment can now destroy the Capitol. It is treated as a regular building.

Spherical Weapons Range

Spherical weapons are Pulsar, Plasma Flux and Spatial Compressor. In classic, the targeting range for those weapons was inconsistent with the damaging range. Sometimes you could fire at an object (ship or missile) and not hit it, and sometimes you could hit an object which you were unable to fire at. This is considered a bug, because for all other weapons you can only fire at an object if it's in range. In 1.50, targeting ranges have been made equal to actual damaging ranges, so now you can fire at an object if and only if it's possible to damage it. In addition range is now calculated from the firing ship's center to the target's edge; in classic it was the distance between centers. In effect, sphericals ranges to ships are 6, 6 and 4 squares respectively, and a fraction more to missiles.

BHG Doesn't Use the Whole Slot

Ships no longer fire all Black Hole Generator shots from one slot, they use only one shot at a time.

BHG Simultaneous Action

Ships affected with BHG for 2 turns straight are destroyed at the end of turn 2, unless the BHG carrying ship is destroyed before, in which case the target is released. In classic this led to asymmetric behavior where ships on one side are destroyed first and ships on the other side affected by BHGs from destroyed ships are released. We consider it a bug, in 1.50 all such ships are destroyed simultaneously.

Stasis Field

The following bugs have been fixed:

- Stasis field now recharges correctly. It used to gain the wrong number of shots because the number of current targets was not used in calculation.
- Even if stasis field is present at the beginning of the turn, a ship will be able to act this turn if stasis is removed. In classic such ships were unable to act until next turn.
- In classic removing stasis field zeroes ship's shots. While not technically a bug this behavior is deemed unnecessary as it reduces interactivity and gives even greater advantage to a weapon already very powerful, so in 1.50 shots are not zeroed.
- Ships in stasis now cease to apply effects of Wide Area Jammer, Scout Lab and Warp Dissipators installed on them to other ships.
- Putting a ship in stasis now ceases Tractors and BHGs targeting that ship and also Tractors, BHGs and Stasis fields being projected by it.

Destroyed BHG and Stasis Freeing Ships

When a BHG or Stasis weapon is destroyed, a buggy number of ships used to be freed. Now it works as follows:

- If the slot still has shots then one shot is decreased.
- If the slot is out of shots then one ship is freed from weapon's action.

Cloaking Device Bugs

- Cloaking Device missile miss chance has been fixed to 50% (was 49%).
- A ship will now decloak and lose the ability to recloak if its cloak-inducing device is broken. In classic destroying such device had no effect on cloaking ability.

Phasing Cloak Area Damage

Ships cloaked by Phasing Cloak are no longer affected by spherical weapons or ship explosions.

Phasing Cloak Cuts Tractor Beams

Ship which phase cloaks is supposed to go to "another dimension". But tractor beams targeting such ships and outgoing from such ships are not cut in classic. Moreover such ships can be captured while phase cloaked which is obviously a bug. In 1.50 tractors both from and towards phase cloaked ships cease. Such ships cannot be boarded when cloaked.

Displacement Device

Miss chances for missile and absorber shot against displacement device have been corrected to 30% (was 29% for missiles and 70% for absorber, which contradicted description and was inconsistent with beams).

Energy Absorber

- Fixed a bug which caused stored damage to overflow, maximum stored damage is now 30k. Note that the energy fired from the absorber always hits, unless the target has a displacement device. Note also that firing the stored energy will not cause the ship to decloak.
- In INI games absorber no longer loses charge at end of turn. This feature was designed for non-[initiative](#) combat where attacker and defender have their own combat turn, but is unfair in INI combat where all ships act during the same combat turn because ships that accumulate a charge after they have finished their turn do not get a chance to fire it.

Inertial Nullifier

Inertial Nullifier reduces the turning cost of a ship from 8 per 90° to zero, effectively being a teleport for the purpose of rotation, but unlike Sub-Space Teleporter it causes the missiles targeting such ship to move. In games with [ship initiative](#) on, but missile initiative off, this could even lead to missiles striking Nullifier ships a turn earlier than ships without such device. Missiles now ignore Nullifier rotations.

Sub-Space Teleporter

- Fixed Sub-Space Teleporter not breaking tractor beam out of range.
- Fixed Sub-Space Teleporter getting increased range for faster ships.

AI Expected Damage Bugs

During tactical combat the AI assesses possible damage to enemy and friendly targets. In situations where no damage can be done, miscalculations resulted in AI stuck attacking impregnable targets or fleeing with no reason. Fixes are:

- Ineffective Ion Pulse Cannon against a planet is now accounted for.
- Fixed incorrect calculations for several weapon mods.
- Bomb expected damage now accounts for ground defense shields.
- Ordnance is now accounted for.
- Calculations for Energy Absorber, Damper Field, Hard Shield, Cloaking Device, Phasing Cloak, now depend on config. Previously classic values were hardcoded.

AI Stall when Targeting Missile

When an AI ship launches a missile and then is captured, another AI ship may decide to attack that missile figuring it was launched by an enemy ship. But the firing code checks that missile is friendly and does nothing. This results in AI trying to fire at the same missile endlessly. This is fixed in 1.50.

No Autodone in Combat

A ship's turn no longer automatically ends when it has no ammo and movement points left. This is helpful if you want to retreat, self-destruct or board after moving.

AUTO Retreat

Individual ships under computer control (both AI ships and human player ships on AUTO or Z) will no longer retreat just because they are out of ammo. In addition, the rule that human player fleets never retreat from combat can be altered with the parameter [human_player_fleet_auto_retreat](#) in which case they act the same way as AI fleets.

Retreat Disappearances Bug

Ships no longer disappear when made immobile while turning to retreat. Such ships stay in combat instead. In classic such ships could be lost after the battle despite a successful retreat animation.

Shuttle Capture Upon Retreat Bug

Ships that are captured by Assault Shuttles during retreat now stay in combat.

Relaxed End of Combat

During a turn, combat now ends on each next ship if its side has won and there are no missiles on the other side and there is no colony on the other side. If the only present side is an AI, then AI ships stop acting even if they still can bomb planets or shoot missiles (missiles last flight still happens). This is to prevent AI jerking ships aimlessly. Upon the end of the turn, the winner check works as before and combat ends even with missiles or a colony present. This more relaxed ending of combat is intended against missile & self destruct exploits, as well as for overall coherence of the turn sequence. If no enemy is present, pressing **T** ends both the turn & combat.

Super-fast Combat Mode (Z) Improved

Super-fast mode is activated when you press **Z** in combat against an AI opponent. It is similar to pressing Auto but skips some graphics and allows to resolve combat much quicker. The following changes were introduced for this mode:

- Ship explosions are now taken into account. In classic they were skipped in super-fast mode.
- Boarding summary pop-ups no longer appear. Since those dialogs introduced a pause they were against the whole point of super-fast mode.
- Sound effects are now suppressed during super-fast mode. This is to avoid incomprehensible sound mess this mode used to produce.

Strategic Combat

Crew Level Bonuses

Classic formulae for strategic Beam Attack and Beam Defense are very simple:

$$\text{strat_BA} = \text{racial_bonus} + \text{computer_bonus}$$

$$\text{strat_BD} = \text{base hull_defense} + (\text{drive_no} - 1) * 10$$

1.50 formulae have been adjusted to optionally honor crew bonuses for beam attack, beam defense and missile defense. As a result, Space Academy is no longer a useless building and Warlord becomes more valuable. Note that a racial bonus for BD now applies but Trans-Dimensional bonus still does not (since there is no combat speed in strategic). Note also that Weaponry and Helmsman bonuses have no effect in strategic combat and ship scan is currently still showing misleading values.

Weapon Selection and Actual Damage

Weapons used to be chosen using the damage values of the strategic column, but for actual damage in combat values from the tactical column were used. This could lead to suboptimal weapons being fitted on ships, for example Neutron Blaster (12 max damage) was favoured over Gauss Cannon (10 max damage), while in combat Gauss max damage is higher than Neutron Blaster (18 vs 12). Now the strategic column is used for both the selection of weapon and actual damage in combat. The strategic column has been updated with values from the tactical column where necessary to preserve classic values, with the exception of Special Weapons (see next paragraph) and Dragon Breath that now does 250 damage instead of 300 (maximum value in the strategic column is 255).

Special Weapons Damage

Special Weapons damage values were incorrect and/or inconsistent. Most notably Bombers and Heavy Fighters did no damage in combat at all because their damage values were set 0 in the tactical column of the weapons table. Damages of other weapons were inconsistent with their tech level. The special weapons damages of the 1.50 patch have been taken from the strategic column of the weapons table, except Plasma Web that uses the tactical values and Bomber / Heavy's that use values from the book "Master of Orion II: Battle at Antares, The Official Strategy Guide" (1996). Note that weapons are chosen basis highest max damage and in case of a tie basis lowest weapons table id, and therefore Bomber (#30) is correctly chosen over Pulsar (#36) in case both technologies are Known.

Weapon	Tech Lvl	Cum RP	Classic dmg	1.50 dmg	Source for 1.50 value
Interceptor	2	80	6-15	1-4	Strategic Column
Gyro Destabilizer	6	900	1-4	3-8	Strategic Column
Pulsar	10	5300	2-24	4-20	Strategic Column
Bomber	10	7080	0-0	5-20	Strategy Guide
Plasma Web	12	9450	5-25	5-25	Tactical Column
Heavy Fighter	14	16580	0-0	8-32	Strategy Guide
Spatial Compressor	22	Xenon	4-32	5-40	Strategic Column
Black Hole Generator	22	Xenon	6-15	100-100	Strategic Column
Stellar Converter	17	34950	400-400	250-250	Strategic Column

Hard Shields

Hard Shields now increase blocked damage in strategic combat. Note that in contrast to tactical combat, in strategic combat mode regular shields function in Nebula.

Artemis System Net Defender Wins Bug

Artemis System Net will no longer grant a wrongful victory to the defending side in strategic combat. This happened when Artemis System Net managed to destroy at least one attacking ship before the combat. In such a case the defender was declared a winner even if the whole defending fleet was destroyed. No prompt for bombardment or invasion was presented to the attacker and his fleet was forced to flee.

Ships and Fleets

Inconsistent Rounding of Range

The calculation of range for contact was rounded down, while the range for ships was rounded up. Notably with Iridium Cells this caused situations where a ship could orbit an enemy colony, without establishing contact. Range calculation for contact is now also rounded up, making it consistent with the ability to visit a colony.

Scanners and Communications Discrepancy

Fixed the discrepancy between the effective ranges of Scanners and Communications by increasing the default ranges of Tachyon and Sub-Space Communications by 1:

Scanner	help	exe	Comms	help	exe	exe
Space	1	2			1.31	1.50
Tachyon	3	4	Tachyon	within 3	2	3
Neutron	5	6	Sub-Space	within 6	5	6
Sensors	8	9	Hyperspace	unlimited	255	255

Depending on ship movement (approach of depart) range differs. The minimum range is listed for scanners, but maximum range is set in code. For communications the listed value is now equal to the value in code.

Navigator Affects Fleets Immediately

All actions with navigator leaders now affect fleets immediately. In classic you could send several fleets to different destinations with one single navigator. This is no longer possible and only the fleet in which the navigator actually travels gets a speed bonus and the ability to pass black holes. If you split fleets en-route, leaving one new fleet without a navigator, or just send the last navigator away from a fleet, you are prompted that such action will lead to an ETA change or even to loss of the fleet to a black hole, and given a chance to cancel your action. If a navigator levels up or catches up with a fleet en-route, it will increase that fleets' speed immediately.

Other Player's Dimensional Portal Bug

In classic you could attack Antares using a Dimensional Portal built by another player. In that case your fleet would travel to coordinates 0, 0 instead of attacking immediately. Upon

reaching the destination battle with antarans would take place. This was mostly a multiplayer issue because AI never builds a portal and rarely can acquire one. This bug is fixed in 1.50, it is no longer possible to attack Antares using another player's portal.

Auto-Scrap

To prevent your treasury from becoming negative the game automatically scraps things.

The patch changes the following:

- A correct number of ships is scrapped to cover your debt. In Classic, the game used to scrap one extra ship due to a bug.
- When a ship is scrapped en-route and a leader resides on a ship, the game makes an attempt to move this leader to another unoccupied ship in the fleet. The leader is put into the officers pool only if there are no suitable ships. This was added to offset the effect of navigator being randomly removed from the fleet, since in 1.50 it may cause the fleet to be lost in a black hole.

Auto Ship Design

A number of bugs causing auto-designed ships to be different from manually designed ships have been fixed. This includes both AI and player starting ships. Auto-designed ships are now fully equivalent to manually designed ones:

- Empty space provides a speed bonus. Consequently the two starting scouts will have 12 combat speed instead of 10.
 - AI ships using real speed revealed a bug causing Augmented Engines +5 speed bonus to be counted double for AI ships sometimes, which has also been fixed.
- Megafluxers are taken into account.
- Shield space is taken into account.
- Bomber Bays and Heavy Fighter Bays use up space according to their own space value instead of the Fighter Bays value.
- Battle pods / Extended Fuel Tanks now give / take up space according to the values from the systems table, instead of a hard coded formula / value.
- A heavy beam variant will no longer be fitted on ships or satellites if that beam does not have the Hv mod enabled. For example, Hv Ion Pulse Cannons are no longer fitted on star bases.

Warlord Ships

The crew level bonus now applies right away for new ships built by Warlords instead of from the next turn.

No Computer Hit Points Bug

Ships that have no computer fitted no longer receive the computer's hit points.

Ship Detection Bug

Destroyed stealth devices now actually lose their effect on the main screen instead of providing an additional bonus.

Antaran Fighters Bug

Fixed Antaran fighters not working on defensive Cruiser and Titan ships.

Antaran Bombs Bug

Fixed bombs having a forward arc instead of 360 degrees on Antaran offensive Battleship and Titan ships as well as on the Avenger ship.

Antaran State Not in Savegame Bug

Starting 1.50.10, Antaran states of max_ships and ship_costs are recorded in the savegame, so these data persist after reloading the game.

Ship Refit

Pre-Warp Refit Bug

In Pre-Warp games it is now possible to refit ships without having researched Cold Fusion (Colony Ship field). As soon as you are able to build ships, you can refit them.

Refit Design vs Queue Discrepancy

Fixed the inconsistency between the cost shown in the Refit screen and the actual refit cost that the player had to spend.

Incorrect Feudal Refit Cost

Fixed refit cost calculation for the Feudal government. Now the Feudal reduction for hull cost applies properly.

“Feudal Bug”

In multiplayer games, both in hotseat and network, the cost for building or refitting a ship is now calculated correctly. Sometimes the basic ship cost was calculated in another player's context, which had the most noticeable effects when a Feudal player was involved, hence the name of the bug. It was the reason why Feudal was usually banned in multiplayer games. This bug happened for non-Feudal players too, but with a much smaller effect.

Lander Ships

Command Points not Updating After Landing OP or CS Bug

Fixed occurrences where landing a Colony Ship or Outpost Ship would not decrease the used command points and maintenance cost. This could even lead to auto scrapping in the next turn if at negative command and low on money.

Outpost Ship Conflicts with Colonization Bug

If you had both an outpost ship and a colony ship present in a star system you were sometimes unable to colonize habitable planets in that system both with colony ship and colony base. The game wouldn't present colonization prompt and the "colonize planet"

button wouldn't appear when a fleet was selected and a colony base would be trashed (sold). This is fixed in 1.50.

Colony Ship Conflicts with Building Outpost Bug

Similar to the previous bug. If you had both an outpost ship and a colony ship present in a star system you were sometimes unable to build an outpost in that system. The game won't present the outpost building prompt and "build outpost" button won't appear when a fleet is selected. This is fixed in 1.50.

Lander Ships Armor

The 'best armor minus 1' rule for lander ships has been removed. They now always have best armor fitted, irrespective of whether they are already in the queue or not when new armor tech becomes available.

Satellites

Satellite Weapon Mods

Satellite beam weapons can now have mods. By default all mods are allowed except AP and SP for point defense weapons. Missiles can now be made MIRV (though not enabled by default). This can be configured with [defenses_allowed_mods](#). Mods now cost space for both beam weapons and missiles. This causes slightly less beam weapons to be fitted when mods are applied at L1 and higher. For missiles, ECCM is still free of cost and available at level 0 miniaturization (a change that was made in Simtex v1.3 patch), while for ships it's a L1 tech at +25% cost. FST and ARM are available at L1 as before, but each now have the same +25% cost as for ships. The space of satellites has been increased in compensation. Note that a Star Base now starts with 4 nukes at L0 instead of 3, and still has 4 and 5 nukes at L1 and L2 respectively, same as in classic.

Beam Weapons Arc Cost

The cost of the 360° Beams on satellites now is +50% instead of +25%. The space of satellites has been increased in compensation.

Choice of Pd Weapon

The best Pd weapon by dmg/space for combat satellites is now selected taking Auto Fire and Enveloping mods into account. Natural ENV is also taken into account.

Evenly Spread Missiles

A combat satellite has three slots for missiles. In classic, each slot can contain a maximum of 30 missiles and missiles 1-30 are fitted in the first slot, 31-60 in the second slot and 61-90 in the third. As a result, most of the time only the first slot was used in unmodded games, which restricted a satellite's firing options (could only shoot missiles at one target each combat round). In 1.50, 1-3 missiles are fitted in the first slot, 4 missiles are fitted as 2-2-0 and if there are more than 4 missiles, they are evenly spread over the three available slots. In addition, each slot can now contain up to 99 missiles instead of 30.

Space Allocation

The allocation of available space for heavy beams, regular beams, point defense beams and missiles / torpedoes can be configured with [satellite_space_allocation](#). In classic, a Star Base had 300 space allocated as 25%/ 12.5%/ 12.5%/ 50% for Hv, regular, Pd and missiles respectively. The default Star Base now has 400 space (+100 in compensation for mods and arcs) with a new 26/13/12/49 allocation, for a starting weapons complement of 3 Hv / 3 reg. / 6 Pd / 4 nukes (Classic had 3/3/6/3). Note that AI's satellite strength assessment takes these custom allocation percentages into consideration.

Compare classic vs new default Star Base with L1 Fusion Beams and L1 Nukes:

Star Base		
 Immobile	Combat Bonuses	
	Beam Attack:	+90
	Beam Defense:	-5
	Regular Crew	
	Marines:	20
Weapons	Ammo	Mods
3 Fusion Beams (360)	-	Hv
3 Fusion Beams (360)	-	None
7 Fusion Beams (360)	-	Pd
4 Nuclear Missiles (360)	20	ECCM, ARM, FST

Weapons	Ammo	Mods
3 Fusion Beams (360)	-	Hv, CO
3 Fusion Beams (360)	-	CO
6 Laser Cannons (360)	-	Pd, CO, NR, AF
2 Nuclear Missiles (360)	20	ECCM, ARM, FST
2 Nuclear Missiles (360)	20	ECCM, ARM, FST

Satellite Size Class

Satellite generation and repair now uses hull table rows 6-8 (Star Base, Battlestation, Star Fortress) for hit points of computer and shield. This means that a star base has 10 hp for a computer instead of 5 and 15 hp for the shield instead of 6. For size calculation of special systems, classes 2-4 (Cruiser, BB, TT) are assumed, unchanged from classic.

Satellite Capture Bug

Unrelated to [starbases_capture](#) option, a rare bug could cause the attacker to capture a satellite. The attacker should capture the satellite and the defender should recapture it but lose the battle afterwards. If the attacker proceeds to conquer the colony the satellite will be captured. This is fixed in 1.50.

Ground Defenses & Troops

Fighter Squadron Buggy Counts

Fighter crafts used to create problems when returning home. Instead of trying to fill all space of the available bays, they only landed in the first available empty slot, resetting the weapon amount in the process.

Example:

1. You have slot 1 = 10 interceptors, slot 2 = 1 interceptor and launch both.
2. First 1 interceptor returns and lands to slot 1, setting the weapon amount of that slot to 1, in effect “breaking” 9 bays.
3. Then 10 interceptors return and choose not to land to slot 1 since it already has 1 fighter residing. They land to slot 2, but since that slot can only hold 1 interceptor, the other 9 are immediately lost.

The amount of fighters returning does no longer create such issues and fighters can even return to partially filled slots. They will now try to fill up every vacant slot upon return. Additionally, newly spawned fighters at a Fighter Garrison will always have the maximum amount of squadrons.

Consider 2. and 3. of the above example again for the new situation:

2. First 1 interceptor returns and lands to slot 1, setting the weapon amount of slot to 1 (again “breaking” 9 bays).
3. Then 10 interceptors return and try to land on slot 1 first, filling 9 free bays (restoring the amount of bays to 10), after which the remaining interceptor fills the 1 space of slot 2.

Note that returning fighters reset a slot’s shot, so no fighters can be launched from that same slot in that turn. Note also that fighter craft bays that are destroyed by damage or raids, will not be able to be refilled on return.

Ground Batteries Arc Cost

The cost of the 360° Beams on batteries now is +50% instead of +0. Total space of batteries have been increased by +50% in compensation.

Max Ground Unit Dies Bug

When marine and armour units of a subterranean colony reaches the maximum number, that last unit will no longer die and be rebuilt 5 turns later in an endless cycle.

Barracks / No Barracks Inconsistency

The number of transport ships that will be disbanded after a successful invasion is calculated as the maximum number of troops the colony can hold, divided by four and rounded up. As a result the actual number of troops that remain on a planet can exceed the maximum number by 1-3. Those troops will die by 1 unit per turn. Due to a bug, this happened only on colonies with a Barracks, making it possible for colonies without Barracks to have troops in excess of the maximum. The same situation also occurred on colonies that had Biospheres scrapped. Fixed in 1.50.

Production & Buildings

Buildings & Freighters Free Cash Bug

Upon completion of a building or a spy in version 1.31, the corresponding maintenance fee was charged immediately. To prevent bankruptcies due to completion of such building or spy, the game compensated once for that fee. Due to a rule change in version 1.40 (a significant side effect of fixing the Credit Cheat), maintenance was no longer charged immediately but started only the next turn. The compensation however still existed, causing the player to receive free money upon completion of such projects. In 1.50 this compensation for buildings and spies has been removed.

The same mechanic applied to freighter fleets, however the actual maintenance charged in version 1.31 was between 0 and 3 BC depending on food shortage (while the food was not actually freighted!), and the compensation was fixed at 5 BC. As a result, there always was a net benefit of 2-5 BC's. In version 1.40 no maintenance is charged for freighters on the turn of building so the net benefit was always 5 BC. The new default is 0 BC. Because freighters are a special case and some players are accustomed to the old behaviour, the amount of BC compensation is tunable with parameter [freighters_cash_bonus](#).

	1.31	1.40	1.50
Maintenance cost from new building	Immediately	Next turn	Next turn
Maintenance cost 1x compensation	Yes	Yes (free cash)	No
New spy immediate cost	1 BC	0 BC	0 BC
New spy 1x compensation	1 BC	1 BC (free cash)	0 BC
New freighter immediate cost if shortage	0-3 BC (0.5 BC each, rounded down)	0 BC	0 BC
New freighter cost 1x compensation	5 BC	5 BC (free cash)	0 BC (tunable)
New freighter actually used for food transport if shortage	Next turn!	Next turn	Next turn
Food from new building	Next turn!	Next turn	Next turn

used if shortage			
Food from new building sold if surplus	Immediately!	Next turn	Next turn
Tax from new population	Immediately	Next turn	Next turn
Tax from new spaceport and stock exchange	Immediately	Next turn	Next turn

Building Removal Bugs

- Productivity recalculation now works correctly after selling a building. In classic production per worker bonus remained until next turn giving one time extra production. This could be observed in the Colony screen, where this one time extra production was visible in the Jobs Output box and would disappear if clicked on.
- Selling a building can cause some products to be removed from the queue (e.g. transports are removed when selling marine barracks), so in classic it was possible to remove a bought product. In 1.50 buy action will be reverted in such case.

Autobuild recalculation

Colonies are not recalculated in autobuild anymore, so newly grown pop doesn't participate in production when autobuild is on.

Opponent's Bought Production

Normally production is zeroed when you capture a colony. Sometimes AI has bought production there which will appear as non-zero production after capturing. This is fixed in 1.50 by also zeroing the bought prod. Note that it should not be possible to create such a situation, all bought production must resolve and be zeroed before battles, so this is likely a bug in AI.

Food Replicator

Replicator will no longer cause situations of negative production, only producing food if there is sufficient production available.

Research & Technology

Turn 0 Research Points

Research Points produced on turn 0 are not lost if you did not choose tech on turn 0.

Advanced Damage Control

Being redundant for Cybernetic races, ADC technology is removed from their tech tree.

Strategic Tech Tree Corrections

Removed the following unused techs for Strategic games:

- Anti-Missile Rockets. There is no anti-missile fire in strategic combat.
- Energy Absorber. Does not work in strategic combat.

- Security Stations. There is no boarding in strategic combat.
- Warp Dissipator. Has no influence in strategic combat.

Transporters tech is also unused in strategic but this tech has not been removed because for Lithovore races the Food Replicators tech is not placed in the tree, so the absence of Transporters would cause an empty tech field, and consequently a crash.

Added Warp Interdictor to the tree (perhaps Warp Interdictor and Warp Dissipator were accidentally swapped).

Hyper-Advanced Tech Cost Bug

Fixed the cost of level 1 hyper-advanced tech fields that were shown as 25k research points but had a real cost of 15k. Now both actual and displayed cost is 25k RP.

Techs from Scrapping

Added the possibility to acquire a shield tech from a scrapped ship. In addition, the occasional "You received the following techs from scrapping this ship" message pop-ups with a blank list have been fixed.

Techs from Surrender

The player that an opponent surrenders to now receives all technologies from that opponent. Previously he only received technologies up to #83 from the technology list, due to the erroneous use of technology *field* number instead of technology number.

Map Knowledge from Surrender

Map knowledge is now transferred on surrender, preventing the occurrence of some odd situations for the receiver like having a surrendered fleet at an unexplored system.

Human-to-Human Technology Interaction

Diplomacy interactions involving technologies (exchange, gift, demand) between human players now include every possible technology. Previously it followed AI trade preferences (AI could be unwilling to trade some tech it deemed "useless", most notable example being Optronic Computer).

Spying

Spy Roster Overflow Exploit

You can have maximum 63 defending spies in MOO2. If this number is reached then upon building a new spy the game will scrap it. In classic it provides you with 100 BC, which is about twice as

SPIES	Classic 1.31 / 1.40	1.50 Patch
#	Bonus Formula	Bonus Formula
1	2 #x2	2 #x2
2	4	4
3	6	6
4	8	8
5	10	10
6	11 #+5	11 #+5
7	12	12
8	13	13
9	14	14
10	15	15
11	15 (#-10-1)/2+15	16 (#-9-1)/2+15
12	16	16
13	16	17
14	17	17
60	40	40
61	40	41
62	41	41
63	41	42

profitable as trade goods are. This can be considered an exploit. In 1.50, the extra spy is scrapped at a common rate of ½ cost.

Enhanced Spy Formula

The formula for the bonuses of individual spies has been tweaked in such a way that the 63th spy (last spy) adds 1 bonus point instead of 0. The total bonus for 63 spies now is +42 instead of +41. This change benefits every other spy from #11 and higher. For more information on spying, see [Notes on Spying](#).

AI & Diplomacy

AI Objective Bug

At the start of a game, each AI will get one of 6 objectives assigned: Diplomat, Ecologist, Expansionist, Industrialist, Militarist or Technologist. The AI's race picks are an input for this determination. The function that is used for that purpose had incorrect values for Ship Defense and Ship Attack (SD+20, SD+40, SA+25) and as a result those traits were not taken into account. These values are now variable and depend on the actual settings for Custom Race (where classic is: SD+25, SD+50 and SA+20).

Diplomatic Blunder and Marriage Events Bug

The Diplomatic Blunder and Marriage events that GNN reports used to have no effect. This was fixed, they now modify relations between the players involved.

Population & Androids

Assign To Farming Bug

Fixed inability to move pop from non-food world to farming on food world. Previously, when using the Colonies screen to assign a colonist as a Farmer on another planet, and the originating planet cannot farm, you incorrectly got an error, "No room for another colonist in this job field".

Ghost Colonies

A ghost colony is a colony with no population. Such a colony may appear due to the use of bioweapons, extermination of conquered population, or as a result of starvation (if [planet_extinction = 1](#)). A ghost colony exists as long as it has buildings. No new buildings can be built on a ghost colony, and every building present has a 10% chance to be destroyed each turn.

```
The average number of turns a colony lives with 1..48 buildings:
0  0  (colony is destroyed immediately if no colonists inbound)
1  10
2  14.7
3  17.9
4  20.3
5  22.2
...
```

When there are no buildings left on the planet, it becomes a zero colony. A zero colony is a special ghost colony with no population and no buildings. Such colony is lost immediately. By setting `zero_colony_lost = 0`, a zero colony is not lost next turn for as long as it has freighted colonists inbound.

In classic there was a bug which made it impossible to bomb or invade a ghost colony, causing it to essentially become an indestructible outpost. This is fixed in 1.50. Note that invasion is only possible when the colony has at least 1 building present.

Setting `planet_extinction = 1` makes starvation lethal for the last colonist, so it is possible to create a ghost colony by starving populace. This option does not affect AI as it tends to starve its citizens and suffers too much from such a rule.

Population Capacity Clipped To 42

The maximum population on a planet is now clipped to 42, which is the maximum properly supported by the game. No matter which techs or racial traits you've got or how you mod population tables, no planet will support more than 42.

43rd Android Ignores Pop Limit Bug

Fixed the bug that occurred when you already had 42 colonists on a colony and built an android. The game would not warn you of the pop limit when an android was inserted into the queue. This android would not kill a colonist when built but became a 43rd colonist. You could continue building androids at such colony until the game crashed.

Freighted Colonists Ignore Pop Limit Bug

Fixed bug that allowed to overpopulate colonies. Previously, if for a given planet race S supported more pop than race A, (when S is aquatic, subterranean or tolerant) and you had only colonists of race S on this planet then you could send colonists of race A there in amounts exceeding allowed maximum. E.g. if you had a Sakkra colony 7/7 and Alkari supported 5 colonists on the same planet, then you could send 5 Alkari there without losing any colonists, resulting in a colony with 12/7 pop.

Leaders

It's an urban legend that the game likes to compensate for a race's weakness with leaders.

Random Officer Check Players Order

Randomized the order in which players roll for leaders. The check is no longer done in ascending order (player 0, player 1, etc) each and every turn, so player 0 no longer always gets the first choice from the available leaders.

Ordinary Assassin Skill Bug *

Leaders with the ordinary Assassin skill (without the asterisk) are now able to kill enemy spies.

Assassin Blocking Mind Control Bug

Leaders with ordinary Telepath or Telepath* skills now protect colonies from being mind controlled. In classic, leaders with ordinary Assassin skill did that instead.

Telepath Skill Bug *

Leaders with the Telepath skill now get the correct skill level applied. Previously it was using one level less than the actual level of the leader.

Leader Arriving on a Captured Ship Bug

Normally a leader present on a ship that is captured is killed. But a leader who was still travelling to a now-captured ship was totally unaffected by such fact of capture, resulting in an enemy leader residing on your ship. From now such a leader will be sent back to the owner's officer pool during ship capture.

GNN & Random Events

GNN Reports Systems Instead of Colonies

In a number of GNN news occasions, the system name was reported instead of the colony name. All these occasions have been fixed and an updated EVENTMSE.LBX is supplied for all supported languages.



Wandering Monsters GNN

Now players should get correct GNN reports about monster events for all monster types and states of event.

Monsters Search Range

10 parsecs were added to the monster's search range to find a new target colony. Previously it was possible that a monster that could have stayed, disappeared due to its inability to find a new target.

Toxic Amoeba

The effects of an amoeba that has won combat at a colony now properly applies to AI colonies too, transforming the planet to a Toxic climate. In addition the Amoeba is ensured to stay in the game if its target colony is destroyed before it arrives.

Nova Fixup

Planet food output is now zeroed and soil enrichment removed from planets that have been hit by a Nova, preventing such planets from being farmable after recolonization.

Comets

A comet now immediately counts as destroyed when 100% of that comet is destroyed, not the turn after. In addition an overflow in GNN's comet message has been fixed, and more than 100% progress is no longer reported.

Comets and Monsters Hyperspace Flux Bug

Fixed a bug that failed to prevent comets and monster events from occurring during a hyperspace flux and that even made it possible for them to appear during a flux before their set turn delays, eg a dragon could already show up at turn 60 during a flux.

Serendipity Bug

The Serendipity event will no longer cause a blank box in tech choice if it occurs in the same turn as a regular technology breakthrough.

Pirate Raid Bug

The Pirate Raid event will no longer cause an income if it happens to a player with large reserves. Due to overflow, pirates used to “donate” money to richer empires.

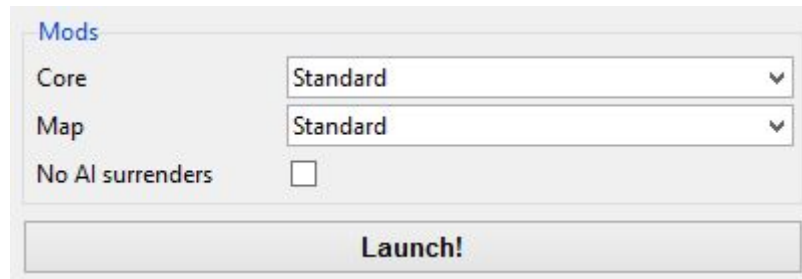
Unstable Wormhole Bug

The unstable wormhole can now happen to fleets with eta=2 turns. It used to be possible only to fleets with eta>=3 turns.

Game Mods

Standard

Playing Standard game mode, you get all the fixes and improvements as described in the chapters above. All config settings are at default in Standard mode. If you select this Core option in MOO2 Launcher, the Map option field is automatically set to Standard too.



1.50 Improved

The 1.50 improved mod (150i) aims, as the name suggests, to improve on the standard experience by enabling enhancements to tactical combat and weapon mechanics and by making several tweaks, mostly 'consistency changes', while keeping major elements like custom race picks and the tech tree unchanged. Some notable changes are described below. More information about changes, like 150 improved map settings, updated weapons and specials stats, etc, can be found in the Excel manual. For a complete overview of all changes, refer to the actual [150i config files](#).

Toxic Planet Terraforming

Once Biomorphic Fungi have been researched or obtained otherwise, Weather Controllers can be built on Toxic worlds, transforming them to Barren climates.

Research

The accumulated research points (RP's) exceeding 2x the research cost of the tech being researched are now stored over instead of lost. In addition, accumulated RP's are not reset to 0 when the tech currently being researched is acquired from non-research means like spying, capture, or artifact planets.

AI Behaviour

The AI makes better use of colony bases and builds ships of better design. It is more likely to research the automated factory tech field early and can research hyper-advanced tech fields that miniaturize late game weapons and specials.

Tactics Skill

Since the Tactics and Tactics* skills do not work, the three leaders with this skill have been adjusted for 1.50 improved:



Khunagg

- Removed Tactics
- Added Assassin



Nimraaz

- Removed Tactics*
- Added Famous



Rash-Iki

- Removed Tactics
- Upgraded to Commando*

Commando Skill

A defending commando gets, just like an attacking commando already has in classic, 2.5x the normal bonus on the ground.

Skill Cost

The following skill cost have been revalued:

(2nd column denotes improved* version of the skill; classic values between brackets.)

Famous	30 60	(20 40)
Fighter Pilot	20 40	(30 60)
Spy Master	20 40	(30 60)
Tactics	10 20	(20 40)
Weaponry	40 80	(30 60)

Ship Initiative 2.0 (fka Strict Combat Sequencing)

This combat mode is an improvement of classic [ship initiative](#) combat. If enabled it automatically force-enables ship initiative, regardless of its setting in the Game/Settings menu. It changes rules for selecting which ship moves next: Combat is split in two stages, pre-wait and post-wait. In the pre-wait stage ships move in order of their initiative (highest to lowest) and can wait if they want to act later. In the post-wait stage ships move in reverse order (lowest initiative to highest) and cannot use the Wait button anymore. Because the Wait button can be used only once for each ship, the player can no longer cycle ships endlessly.

Missile Initiative

In classic games with ship initiative off, missiles move at the end of each combat turn, while with ship initiative on, missiles move at the end of the next turn. In 1.50 improved, missiles move at the end of the combat turn the same way as in classic games with ship initiative off. In addition, missiles launched in different turns will not glue together. Under classic rules, missile stacks from different turns can join and form one stack.

Simplified Beam Formula

This new formula fixes irregularities in the classic formula. In general the accuracy on ranges 6+ becomes lower and a large BA-BD delta won't cause the range penalty to be ignored (range 6+ is; 7+ squares for Pd, 16+ for normal and 34+ for Heavy mount). At the same time [ranged_to_hit_penalty](#) has been lowered by 5 in 150i for the ranges 6, 7 and 8: from -55, -70, -85 to -50 -65 and -80.

Star Bases

Since the enabling of `simplified_beam_formula` lowers accuracy at longer range and star bases are immobile hence often have to fire from longer distances, the attack bonus of all satellites has been raised by +10. This raises beam attack and initiative of the whole defending fleet by the same +10.

Interactive Combat Stats

Under classic combat rules, ships recalculate most of their stats at the beginning of the next turn. First, this is inconsistent with several effects applying immediately. Second, this is somewhat counterintuitive, e.g. a ship tracted to full immobilization is legal for boarding (counted as immobile), while still being able to move. Interactive Combat Stats (ICS) causes ship stats to update *within* the turn, as soon as any event affecting them occurs. Note that with ICS enabled, each ship's initiative rating can also change *during* the turn, affecting ship ordering instantly.

Involved stats are:

- Ship speed and immobility state
- Ship move points (amount of squares a ship can fly this turn)
- Beam attack
- Beam defense
- Missile evasion
- Fleet ordnance bonus

Involved events are:

- Cloaking / Decloaking
- Tractor beam attack / cessation
- Black Hole Generator attack / cessation
- Damaging of internal system (special, drive or computer)
- Ship destruction, retreat or capture

Example 1: Ship Destruction.

Destroying enemy ship A may result in:

- Cessation of tractors from A towards our ship B.
 - Ship B becomes mobile.
 - B's speed increases, consequently beam defense increases.
 - B's move points increase (restore), it can now move.
- Death of a leader on ship A.
 - Enemy fleet loses beam attack bonus provided by the leader.
 - Enemy fleet loses ordnance bonus from the leader.

For the same event in classic (or with ICS off) only the mobility state is changed. The rest of stats do not update until the end of the turn and ordnance does not change for the rest of the battle.

Example 2: Ship speed update.

Let's assume that a ship with speed 10 and 8 unused move points has just been fully stopped with tractor beam:

- Classic: ship is immobile, but the only effect of it is that it can now be boarded, otherwise it still can move up to 8 squares and keeps the defense bonus from speed.
- ICS: ship is immobile, can be boarded, cannot move and has defense decreased. Moreover it will regain full mobility and its 8 move points during that turn in case the tractor beam affecting it ceases (e.g. is destroyed).

If the tractor beam is removed on the next turn:

- Classic: ship becomes mobile and cannot be boarded, but still has zero move points and defense penalty from immobilization.
- ICS: ship is not immobile in any sense and regains 10 unused move points it acquired at the start of turn, because tractor beam effect 'stopping' the ship has ceased.

Note that setting a tractor weapon slot to yellow or red no longer stops the beam in 1.50.



Below two tables summarize the differences between 1.31/1.40, 1.50 standard and 1.50 improved with ICS. The columns are:

- **Move points** -- move points the ship can spend this turn.
- **Stashed speed** -- speed stashed in ship structure. It is updated by Tractor but not by BHG for some reason. The immobile label appears if this parameter is 0.
- **Immobile label** -- “immobile” is written in red over ship icon on info panel.
- **Calc speed** -- speed calculated by Calc_Current_Speed according to all current effects on ship. At the beginning of each turn this function is called and the result is stored in the Stashed speed field. Most checks on ship speed actually recalculate it rather than use Stashed speed, e.g. an ability to board corresponds to Calc speed, not to Stashed speed.
- **Boardable** -- can ship be targeted by a boarding action by ships without transporters.

The tables show that 1.50 standard makes column Boardable consistent with “Immobile” label, and column Stashed speed consistent with Calc speed. 150i ICS also makes Move points consistent with both speed columns.

Table 1. The effects of firing with Tractor / BHG at a ship with moves left.

1.31/1.40	Move points	Stashed speed	“Immobile” label	Calc speed	Boardable
Tractor	> 0	0	yes	0	yes
BHG	> 0	> 0	no	0	yes
1.50 standard	Move points	Stashed speed	“Immobile” label	Calc speed	Boardable
Tractor	> 0	0	yes	0	yes
BHG	> 0	0	yes	0	yes
150i ICS	Move points	Stashed speed	“Immobile” label	Calc speed	Boardable
Tractor	0	0	yes	0	yes
BHG	0	0	yes	0	yes

Table 2. The effects of releasing ship from Tractor / BHG on the next turn of firing.

1.31/1.40	Move points	Stashed speed	“Immobile” label	Calc speed	Boardable
Tractor	0	0	yes	> 0	no
BHG	0	0	yes	> 0	no
1.50 standard	Move points	Stashed speed	“Immobile” label	Calc speed	Boardable
Tractor	0	> 0	no	> 0	no
BHG	0	> 0	no	> 0	no
150i ICS	Move points	Stashed speed	“Immobile” label	Calc speed	Boardable
Tractor	> 0	> 0	no	> 0	no
BHG	> 0	> 0	no	> 0	no

Melee

Another type of mod entirely, is the experimental Melee mod for 2-player tactical combat. The melee map has 4 systems: Orion, 2 home systems, and a neutral system. Each player builds 30 command points worth of ships. Both players send their fleet to the neutral system and duke it out. No retreating! The loser can now make designs to counter his opponents ships and rebuild his fleet, while the winner adds new ships (can be new designs also) to his surviving ships until he again has a fleet worth 30 command points.

New Game settings

Difficulty Level:	Any
Galaxy Size:	Small
Galaxy Age:	Any
Players:	2 (Any other # will crash the game on mapgen!)
Tech Level:	Pre-warp, Average, Post-warp (Advanced will crash the game!)
Tactical Combat:	On
Random Events:	On/Off (Events are delayed by 127 turns)
Antarans Attack:	On/Off (Antarans are delayed by 127 turns)

Command usage per ship class

Frigate	1
Destroyer	2
Cruiser	6
Battleship	10
Titan	15
Doom Star	30

The config is not described in detail here since it's very much in beta. Three parameters of note are:

`multibuild = 1;`

Enables multiple ships to be built each turn. New (beta) parameter. Used in Melee mod. Known bug: Colony on Trade Goods gets both BC and production points each turn.

`confirm_battle_message_timeout = 90;`

Sets the timeout for the disappearance of the confirmation messages "X attacks Y at Z", "outpost destroyed" and "colony captured by mind control" in Multiplayer. The timeout is in ticks and set to 90 for the melee mode. The default 32767 is approximately 30 minutes.

`auto_close_board_result_popup = 1; *`

If set to 1, the pop-up of boarding results for raid and capture will close automatically, using the same delay as in AUTO combat. Useful for multiplayer games, because with this setting enabled the defender does not get an action when it isn't his turn.

Mapmods

In addition to the standard, 150i and melee maps, four more mapmods are available:

ICE

Small galaxies have 35 stars instead of 20 in a size equal to that of the classic Medium galaxy. Medium galaxies have the same size as Large ones, but with 47 stars instead of 54 (Classic medium has 36 stars). Large and Huge galaxies have 59 and 71 stars respectively. The star density of the Large galaxy has been increased with a script. ICE map generates galaxies with less black holes, more satellites per system especially for white stars, but less Gas Giants and Asteroid belts. Planet quality is somewhat improved and the chance for wormholes is lowered to 3%.

ICE MP (multiplayer)

Galaxies have 30, 54, 63 and 71 stars from small to huge. The star density is the same for all galaxies. All home systems have 5 planets. The Orion system is disabled, it is replaced by a regular star. Splinter worlds are replaced by Gem Deposits. Chance for wormholes is only 1%.

Orange

All stars in an average aged galaxy are of orange color, all stars in a young galaxy are white, while old galaxies have only red stars. The Orange mapmod should help players that do not like empties, singletons or rocky planets in their neighborhood. There are less Gas Giants and Asteroids and more planets generated per system. In average and old galaxies, systems with Ultra Rich planets are always guarded by a monster. The chance for wormholes is 3%.

GoodMap3

Goodmap3 generates 3 planets in every system and all planets are from the 'Life Supporting' group, which, as the name suggests, creates more hospitable galaxies than classic mapgen does. GM3 for 1.50 is modified from the classic Goodmap3, further improving planet quality. Systems with Ultra Rich planets are always guarded by a monster and the chance for wormholes is only 1%.

Modding with Config

Overview

This patch uses configuration files to customize the game and to support mods. They are plain text files and can be viewed and edited with Notepad or any other plain text editor. Config is modular, each config file can "include" other config files. This helps keeping config files short while allowing easy switching between mods. By default the game loads ORION2.CFG on startup, which may look like this:

```
include 150\150i.CFG;  
# include 150\ICE-X.CFG;
```

In this example the mod 150i is enabled and ICE-X is disabled (commented out by # sign) and. If you comment out 150i and uncomment ICE-X, the game will start with ICE-X enabled.

A quick way to understand config syntax is to look inside the configs that are shipped with this patch. For a more formal description about config machinery continue reading.

Startup and Command Line

By default the game loads ORION2.CFG from the game folder. It will complain and terminate if this file does not exist or is malformed. Although most users will never need to use anything but this default file, there is a way to provide another file or even several files. This is done by using /c switch:

```
ORION150.EXE /c=A.CFG
```

If you did specify at least one /c switch then configs provided this way will be read instead of ORION2.CFG. In the example above config will be loaded from A.CFG. You can specify /c several times, in this case files will be loaded sequentially. You may specify paths, but remember that all file and directory names must be in DOS 8.3 format.

If all config files have been loaded successfully the game will extract all current settings to EXTRACT.CFG. This file is a full config and can be loaded (for example you can rename it to ORION2.CFG and restart the game). Extraction is mostly intended as an aid for modding and development, but you can also use it to review your current settings. For creating a new mod EXTRACT.CFG is a good starting point: make a copy of it in the 150\mods\ folder, rename it to a new mod name and adjust parameters.

You can change extracted file's name by specifying /extract command line switch:

```
ORION150.EXE /extract=X.CFG
```

Reloading and Extracting on the Fly

You can reload config without restarting the game. This is done by pressing [ALT-RE](#) in main screen, colony build screen or in combat, after which success or failure is reported via a pop-up. This is very useful for testing but can be used to cheat so it won't work in multiplayer games.

You can extract current settings anytime in the same mentioned screens. Press [ALT-EEE](#) and the game will write settings to `EXTRACT.CFG` (or whatever was specified in `/extract=`). This again is mostly for testing and modding, but you can also use it to check server's game settings if you are a client in network multiplayer.

Network Synchronization

In network multiplayer the host's config is broadcast and applied by clients so that all sides have the same game settings. This doesn't change config files on client's disk, only memory state for the duration of the game. Only non-interface options are broadcast, so if the host has renamed some weapon, the change will be visible only to the host. The same goes for parameters like [scroll_interval](#), [clear_button](#), etc.

Syntax

The syntax should be fairly obvious from reading `ORION2.CFG` or `EXTRACT.CFG`, but for those interested here is the summary:

- Config file supports comments. Character <#> and anything after it is considered a comment until the end of the line. This can also be used for disabling parts of config.
- Empty lines are ignored, series of whitespaces are equivalent to a single space.
- Apart from comments, config consists of parameter assignments and commands. Both are terminated by a `;` symbol.
- Commands are: [include](#), [enable](#), [stop](#).
- Command [include](#) triggers parsing of a subconfig (by file name).
- Command [enable](#) is used by MOO2 Launcher to mark enabled mods (by `mod_id`).
- Command [stop](#) skips the rest of the current file.
- Each parameter assignment changes some game rule, e.g. the following will make the game use Point Defense on fighters' beams: [fighters_use_pd = 1](#).
- Each parameter has a type: a number, a ratio, a fixed set string or an arbitrary string.
- Numbers can be written in decimal or in binary form.
- Parameters of type ratio are needed to represent rational numbers. They are specified as two numbers separated by `/` symbol.
- Strings containing whitespaces or special symbols `" # ;` need to be surrounded by double quotes (`""`). The [escape character](#) is [^](#).

Commands

Include

Command `include` allows to spread configuration among several files. Its primary function is to allow easy enabling and disabling of mods, but also can be useful if you want to separate several aspects of a mod. For example game rules and map generation rules are generally independent, so you can write:

```
include 150\MyMod.cfg;  
include 150\harshmap.cfg;
```

This way you will be using MyMod.cfg game rules with map generation controlled by harshmap.cfg.

Relative Include

By default, all file paths in config are relative to the game directory, but paths starting from `.\` are interpreted relative to the CURRENT FILE, e.g. if you have file:

```
150\mods\my.cfg
```

Then inside it, two following includes are equivalent:

```
include 150\mods\cfg\extra.cfg;  
include .\cfg\extra.cfg;
```

Variable Include

File path in `include` is actually a template that supports variables `LANG`, `LANG_ID` and `LANGUAGE`, e.g. the following command:

```
include 150\MyMod\${LANGUAGE}\mymod.cfg;
```

will include file `150\MyMod\English\mymod.cfg` if your installation has English set as a language. This allows to create multilingual mods. Variables and their values are:

Installation Language	\$LANGUAGE\$	\$LANG\$	\$LANG_ID\$
English	English	en	0
German	German	de	1
French	French	fr	2
Spanish	Spanish	es	3
Italian	Italian	it	4

Installation language may be changed by putting a number from `LANG_ID` column to `language.ini` file in the game directory and restarting the game.

Optional Include

Normally include requires a file to exist. The game will report an error if the file being included is missing. This can be prevented by putting `?` before the file name:

```
include ?150\maybe.cfg;
```

This prevents the config loader from aborting if 150\maybe.cfg does not exist.

Stop

You can skip the rest of the current file using `stop` command:

```
stop;
```

It has no arguments and is intended for testing. Note that config parsing will continue after include if current file was included. For example if file's A 10th line is `include B`; and file's B 20th line is `stop`; then lines beyond 20 in B are skipped and parsing continues from line 11 of A.

Single Value Parameters

The General form of setting a parameter is:

```
<parameter> = <value>;
```

Here parameter is one of fixed parameter names like `speed_fast_bonus`, `android_morale` or `mod_name`:

```
speed_fast_bonus = 4;
android_morale   = workers_only;
mod_name         = "My mod";
```

Here all 3 parameters have different types. The first is a number, the second is a string from a fixed set and the third is an arbitrary string.

Numeric Value

Numeric parameters accept numbers in a certain range. Each parameter has its own range, for example `speed_fast_bonus` can be 0 to 255, while `fighters_use_pd` can be only 0 or 1 (this is called boolean; for such parameters 0 means disabled or off and 1 means enabled or on). Sometimes you need to write parameter in binary (a bit mask), this can be done by prepending a value with 0:

```
weapon plasma_cannon available_mods = 010010;
```

Here 010010 is a binary form of the number 18. All numbers starting with 0x are parsed as hexadecimal, for example 0x1a or 0x1A equals to 26. Any other number starting from 0 is interpreted as binary, so writing 0123 will result in a parse error (2 and 3 are not binary digits).

Ratio Value

Ratio value represents a rational number. This is needed when ratio cannot be accurately expressed as percentage and rounding is undesirable for some reason. It consists of two 16 bit integers separated with / symbol:

```
govt_bonus feudal_reduction = 1/3;
```

Note that no space is allowed between / and numeric components, but you can optionally drop /<num> part if you want an integer value, i.e. specifying 2 is legal and is the same as specifying 2/1.

String From a Fixed Set

Some parameters accept a string from a fixed set. For example `android_morale` accepts one of 8 strings:

- `workers_only`
- `farmers_only`
- `scientists_only`
- `farmers_and_workers`
- `workers_and_scientists`
- `farmers_and_scientists`
- `all_droids`
- `none`

You cannot write “all_androids” for example. The list of options for each parameter can be found in the corresponding entry in PARAMETERS.CFG.

Arbitrary String Value

Some interface parameters like `mod_name` accept arbitrary strings:

```
mod_name = MyMod;
```

If you want spaces or special symbols inside the string you'll need to use double quotes:

```
mod_name = "MyMod version 1.0";
```

Inside the quotes all special characters but " and ^ are interpreted as part of the string. For example a # symbol inside a quoted string will not start a comment. Symbol ^ is an [escape character](#) and allows the use of symbols " and ^ in strings.

Table Parameters

Some parameters are tables. You can set a single value or the whole table in one shot. To set a single value in a table:

```
<table> <row> <column> = <value>;
```

E.g. to set damage bonus for point defense mount when no high energy focus is present:

```
mount_dmg nohef pd = 50;
```

To set the whole table:

```
<table> = <value1> <value2> ... <valueN>;
```

E.g.:

```
mount_dmg = 50 100 150 75 150 225;
```

The latter form is called *bulk notation* and requires you to know the order of rows and columns. Consult PARAMETERS.CFG comments for specific table, columns and rows are listed in the correct order there.

You do not have to always specify the whole table, you can specify a part of it:

```
mount_dmg hef pd = 75 150 225;
```

In this example you can also drop Pd if you know it's a first column:

```
mount_dmg hef = 75 150 225;
```

In tables you usually want to specify all values for completeness but if you want to leave some intermediate values unchanged you may skip items by using - (dash) symbol:

```
mount_dmg nohef pd = 50 - - 75;
```

In this example values 50 and 75 are assigned to Pd mount without and with HEF respectively. Two dashes skip values for normal and Hv mods without HEF.

More bulk notation examples can be found in [Modding Notes](#) section.

LBX substitution

For a number of LBX files you can specify an alternative file to be loaded instead. This is useful to provide custom texts or graphics. Since 1.50.5 this feature is also used for multilingual support.

If you specify non-existing files the game will refuse to start or reload config. The check is simplistic and cannot detect malformed files, using those will result in sudden crashes. The following LBXs are supported:

- Cmbshp
- Credits
- Colsysdi
- Combat
- Diplomse
- Estrings
- Eventmse
- Fonts
- Help

- Herodata
- Hestrngs
- Info
- Kentext
- Kentext1
- Maintext
- Newgame
- Officer
- Raceicon
- Racename
- Races
- Racesel
- Rstring0
- Shipname
- Ships
- Skildesc
- Starname
- Techdesc
- Techname

For example:

```
info.lbx = 150\MyInfo.LBX;
```

Here we tell the game to load MyInfo.LBX from 150 subdirectory instead of INFO.LBX.

To reset to a default LBX set the corresponding parameter to 0 (a null string):

```
info.lbx = 0;
```

You can change these parameters on the fly because most LBXs are loaded on demand whenever the game needs them.

Multilingual mods require different LBXs depending on current language. To support such mods all lbx parameters are processed as templates similar to [include](#) command's templates. Actual filename depends on the current language, e.g. this:

```
help.lbx = 150\HELP_${LANG$.LBX};
```

will expand to 150\HELP_EN.LBX if your current language is English. Refer to [include](#) command description for the complete list of variables and their values. Note, that unlike [include](#) templates, optional files via [?](#) are not supported.

Default Configuration

This patch comes with an extensive configuration. The main config file is ORION2.CFG, and it refers to other config files by means of the “include” command. Default configuration is also supplied in machine-readable form in config.json.

ORION2.CFG

ORION2.CFG specifies the location of build lists, scripts, updated 1.50 LBX's as well as other CFG's to be loaded:

```
build.cfg = 150\build\BUILD$ID$.CFG;
```

Location of all eleven build lists.

```
main.lua = 150\scripts\main\MAIN$ID$.LUA;
```

Location of main scripts.

```
newgame.lbx = 150\lbx\NEWGAME.LBX;
```

This is a **required file** that contains updated graphics for the New Game screen. Without it the 1.50 exe will crash. The file has been made optional and not a replacement of the original to preserve compatibility with the classic exe's: This updated lbx file cannot be used with version 1.31 or 1.40.

```
race sel.lbx = 150\lbx\RACESEL.LBX;
```

Contains the redrawn Darloks button, without letter 'c' in the name.

```
colsysdi.lbx = 150\lbx\COLSYSDI.LBX;
```

Fixes colors for tiny toxic, radiated and barren planets in the Colony screen.

```
techname.lbx = 150\lbx\TECHNAME.LBX;
```

This file contains a couple of spelling corrections.

```
eventmse.lbx = 150\lbx\LANG$\EVENTMSE.LBX;
```

Required file containing GNN news fixes (available in all languages).

```
estrings.lbx = 150\lbx\LANG$\ESTRINGS.LBX;
```

Required file because it supports the updated Colony Info Summary window in the Colonies screen (available in all languages). The English language file also contains updated Leader Hire Pop-up texts and several spelling corrections.

```
help.lbx = 150\lbx\LANG$\HELP.LBX;
```

English only: Contains corrected and substantially improved descriptions.

```
hestrngs.lbx = 150\lbx\LANG$\HESTRNGS.LBX;
```

English only: Contains several text corrections.

```
maintext.lbx = 150\lbx\LANG$\MAINTEXT.LBX;
```

English only: Contains a text correction.

`rstring0.lbx = 150\lbx\${LANG$\RSTRING0.LBX;`

English only: Deletes 'Used' that appeared after Robotic Factory in the Industry Summary.



`skildesc.lbx = 150\language\${LANG$\SKILDESC.LBX;`

English only: Corrects texts of Leader Skills.

`techdesc.lbx = 150\language\${LANG$\TECHDESC.LBX;`

English only: Corrects weapons and specials texts as seen in the Ship Design Dock.

`scan_mods = 150\mods;`

Where to search for mods.

`include ?150\ENABLE.CFG;`

Contains the mods that are enabled by MOO2 Launcher. Set your desired mods in ENABLE.CFG manually when not using MOO2 Launcher.

`enable USER;`

Causes USER.CFG to be included after all other mods. See [Custom Interface Settings](#).

USER.CFG

Config file 150/USER.CFG contains all user specific interface settings. This file can be opened from MOO2 Launchers Edit menu. The settings are:

`disable_vsync = 0;`

Screen switches can be made even faster by setting `disable_vsync = 1`. With this setting screen switches happen without delay, greatly speeding up the interface. It might produce some funky colors during screen switching from time to time.

`screen_fade_speed = 25;`

Sets fade-ins and fade-outs when switching screens. The 1.50 default setting is 25, while classic was 10. Values up to 100 can be set.

scroll_interval = 2;

Slows down edge based scrolling in tactical combat. The scroll interval value sets the number of ticks between scrolling events. One tick is approximately 1/18 of a second. We have set the default at 2 ticks. 1-3 ticks should be optimal for most people. Set it to 0 to experience the classic scrolling behavior, which is unreasonably fast on modern computers.

wormhole_color = 4;

This parameter specifies the index of the color used to draw wormholes. Possible values are 0-255. Classic value of 4 is a dark grey (default). Use 10 or 20 for lighter greys. Color map:



no_graph_smoothing = 1;

if set to 1, history graphs will not be smoothened.

no_initial_tech_prompt = 0;

If set to 1, the Select Research prompt on turn 1 is skipped.

no_outpost_prompt = 0;

If set to 1, the outpost creation prompt upon arrival at a system is skipped.

warn_blockers = 0;

This config parameter allows to skip the “repeat before a product” dialog in the Colony Build screen. Depending on this and the ‘Auto Delete Trade Goods/Housing’ setting, repetitive items (housing, trade goods or repeat builds) in the queue may be deleted, kept, or a dialog will appear asking what to do upon exiting the Colony Build screen.

	warn_blockers = 1	warn_blockers = 0
Auto Delete = off	ask	keep
Auto Delete = on	delete	delete

Classic default behaviour was to ask and 1.50 default is to keep. Additionally the 'Auto Delete Trade Goods/Housing' setting now functions properly when using the , and . keys to cycle colonies in the Colony Build screen.

design_button_shield = update;

This parameter controls if the shield of a ship design is updated to best available or stays as is upon clicking the Design button (in Colony Build screen). The default is set to 'update', which is classic behavior. Alternatively it can be set to 'intact', which disables this auto update and preserves current designs.

design_button_computer = update;

Same as above, but for computer.

clear_button_shield = intact;

This controls how the CLEAR button in Ship Design (Design Dock) behaves regarding shield. The three options are:

- intact - Don't change shield currently set (default, classic).
- update - Update to the best available.
- clear - Set to none.

clear_button_computer = intact;

Same as above, but for computer. Classic is 'update', which is inconsistent with shield behaviour: It doesn't remove the shield but puts the best available computer to the design. In 1.50 the default is 'intact', the same as for the shield.

missile_ammo_x2 = 1;

Default ammo when selecting a missile in Ship Design is x2. Classic is x5.

confirm_battle_message_timeout = 180;

Timeout for the following combat confirmation messages in Multiplayer: 'X attacks Y at Z', 'outpost destroyed' and 'colony captured by mind control'. The value 180 is approximately 10 seconds.

auto_close_board_result_popup = 1;

If 1, board results pop-up times out like AUTO resolve.

no_center_on_next_ship = 0;

If 1, the Combat screen is not centered on the next ship, in the same way it is in combat with ship initiative off.

finds_presented_by_scientist = 0;

If 1, a scientist instead of a trooper presents tech finds from artifacts planets.

rebel_display = 0;

Rebels are only present on conquered colonies. With this parameter a rebel picture along with statistics can be shown in a colony's military pop-up anyway.



```
info_lbx_menu = classic; info.lbx = 0;
```

Setting `info_lbx_menu` to 'ice' instead of 'classic' and loading the corresponding INFO.LBX with `info.lbx = 150\INFO.LBX` causes the INFO menu to start with the Turn Summary instead of the History Graph button:



```
# format version = "Version: $VERSION$" 1 r 587 408;
```

If enabled, sets the position of the version number on the Title screen for all mods.

```
# format mod_name = "Mod: $MOD$" 1 r 587 422;
```

If enabled, sets font size, alignment and position of the config name on the Title screen for all mods.

```
# format prod = "$TURNS$ turns" 0 l 531 103;
```

If enabled, sets placement of turn counter on the Colony screen for all mods.

```
# format prod2 = "$TOTAL_PROD$ / $PRODUCT_COST$" 0 r 625 103;
```

If enabled, sets placement of stored production and item total production cost on the Colony screen for all mods.

```
prod_format housing = -2 g0;
```

Prod format allows to reorder building list items in colony production screen and to assign color groups to products. The first parameter is called order and defines order in which products appear in the list. Items with smaller order appear first. Items with same order are sorted alphabetically. E.g. by default order is -2 for housing, -1 for trade goods, and 0 for all buildings. This places housing first, trade goods second and then all buildings sorted alphabetically. The second parameter sets color group for item, see [font_color_group](#) below.

```
font_color_group g0 normal = 0xCC 0xCB 0xC9;
```

```
font_color_group g0 queued = 0x99 0x98 0x96;
```

There are 10 groups in total, g0 through g9. Each group has a color for products not in the build queue (normal) and for products added to the build queue (queued). Each color has three components: base, dim and dark. The two latter are needed for anti aliasing. For best effect they should be darker shades of the same color as base. Each color is a palette index from 0 to 255. By default all groups are set to the classic orange font. The palette is:



ENABLE.CFG

This file 150/ENABLE.CFG lists the enabled mods. It is generated automatically by MOO2 Launcher every time it starts the game, so all manual edits are lost. Its defaults are:

```
enable 150i;          (core mod)
enable MAP1_150i;     (map)
```

Edit these enables manually if you want to play another mod and are not using MOO2 Launcher. For example to play ICE-M, comment out (or delete) the existing lines and write:

```
enable ICE-M;         (core mod)
enable MAP2_ICE;      (map)
```

Choices of mods included with the standard pack are:

Core Mod	Mod Name
enable 120c;	Version 1.2
enable 150;	Standard
enable 150i;	1.50 improved
enable 150ip;	1.50 improved + Picks
enable ICE-M;	ICE-M
enable ICE-X;	ICE-X
enable Melee;	Melee
enable VDC-REG;	VDC ...-REG
enable VDC-GM3;	VDC ...-GM3
Map	Map Name
enable MAP0_STD;	Standard
enable MAP1_150;	1.50 improved
enable MAP2_ICE;	ICE
enable MAP2_ICE_MP;	ICE MP (multiplayer)
enable MAP5_GM3;	Goodmap3
enable MAP5_GM3_MP;	Goodmap3 MP (multiplayer)
enable MAP6_OR2;	Orange
enable MAP7_MELEE;	Melee (2 players)
enable MAP9_SQUARE;	Fixed Square (8 players)
Additional Options	
enable 1_NOSURR;	AI's do not surrender before turn 1000

150i.CFG

This base config for the mod 1.50 improved contains the following items:

```
enable MAP1_150;
```

This sets the 1.50 improved map as default map in MOO2 Launcher. If you choose the mod 1.50 improved in MOO2 Launcher, then it will automatically select the 1.50 improved map as well. You can select any other map manually as you wish.

```
combat.lbx = ..\..\lbx\COMBAT.LBX;
```

Loads updated picture file containing a greyed Wait button needed for Ship Initiative 2. Ship Initiative 2 is enabled in tweaks.cfg.

```
herodata.lbx = lbx\${LANG$\HERODATA.LBX;
```

Loads updated herodata for all languages.

```
help.lbx = ?lbx\${LANG$\HELP.LBX;
```

Loads updated help file for the English language only.

```
techdesc.lbx = ?lbx\${LANG$\TECHDESC.LBX;
```

Updates Multi-Phased Shields text for Ship Design dock.

```
include 150\mods\150\150i\AISHIPS.CFG;
```

```
include 150\mods\150\150i\ANTS.CFG;
```

```
include 150\mods\150\150i\RACES.CFG;
```

```
include 150\mods\150\150i\TWEAKS.CFG;
```

Loads sub configs of 1.50 improved. Some notable options contained in these four files are described in chapter [Game Modes](#) and in the Excel manual (map, weapons, specials, aiships, etc).

```
newgame_postprocessor_script = 150\mods\150\cfg\TECHTREE.LUA;
```

Loads scripting file that modifies the techtree for AI and for Uncreative races.

Modding

Config parameters are many, so not all are listed in this manual. The complete overview can be found in PARAMETERS.CFG, which lists each parameter along with some description and minimal usage example. It can serve as a reference for determining row and column order needed for using bulk notation. Other sources of information are the file EXTRACT.CFG and the mods supplied with the patch.

Switches

Command Line Switches

The command lines switches from the 1.40 patch are still supported even though they have a config counterpart. Note that switches specified on the command line take precedence over those specified in Config.

1.31 switches		
Command line form	Config form	Meaning
/skipintro	-	Skips the intro movie.
/date	-	Displays the version date and exits game.

Game rule switches		
Command line form	Config form	Meaning
/noreport	/noreport = 1;	The report button on the diplomacy screen will be disabled, preventing you from seeing your opponent's technology. Also, Technology demands and trades are greyed out.
/noscan	/noscan = 1;	Disables the scan button in combat. Detailed scans of ships will no longer be possible. Only quick scans will be possible by mousing over the ships.
/nohousing	/nohousing = 1;	The housing option will no longer be available from the build list and housing production will not be possible. (The 150% bonus to population growth has been removed. It can be set separately)
/droids	/droids = 1;	All players start out with the ability to build androids (all 3 types).

The switch /picks was removed because of its range limitation of 10-14 picks. The number of picks is now accessible via the parameter [number_of_race_picks](#).

Map generation switches		
Command line form	Config form	Meaning
/seed=0 (v1.31 switch)	-	Seed for random number generator. Valid values are signed long integer (-2,147,483,648 to 2,147,483,647). Default is 0. Savegame address: 0x108 - 0x10B (4 bytes). Seems to only affect the first galaxy map generated and does not affect monster placement.
/nobh	mapgen /nobh = 1;	No black holes on a map.
/nowh	mapgen /nowh = 1;	No wormholes on a map.
/nonebula	mapgen /nonebula = 1;	No nebulae on a map.
/nosplint	mapgen /nosplint = 1;	No splinter worlds unless there is a monster guarding it.
/noorion	mapgen /noorion = 1;	Orion and the Guardian are not placed on a map.
/monsters=255 (v1.31 switch)	mapgen /monsters = 255;	Set the number of monsters. The default of 255 means a random number will be used.
/planets=3	mapgen /planets = 3;	Sets the minimum number of planets in all home systems. Valid values are 1-5, the default is 3.
/minstart	mapgen /minstart = 1;	The unoccupied planet closest to the star in all home systems will be at least 2 production per worker to a normal G race.
/hugestart	mapgen /hugestart = 1;	The unoccupied planet closest to the star in all home systems will be Huge and its gravity will match that of the homeworld.
/richstart	mapgen /richstart = 1;	The unoccupied planet closest to the star in all home systems will be Rich and its gravity will match that of the homeworld (this parameter is ignored if /goodstart parameter is specified).
/goodstart	mapgen /goodstart = 1;	The unoccupied planet closest to the star in all home systems will be Ultra

		Rich and its gravity will match that of the homeworld.
Note: The switches /minstart, /hugestart, /richstart and /goodstart all affect the same ONE planet and their effects are cumulative.		

Mapgen.exe Based Parameters

The following parameters are modelled after the original implementation of the program 'mapgen.exe' by TF8. In this patch there is no need for launching external mapgen.exe against a saved game and then reloading it. All mapgen settings are specified in Config and apply each time you generate a map. There are no command line counterparts for these parameters.

For all parameters the first letter represents its type:

- t Terraform
- s Specials Change
- m Monsters Change
- b Balance Galaxy

mapgen -ttoxic = 1;	Toxic planets become radiated.
mapgen -tupoor = 1;	Huge Ultra Poor planets becomes Poor. Other Ultra Poor planets become Abundant.
mapgen -tlowg = 1;	Low Gravity planets become Normal Gravity.
mapgen -theavyg = 1;	Heavy Gravity planets become Normal Gravity.
mapgen -ttiny = 1;	Tiny planets become randomly from Small to Large. Except if -tsmall flag is used they become Medium.
mapgen -tsmall = 1;	Small planets become medium.
mapgen -sarti = 1;	Arti planets still exist, but don't give techs anymore.
mapgen -shero = 1;	All stars on the map that contain a hero become brown color, while brown stars without heroes become red color.
mapgen -smarooned = 1;	Marooned leaders are replaced by Pirate Caches. (Not in the original mapgen.)
mapgen -snatives = 1;	Natives are replaced by Gold Deposits.
mapgen -ssplint = 1;	Splinters are replaced by Gem Deposits.
mapgen -mgrav = 1;	Guarded planets become normal gravity.
mapgen -mterraform = 1;	Guarded Rich & U-Rich planets are terraformed: Toxics, Rads, Barrens, Deserts become Tundra.

<code>mapgen -mmonst = 1;</code>	Forces <code>-mgrav</code> and <code>-mterraform</code> .
<code>mapgen -tflathw = 1;</code>	Flattens unoccupied planets in home systems. They all become Abundant. Size is set in order: Large, Large, Large, Medium until there are no more planets to modify. Toxics and Rads become Barren and Gaia's become Terran. If your homeworld is Low-G or Normal-G, then all other planets will get the same gravity. If it is Heavy-G, all others become Normal-G except for one planet which becomes Heavy-G.
<code>mapgen -tfixedhw = 1;</code>	Forces <code>-tflathw</code> . Planets become: Large Abundant Swamp, Large Abundant Arid, Large Poor Tundra, Medium Poor Terran. If your homeworld is Heavy-G, then Swamp becomes Heavy-G.
<code>mapgen -tgaia = 1;</code>	Does not imply <code>-tfixedhw</code> . Fifth planet becomes Small Poor Gaia unless you are creative, aquatic or tolerant in which case it's Medium Poor Terran.
<code>mapgen -trichhw = 1;</code>	Makes first unoccupied planet Rich.
<code>mapgen -thugehw = 1;</code>	Makes first unoccupied planet Huge.
<code>mapgen -tgoodhw = 1;</code>	Forces <code>-trichw</code> and <code>-thugehw</code> . Makes first unoccupied planet Terran.
<code>mapgen -bshowring = X;</code>	Specifies radius in parsecs (X); all planets closer to their HW than X are revealed to players.

Number of Stars per Galaxy Size

With the `stars_in_galaxy` table the amount of stars can be set per galaxy size. The wide range of settings allows special galaxies to be generated, for example a small galaxy with only 3 stars. Keep in mind that certain settings can cause the game to stall during the galaxy generation phase. For example generation won't succeed if you start a new game with 8 players in a medium galaxy that is set to contain only 6 stars.

Planet Specials

With `planet_special_weighted_chance`, the chances for Wormholes, Natives, Deposits, etc. become configurable. All values combined should add up to 100 here.

Population

Population Capacities

Two parameters modify population capacities for each planet type:

```
pop_max      = 5 10 15 20 25;
pop_climate = 25 25 25 25 25 25 40 60 80 100;
```

The screenshot below from MANUAL_150.XLS highlights these values in blue:

POPULATION LIMITS CALCULATOR 1

BASE	Gaia	Terran	Arid	Swamp	Ocean	Tundra	Desert	Barren	Radiated	Toxic
Food Production	3	2	1	2	2	1	1	-	-	-
Maintenance Cost	-	-	-	-	-	-	25%	0%	25%	50%
Planet Size Multiplier	100	80	60	40	25	25	25	25	25	25
1 Tiny	5	4	3	2	1	1	1	1	1	1
2 Small	10	8	6	4	3	3	3	3	3	3
3 Medium	15	12	9	6	4	4	4	4	4	4
4 Large	20	16	12	8	5	5	5	5	5	5
5 Huge	25	20	15	10	6	6	6	6	6	6

Subterranean and Tolerant

With [pop_bonus_subterranean](#) and [pop_bonus_tolerant](#) the bonuses for respective racial traits can be set.

Biospheres and ACP

The Biospheres and Advanced City Planning bonuses can be set via separate parameters [pop_bonus_biospheres](#) and [pop_bonus_advanced_city_planning](#).

Android Morale & Cost

With classic settings, only the Android worker is affected by morale. Each android type can now have morale on or off. With the parameter [android_morale](#) all 8 variants can be set. In addition the cost of each toaster type can be set with:

```
misc_costs android_farmer    = 50;
misc_costs android_worker    = 50;
misc_costs android_scientist = 50;
```

Buildings

The build and maintenance cost of buildings can be configured. Take the cost of Armor Barracks for example. The default cost is 150 PP and 2 BC/T maintenance, which is quite expensive for a few cool tanks or Battleoids. It can be lowered by writing:

```
building armor_barracks cost = 60;
building armor_barracks maintenance = 1;
```

Or alternatively:

```
building armor_barracks cost = 60 1;
```

Initial Buildings

The number and types of buildings that each colony has built at game start depends on:

- Starting tech level (Pre-warp, Avg, Post-warp, Advanced),
- Population size of a colony.
- Known techs and
- Priority listing in the table [initial_buildings](#).

The number of starting buildings on each colony is capped to 3 for Prewarp, 5 for Average/Postwarp and 9 for Advanced game starts. Apart from cap, colonies with more population start with more buildings, the maximum number of buildings (not counting the Capitol) is $\frac{2}{3}$ pop rounded up. For example a HW with 8 pop can have 6 buildings on Advanced Tech start, but only 5 on Average start due to the cap.

Prewarp and Average Tech games only start with Marine Barracks and a Star Base because no other techs are Known that are also in the default initial buildings list. If, for example, Colony Base building is added to the [initial_buildings](#), it will be given to all players' homeworlds at game start.

The [initial_buildings](#) is a strict list, in that the game starts at entry 1, checks if it's allowed to place it and works its way down. The default list order potentially causes 1-3 pop colonies on Advanced to start without Marine Barracks because the first two list items are a satellite (#1-3) and Hydroponic Farms (#4). Marine Barracks is entry #5. See MANUAL_150.XLS for further details.

Productivity

Productivity bonuses

Config allows setting of all building and achievement bonuses for food, production, research, money and morale.

Weather Controller

The parameter [weather_control_climate](#) sets the minimum climate where weather controller can be built. As an exception, setting Radiated, will disallow the building only on radiated worlds (and not on both toxic and radiated worlds).

Biomorphic Fungi

Biomorphic Fungi normally add +1 to farming on non-farming worlds. Parameter [fungi_climate](#) allows to choose its behavior from 3 options:

- [classic](#) - affect only non-farming worlds
- [reversed](#) - affect only food-producing worlds
- [united](#) - affect all kinds of worlds

The +1 bonus can be changed using [food_bonus_biomorphic_fungi](#). Note that this bonus is in half-food units, so setting it to 1 corresponds to + $\frac{1}{2}$ food per farmer.

Food Replicator

The production cost of 1 food can be set with [replicator_food_pp](#), and the bc cost with [replicator_food_bc](#).

Toxic Planet Terraforming

With parameter [terraform_toxic_building](#), the building can be specified that will cause a Toxic climate to convert to a Barren one. In the 150 improved mod, this was set to Weather Controller, which can only be built on Toxics when Biomorphic Fungi technology

is Known. Setting this to Terraforming or Gaia Transformation will not work, since those two cannot be built on a Toxic planet.

Pollution Processor and Atmosphere Renewer

Ratios can be changed in Config. Note that the effects of Pollution Processor and Atmosphere Renewer are applied before Pollution Exempt Production is subtracted from the remaining worker production.

Nano Disassemblers

Production generates pollution and a base rule is that half of any production of your workers (including Robotic Factory output) will be used to clean up the pollution (rounded up) and the remainder is usable production. Every planet however is inherently tolerant to a certain level of pollution, and the size of that the "pollution exempt production" depends on the size of your planet. Nano Disassemblers technology doubles this value:

	<u>Base</u>	<u>Nano's</u>
Tiny	2	4
Small	4	8
Medium	6	12
Large	8	16
Huge	10	20

This multiplier '2' can be tweaked in Config with [nano_disassemblers_coeff](#).

Ships and Satellites

Hull Table

With the Hull Properties table, the cost and available space can be set for all ship classes and available space (not cost) for all three satellites. In addition, hit points for armor, structure, computer, drive and shields can be set, as well as the number of marines onboard. For strategic games, the number of beams, missiles, special weapons and bombs can be set as well as the defensive bonus and hit points.

Alternative Refit Formula

The classic refit cost is calculated as the larger of either twice the difference of the old and new cost (the delta) or the minimum refit cost, where the minimum refit cost is a quarter of the hull cost:

$$\text{cost} = \max(2 * \text{delta}, \text{min_refit_cost})$$

$$\text{delta} = \text{abs}(\text{new_cost} - \text{old_cost})$$

$$\text{min_refit_cost} = \frac{1}{4} \text{ standard hull cost.}$$

[alternative_refit = 1](#) sets a new refit formula, which calculates the cost as one time the delta cost (with a minimum of 0) plus the minimum refit cost:

$$\text{cost} = \max(\text{delta}, 0) + \text{min_refit_cost}$$

Automatic Update of Ship Designs

Ship designs are automatically updated when the physics tech field (laser) becomes known. Setting [no_designs_update_for_laser = 1](#) prevents such update.

Disabling of Engine Explosions

Setting parameter [broken_engine_explodes = 0](#) will prevent ships explosion due to destroyed engine. Ships with engine destroyed normally will just stay in battle. Self-destructing a ship will not cause an explosion. Intended for testing purposes.

Lander Ships Use Stealth **

Lander ships are Colony Ship, Outpost Ship and Transport. The table [lander_ship_uses_stealth](#) controls whether to install best stealth device available on landers. You can control this separately for each lander type.

Lander Ships Cost Table

Allows to set build costs for Colony Ship, Outpost Ship and Transport in config.

Lander Ships Size Class

Allows to set size class for lander ships in config.

Satellites Use Torpedoes

Setting [satellite_uses_torpedoes = 1](#), will arm satellites and missile bases with torpedoes if available. Available mods can be configured with [defenses_allowed_mods](#). For balancing the ratios of missile/torpedoes on satellites versus on a missile base the parameters [satellite_ammo_basis](#) and [missile_base_ammo_basis](#) have been introduced.

Special Systems

With parameter [starbase_special](#), 18 specials can be listed to be fitted on a satellite, of which up to 8 specials are actually fitted if available. Specials are not mutually exclusive here, except for slots 5a, 5b, 5c, and 6a, 6b, 6c of which only the highest ranked available special will be fitted.

Satellites Get SD bonus

If [satellite_racial_defense_bonus](#) is set at 1, the racial Ship Defense bonus will also apply to satellites and planetary bases.

Satellites Get Warlord bonus

If [satellite_warlord_bonus](#) is set at 1, the Warlord bonus will also apply to satellites and planetary bases and their crews will be of veteran skill level.

Defensive Range

Added [defensive_range_bonus](#) that sets a range bonus in 3-square range units to improve the range beam weapons on satellites and planetary defenses.

Captured Satellites Live

With the option `satellite_capture = 1`, a satellite that has been captured in battle, remains as a colony building if the colony is captured right after the battle. This option is off by default, which makes satellites impossible to capture, an intended classic behavior.

Command and Scanning

Command and Communications

Command usage per ship's size class can be configured with `ship_command_points_usage`. Note, that Lander ships size class is 0 (frigate) by default. Command bonuses for satellites and communication technologies can be set with `command_points`. Communications ranges can be customized with `ship_communication_range`.

Scan Table & Stealth Tables

All detection-related values are now configurable. Overmap scan and stealth bonuses can be configured using:

```
scan_bonus    <modifier> = <value>;
stealth_bonus <modifier> = <value>;
```

This allows to set distinct stealth bonuses for racial trait Stealthy Ship, and each of specials Stealth Field, Cloaking Device and Phasing Cloak. Use tab 'Detection' in the addendum to calculate the effects of custom settings.

Ground Defenses & Marines

Ground defenses Table

Ammo space for Missile Base and Ground Batteries can be modded. Amount of fighters per turn and ammo for Fighter Garrison can be set, as well as the frequency of replacements. The number of Stellar Converters and more can be set.

Planetary Damper Field **

Parameter `planet_damper` enables Damper Field to be used on planetary defenses instead of regular shields if available. This is cumulative with planetary shield if it's present, but doesn't reduce the damage when there is no defensive buildings left (similar to regular shields).

Ground Defenses Hit Points

The parameter `ground_defense_armor_multiplier` allows modification of the base 100 hit points to a maximum value of 127.

Civilian Hit Points

By default civilian structures (buildings, colonists, etc.) have 100 hit points each. As an option, with the table [civilian_armor](#) the hit points can be changed per individual armor technology.

Bonuses

With the [troop_type](#), [troop_bonus](#) and [rifle_bonus](#) tables most combat bonuses and hits of troops and marines can be configured.

Weapons

Weapons Table

Enables modding of cost, space usage, minimum and maximum damages. You can also change weapons' mods, both inherent (like Neutron Blaster's marine killing ability) and regular ones, obtained with miniaturization (like autofire).

For example lowering Plasma Cannon min/max damage from 6/30 to 4/20:

```
weapon plasma_cannon minimum_damage = 4 20;
```

To remove the continuous mod from Plasma Cannon its mods mask:

```
00000000000010010 (18 in decimal)
```

needs to become:

```
00000000000000010 ( 2 in decimal)
```

So write:

```
weapon plasma_cannon available_mods = 2;
```

or alternatively (starting 0 indicates a binary number):

```
weapon plasma_cannon available_mods = 010;
```

And combined you can write:

```
weapon plasma_cannon minimum_damage = 4 20 6 24 2;
```

Where '6 24' are unchanged damage values for strategic games.

Note that changing ammo values for weapons in this table can have unexpected effects (bugs). Tab 'Weapons' in MANUAL_150.XLS has an overview of all weapons mod flags.

Missiles Defensive Bonus

In addition to the defensive bonus that a missile receives from its speed (speed * 5), it gets a bonus depending on its type. The classic bonus values for Nukes, Mercs, Pulsos and Zeons are respectively: -10, +15, +40, +70. These bonuses are modified with [flyer_combat_modifier](#). For example, a bonus of +15 for Merculite Missile is set by: [flyer_combat_modifier merculite_missile_defense_bonus = 15](#).

Plasma Torpedo

Plasma Torpedo is moddable in the following ways:

- Added [plasma_torpedo_dissipation](#) to set plasma torpedo per travel square dissipation (5 by default).
- Speed has been made tunable via [speed_base plasma_torpedo](#).
- Damage has been made tunable via [weapon](#) table.

Although [weapon](#) and [speed_base](#) tables are not exclusive to plasma torpedo they are mentioned here because along with [plasma_torpedo_dissipation](#) they could trigger two hidden bugs described below. Both bugs don't occur in unmodded classic since classic values for plasma torpedo don't trigger them. Both bugs are fixed in 1.50:

- Fixed incorrect dissipation on impact. This happened when non-NR plasma torpedo survived more than one turn. For such torpedo dissipation was calculated as if torpedo was fired on the turn of impact. So if torpedo flies 20 squares on turn 1, then 3 squares on turn 2, and then hits the target, it loses $3 * 5 = 15$ damage points by dissipation, not $23 * 5 = 115$ as it should have. Note, that in unmodded classic this is impossible since plasma torpedo dissipates fully in one turn.
- Fixed instant dissipation on launch. When ship initiative is on and [missile_initiative](#) is set to -1, Plasma Torpedo would sometimes dissipate instantly when fired. This happened for some speed/damage combinations but not for others. For classic speed and damage the bug didn't occur.

Proton Torpedo

It's default range is 24 squares which can be set with [proton_torpedo_range = 8](#), where each range unit equals 3 squares ($24 = 8 * 3$). Travel speed is limited to the value set in [speed_base proton_torpedo](#) if [proton_torpedo_apply_speed_base](#) is set to 1.

Fighters

Several aspects of fighters' behavior were made configurable.

- In classic Fighters used normal mount beams instead of Pd. Now you can make them use Pd by setting [fighter_uses_pd = 1](#). Note that fighters' Pd damage is rounded up, in the same way as for ships.
- In classic Fighters used to deal up to listed damage +1 damage by any weapon but Mass Driver. For example a Fusion Beam fired from a Fighter can do max 7 damage instead of 6. Fighter's damage can be capped to weapon's maximum by setting [fighter_beam_no_plus_one = 1](#). Despite being most certainly a bug, the fixed behaviour was made optional to preserve certain classic strategies.
- By default, Fighters get an offense bonus of +50. This bonus can be changed using [flyer_combat_modifier fighters_offense_bonus](#).
- The number of shots each fighter has can be configured with [fighter_shots](#).

Heavy Fighters Can Target Missiles

As an option, Heavy fighters can be used as regular ones for fighter/missile interception if [heavy_fighter_can_scramble = 1](#). They attack flyers using their beams only.

Continuous Black Hole Generator

BHG is a continuous weapon by nature, because if the generator is destroyed its target is freed. But unlike other such weapons (tractor beam and stasis field) it's possible for a single BHG to affect two or more ships at the same time. This makes calculations of the number of freed targets somewhat inconsistent. Example:

- You have ship A with 2 BHGs.
- Enemy ships B and C are both inside black holes created by A.
- One of the generators on A is just destroyed.

In this example one ship (say B) will be freed from BHG but C will be not, as you still have one generator functioning (so not enough to hold two ships). Now you can trap ship B again with the remaining generator that was used in the previous turn to trap ship C. Ships B and C are now in black holes using just one generator. To solve this inconsistency [continuous_bhg](#) option was introduced. If enabled, BHG becomes similar to stasis in that you cannot use BHG on other ships as long as its current target is alive and affected by it.

Black Hole Generator & Boarding

By default, ships caught in a Black Hole can be boarded by enemy troops. We couldn't not help but wonder: Why are troops able to go into a black hole, board & fight on the enemy ship, then escape that black hole and return safely to the mothership? If you wonder as well, set [board_in_black_hole = 0](#). If boarding to BHG immobilized ships is disabled, boarding from such ships is prohibited too. Note that the AI will not self-destruct such ships to avoid capture.

Plasma Web Dissipation Mode **

A new setting for the Web, [plasma_web_dissipation_step = halve](#), where the total damage done by existing webs halves each turn, instead of decreasing by -5 (= minus5). When you choose halve, the maximum damage per turn can not grow larger than 2x the initial damage, while for the classic setting the damage keeps increasing until the ship is destroyed or the end of combat is reached. Especially when firing multiple Webs per turn, the damage potential can grow really large. Below table compares both settings for shooting a single Web and shooting 8 Webs each turn at the same target.

	1 Plasma Web				8 Plasma Webs			
	'minus5'		'halve'		'minus5'		'halve'	
Damage								
min - max	5	25	5	25	5	25	5	25
Enveloping	20	100	20	100	20	100	20	100
Dissipation	20	20	50%	50%	20	20	50%	50%
Turn	min	max	min	max	min	max	min	max
T1 dmg	20	100	20	100	160	800	160	800
T2 dmg	20	180	28	148	300	1,580	240	1,200
T3 dmg	20	260	32	172	440	2,360	280	1,400
T4 dmg	20	340	36	184	580	3,140	300	1,500
T5 dmg	20	420	36	192	720	3,920	308	1,548
T49 dmg	20	3,940	36	196	6,880	38,240	316	1,596
T50 dmg	20	4,020	36	196	7,020	39,020	316	1,596

Spatial Compressor

Added [compressor_per_size_class_damage](#) parameter which enables optional per size class damage increase for Spatial Compressor (larger ships receive more damage and smaller ones less). This is similar to how pulsar normally works.

Spherical Weapon Ranges

Ranges can be defined with [spherical_range_to_ship](#) and [spherical_range_to_missile](#).

Weapon Arcs and Mods

The cost and space of arcs and of each mod can be set with [arc_cost_and_space](#) and the table [mods](#). With [mods_available](#) individual mods can be enabled or disabled for the groups Beams, Missiles and Torpedoes.

2x Range Penalty

This somewhat obscure inherent mod used to cause a question: what essentially does it do? Nothing? Penalizes accuracy? Penalizes damage? Technically this inherent mod was properly penalizing accuracy, and was for example supposed to balance Plasma Cannon, by making it a very powerful weapon but only at a short range. That didn't work as intended though. Perhaps the 2x penalty has more sense affecting the dissipation instead. Therefore, 1.50 allows the choice between both ways, or a combination:

- [2x_range_accuracy_penalty](#), double accuracy penalty for the 2x weapon mod (original, default);
- [2x_range_damage_penalty](#), double damage dissipation for the 2x weapon mod.

Enveloping Mod

Setting [planet_non_enveloping](#) = 1 disables the enveloping weapon mod against a planet (except Stellar Converter).

Inherent Mods

Several inherent mods now also work for missiles/torpedoes:

#0 Shield damage only ('Zeroth'),

- #3 Internal systems damage (Ion),
- #4 Kills marines (Neutron),
- #5 Extra structural damage (Graviton).

ESD Flag

The bonus of the Extra Structural Damage flag (Graviton Beam) can be set in config. Extra Structural Damage subtracts the ESD value from a ship's structure (not a damage dealt technically, similar to Spatial), while the regular damage part is just a usual damage, like from most other weapons.

Zeroth Weapon Flag

The zeroth weapon flag has been made usable. It was intended as anti-shield weapon flag but ended up unfinished and unused by the developers. No weapon in classic game has this flag enabled, so this is strictly a modding matter. In 1.50, a weapon with this flag set will not damage planets and ships armor or structure, but will damage missiles, fighters and ship shields. This flag can be used not only for beam, but also for missile weapons. E.g. it is possible to create powerful anti-shield only torpedoes, that are otherwise non-harming. As an exception, a weapon with this mod and the shield piercing mod will ignore hard shields. This combination will not damage ships at all, thus serving as a strictly anti-missile weapon. A beam weapon with this flag enabled is never installed on fighters.

Defensive Fire

Defensive Fire is a special ability of regular mount beams, intended to give an inactive player some defensive means during the active player's move. Every ship equipped with such beam is performing checks every time an enemy ship moves using a pre-calculated value, the "Defensive Fire Range", that is the closest distance some enemy ship can move to that ship. The closer the moving ship position to that value - the greater chance the Defensive Fire will occur, and if that ship will reach DFR - the chance becomes 100% (as its "most optimal time" to use the guns, no other ship can move closer from now). The following table summarizes chances for defensive fire to occur:

range (sq)	22-24	19-21	16-18	13-15	10-12	7-9	4-6	1-3
22-24	12.5%	14.3%	16.7%	20%	25%	33%	50%	100%
19-21	25%	29%	33%	40%	50%	67%	100%	-
16-18	38%	43%	50%	60%	75%	100%	-	-
13-15	50%	57%	67%	80%	100%	-	-	-
10-12	63%	71%	83%	100%	-	-	-	-
7-9	75%	86%	100%	-	-	-	-	-
4-6	88%	100%	-	-	-	-	-	-
1-3	100%	-	-	-	-	-	-	-
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24
	DFR (sq)							
	Regular Beam Weapon, Proton Torpedo range							
	Gyro, Plasma Web, BHG range							
	Point Defense Beam Weapon, Tractor Beam, Transporters range							
	Stasis range							

Sadly in combat with [ship initiative](#) enabled the whole mechanic was plagued with bugs, which rendered it inconsistent and incomprehensible:

- As DF wasn't adapted to ship initiative mode at all, the DFR value controlling its behaviour was calculated only once per turn, at the end of it. It was suitable for non-initiative combat, as a player cannot move his own ships during the opponent's turn, so even calculated only once, this value was correct. But when both players share the same turn, the DFR had to be updated after every ship's move (as it's about relative distance between ships).
- As the DFR value originally had meaning only during the opponent's turn, when the non-active player cannot move own ships, the DFR value itself was corrupted during AI-controlled move for that ship (assumed that when it will be actually needed - it will be already recalculated by that time). So in a shared combat turn, AI-controlled ships had lost their DFR values after they performed any move action and used some wrong values for the rest of that turn.
- A bug in the range calculation prevented DF from happening in case when a moving ship's start position was out of Normal beams range, or its destination position was too close to a DF ship.
- Ship retreat procedure was incompatible with DF when Ship Initiative is on. Retreats could cause DF, but some ships were able to retreat prior to other ships getting their weapons recharged. Example: ship A is attacked by ships B and C and chooses to retreat on the first turn. The retreat takes place at the beginning of turn 2, ship A is processed first as defender and retreats. B and C do not fire since their weapons are not recharged yet. In the same example, if A was the attacker then both B's and C's weapons are recharged before A retreats, so they fire at A when it turns to fly away.
- Not a bug but a mechanic's flaw, was the intention of the effect to be applied only to beams that a player did not use during his own turn and were not turned off. As a result it couldn't happen on the first turn of battle. Note that this effectively means only the first turn of the attacker in non-initiative combat. Defender ships were unable to perform DF at all, but during Defender's first turn (second turn), attacker's ships with Normal beams ready were able to fire. With shared turn (when initiative is on) it meant that DF could not happen at all during the first turn. As players are indeed unable to show their intent about keeping beams on or off, as a new rule DFR value is three times lower for that first turn, so the chance to fire is lowered in comparison, but ships will still fire if a target moves too close.

All of the above problems have been fixed in 1.50. However, because the whole mechanics was so severely bugged for all the years, and it was impossible to improve on it while keeping the "original feel" in combat, we have turned DF off by default for games with ship initiative on and added the parameter [defensive_fire](#), that controls whether DF is enabled or not in INI games. With INI off, DF is always on as it was in classic.

In addition, the parameter [defensive_fire_max_range](#) can limit the range at which DF is operative, and [alternate_defensive_fire](#) can be used to set a more straightforward static chance dependency on a range between 2 ships. Note that rolls happen per travel square, but probability is set per 3 squares, so the chance of triggering fire is different between entering the range and passing through it. The chances per range can be set with [alternate_defensive_fire_range](#).

Special Systems

Specials Table

Enables modding of space and cost values per size class of ship. Mutual exclusivity of special systems is also set here.

Augmented Engines

Combat speed bonus is configurable via [augmented_engines_speed_bonus](#).

Automated Repair Unit

The repair rate for Armor and Structure can be adjusted using [repair_rate](#) table. The repair rate for Internal Systems is defined as percentage of that rate via [systems_repair_percent](#) (50% by default).

Battle Pods and Combat Speed

When Battle Pods are fitted on an otherwise empty ship, that ship gets a bonus to its combat speed. That bonus is gradually lost with fitting more stuff on the ship and the minimum combat speeds of ships with and without Battle Pods are equal. If the parameter [battle_pods_speed_bonus](#) is set at 0, ships will not get this speed bonus.

In addition, [minimum_combat_speed](#) sets the minimum combat speed of a ship, excluding Augmented Engines, controlling the maximum overload speed decrease possible when [battle_pods_speed_bonus](#) = 0. 'Overload' being a speed decrease from the extra stuff that can be fitted in the Battle Pods space. By default it's set at 255, not allowing combat speed to decrease due to overloading the ship. If another value is chosen, it determines the minimum combat speed that a ship cannot go below due to overload. For example: if set as 5, it will prevent an overloaded Nuclear Drive frigate with a base minimum speed of 10 to become slower than 5, while a Nuclear Drive doomstar with a base minimum speed of 3 cannot become slower than 3.

Battle Scanner

Both its scan range and its beam attack bonus can be configured. Use [scan_bonus](#) [battle_scanner](#) and [combat_bonus](#) [battle_scanner_beam_offense](#) respectively.

Stealth Field as a Cloak

By setting a value >0 for [stealth_field_beam_defense](#), Stealth Field will act as a Cloaking Device in combat, with the set value adding to a ships beam defense while cloaked and missile miss chance equal to that of the Cloaking Device (default = 50).

Cloaking Device

Optionally with [cloaking_device_missile_defense](#) = 1, a Cloaking Device adds to the missile evasion bonus instead of using 'miss chance' mechanics. If enabled, the missile evasion of an ECM Jammer + Cloaking Device equipped ship becomes 120, which means that non ECCM missiles will always miss instead of having a 15% chance to hit ($0.5 \cdot (1 - 0.7)$), while ECCM missiles get a slightly better chance to hit of 40% versus 32.5% ($0.5 \cdot (1 - 0.7/2)$).

Phasing Cloak

Setting timeout counter to 0 now have a different effect -- equipped ships will start a battle in regular cloaking state instead of one turn in phasing state.

Next Turn Recloak

Set [recloak_next_turn](#) to 1 to make all ships recloak at the start of the next turn, removing the need for ships to wait a full turn without firing to recloak. For phasing cloak there is a separate parameter [rephase_cloak_next_turn](#) with same functionality.

Different Cloaks Compatible on One Ship

Under classic rules ship can have only one device enabling combat cloaking (Cloaking Device or Phasing Cloak). Now it's possible to have both of them on one ship. Normally Phasing Cloak will apply its bonus, but if it's destroyed Cloaking Device will apply its bonus instead. Note that this does not override specials' exclusions and by default you still cannot install both devices on one ship. To do that you'd need to mod exclusions via [exclude1](#), ... , [exclude6](#) columns of the [special](#) table.

Damper Field

The remaining damage percent after applying damper field damage reduction is set with [damper_field_ratio](#), that is 25% by default. Damper Field also distorts a transporter beam attempting to move troops onto the equipped ship, killing a portion of troops instantly. The ratio total troops / survivors can be set with [damper_kill_ratio](#). Default value is 3 (meaning $\frac{1}{3}$ of troops survive transportation) and valid values are 0-127. Setting this parameter to 0 will result in Damper Field preventing use of transporters for boarding.

Energy Absorber

- The setting [absorber_keep_charge](#) prevents charge loss at end of turn for non-[initiative](#) games so that it can be fired on another turn. Note that in combat with INI, a charge is always kept regardless of this setting.
- Damage reduction now is configurable with [absorber_damage_reduction](#).

High Energy Focus Bonus

The High Energy Focus (HEF) description states that it increases beam weapon damage by 50%. But when the game calculates those 50% it uses damage of the normal mount and then adds it to the damage of actual mount. Thus a Pd weapon becomes twice as powerful and heavy weapons becomes only 1.33 times more powerful. This is usually considered a bug and has been corrected in 1.50 improved. Config allows to customize HEF and regular mount bonuses using [mount_dmg](#) table. Note that HEF has no effect on a Stellar Converter.

Lightning Field

Lightning Field roll is buggy, which in classic leads to $\frac{1}{3}$ instead of $\frac{1}{2}$ missiles / fighters being killed on average. The distribution is also asymmetric and yielded different results depending on the size of missile stack. E.g. 8 missiles fired one by one and 8 missiles fired in one group had significantly different survival rates (50% in a stack will surely survive).

This could be exploited in Guardian rush games which is why we deem it to be a classic feature. Setting [lightning_field_mode = uniform](#) results in a binomial distribution for the amount of missiles killed. This means that on average $\frac{1}{2}$ of all incoming missiles / fighters will be killed. The default setting of 50% kill chance can be configured via the [lightning_field_ratio](#) parameter.

Megafluxers

The space bonus for Megafluxers can now be tuned with [megafluxers_tactical_bonus](#), which gives +25% space to a ship by default. This technology works differently in strategic mode, where it adds +50% to the number of beams on a ship. The result is rounded down, causing the 1 beam Frigate to get no extra beam. This bonus can be altered with [megafluxers_strategic_bonus](#).

Scout Lab

By setting [lab_and_lore_against_antarans = 1](#), Scout Lab (and the Galactic Lore skill) will also provide its combat bonus when fighting against Antarans. The research bonus for the lab depends on the size class of the ship and can be configured via [scout_lab_research_bonus](#) table.

Sub-Space Teleporter

- The original square jump range seems like a bug, but was kept since it has become a known and distinctive feature. Optionally, setting [round_teleporter](#) makes the teleporter jump area approximately round (octagonal).
- With [sub_space_teleporter_range](#), the range can be set to a custom value.

Structural Analyzer

The Structural Analyzer bonus can be configured using [analyzer_bonus](#).

Shields

All aspects of Shields can be fine tuned in Config:

- Shield class, space and cost via the [shield](#) table
- Shield strength via the [shield_hull_multiplier](#) table.
- Shield regeneration for standard shields (30%) and Shield Capacitor (100%).
- Multi-phased shields bonus (+50%).
- Hard Shields (+3).

Research & Spying

Spying Related Parameters

[misc_costs_spy](#)

Sets spy cost.

[spy_govt_bonus](#)

[spy_tech_bonus](#)

Spy bonuses for Governments and Technologies.

[spy_roll_success_threshold](#)

Table containing thresholds for values for successful spy rolls of stealing and sabotage and if another race was framed.

[steal_mode](#)

In addition you can specify what spies can steal. Normally, an exception is set for spies so they will not be able to steal any tech of the technology field that is currently being researched. 1.50 provides alternatives via [steal_mode](#):

- [except_current_field](#) - classic behavior.
- [except_current_tech](#) - relaxed version of classic.
- [anything](#) - anything, including tech currently being researched.

[spies_can_frame_anyone](#)

By default, another race can only be framed for espionage if it is not in possession of the stolen tech. Unknown why this rule was introduced, but it does allow you to check via race reports (with exceptions) if the named race was indeed the one that has stolen your technology. Enabling this parameter overrides this requirement.

Tech Tree

The Tech Tree can be modded both by moving technologies to different fields in the tech tree, as well as by changing the techfields themselves. A little more care is appropriate when modding this area of the game to prevent crashes from occurring. Some tips:

Notes on techfield modding:

1. A broken chain of techfields within a branch, will cause a game crash.
2. The first tech field in each branch is always tech field 0 'Starting Technology'.
3. The field in position 0 and the techs that are in it, are always assumed known.
4. Thus, each first 'real' field in a branch should have `prev_field` set at 0. The eight branches / categories of technology each has a specific starting field. These starting fields are keyed to fixed positions in the techfield list. Positions 29, 55, 22, 10, 28, 18, 57, 7 in the displayed category order: Construction, Power, Chemistry, Sociology, Computers, Biology, Physics, and Force Fields as default, and can be set using [starting_techfield](#).
5. In seven of the categories (all except Construction) the starting field is the category's first Researchable field, i.e. it's the field that you see in that category when you open the research screen in a Prewarp game. By default the field Engineering is Known. Thus, MOO2 starts with two already Known fields, the (Starting) field in position 0 and the (Construction) field in position 29. Table [prewarp_techfield](#) sets 6 tech fields in order of applying, that will be Known at the start of a Prewarp game (first value only, normally 29) or an Average/Advanced (all 6 values) game.
6. Each branch should end with their generic 'hyper advanced' fields (field numbers 75-82).
7. `AI_group` (or: tech level) sets the value of the field for AI. By default a 50 RP field has `AI_group` 1, an 80 RP field has `AI_group` 2, etc. Increasing the `AI_group` value increases the desirability of that field for an AI.

Example techfield mod:

Move Field 46 from the 'Power' branch to 'Fields' and rename it to 'testername'.

13. Anti-Matter Fission (L10)	45. Magneto Gravitics (L7)
Anti-Matter Bomb	Class III Shield
Anti-Matter Drive	Planetary Radiation Shield
Anti-Matter Torpedoes	Warp Dissipator
3150	1800
46. Matter Energy Conversion (L11)	Level 8
Food Replicators	
Transporters	
5900	
37. High Energy Distribution (L12)	27. Electro Magnetic Refraction (L9)
Energy Absorber	Personal Shield
High Energy Focus	Stealth Field
Megafluxers	Stealth Suit
9400	3300

becomes:

13. Anti-Matter Fission (L10)	45. Magneto Gravitics (L7)
Anti-Matter Bomb	Class III Shield
Anti-Matter Drive	Planetary Radiation Shield
Anti-Matter Torpedoes	Warp Dissipator
3150	1800
Level 11	46. testername (L8)
	Food Replicators
	Transporters
	2950
37. High Energy Distribution (L12)	27. Electro Magnetic Refraction (L9)
Energy Absorber	Personal Shield
High Energy Focus	Stealth Field
Megafluxers	Stealth Suit
6650	4450

Requires the following lines:

```
tech_field anti_matter_fission next_field_id      = 37;
tech_field high_energy_distribution prev_field_id  = 13;
tech_field magneto_gravitics next_field_id        = 46;
tech_field matter_energy_conversion prev_field_id = 45 27 1150 8;
tech_field electromagnetic_refraction prev_field_id = 46;
tech_field_name matter_energy_conversion          = "testername";
```

Notes on modding technology positions:

1. To remove a tech entirely from the game, set its tech field number in the tech table to -1, like its done by default for the Phase Shifter technology:
`tech phase_shifter = 125 -1 38 0;`
2. To make a tech known from the start, assign tech field number 0 to the tech.
3. Empty tech fields will lead to a crash at the start of a new game. Keep in mind that an empty tech field can have several causes:
 - i. You have not placed any techs in a field during your design.
 - ii. The game deletes certain techs for certain race abilities, for example: food techs will be removed for Lithovore races.
 - iii. The game deletes certain technologies for Strategic games, for example Battle Pods or indeed also Phase Shifter. The relevant techs have a 0 in the fourth column of tech table (see above example).
4. Star Bases follow their own rules and have a best beam and best missile fitted even if you actually do not have any beam or missile tech.
5. Changing tech positions might break the Post-warp Techtree. The table `postwarp_tech` was added to defines a set of up to 29 Known technologies at the start of a Post-warp game. The first 7 techs in this list are excluded in strategic mode.

Custom Names

Names for some game objects can be specified in config. Such names override names from LBX. If no name is given in config (name is set to null) original name from LBX is used. By default all names are taken from LBX. Name tables are:

- `tech_name`
- `tech_field_name`
- `weapon_name`
- `weapon_name2` (plural for weapons)
- `special_name` (special systems)
- `building_name`
- `SHIELD_name`
- `ARMOR_name`
- `COMPUTER_name`

For weapons there are name tables for both single and plural spellings, for example you can specify:

```
weapon_name mass_driver = "Mini Cannon";  
weapon_name2 mass_driver = "Mini Cannons";
```

To reset to default:

```
weapon_name mass_driver = 0;  
weapon_name2 mass_driver = 0;
```

For languages other than English special characters are encoded with a subset of symbols `{ } [] < > @ # |` . For example German letter ß is encoded by |, so the word "groß" becomes

“gro|”. The encoding is language-specific and is not described here in detail. The direct use of unicode characters is not supported and won't work.

Custom Race Options

Picks

The maximum and minimum picks that can be used to create a custom race can be set, as well as the number of picks available for Evolutionary Mutation:

```
number_of_race_picks maximum_positive_picks      = 10;  
number_of_race_picks maximum_negative_picks      = -10;  
number_of_race_picks evolutionary_mutation_bonus = 4;
```

The valuation for all traits and special abilities can be adjusted. For the first 9 traits growth - spying, the actual bonus value can be changed as well. Note that the Food and BC bonus values are doubled: -1, 2, 4 translate in game to -½, +1 and +2 bonus per farmer. Thus Food +1 for 4 picks is written as:

```
race_pick farming2_cost = 4;  
race_pick farming2_value = 2;
```

Or can be compressed to:

```
race_pick farming2_cost = 4 2;
```

All other values are more straightforward to set, for instance to change negative growth -50% for -4 picks to a positive +25% for 2 picks:

```
race_pick growth1_cost = 2 25;
```

Additional Settings

A few more tweaks are exposed in Config:

Under classic rules, a Ship Offense bonus applies to both ships and orbital platforms and planetary installations. The more expensive Ship Defense bonus on the other hand, does not apply to satellites. Too bad for the Alkari. The SD bonus can be made to apply to satellites and planets too by setting:

```
satellite_racial_defense_bonus = 1;
```

Similarly the Warlord bonus can be made to apply to satellites and ground installation too with the parameter [satellite_warlord_bonus](#).

Government bonuses can be precisely manipulated now:

```
govt_bonus feudal_reduction      = 1/3;  
govt_bonus confederation_reduction = 2/3;  
govt_bonus feudal_science       = -10;  
govt_bonus confederation_science = -5;  
govt_bonus democracy_science    = 10;
```

```

govt_bonus federation_science      = 15;
govt_bonus democracy_money         = 10;
govt_bonus federation_money         = 15;
govt_bonus unification_food         = 10;
govt_bonus gal_unification_food     = 20;
govt_bonus unification_production   = 10;
govt_bonus gal_unification_production = 20;

```

Where value * 5 is the percent bonus for the item, for example democracy has a 10 * 5 = 50% bonus to research. Feudal and confederation reductions are set as ratios.

Additionally, the base morale penalty can be set per government, as well as the morale penalties for not having a Capitol and the morale bonuses for the presence of Barracks.

[federation_no_mixed_races_penalty](#)

If enabled, the Federation government will not be penalized for having mixed races on a colony.

[spy_govt_bonus](#)

Table that allows to set a bonus or penalty for all government types.

[repair_rate cyber = 10;](#)

For a 10% repair rate. Repair rate of internal systems is normally half of this value, but can be adjusted via [systems_repair_percent](#).

[spy_telepathic_bonus = 5;](#)

Allows to change the spy bonus for Telepaths.

[mind_control_ship_class = cruiser;](#)

Sets the minimum ship class of a Telepathic race that can Mind Control a colony. The default is Cruiser class. Size classes are frigate, destroyer, cruiser, battleship, titan, doomstar.

[event_roll lucky_player = 1000;](#)

As described in Random Events, a lower value increases the chance for Lucky events.

[td_ftl_bonus = 2;](#)

Ship drive speed bonus on the main galaxy map for Trans-Dimensional races.

[td_combat_speed_bonus = 4;](#)

Combat speed bonus for ships and fighter craft of Trans-Dimensional races (also affects combat AI calculations). Does not apply to missiles and torpedoes.

[warlord_command_bonus = 2;](#)

By default, each colony owned by a Warlord race adds +2 to the Command Rating.

AI Opponents

Generic AI bonuses

Below table summarizes standard AI bonuses per difficulty level:

	Growth Percent	Food	Prod	Res	BC	Command Deficit BC	Spy Bonus	Troops & Marines	Antaran Marines
Tutor	0	-1/4	-1/2	-1/2	0	12	-2	-2	-4
Easy	+1	0	0	0	0	11	-1	-1	-2
Avg	+2	1/4	1/2	1/2	1/4	10	0	0	0
Hard	+3	1/2	1	1	2/4	9	1	1	2
Imp	+4	1	2	2	3/4	8	2	2	4

Note that difficulty level also influences other aspects of the game, like the way AI conducts diplomacy and spying, AI's eagerness to attack, random events, Antaran likelihood of picking a human player as victim (/10, /5, 0, *1.5, *3), etc. The bonuses for food/production/research or "productivity" and the cash bonus the AI receives per difficulty level can now be set with two tables in config. The first table tweaks AI productivity bonuses. The set value divided by 20 is the bonus per population unit.

```
ai_productivity_bonus tutor      = -10;  
ai_productivity_bonus easy      =  0;  
ai_productivity_bonus average   = 10;  
ai_productivity_bonus hard      = 20;  
ai_productivity_bonus impossible = 40;
```

A second table governs income from taxation. Set value divided by 4 is the cash bonus per population unit, so it follows that AI receives +3/4 BC/pop on impossible difficulty level:

```
ai_income_bonus tutor      = 0;  
ai_income_bonus easy      = 0;  
ai_income_bonus average   = 1;  
ai_income_bonus hard      = 2;  
ai_income_bonus impossible = 3;
```

Stock Races

Stock Races can be adjusted in config. An example:

```
stock_race Alkari =  
dictatorship g0 f0 i0 s0 m0 sd3 sa0 gc0 spy0  
0 0 0 0 0 -1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0;
```

The values that follow spy0, are ordered in the same way as the Special Abilities in the Race Customization Screen, e.g. low-G, high-G, aquatic, subterranean, etc.

These Alkari are a Dictatorship, have Ship Defense +50 (sd3), a Poor Homeworld (position 6 = -1) and are Cybernetic (position 8 = 1). Changing sd3 to sd1 gives the Alkari the SD-20 penalty and to sd2 the SD+25 bonus.

Unlock Extra AI Race Variants

When playing on Hard and Impossible difficulty levels, each opponent has three variants that the game will choose from. The tables in the code however contain 5 variants (check the addendum for details) and variants 4 and 5 are now available to play against, either as separate set including them only, or together with regular 3 variants by setting `ai_races_variants`:

- 1-3 - variants available in classic game (default),
- 4-5 - only previously unused variants,
- 1-5 - all variants.

Note: use values literally, e.g.: `ai_races_variants = 4-5;`

Modding the Race Variants

Coding Table

0 0 Feud	1 0 Pop	+0	2 0 F+0	3 X Prod	6 X SD
0 2 Dict	1 1 Pop	-50	2 1 F-½	4 X Res	7 X SA
0 4 Demo	1 2 Pop	+50	2 2 F+1	5 X Tax	8 X GC
0 6 Uni	1 3 Pop	+100	2 3 F+2		9 X Spy
10 1 lowg_world	17 1 cybernetic		25 1 telepathic		
11 1 highg_world	18 1 lithovore		26 1 lucky		
12 1 aquatic	19 1 repulsive		27 1 omniscient		
13 1 subterranean	20 1 charismatic		28 1 stealthy_ships		
14 1 large_hw	21 1 uncreative		29 1 trans-dimensional		
15 -1 hw_richness	22 1 creative		30 1 warlord		
15 1 hw_richness	23 1 tolerant				
16 1 arti_world	24 1 fantastic_traders				

Let's examine the first row of the Alkari Hard variant 1:

```
ai_race_variant_table Alkari
Hard v1 =
2 7 2 8 2 0 0 0 0 0 0 0 0 0 0 0 2 7 3 8 3;
```

Two extra traits, SA +20 (7 2) and GC +10 (8 2) are added to the base race design. For Evolutionary Mutation it will get 2 extra traits, upgrading here to SA +50 (7 3) and GC +20 (8 3). If you write (intended or not):

```
ai_race_variant_table Alkari
Hard v1 =
3 7 2 8 2 0 0 0 0 0 0 0 0 0 0 0 2 7 3 8 3;
```

Then 3 traits are taken into account and the race becomes Feudal (0 0).

AI Patience Counters

An option for diplomacy [alternate_diplomacy](#), when enabled attempts to use correct patience counters. Previously, attempts on alliance, trade/research treaty etc, all were controlled by a single counter. But there are several separate counters for this in the code, and other counters were never checked. Since there is no telling if it is a bug or a feature, it is made optional and not enabled by default.

AI Ships

All non-player ships can be modded in some way;

- Auto Design ships
- Star Base specials
- The Guardian
- The Avenger
- Monsters
- Antaran ships
- Antaran Fortress

Auto Design Ships

There are 8 different templates (ship design tables I-VIII) that Auto-Design can build ships from. Every table contains a row per ship class and 12 columns for categories of weapons:

Table I: `ai_ship_design_standard_beam_missile_x2`

<code>frigate</code>	<code>=</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>15</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>85</code>	<code>-1</code>	<code>0</code> ;
<code>destroyer</code>	<code>=</code>	<code>10</code>	<code>0</code>	<code>-1</code>	<code>5</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>45</code>	<code>30</code>	<code>-1</code>	<code>10</code> ;
<code>cruiser</code>	<code>=</code>	<code>15</code>	<code>0</code>	<code>-1</code>	<code>0</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>10</code>	<code>30</code>	<code>30</code>	<code>-1</code>	<code>15</code> ;
<code>battleship</code>	<code>=</code>	<code>15</code>	<code>0</code>	<code>-1</code>	<code>5</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>15</code>	<code>25</code>	<code>25</code>	<code>-1</code>	<code>15</code> ;
<code>titan</code>	<code>=</code>	<code>15</code>	<code>0</code>	<code>-1</code>	<code>10</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>15</code>	<code>25</code>	<code>20</code>	<code>-1</code>	<code>15</code> ;
<code>doomstar</code>	<code>=</code>	<code>15</code>	<code>0</code>	<code>-1</code>	<code>15</code>	<code>-1</code>	<code>-1</code>	<code>-1</code>	<code>15</code>	<code>20</code>	<code>20</code>	<code>-1</code>	<code>15</code> ;

Columns are:

1. Theme Special
2. Beam Special
3. Missile Special
4. Defense Special
5. Special Weapon
6. Special Device
7. Fighters
8. Missile x2 (I), Missile x5 (III), Missile x10 (IV) or Torpedo
9. Heavy Beams
10. Beams
11. Point Defense Beams
12. Bombs

Auto Design will equip ships in order from left to right from this table, equipping the ship with specials that are available and it has space allocated for. Fields with -1 are ignored, even if overwritten. Values are a percentage of the ships space. In the classic tables values

add up to 100 per row. Should you assign higher values to the columns, in such a way that the sum > 100, then auto-design ships will use more space than they legally should have (cheat ships).

Theme Specials:

- a. Bio Weapons -- teleporter, augs, death spores, etc
- b. Capture -- transporters, shuttles, tractors, troop pods, etc
- c. Cloaking -- cloaking device, stealth field, phasing cloak
- d. Beam Defense -- inertial stabilizer/nullifier, augs
- e. Missile Defense -- jammers, pulsar, a-m rockets, etc
- f. Armor -- heavy armor, reinforced hull, automated repair
- g. Shield -- hard shields, multi-phased shields, capacitors

Specials are picked at the beginning of each game, based on one of seven racially assigned themes. The Bio Weapons tables for example has 5 entries:

```
ai_ship_design_bio_weapons_theme
special_1 = 22 0;
special_2 = 33 0;
special_3 = 2 0;
special_4 = 26 1;
special_5 = 25 1;
```

These numbers are either weapons or specials (denoted by the second number, 0 is special, 1 is weapon). They are weighted from top to bottom and Auto-Design picks them based on the ship design tables, hull space allocation and available tech.

Other Ships

As an example the first weapon of the Guardian ship design:

```
guardian weapon_1_type = 11;
guardian weapon_1_arc = 15;
guardian weapon_1_mods = 0000000000000010;
guardian weapon_1_ammo = 0;
guardian weapon_1_amount = 2;
```

type: weapons table number (11 = Death Ray)
arc: firing arc (1= Fwd, 2= Fwd Ext, 4= Bwd, 8= Bwd Ext, 15= 360 degrees)
mods: weapon mods (010 = Hv)
ammo: ammunition (0 here for beams)
amount: weapon count (and weapon count remaining when weapon is damaged)

Refer to MANUAL_150.XLS for more detail.

The Antaran Fleet

[prewarp_delay](#), [average_delay](#), [advanced_delay](#)

Antarans' resources calculation delay for each Tech Level. Antarans do not attack during the first two calculation cycles, so the actual attack delay is this delay plus twice the [resource_increment_calculation_frequency](#).

[resource_increment_calculation_frequency](#)

The frequency in turns at which antarans production values are recalculated.

[attack_frequency_determinant](#)

Random roll value that determines how often Antarans can attack: if the roll is lower than the number of turns since the last attack, a new attack happens.

[antaran_cease_of_attacks_coefficient](#)

For an attack to happen, the antaran attack force should meet the following condition:

$$2 \wedge \text{this coefficient} * A \geq A + D + Ra + Rd$$

A: build cost of the offensive fleet (fleets in flight do not count),

D: cost of all defensive ships built,

Ra: offense production resources,

Rd: defense production resources.

[_resource_multiplier](#)

Per difficulty level specified for both defensive and offensive fleets.

[offensive_shiptype](#), [defensive_shiptype](#)

Ship type limit per fleet. Ship types are: raiders, marauders, intruders, interdictors, harbingers. Note that you can see here that the Antaran HW has no defending frigate and destroyer class ships.

[antaran_ship_costs_shiptype](#)

Resource cost per ship type.

[cease_building_frigates_after_n_turns](#)

[cease_building_destroyers_after_n_turns](#)

[frigates_cease_difficulty_divisor](#)

[destroyers_cease_difficulty_divisor](#)

Determines after which Antarans stop building frigate and destroyer class ships.

Calculated for hard and impossible difficulty as 12500/dd and 20000/dd respectively, where dd stand for difficulty divisor value. Note that if frigates or destroyers are not destroyed in combat, they can keep appearing after these turn limits. Antarans do not dismantle their ships.

[elite_offensive_ants](#)

Antaran offensive ships have Veteran crews in classic, while the defensive ships have Elite crews. With this parameter the offensive ships can be set to Elite as well, both crew level and experience points will be increased.

Monsters

Monsters Stay Chance

`monsters_stay_chance` determines the chance for wandering space monsters to stay after battle. The value sets the range of a random roll, which causes a space monster to leave if it rolls 1 twice. Thus, at the default value 2, a monster has $1/2^2=1/4$ chance to stay. At 3, that chance is $2/3^2=4/9$, etc. This setting has no effect on the Toxic Amoeba that always leaves the galaxy after winning a battle.

Monsters Stay

If `monsters_stay` is set at 1, wandering monsters will not leave the galaxy if they have won a fight, but stay until destroyed no matter what is set in `monsters_stay_chance`. The Toxic Amoeba is also ensured to stay with this setting. This is considered a test option and it will cause false GNN reports.

Amoeba Regeneration

If `amoeba_regeneration` is set at 1, Toxic Amoebae will regenerate 20% each combat round. Value can be tweaked with `repair_rate regen`.

The Crystal Fleet

If `crystal_keep` is set at 1, a Crystal that has captured enemy ships and is victorious in combat, will keep those ships as part of its own fleet.

Events & Delays

Frequency of Events

The frequency of events can be altered by changing the value of `event_roll all_events = 512` where a lower number will cause an increased frequency. Similarly, the occurrence of good things for Lucky players can be manipulated by adjusting `event_roll lucky_player = 1000`. In addition, with parameter `between_events_delay` the minimum turn delay between events can be set (default = 5).

Delay of Events

By default events can not happen before turn 50, as set by `event_delay all_events = 50`. Each individual event delay can also be set:

```
event_delay derelict           = 0;
event_delay climatic_change    = 0;
event_delay comet              = 200;
...
```

The generic delay and specific delays are not cumulative.

Events Duration

The duration of the three events Hyperspace Flux, Warp Beast and Time-Space Anomaly can be tweaked with minimum duration and chance to stop values. Classic settings are:

```

event_duration anomaly_min    = 4;
event_duration beast_min      = 4;
event_duration flux_min       = 4;
event_duration anomaly_chance = 20;
event_duration beast_chance   = 20;
event_duration flux_chance    = 20;

```

Note that the delay value (4) is added to a base 2 delay, for 6 turns effectively.

AI Surrender Delay

The parameter [ai_surrender_delay](#) specifies after which turn AIs can surrender their empire. Default value is 150.

Leaders

Optional Unlimited Leaders

The parameter [leaders_no_limit](#) enables more than 4 leaders to be in service or in the pool, both for colony leaders and ship officers. Scroll the lists with the new arrow buttons or with “[” and “]” hotkeys.

Better Warlord Leaders

Optionally, leaders in the service of a Warlord can now function at +1 skill level higher, in the same way as ship crews do, by setting [leader_warlord_bonus](#). Otherwise Warlord will only enable the possibility for a leader to reach skill level 6.

Customizing Leaders

A custom HERODATA.LBX can be created with the MoO2 Workshop (separate download) and loaded via Config, for example the following loads custom leaders from ICE mod:

```
herodata.lbx = 150\mods\ice\lbx\${LANG$\HERODATA.LBX;
```

If the order of leaders in the list was changed, take note to change accordingly in config the leader id's of the three special leaders. They must match those set in herodata.lbx:

```

leader_data advanced_govt_hero_id = 47;
leader_data random_attributes_colony_leader_id = 41;
leader_data random_attributes_ship_captain_id = 52;

```

The first one sets the leader id that brings advanced government (default is 47, Tanus). The other two set the id's for the leaders with the random skills set.

Leaders Skill Cost

With the table [skill_cost](#) the cost of all leader skills can be set. The value set is 1/10 of the actual base skill cost. Example:

```
skill_cost assassin = 2;
```

sets the cost of the assassin skill to 20 BC for a Level 1 leader. Skill cost increases for each level. The assassin skill is 40 BC for a L2 leader, 60 BC for a L3 leader, etc.

The commando skill cost is set separately because it differs for colony and ship leaders. The default base level cost is 10 BC for colony leaders and 30 BC for ship officers.

The presence of Megawealth in a leader's skill set doubles the cost of all skills of that leader. This can be disabled with:

```
megawealth_no_double_cost = 1; *
```

Note also that leaders who bring a technology do not share it for free! The base technology cost is based on its research points value:

```
< 1000 RP: 10 BC
1000 < 5000 RP: 30 BC
>= 5000 RP: 40 BC
```

Experience

The experience points required for a leader to gain the next skill level can be set:

```
leader_data level_2_experience = 60;
leader_data level_3_experience = 150;
leader_data level_4_experience = 300;
leader_data level_5_experience = 500;
leader_data level_6_experience = 1000;
```

Level 6 can only be reached by leaders in the service of Warlords. Colony leaders gain 1 experience point per turn, while Ship Officers (and ships) gain additional experience in combat equal to the halved sum of size classes of destroyed enemy ships (where FF-DS = 1-6), rounded down and minimum 1 XP. Note that an instructor does not give XP to leaders, only to ships.

Chance to Hire a Leader

The formula for the chance to get a new offer of a (randomly chosen) leader is:

$$\text{Roll}(0-99) < (\text{turns since last offer} + \text{hire_chance_charismatic_bonus} - \text{hire_chance_repulsive_penalty} + \text{sum of all famous leaders' skill levels}) / (1 + \text{number of leaders in pool both hired or for hire})$$

No leaders will offer to join in the first 5 turns of a game. This delay can be set with [hire_chance_delay](#). Note the importance to Dismiss a leader you do not wish to hire, as it improves your chance to get a new offer the next turn(s). Charismatic and Repulsive values can be set and by default they are:

```
leader_data hire_chance_charismatic_bonus = 5;
leader_data hire_chance_repulsive_penalty = 10;
```


Number of Leaders for Hire

The pool size of leader available for hire is governed by the following formula:

(Base Amount + Number of players + turn/increment step + Charismatic bonus) / 2
(if Repulsive).

```
leader_data availability_base_amount      = 10;  
leader_data availability_increment_step   = 5;  
leader_data availability_charismatic_bonus = 10;
```

Thus, a new leader becomes available every 5 turns, unless you are Repulsive then only once every 10 turns. This explains why it takes such a long time for Repulsive races to get any good leaders, as the halving part has a significant impact on the available leaders at game start. Leader available at the start of a game with 8 players:

Base player:	18
Charismatic player:	28
Repulsive player:	9

Modding with Scripting

Since 1.50.7 there is limited scripting support. The language used for scripts is a modified version of Lua 5.3. This is an experimental feature, it may be a bit rough to use. For example, currently there is no way to interrupt a script, so if you forgot to break from an endless loop you'll have to crash and restart the game.

Changes in Lua

- All numbers are integer, not floating-point. Division by zero will throw an error.
- Operator `^` does not work.
- Some standard library functions are not included. This may change in the future. Notable examples are: `require`, `loadfile`, and the whole `math` library.
- Some standard functions (e.g. `tostring`, `print`) behave a bit differently.

Contexts

Each script is run in a certain context. This determines the set of available API functions as well as details of their workings.

Context	Description
player	Scripts run in Main screen by a player (unless lua cheat is enabled). Get functions return only objects observable by the current player. Only owned objects are modifiable, e.g. can scrap or rename ships.
universal	Scripts specified by newgame_postprocessor_script parameter that are run right after a new game is generated. All game objects are available and modifiable.
	Scripts run in Main screen when lua cheat is enabled. Used for testing.
pregame	Scripts specified by pregame_script parameter that are run before race selection. Only config and game settings are available, no galaxy or players exist yet. Can be used to randomize tech tree or race picks.
combat	Scripts run in combat by a player. Combat ships and the rest of the game objects observable by a player are available.

Running a Script

A player can run a script in the Main screen by pressing 0, ..., 9 to run MAIN0.LUA, ..., MAIN9.LUA. Those scripts are run in player context unless lua cheat is enabled.

Running scripts in combat is currently disabled.

The game will automatically run a script from a file given by config parameters [newgame_postprocessor_script](#) and [pregame_script](#). Both parameters allow specifying

multiple files separated by a semicolon. They are also accumulative, which means that specifying them multiple times results in joining values. E.g this:

```
newgame_postprocessor_script = CORE.LUA;  
newgame_postprocessor_script = MAP.LUA;
```

is equivalent to:

```
newgame_postprocessor_script = "CORE.LUA;MAP.LUA";
```

This is needed so that different mods don't overwrite each other's scripts.

MOO2 API

Utility Functions

Lua library functions are available and work as described in Lua documentation.

Name	Contexts	Description
tostring	any	Returns stringified version of its args, concatenated if args are many. Used internally by print and msgbox.
print	any	Outputs a line to ORION2.LOG.
msgbox	any	Brings up a message box, useful for debugging.

Manipulating Players

Player table - is a lua table with player info indexed by player id. Example:

```
{ [0] = {name = "Human", ... }, [1] = {name = "Alkari", ... } ... }
```

Tech table - is a lua table with state of each tech for a player indexed by tech id.

Name	Contexts	Description
get_players	universal, player	In universal context returns a <i>player table</i> with all players. In player context returns only those in contact with the current players.
get_current_player_id	player	Returns the id of the player calling the script.
get_player_techs	universal, player	Accepts player id and returns a tech table. In player context will return nil if you have no contact with that player or /noreport config option is enabled.
set_player_techs	universal	Accepts tech table, sets players techs.

Manipulating Stars

Star table - is a lua table with star info indexed by star id. Example:

```
{ [0] = {name = "Orion", ... }, [1] = {name = "Sol", ... } ... }
```

Star id array - is a lua table in which values are star ids and keys are numbers 1..n.

Name	Contexts	Description
get_stars	universal, player	Returns a star table for all stars in the galaxy except Antares.
set_stars	universal	Accepts star table, sets star attributes.
del_stars	universal	Accepts star id array, removes stars.
add_stars	universal	Accepts a number, adds that many stars. Returns star id array of created stars.

Manipulating Planets

Planet table - is a lua table with planet info indexed by planet id. Example:

{ [0] = {star = 12, orbit = 0, ... }, [1] = {star = 12, orbit = 4, ... } ... }

Planet id array - is a lua table in which values are planet ids and keys are numbers 1..n.

Name	Contexts	Description
get_planets	universal, player	Returns a planet table for all planets. In player context only known planets are shown.
set_planets	universal	Accepts planet table, sets planets attributes.
del_planets	universal	Accepts planet id array, removes planets.
add_planets	universal	Accepts a number. Returns planet id array of created planets.

Observing Ships

Ship table - is a lua table with ship info indexed by ship id. Example:

{ [0] = {design = { name = "Scout", ...}, x= 56, ... }, [1] = { ... } ... }

Function get_ships returns ship table of all active ships you can see (not including those currently being built or refitted). In player context only ships you scan or own are returned.

Experimental "raw" API

Patch 1.50.18 introduces a number of new functions which use an experimental binding library and will likely change, so no in-depth description is provided. See MIRROR.LUA and RANDTECH.LUA for usage examples. Currently all such functions work only in universal and pregame contexts.

Accessed Objects	Get	Set	Del	Add
Overmap ships	rget_ships	rset_ships	rdel_ships	radd_ships
Leaders	rget_leaders	rset_leaders		
Nebulas	rget_nebulas	rset_nebulas	rdel_nebulas	radd_nebulas
Players	rget_players	rset_players		
Tech tree (tech config table)	rget_techs	rset_techs		
Tech tree (tech_field config table)	rget_fields	rset_fields		
Tech tree (starting_techfield config table)	rget_starting_fields	rset_starting_fields		
Race picks (race_pick config table)	rget_picks	rset_picks		

Notes on Population Growth

Definitions

POPSPACE	Population of the considered race.
POPAGG	Aggregated Population of the planet. (POPSPACE, annexed pop, natives and droids)
POPMAX	Maximum population of the planet.
PROD	Total industry produced on the colony
FACTOR1	2000
FACTOR2	40
g	general bonus (default 0)
r	race bonus (-50% growth = -50, +50% = 50, +100% = 100)
i	AI bonus (0-4 based on difficulty level)
t	tech bonus (microbiotics = 25, universal antidote = 50)
l	leader bonus (only the best medicine bonus applies)
e	event bonus (boom = +100, plague = -200)
h	housing (formula)

Growth Formula

Population growth is calculated separately for each race on a planet.

The formula for the basic growth of a race (a) is:

$$a = \text{trunc}[(\text{FACTOR1} * \text{POPSPACE} * (\text{POPMAX} - \text{POPAGG}) / \text{POPMAX})^{0.5}]$$

The default value of FACTOR1 can be modified with [growth_formula_factor](#).

(a) is truncated (rounded down) before it is multiplied with the sum of seven bonuses (b):

$$b = (100 + g + r + i + t + l + e + h) / 100$$

If all seven bonuses are zero, then (b) is 1.

The general bonus (g) is applied to all players in the game and can be set with [growth_rate_bonus_general_modifier](#) which is 0 by default.

The growth bonuses from the technologies (t) microbiotics and universal antidote can be set individually with [growth_rate_bonus](#). By default the bonuses from these two techs do not stack. This can be changed with [microbiotics_and_antidote_cumulative](#).

The formula for housing (h) is:

$$h = \text{FACTOR2} * \text{PROD} / \text{POPAGG}$$

Obviously this only applies when you are housing. The default value of FACTOR2 is 40, which can be set via [housing_formula_factor](#). In addition POPAGG can be removed from the formula with parameter [housing_no_popagg](#).

The product $a*b$ is again truncated after which the growth bonus of cloners is added.

Cloning Center

The standard bonus of cloners is +100k. The bonus is shared pro rata between all races on the planet, no matter if a race can grow or not, thus for each race:

$$c = 100 * (\text{POPRACE} / \text{POPAGG})$$

If there is only one race on the colony, then $\text{POPRACE} = \text{POPAGG}$ and the full bonus is applied to that one race. If a race cannot grow, then it's share of growth is lost.

Examples:

1. On a new colony with natives, +75k is allocated to the 3 natives and +25k to the one colonist, resulting in a loss of the +75k and a net growth of only +25k.
2. On a colony with 1 droid and 1 regular pop, Cloners' net bonus is +50k.
3. On a colony with mixed races, Cloners' bonus will be lower than +100k if there is a non-subterranean race that cannot grow anymore and a subterranean race that still can.

The growth bonus provided by Cloning Center can be set with [cloners_growth_bonus](#) up to a maximum bonus of 127 (default is 100).

Notes on Spying

Spy Bonuses

Every Spy you train can fulfil one of two functions. (1) On a mission, your spy goes off into the colonies of a race of your choice and tries to steal technologies, attempts to destroy enemy buildings or hides awaiting new orders. Any spy's success is noticed by the target race and has an adverse effect on relations, unless you are able to frame another race for your actions. (2) As an Agent, your operative roams inside your empire, ferreting out enemy spies and eliminating them.

You can train maximum 63 defensive agents and maximum 63 spies per opponent. Though not shown on the Races screen, each spy increases the bonus for the specific slot he is assigned to: The first five spies add 2 points each and spies 6 to 10 add 1 point each. Subsequently, each pair of spies will add a point to the bonus. Thus, 11 or 12 spies add 16 points, and the maximum bonus is +42 for 63 spies.

Total spying bonus per slot is the sum of racial, governmental, leader and technology bonuses plus the bonus from the spies assigned to it. Bonuses are:

		Defense	Offense
Government	Feudalism	0	-
	Confederation	0	-
	Dictatorship	10	-
	Imperium	15	-
	Democracy	-10	-
	Federation	-10	-
	Unification	15	-
	Galactic Unification	15	-
Race	Spy -3 picks	-10	-10
	Spy +3 picks	10	10
	Spy +6 picks	20	20
	Telepathic	10	10
Technology	Neural Scanner	10	10
	Telepathic Training	5	5
	Cyber Security Link	10	10
	Stealth Suit	10	10
	Psionics	10	10
Leaders	Telepath	2 to 18	-
	Spy Master	-	2 to 18

Assassins

Before any spy activity happens, assassins get a chance to act. The chance to assassinate an enemy spy depends on a leader's skill level and varies from +2% to +18% per turn. Only the best leader's bonus is effective.

Roll Chance

To have a chance for stealing and sabotage at least one spy needs to be sent to the opponent, but for defending this is not required. Even with zero defending agents, defenses against enemy spies are active (and enemy spies can be killed) just without the additional bonus provided by the agents.

Action Thresholds

For offensive spies to be successful a threshold needs to be overcome that consists of the defender's bonus (DB) and an action threshold (T). Default action thresholds are:

stealing is successful:	80
stealing is successful and frame another race:	90
sabotage is successful:	70
sabotage is successful and frame another race:	90

Definitions

T	— action threshold
DB	— defender bonus
AB	— attacker bonus

$E = T + DB - AB$ — effective threshold

AR	— attacker roll 1..100
DR	— defender roll 1..100

Formula

Each turn both attacker and defender get a roll(100). A spying action is successful if:

$$AR = 100 \text{ (aka lucky roll)}$$

or

$$AR - DR > E$$

So with a low enough effective threshold you always succeed, but with a high enough threshold you don't always fail, because of the lucky roll.

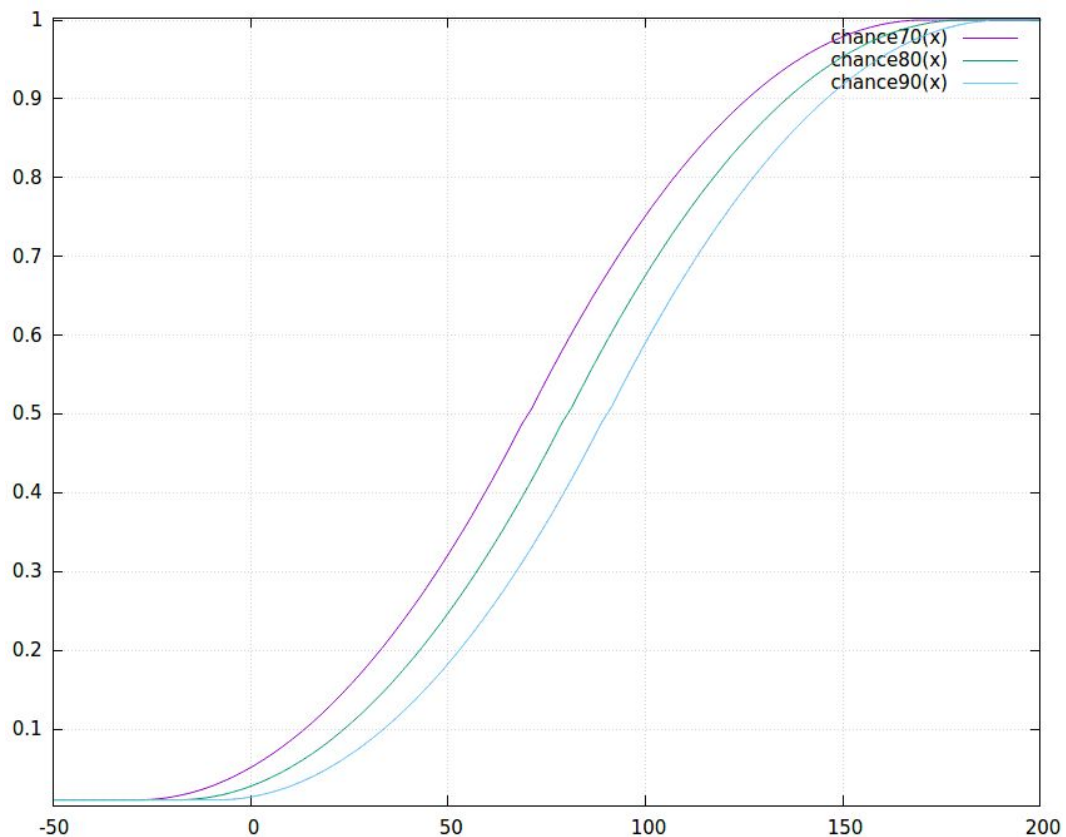
The probability (p) of success can be formalized as follows:

```

      E <= -100 : p = 1
-100 <= E <= -1 : p = 1 - (101+E)*(100+E)/2/10000
      0 <= E <= 99 : p = (99-E)*(98-E)/2/9900 + 0.01
      99 <= E : p = 0.01

```

Below graph has three lines plotted, one for each action threshold (T). On the x-axis the attacker - defender bonus (AB-DB) and on the y-axis the chance for success (p). Note that on the left side the lines do not quite reach 0 because of the lucky roll.



Spy vs Spy

The invisible wars between spies are both deadly and silent. Most of the time, spies simply fail. Sometimes they are killed by enemy spies.

After the roll for stealing and sabotage happened, there is a roll for spies killing spies. The kill formula is comparable to the formula for stealing and sabotage, except that the defender gets an extra +20 bonus, and the attacker gets +20 if he has chosen HIDE. (So on HIDE your spies are not active, but can still be killed by an opponent.) At +80 a defender is killed, and at -80 an attacker, and both parties have the possibility to kill with lucky rolls, so both can lose a spy in the same turn.



Notes on Beam Weapon Mechanics

Accuracy

Several things determine the chance to hit, but it boils down to three factors: Beam Attack, Beam Defense and Range Penalty.

Beam Attack Modifiers

Beam Attack (BA) is a way of rating the firing ship's beam offense capability. It is calculated based on the type of computer on board, ship systems like battle scanner, crew experience, leaders and racial bonuses. Battlestation and Star Fortress give an additional BA bonus to all ships in the defensive fleet. Individual beam weapons get additional bonuses based on mount type (Pd +25 BA) and mods (Co +25 BA, AF -20 BA).

Beam Defense Modifiers

Beam Defense (BD) is a rating of the target ship's dodging ability, calculated basis 5x its combat speed plus bonuses from ship systems like inertial stabilizer, crew experience, leaders and race.

Range Penalty to Accuracy

The farther away a target is, the less likely it becomes for a beam weapon to hit it. The range penalty to a beam's accuracy comes from below table:

Range	0	1	2	3	4	5	6	7	8
Penalty	0	0	10	20	30	40	55	70	85

One range unit equals 3 squares. At range 0 two opponents share the same square, for example when interceptors are on top of the target ship. At range 1 opponents are adjacent to each other or have 1-2 squares between them.

For calculation purposes, Point Defense weapons get a penalty as if range is doubled and for Heavy mount weapons the actual range is halved (and rounded down):

Range	0	1	2	3	4	5	6	7	8
Regular (sq)	0	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24
Pd (sq)	0		1-3		4-6		7-9		10-12
Hv (sq)	0-3	4-9	10-15	16-21	22-27	28-33	34-39	40-45	46-51
Penalty	0	0	10	20	30	40	55	70	85

Classic Fusion Beam, Plasma Cannon and Mauler Device have an inherent 2x range to-hit penalty (weapon flag #1). This mod doubles the calculated penalty. So after all Hv/ Reg/ Pd calculations are done and Rangemaster Unit effect is applied, the result is doubled.

Obviously for Mauler Device, that always hits, there is no effect and therefore in 1.50 this mod has been removed from the weapon via a patch. Further, in 1.50 improved the penalty has also been removed from Fusion Beam so only the Plasma Cannon keeps it.

Chance to Hit Formula

Then it's a matter of chance. A random number between 1 and 100 (inclusive) is rolled and the following formulae apply:

```
HIT IF: (with max dmg)
[1] random(100) roll > 95

ELSE HIT IF: (with max dmg)
[2] BA+CO-AF-BD >= 99

ELSE HIT IF: (real penalty affects dmg distribution)
[3a] BA+CO-AF-BD + roll >= hit_threshold
[3b] hit_threshold = min(40 + range_penalty* - Pd_bonus; 95)
      *doubled for inherent 2x range to-hit penalty mod
```

Thus, if the random number is greater than 95 (a 5% lucky shot, no matter the odds), or BA+CO-AF-BD is larger than 98, the beam strikes the target. Else, BA+CO-AF-BD minus the range penalty (plus possible Pd bonus) must be 39 or higher to ensure a hit.

Note that Mauler Device and Energy Absorber always hit unless the target ship has a Displacement Device. Stellar Converter, which is not a beam weapon but a special weapon, always hits regardless of the presence of a Displacement Device.

Optional Alternative Chance to Hit Formula

The chance to hit formula contains a major flaw: Range penalties, being a big deal in theory, don't work well in reality, up to having no effect at all. Formula 3 contains a cap of 95, making range penalty above 55 for non-Pd beam or 80 for Pd beam of no additional effect (despite being present in the game). Moreover, formula 2 contains a deeper flaw: with good BA and low BD the range penalty is ignored altogether. Among good examples of this flaw are 'sure-hit-no-matter-the-distance' situations, low usability of Rangemaster Unit (especially compared with Battle Scanner), and a very low effect of the inherent 2x range to hit penalty weapon mod.

Setting `simplified_beam_formula = 1` enables a more straightforward way of chance to-hit calculations, with distance penalties consistently affecting chance:

```
HIT IF: (with max dmg)
[1] random(100) roll > 95

ELSE HIT IF: (with max dmg)
[2] BA+CO-AF-BD - range_penalty + Pd_bonus >= 99

ELSE HIT IF: (real penalty affects dmg distribution)
```

[3] BA+C0-AF-BD - range_penalty + Pd_bonus + random(100) roll >= 40

Damage Potential

There are 2 pairs of types of beam weapons, affecting damage distribution:

1. Not reduced by range / Reduced by range.
2. Equal min-max damage / Different min-max damage.

Damage values of both types are later modified with Hv, Pd, HEF and Ordnance effects.

Not Reduced by Range

If a beam hits, it does damage. For weapons of which the damage is not reduced by range, like Mass Driver, Gauss and Disrupter, no dissipation penalty applies. Note that a Laser Cannon with NR mod can still do lower than 4 damage (1-3 dmg), in cases of low accuracy. Example: The lowest damage of a NR Laser with base damage 10-40 instead of 1-4 is 10, whereas an unmodded 10-40 Laser can have a damage as low as 4 at range.

Reduced by Range

For weapons of which the damage is reduced by range (dissipation), a penalty based on the distance the beam must travel to the target is taken into account, lowering the damage potential (round to nearest applies and the minimum damage potential is always 1). Below table of damage potential by range includes examples for Laser Cannon, Phasor, Mauler and Death Ray:

Range (sq)	0	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24
Penalty	0		-10	-20	-30	-40	-50	-60	-65
Dmg	100%		90%	80%	70%	60%	50%	40%	35%
Laser	1-4		1-4	1-3	1-3	1-2	1-2	1-1	1-1
Phasor	5-20		5-18	4-16	4-14	3-12	3-10	2-8	2-7
Mauler	100-100		90	80	70	60	50	40	35
Death Ray	50-100		45-90	40-80	35-70	30-60	25-50	20-40	18-35

Equal Min-Max Damage

As can be seen from the table, for Mauler Device because min=max dmg the actual damage is known after applying the damage dissipation and Hv, Pd, HEF and Ordnance effects. If the beam hits, the min damage value (possibly modified with effects named above) will be applied. For weapons with different min-max damages there is still no final damage value and the story continues:

Different Min-Max Damage

The actual damage for weapons with different min-max damages is based on the damage potential modified with the accuracy of the shot, using the following formula:

UNCAPPED DAMAGE IS:

$$\text{min_dmg} + (\text{max_dmg} - \text{min_dmg} + 1) * A / B$$

WHERE:

$$A = \text{roll_plus_attack} - \text{hit_threshold}$$

$$B = 100 - \text{hit_threshold}$$

$$\text{roll_plus_attack} = \min(\text{random}(100) \text{ roll} + \text{BA} + \text{CO} - \text{AF} - \text{BD}; 100)$$

$$\text{hit_threshold} = \min(40 + \text{range_penalty} * - \text{PD_bonus}; 95)$$

* doubled for inherent 2x range to-hit penalty mod

CAPPED DAMAGE IS:

The overall result is capped at max_dmg.

Examples

1. Death Ray's dmg at 23 sq, assuming roll=85 and (BA+CO-AF-BD-range_penalty)=10:

$$18 + (35 - 18 + 1) * A / B$$

$$A = ((85 + 10) - (40 - -85)) = (95 - 95) = 0$$

$$B = (100 - (40 - -85)) = (100 - 95) = 5$$

Thus, actual damage is equal to min_dmg = 18.

2. If the target is closer, and the distance is only 11 squares:

$$35 + (70 - 35 + 1) * A / B$$

$$A = ((85 + 10) - (40 - -30)) = (95 - 70) = 25$$

$$B = (100 - (40 - -30)) = (100 - 70) = 30$$

And it follows that the actual damage is $\text{min_dmg} + \% (\text{max_dmg} - \text{min_dmg} + 1) = 65$.

Hv, Pd, HEF & Ordnance

These bonuses are percentages of damage of a regular mount beam. (In 1.50 the HEF bonus can be set for each mount separately.) Their interaction is not multiplicative but additive and they work the same way as dissipation range penalty, modifying min&max damage, so these bonuses are not subject to dissipation themselves.

Ordnance works best for (regular) ship beams, since they benefit from rounding up, so a 10% Ordnance bonus for a 5 damage ship beam will mean +1, while for a 5-9 damage fighter beam and for a 5-9 damage missile it will be +0.

Examples for a 50-100 beam with dissipation Range_penalty of 30:

Hv

```
50*(100 {base} + 50 {Hv} - 30 {Range_penalty})% = 60;  
100*(100 {base} + 50 {Hv} - 30 {Range_penalty})% = 120.
```

Hv+HEF

```
50*(100 {base} + 50 {Hv} + 50 {HEF} - 30 {Range_penalty})% = 85;  
100*(100 {base} + 50 {Hv} + 50 {HEF} - 30 {Range_penalty})% = 170.
```

Pd

```
50*(100 {base} - 50 {Pd} - 30 {Range_penalty})% = 10;  
100*(100 {base} - 50 {Pd} - 30 {Range_penalty})% = 20.
```

Pd of beam with 2x penalty set to applying for dissipation

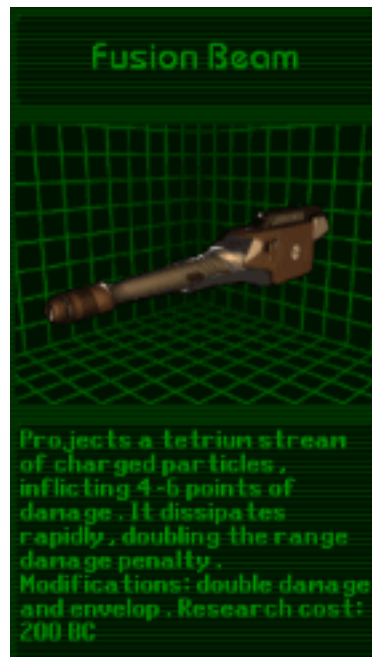
```
50*(100 {base} - 50 {Pd} - 2*(30) {Range_penalty})% = -5;  
100*(100 {base} - 50 {Pd} - 2*(30) {Range_penalty})% = -10
```

Note: in this case actual min and max damage will be 1.

At max distance all Pd beams that are reduced by range will do a miserable 1 dmg without HEF/Ordnance, no matter their max dmg strength. For example: A 1000 dmg Pd beam will still do 1 dmg at max range. So Pd does less damage at range than one might expect.

Pd + HEF of beam with 2x penalty set to applying for dissipation

```
50*(100 {base} - 50 {Pd} + 50 {HEF} - 2*(30) {Range_penalty})% = 20;  
100*(100 {base} - 50 {Pd} + 50 {HEF} - 2*(30) {Range_penalty})% = 40.
```



Pre-release screenshot.

Notes on Missile Defenses

Weapons

Missiles can be shot down by regular and Pd mount beam weapons, Interceptors, Anti-Missile Rockets (hit chance: 61% at 1 square distance - 10/3% per square distance, 15 sq. max range) and spherical weapons like Pulsars. Torpedoes, unlike missiles, cannot be fired at or damaged by these weapons.

Special Systems

Three special systems can defend against both missiles and torpedoes:

- Lightning Field: has a 50% chance to destroy each missile, torpedo or fighter attempting to strike the equipped ship.
- Cloaking Device: Missile warheads and torpedoes have a 50% chance to miss, but only if the device is active (ship is cloaked).
- Displacement Device: Missile warheads and torpedoes have a 30% chance of missing completely, regardless of any other equipment or considerations.

Note that Lightning Field acts before MIRV missile warheads separate but Cloak and Displacer effects happen afterwards.

Missile Evasion

Missiles and torpedoes that get through enemies defenses and reach a ship, have a 100% chance to hit that ship, unless that ship has missile evasion capabilities from:

- Ship Defense racial trait,
- Crew experience level,
- Helmsman fleet leader,
- Jammer and Inertial technologies.

The probability of a single missile warhead getting jammed is equal to the missile evasion bonus of the defender minus the best known scanner bonus of the attacker. (All monsters, the Guardian and Antarans have a Neutron Scanner³ onboard.) This probability is halved if the missile has ECCM (Electronic Counter Countermeasures). For MIRV missiles the jamming chance is not calculated per missile but for each warhead separately and it may happen that not all warheads of a MIRV missile hit, but some get jammed. Note that the Dragon Breath (a special torpedo with a standard damage of 300 and a dissipation of 15 damage per square) is unaffected by jamming.

Example

The probability that an ECCM warhead guided by a Tachyon Scanner gets jammed by the target ship that enjoys evasion from a Wide Area Jammer fleet bonus (+70), Stabilizer (+25), race penalty (-20), regular crew and a leader with 10 helmsman bonus, is:

$$P = [(70+25-20+7+(10/2))-20] / 2 = 33\%$$

³ Sensors in strategic combat.

Notes on Spherical Damage

Spherical Weapons

Pulsar

Does 2-24 damage points per size class of affected ship, in a 6-square radius.

Plasma Flux

The Eel's weapons is very similar to the Pulsar but does 10-40 points of damage.

Spatial Compressor

Can do 4-32 damage irrespective of size class and does all damage to structure only, ignoring shields and armor, similar to a Gyro or the ESD mod. Range is 4 squares. Contrary to Pulsars, Compressors autofire against incoming missiles and fighters.

Engine Explosion

If a ship's drive is destroyed, it will cause an explosion that has a damage potential of 5 times the maximum engine hit points (without Reinforced Hull). This damage value is tripled if the ship has a Quantum Detonator onboard. Contrary to other spherical weapons, the damage caused by a drive explosion dissipates linearly over range.

Satellites

Satellites have no drive, however if an orbital platform self-destructs it will still cause an explosion as if it has an engine of its corresponding ship size class (Star base gets Cruiser engine hp).

Damage Calculation

Actual damage done is calculated in different, independent ways for flyers and ships:

Missiles and Fighters

First of all, Fighters have a 50% chance to avoid the effects of any spherical damage. If they fail this 'evade' roll, they are treated in the same way as missiles. For each weapon in a slot a damage value is generated:

$$D = (\text{DamageMin} + \text{random}(\text{max}-\text{min})) * \text{ordnance}$$

Note that Ordnance does not affect engine explosion. An engine explosion against missiles is just a static damage with dissipation without roll.

The sum of all these damage values is multiplied by 25 and divided by the given hit points of one missile or fighter in the stack. Then, a random(100) value is generated for each flyer in the stack and compared with the result. If result \geq roll, the flyer is destroyed:

DESTRUCTION IF:
 $\text{aggD} * 25 / \text{hit points} \geq \text{random}(100)$

Ships

For ships, the process is repeated and a new damage value (**D**) is generated. In the same way as for flyers above, the total damage per slot is calculated. The resulting value is the (structure) damage for Spatial Compressor. For other sphericals: After that, additional $\text{random}(\text{aggD})$ roll(s) follow and the number of rolls is determined by the size class of the target ship (0,1,2,3,4,5) + 1. Thus a frigate gets one roll, a destroyer two rolls, etc. Each roll is re-rolled if the outcome is not 1, causing a bigger chance to roll 1 in result. The addition of all results is the damage value against that ship.

Final Notes

Unlike beams, sphericals always use all weapons from the slot. As a result, it makes a difference for missiles and shields if you have 1 slot with 5 weapons or 5 slots with one weapon. Fired from one slot, they do damage together (cumulative) and not separately.

Every described damage calculation is done per target, so damage values for two different missile stacks or two separate, same-size class ships that get hit from the same spherical weapon shot can differ.

Finally, damages of ship explosions can dissipate to 0 for missiles, but have a minimum damage of 1 against ships.

Notes on Orbital Assault

If you attack an enemy's colony world that has no defenses present or if you win the combat that results from it, your fleet gains control of the orbital space around the planet. This gives you the opportunity to assault the colony itself. One of the choices you can have in the Orbital Combat Selection window is to bombard the colony.

Orbital Bombardment

Estimated Bomb Hits

The orbital bombardment phase can be seen as a micromanagement reducing process. In a simulation the number of bomb hits is determined as follows: All remaining ships fire all weapons 10 times, or as many times as there is ammo in 10 turns (so for example 5 shots for torpedoes) and total damage is calculated from it. This damage is divided by 100 to get the displayed number in the Orbital Combat Selection window.

Note:

- The maximum amount of bomb hits is 320 for the fleet in orbit.
- Damage of beams and torpedoes are halved just like in tactical combat.
- A better computer helps for beams here too.
- The planet has 7% missile evasion, affecting missiles and torp hit chances.

Depletion of Non-Missile Ammo Bug

Due to a bug in classic, bombs only got 5 ammo and fighters no ammo at all during the 10 turn simulation. Now, bombs get 10 ammo and fighters do 1 launch. Fixing this bug revealed another problem for fighters: the simulation always used the base weapon, eg laser cannon for interceptors, instead of the best available one. This has been fixed too.

Planet Hits

Each building	1 hit
Stored Production (if >0)	1 hit (larger stored prod increases its hit chance)
Each full population	1 hit
Each fraction of pop (100k)	1 hit (population growth happens before combat)
Each Marine	1 hit (modified by Heavy-G, Powered Armor)
Each Tank	2 hits (modified by Heavy-G, Battleoids)

There is no set chance to hit something, the roll is per total of planetary structures.

Notes on History Graphs

Population

From the start of the game, the population graph stays flat for many turns, which can appear to be caused by some turn delay for updating it. This is however not the case. Instead, the line stays flat due to an overactive graph-smoothing function. This smoothing can be disabled with [no_graph_smoothing](#), greatly improving the accuracy of the graph.

Unit value: Each pop = 1.

Buildings

The buildings graph also benefits from disabling graph smoothing.

Unit value: Production cost of the building.

Fleet

Graph smoothing is most helpful here and without it, this graph can become somewhat messy. The unit value for each size class of ship is always the same, no matter if the ship is an empty hull or fully decked out with weapons and specials.

Unit values: Frigate = 20
 Destroyer = 40
 Cruiser = 80
 Battleship = 160
 Titan = 320
 Doom Star = 640

Tech

Creative and non-Creative are handled differently here: When a Creative race completes research of a tech app, it automatically completes the tech field too and gets the full tech field RP added to the tech line. A non-Creative race gets *half* the value of the tech field if it contains more than 1 tech app. If the field has only 1 tech, or it is a pre-warp field, full RP is added. If a non-Creative gains knowledge of a missing techs from the field, one quarter RP is added to the graph.

Unit value: Creative = Research points of the tech field.
 Non-creative via research = $\frac{1}{2}$ Research cost of the field.
 Non-creative other way = $\frac{1}{4}$ Research cost of the field.

Notes on Winning the Game

Your long struggle against hostile forces of the rest of the galaxy can only end in triumph or ignominy. If your last colony is destroyed or conquered, your empire no longer exists. In this case, your personal fate as an ex-emperor is something better left unmentioned.

On the other hand, you might win.

Orion Spoils

Despite the game's name, defeating the Guardian of Orion does not automatically give you the game, although the benefits acquired from doing so brings ultimate victory close. By default you are rewarded with the ancient Death Ray technology. This prize can be changed to any tech with [defeat_orion_reward_tech](#). Use the technology table to look-up the desired tech number (47 = Death Ray).

Win Conditions

There are three ways to win the game - exterminate all opponents; get elected as the supreme leader of the galaxy by a two-thirds supermajority vote; or lead a successful assault against the Antaran homeworld by sending your fleet to their realm using a Dimensional Portal. If you time it right you can achieve two win conditions - defeat the Antarans and all opponents (Battle at Antares needs to happen last); or defeat the Antarans and also win by election.

Score Calculation

The highest score that the game can display is 32.767. One point more results in a displayed score of -32.768. The maximum possible score is -1 (from 65.535 points). The difficulty level has no effect on the score, but the following items matter:

Time

A starting value is calculated from galaxy size and number of players:

Small:	100 points per player
Medium:	120 points per player
Large:	140 points per player
Huge:	160 points per player

One point is subtracted from the starting time value each turn. Time score can go negative if the number of played turns exceeds the starting value!

Population

+1 point for every unit of population.

Player Elimination

+50 points for every eliminated player.

Captured Colonists

Each event of capturing colonists grants you points (note that this is not a modifier for captured population at the end of the game). Points vary according to galaxy size because “larger galaxy provides more opportunities to capture population”:

Small:	2 points per captured colonist
Medium:	1 point per captured colonist
Large:	$\frac{2}{3}$ point per captured colonist (rounded down)
Huge:	$\frac{1}{2}$ point per captured colonist (rounded down)

Technology

Each researched technology field adds 3 points. Tech field 0 (Capitol, Spy Network and Pulse Rifle) and Tech field Engineering (Colony Base, Star Base and Marine Barracks) are always known from the start and are worth 3 points each. Thus, the Average Tech level starts with a tech score of 21 points (2×3 points + 5×3 points for the Pre-warp tech fields Nuclear Fission, Cold Fusion, Chemistry, Electronics and Physics).

Stolen, received or found technology does not increase the score unless it was the last one in a field and completes it. Each Hyper Advanced I level gives 5 points but Hyper Advanced levels II or higher add no points to the score.

The Guardian

Defeating the Guardian adds 100 points. This value can be changed with [hi_score orion](#).

Antares Win

A win by defeating the Antaran Homeworld adds 250 well deserved points to the score. The value can be changed with [hi_score antares](#).

Council Win

Brings in a meager 100 points. The value can be changed with [hi_score council](#).



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Enjoy playing Master of Orion II: Battle at Antares with this patch!

Alexey & Ricardo

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