Metal Crusade

8th December 2010

A tactical military mecha simulator. The game uses OGRE for rendering graphics and OIS for handling low-level input.

The game lets you pilot giant military robots (eponymous metal crusaders) with a third-person overhead view with stress put on tactics, both individual and group, and designing or customising your crusaders.

Contents

Part I.
Gameplay

1. Gameplay layers

1.1. Piloting your crusader and commanding your squad

1.1.1. Piloting your own crusader

Throttle Set the throttle as the desired fraction of maximum speed either as a direct key 1-10(0 on keypad by default) or by stepping using forward and backwards keys in increments of 1/4 for forward drive and 1/2 for reverse. When the speeds hits a certain level (0.75 for most) the crusaders starts to use the alternative walking mode - running, where applicable. Running mechs can be thrown off-balance and tripped. There is a dedicated button to stopping and to reversing the throttle. Generally, crusaders walk backwards more slowly - depends on the type of the drive.

Steering Most mechs have the torso connected to the drive (legs) by a rotational joint. The arc and speed of rotation depends on the model and parts used. Steering the drive is perfectly straightforward left and right affair with the turning arc dependant on speed. If the crusader has legs it can turn on spot when still.

Aiming Aiming is done through a reticule that follows the pointer. The reticule has two parts, one aligned the pointer the other aligned to the current aim of the guns. Aiming can be toggled between targeting crusader torsos, the ground, or air units. The torso can be turned to where the pointer is on click - this can be reversed. You can also reset the drive to turn to the direction the torso is pointing to.

Targeting You can acquire anything you see by targeting under the the cursor. You can cycle targets, target the closest one, cycle friendlies. Targeting isn't the same as acquiring lock for you missiles. This is attempted automatically but may not succeed. Some missile types don't require a lock, or use visual or manual guidance. You can only target objects that you can see (including on the radar).

Powering Down You can power down your crusader do avoid damaging your electronics and easing the load so all power can be redirected to cooling down the crusader. You can also power down as a stealth tactic. You can activate systems selectively, for example only turn on your passive radar.

Crouching Crouching can be used to make your profile smaller or for some models provide extra cover.

Flushing Coolant Cooling systems can use a reservoir of coolant to replenish the coolant level in the system after flushing your coolant. If you continue to flush your coolant, depending on the model, you might flush all the coolant, which will lower your temperature in the short term but will also make the cooling system less efficient or not functional at all.

Operating MFDs Described in detail a separate section. Two buttons to cycle the selected MFD, four cursors keys to operate it and one button to activate the selection of the view in the MFD.

Firing You can fire the currently selected group or weapon on the list. You can fire groups using key-bindings. You can fire all available weapons at the same time. You can cycle groups, you can cycle individual weapons. You can choose between group mode and single weapon mode, and enable or disable auto-advance of the selected weapon after firing.

Log You can see the last two log messages all the time. You can extend the log computer to see more and when extended the same cursor keys used for MFDs can scroll up or down line by line (up, down) or page by page (left, right).

On-board Computer The on-board computer shows two status lines at all times but can be extended to reveal an interactive menu operated with the MFD cursor keys.

Radar Can be turned on and off, set its operating mode to active if available and change the range shown on the display. The speed of the sweep and be set manually or set to vary with the displayed range.

Navigating You can cycle between nav-points and turn on the autopilot to move between points.

Inspecting A target can be scanned to obtain as much info about it as possible, this required closing in on the subject and will either use and MFD with a target view, or will use the first available MFD and switch to that view to display the result. Inspecting will also select the MFD and expose an interactive menu that will allow to issue orders related to the inspected object.

Communication A dedicated menu, operated with the MFD cursors keys used to talk to other pilots and issue commands. F keys can used as shortcuts.

Night-vision and lights Can be activate via shortcuts or via the on-board computer.

1.1.2. Using the MFDs

Select the MFD and when active use the cursor keys to operate it and the toggle key to change views.

damage report shows your status

target report shows the status of your target

target view show the enemy closeup

target inspector shows a context menu for your target, selected automatically when inspect key is pressed

area map show the map, allows you to move around the map, zoom level locked to the zoom level of the radar

enemy list shows a list of targets, can be sorted and filtered with the use of the cursor keys, selecting an object on the list targets it.

systems control shows status of systems, let's you disable and enable them or change their mode

squad tactics a menu of shortcuts for controlling your group. Change formation, engagement rules, move to a different phase/set current objective.

1.1.3. Using the On-bard Computer

Settings for:
auto lock on when missile selected or at all times
speed of sweep of the radar, manual or linked to the zoom level or auto, radar modes
shutting down systems
autopilot
Operated with the cursor keys like the MFD and all other interfaces.

1.1.4. Using the communication menu

This should be primarily used to access the order stacks that need manual release for certain orders or skipping some order. Secondly to access comms of each group, and each crusader if needed to micromanage but if you have to do it like that then you must have skipped the planning phase.

Communication menu operated like the MFDs with the cursor keys.

1.1.5. Terrain on local maps

grass/dirt solid ground, creates slopes

rock might create steep slopes

sand produces dust

forest foliage provides visual cover

marsh/rubble slows down, especially wheeled drives

snow less traction

shallow water better cooling, more resistance, less traction

lava heat damage, resistance

1.1.6. Weather, other conditions and local hazards

Temperature set the ambient temperature. Might be localised.

Precipitation aids the cooling process

Storm visual impairment

Night/Day visual impairment, sometimes linked with temperature.

Electrical Storm raises temperature at random intervals, messes up some electronics

Space Radiation destroys some electronics

Steam obscures heat vision

Smoke obscures vision

Fire/lava temperature hazard.

Fog/thick atmosphere limits visibility (next to impossible to do with overhead view, maybe with some cheating)

1.2. Moving around the planet map

The map shows the world with a hex grid overlay. Each hes can have one of many terrain types. It can be claimed by one party. It can have a structure on it. At any point it can have any number of units on it.

1.2.1. Action resolution

Movement is turn based. Turns are simultaneous - moves are resolved at the same time. All actions take effect after the turn ends.

After turn finalisation, when the moves if resolved would cross paths with the enemy and you detect him before he does you will be prompted if you want to attack him or continue. This happens before the moves are shown so as not to reveal the encounter to other players (assuming this is on a network).

Action that can be done multiple times

- If you are on the same hex as the enemy you can attack him.
- attack the structure on the hex.
- If attacked you can defend or try to flee.

Note on fleeing You will be prompted if you can flee. If not, you can split up the forces to cover your escape to an adjacent hex. Covering the escape route is a mission and can fail. If successful however your other half of‘ your group is moved to an adjacent hex. After attack you can set up the move for your escape but the enemy may choose to pursue which will take it wherever you go and open you to further attacks along the way, unless you stop it along the way by engaging in battle again.

Actions resolved at the end of the turn

- split up your forces or join groups.
- leave a garrison at a structure or set-up a patrol.
- enter a structure you own.
- board or disembark a transport - can be done as part of the move
- move to another hex.

1.2.2. Moving

Moving your units or your convoy is done on hexes. Depending on terrain type and other factors you can move more then one hex at a time. Moving in convoys or by dropships greatly speeds up travel but may not be available.

On Foot Unless you carry spare fuel rods the range of travelling on foot is very limited and in all cases slow.

Wheeled_Drive If all your crusaders have wheel drives your range is greatly extended but not all terrain is suitable for wheeled drive.

By Convoy The fastest land-based mode of travel. Crusaders are loaded up on convoy trucks. Depending on their drive types this limits your paths to better terrain but greatly increases the speed and range of travel.

By Air Transported freely on helicopters between arbitrary points. Same as convoy except flying. Limited range but greatest possible speed except for transport by drop-ship.

Drop-Ship The fastest point to point travel. Can be interplanetary. Unlimited range. If within one planet, can take you to any point in the next turn. Travelling to another planet takes an additional turn.

1.2.3. terrain types on the overhead map

Many graphical sets exits - may be visually different but the qualities remain the same across them. Each turn you have

Urban cities and developed areas, with the transport system intact. If a city is destroyed it loses this status and becomes **rough** terrain.

Plain terrain without major transport limitations.

Rough either hilly, derelict urban, swamps, or anything else that impairs transport.

Mountains mostly impassable except when via a road system or on foot or by air. Can also be any other extreme form of terrain like shallow water or lava.

Sea impassable to road travel.

	leg drive	wheel drive	colour designation
Urban	3	2	grey
Plain	4	3	yellow
Rough	5	10	brown
Mountain	10	impassable	white
Sea	impassable	impassable	blue

Table 1: Ground Movement Cost

Each tile may also have additional qualities like a road system, a river etc. some of which affect the speed and accessibility. A road systems makes any tile an urban tile for purposes of travel. Aircraft travel at cost of 1 per hex regardless of terrain. Sea vessels travel at cost of 3 per hex of sea. Loading and unloading is free.

Each turn you start with 10 movement points, unused points are forfeit.

1.3. Customising your crusaders and running your company

1.3.1. Buying gear

You can sell and buy gear from the free market which has limited supplies. Supplies depend on the manufacturing capability on the planet or the trade links and are specific to planets. You can always order from the merchants guild for things to be shipped in the next few turns but that costs almost as much as jumping to a different planet yourself. Prices are dependent on supply. If there's a manufacturing plant on the planet that creates flamers then they are cheap as dirt, destroy the factory and after a while they cost more. Trade links robustness depends on how big the planets population is. Pillaging cities will make the planet less attractive for trade.

1.3.2. Customising Crusaders

Costs money, can be done at base or mobile base. Can be customising weapons and armour or changing internal structure. Depending on the number of mechanics (place the work at may have a modifier too) available it takes different amounts of time.

1.3.3. Hiring staff

Some gear requires staff. Staff is generic, unless a plot character and cannot die. Loosing gear, the convoy, etc. doesn't kill the staff. Payroll is done every-turn, contracts are signed for 100turns. Failing to pay doesn't immediately cause dismissal. It damages your reputation. Low enough reputation causes actual dismissal. You cannot hire new people until you settle debts.

For simplicity drivers, convoy staff and pilots come bundled with the vehicles and their salary is part of operation costs of the vehicle. Miscellaneous staff at the base are also part of the operation costs. Same goes for staff working in buildings.

Mechanics all repairs and customisations cost time and money, both are affected by the number of mechanics you have

Crusader Pilots each with a rank, promotions can be made after they get enough XP and cause a salary increase, pilots never die but they can leave, especially if you refuse a promotion for too long, they might be available for hire later but with a higher rank. By refusing promotions you can keep a certain number of pilots of each rank and keep them rotated automatically.

Soldiers ground troops, hired in self replenishing groups, as long as not all get killed they restock, used for taking over bases, can be moved in APCs or trucks

You can find special characters that will boost everyone's performance in their group, like a master mechanic, charismatic leader etc.

1.3.4. Contracts

When you run a mercenary company the only sustainable way to earn money is to take contracts. You can go rogue but at some point you will attract enough attention to warrant a contact being drawn up on you. Hostile actions cause your infamy to raise but also the relations with whoever you're attacking to fall.

Contract may be offered to you personally by the interested party or you may take one from the bulletin board. The bulletin board is global but jumping systems is expensive and unless the contract is really lucrative you're stuck with missions from the planet you are on. Contracts are offered by global factions or local authorities or individual people. After picking a contract you may still be refused if the employer doesn't think you're up for the job (this is to stop players from trying to fluke a well paid mission beyond their scope).

Common contract variables include:

employer the person issuing the contract

area where the mission takes place, a group involved

allied faction the faction that will gain from this contract successful completion, not necessarily employers faction

enemy faction faction that will bear a grudge (not always the case, you might not be detected etc.)

time limit may be based on time or other factors, like a unit reaching its destination or other failing condition etc.

objectives doing these will get you paid the contract sum

secondary objectives extra pay but not mandatory, often only paid on mission success

pay including secondary objectives and salvage rights

type the template for the mission or another requirement like a number of bases sacked, damage dealt etc.

1.3.5. Mission

Any type of action available for a certain map is a mission. A contract might specify a mission, an event might result in a mission or you might choose a mission freely. Each mission starts a reciprocal mission for the enemy. Missions need to be planned, unless they're planned by your commander. A missions which is in result of a contract might have some objectives already planned.

Mission Types:

Skirmish (rec. Skirmish)

Defend Attacked Convoy (rec. Attack Convoy)

Attack Convoy (rec. Defend Attacked Convoy)

Cover Retreat (rec. Pursue)

Pursue (rec. Cover Retreat)

Patrol (rec. Patrol, Sabotage, Attack Base, Nothing) the bread and butter of starting out mercenaries, list of navpoints, possibly time constraints, engagement rules

Sabotage (rec. Patrol) might mean destroying certain structure or just inspecting something, might include time limit or stealth requirement

Attack Base (rec. Patrol)

Duel (rec. Duel) this covers tournaments and other challenges, list of enemies, possible crusader requirements

Attack Base (rec. Patrol, Defend Base)

Defend Base (rec. Attack Base)

You can instigate missions yourself. You can attack a convoy, ransack bases etc. regardless of your relationship with either. You can't attack your own units (let's draw a line at this kind of madness).

1.3.6. Mission planning

Before each mission you get to see the map and plan out objectives, some of which may already be there as part of a contract.

Place nav points on map nav points may also be tied to units

Create groups create groups out of crusaders, groups can overlap

Create order stack once you skip an order it is either failed or accomplished and you move onto the next, only the current place in stack is being continuously evaluated for launch, succeed or fail conditions

Create order choose group, choose action

Create objective choose an event, used for triggers

Place order on stack might include time, dependent on other order or objective or automatic (orders and objectives might be failed or accomplished and you can have more than one and have "and" and "or" between them)

Actions to choose from (time might be zero, which means infinite):

- Wait (duration)
- Move to nav point
- Defend nav point (duration)
- Attack nav point (duration)
- Support group (duration)
- Retreat to nav point
- Change formation
- Change engagement rules

Event to choose from:

- Nav point destroyed
- Group destroyed
- Time passed

2. Game progression and ranks

Game, story mode or not, starts of with you working for a mercenary company, getting paid per mission. Missions get you XPs and those get you promoted. Promotions get you more privileges. At any point you can setup a company which will fast track your promotion - you need to pay for the license.

2.1. Ranks

Finishing missions gets you XP points. Setting up a company grants you all the privileges. One mission is roughly 100 XP. You should be able to pay for the license before you reach the XP level of Commander. Unless you totally fuck up you should get promoted after your first mission.

requirement	Ranks	New Privileges
	Cadet	pilot a crusader
100 XP	Ensign	customise your weapons, trade weapons
500 XP	Lieutenant	customise your crusader, trade crusaders
1000 XP	Captain	Command wing-men
2000 XP	Major	customise other crusaders
3000 XP	Colonel	plan mission
4000 XP or start a company	Commander	Sign contracts, hire staff
become a faction	Admiral	Offer contracts, build structures, handle economy

Table 2: Ranks

This also applies to people you hire. You need a major in each internal group, you need a colonel to create a party. Captains can also form groups but are limited to one wingman.

3. Game world

3.1. Factions

Factions mirror to an extent current cultures. Highly original, I know. Bite me.

Mercenary not really a faction, but a catch all term for all kinds of military companies offering military services for money, not necessarily as troops on the ground

Nomads anarchists, Russian, central and northern Europeans, middle east, strong militarily, exert very little control over civilians but also not loyal to any cities or nations in particular, opportunistic. Not very coherent in actions or policy.

Imperium commonwealth countries and Asians, strong economically, efficiently exploiting civilians, a bit like the empire from Star Wars. Not the nicest guys around but very well organised.

United Nations a special coming together of mediocrity and ineptitude, kind of like the real thing, reactive and peaceful in intent, benevolent to the civilians but also cannot be relied on for protection. Easily fills the void left by other nations because cities are unlikely to refuse incorporation. Culturally a incomprehensible mix of every culture out there.

There are also local factions.

3.2. Star system

Maps are asteroids or planets. Jump between each takes a turn after boarding (yay, FLT). The game takes place in one star system. Jumps between star systems are possible but prohibitively expensive.

body name	population	environment	military presence	
Purcell	arcology	lava, ash, rock,	low	
planet 2	terraformed	earth-like	low	
planet 3	terraformed	marsh	high	
asteroid 1	mining outposts	rock, dirt	medium	
planet 4	being terraformed, arcology	snowy/earth like	medium	
asteroid 2	mining outposts	snow, rock	high	
Komeda	mining outposts	active core, mud, water, marsh	low	
planet 5	Hostile not populated	active core, lava, snow, rock	high	

Table 3: Star system

Generally planets and environments are divided into two categories: resource and habitat. The former are mostly small planetoids which house either mining operations or some other raw materials industry. The latter are mostly terraformed planets where people live. They might also have mining industries. In these people form cities and the private sector is more present. It also means that factions have the things divided pretty tightly amongst themselves.

Terraformed Planets they are somehow similar to Earth depending on the progress of terraforming

Arcology Planets they are not terraformed, instead cities comprise of closed systems, the planet environments must still be within tolerance of technology

Asteroids and hostile planets uninhabited except for the staff working in the raw materials industries, may be tiny one company operations or almost as big as planets housing competing corporations.

3.3. Crusaders

3.3.1. Chassis

Chassis are the outer shell, they can be customised internally and some allow for changing the drive type. Each faction has its own colours but the designs are freely available on the market. Some faction favour certain designs and produce more of them but they are classified by the company developing the design.

Serial numbers meaning: type-manufacturer-modelyearvariant-drive, format: U-VVV-WWXXY-Z.

RADOM Peon (R-RDM-PN12A-B)
Templar (A-RDM-TM08A-B)
Husar (C-RDM-HS11A-B)
Catapult (G-RDM-CT01A-T)

Class	Average max tonnage	Description	Average top speed	Code
messenger	100T	specialised unit for surgical strikes at single targets with few slots and panels, cheap hardware, almost no armour or weapons, usually carrying explosives or self-destructing upon reaching the target	100km/h	M
recon	100T	light crusaders, used for recon, patrol, and flanking manoeuvres	60km/h	R
infantry	150T	most common crusaders	50km/h	I
cavalry	150T	specialised crusaders, sacrificing most of the available tonnage and space for speed, sporting few slots and panels, similarly to recon crusaders used for their speed not their firepower but their bulk and armour mean they can fight with other infantry as equals	80km/h	C
assault	200T	used as part of bigger groups, can be easily outmanoeuvred, just as well they are usually used to attack immovable targets or for defence	30km/h	A
goliath	300T	Walking (or more likely, rolling) fortresses, crushing anything in its path (but you've got plenty of time to move out of its way), relying on wing-men for protecting its back	20km/h	G

Table 4: Crusader Classes

Lynx (M-LNX-)
(R-LNX-)
(I-LNX-)
(I-LNX-)

Vi sed (M-VIC-SE01A-B)
awk (R-VIC-AK01A-T)
tail (C-RDM-TL01A-B)
tex (A-RDM-TX01A-Q)

Figure 1: Odin Logo

Odin (C-ODN-)
(I-ODN-)
(A-ODN-)
(G-ODN-)

Parameters:

- weight
- max weight
- heat dissipation base
- heat dissipation rate
- structure base

- internals
- panels
- torso arc
- torso turn speed

3.3.2. Drives

Chasis have different variants with different drives. Not all possible combinations exist.

biped B

quadruped Q

multiped M

tracks T

multiwheel W

Drive parameters:

- weight
- kinetic resistance (reverse)
- turn speed
- traction
- max speed (reverse)

3.3.3. Engines

Parameters:

- engine rating
- heat production
- weight
- size

3.3.4. Weapons

table below is based on an old table with different metrics

3.3.5. Armour

Armour types:

composite superb ballistic protection, poor heat protection

reactive extreme protection, soaks up more damage and creates heat

plastic standard armour, balanced

ceramic superb heat resistance

tesla creates heat, provides no protetction against heat

list name+	name+	weight+	panels+	slots+	ammo	cool-off+	heat+	range	cone	H DMG	B DMG	E DMG	LOCK+	splash	multifire+
EMP Rifle	EMP Rifle	6	1	4	100	12	100	100	90	1	0	6	0	0	1
Plasma	Plasma Rifle	2	1	2	24	2	40	50	90	0	1	1	0	0	1
HVPC	HVPC	12	2	4	240	18	80	140	95	0	15	20	0	0	1
CHVPC	CHVPC	20	2	8	1600	1	100	140	95	0	20	40	0	0	1
Flamer	Flamer	4	1	2	200	1	10	40	95	8	0	0	0	10	1
H Flamer	Heavy Flamer	12	1	4	200	1	20	80	95	14	0	0	0	10	1
Microwave	Microwave	40	4	16	3000	1	200	200	95	10	0	0	2	0	1
EMP Array	EMP Array	60	4	20	1000	10	400	100	80	6	0	40	0	0	4
Plasma Array	Plasma Array	64	6	40	24	10	280	50	80	0	10	40	0	0	6
Machine Gun	Machine Gun Array	1	1	1	80	1	10	100	70	0	1	0	0	0	4
200mm RFC-3	200mm RFC (chain)	2	1	2	60	3	100	20	80	0	2	0	0	0	3
200mm RFC-E	200mm RFC (expl.)	6	1	2	80	3	100	20	80	0	3	0	0	0	1
400mm	400mm Cannon	2	2	4	40	5	150	25	70	0	6	0	0	0	1
Precision	Precision Rifle	8	1	3	32	4	200	50	95	0	16	0	0	0	1
Gauss	Gauss Cannon	20	2	4	24	6	200	100	90	5	18	10	0	0	1
H Gauss	Heavy Gauss Cannon	4	2	6	18	6	400	100	95	5	40	10	0	0	1
Harkonnen	Harkonnen Canon	28	4	20	10	6	800	50	95	0	80	0	0	0	1
Mortar	Mortar	20	4	40	1	4	40	30	40	0	20	0	0	0	1
Hellfire	Hellfire	2	1	1	80	1	80	20	30	1	8	0	0	10	4
Swarm	Swarm	3	2	2	60	4	200	20	60	2	10	0	-1	0	6
Dart	Dart	6	1	1	48	2	80	20	100	2	10	0	1	0	1
Arrow	Arrow	12	1	4	26	4	120	100	100	5	40	0	1	0	1
Dart Array	Dart Array	16	4	4	24	2	160	20	100	5	30	0	1	0	4
EMP Arrow	EMP Dart	10	1	3	20	2	120	40	100	0	0	40	0	0	1
Firefly	Firefly	36	4	6	48	4	120	30	100	50	0	0	1	0	1
Legion	Legion	42	8	10	24	8	400	50	60	10	60	0	-1	0	16
Hail	Hail	62	12	16	32	10	600	100	50	20	80	0	0	80	32

Table 5: Weapons

Armour parameters:

- structure per ton (how much damage the armour itself can take)
- ballistic per ton (protection per ton - how much damage it stops)
- conductivity (insulating armours are susceptible to energy damage and vice versa)
- generated heat (how much damage is converted into heat)

3.3.6. Internals

struts no weight

structure provides damage resistance

heatsink

actuator more weight carry, increase max speed if in legs

gyro stability

coolant extra coolant capacity

ultra gyro generates heat

capacitor

3.3.7. Radar

Different manufaturers and you can put them into any mech. They don't take up any slots but have some weight.
Manufacturers:
WARRAD

Parameters:

- active
- max power output
- heat sensitivity
- electromagnetic sensitivity
- weight
- sweep type (rotating, fixed, oscilating)
- cone angle
- heads (or dishes)

3.3.8. On-board computer

This is part of the personal shell and moves with the pilot. Different HUDs offer different quality of information but also differ in resistance to electronics damage. Not each company makes one but they are cross-compatible. Usually the pilot travels with his own.

RADOM spartan but resistant, mostly analogue displays and ridumentary electronic displays

Lynx high-tech and sophisticated, everyhing on a HUD glass, high resolition and lots of extra info, finicky as hell

Vi high tech but simple, average in reliability and resistance

3.3.9. Equipment

3.3.10. Damage model

3.4. Transport

You can always travel on foot (wheel or whatever's your crusader drive). This has a limited range and is generally slow. You can buy or rent transport.

TUG not actually a tug, complete with platform. All it does is transport one crusader. No staff needed.

Helicopter same as above but flying.

Mobile Base a convoy that can carry up to 16 crusaders (including spare chassis). Provides repair and weapon customisation. Can be loaded up with helicopters or TUGs (take up as much space as 2 crusaders).

Air Base a flying convoy version of a mobile base.

Drop Ship can carry up to 64 crusaders. Provides repair and weapon and chassis customisation.

3.5. Military Units

This is cannon fodder and civilians. Fast means around 100km/h. Slow means below 50 km/h.

Transport various transport vehicles, from trucks to tankers. Fast.

Armoured Transport transport for valuable and fragile goods. Slow.

APC transport vehicle with a single 360 turret housing 1 panel and 1 slot, wheels, tracks, extremely fast

Tank diverse set of units carrying a turret as big as 8 panels, tracks, fast

Artillery no turret, 16 panels, tracks or wheels, slow

Gunboat like tanks, except on water

Attack Helicopter as big as 4 panels, fast, armoured

Bomber used against structures, not armoured, easily taken down by AA turrets

3.6. Structures

Any structure that does not contain non-military buildings is considered an outpost, otherwise it's a city. Non-military buildings and housing is built by private corporations and only on some maps where people live. They cannot be built by the player but the player can encourage such structures by providing security. Some private companies also come with their own militia. In return they can extend your research and manufacturing capacity and provide income depending on the contract.

Military

Airfield houses and provides maintenance for aircraft.

Military Depot houses and provides maintenance for crusaders.

Military Workshop provides repair and and customisation of crusaders.

Military Factory produces military units. Can have different manufacturing lines.

Walls and gates of different type.

Turrets of different type, using the same gear as crusaders.

Barracks houses military personnel.

Research Facility provides improvements to tech.

Power Plant provides power to the grid, though some turrets are self-reliant anyway.

Non-military

Arcology/Residential Block provides food and housing.

Manufacturing Plant creates non-military equipment.

Research Facility provides improvements to tech.

Part II.
Assets

4. Models and textures

4.1. Crusaders

Each one needs a model comprising of seperate parts for each leg and the drive (root node), each arm, and torso. Arms can be destroyed. Legs can be damaged. Torso and arms can be attached to different drives (though the combinations are limited).

Each crusder needs a model, but variants share the same upper part.

Animations needed:

- running
- walking
- crouch

Each crusadaer needs collisions and special nodes to position the panels.

4.2. Buildings and props

Base buildings

City buildings

Environment props

4.3. Other Units

4.4. Projectiles

4.5. Particles

4.6. Terrain textures

5. Planets and maps

Planets are hand-made. Each has a set of textures used for terrain types on the overhead map and on the local maps.

Planet types:

Terraformed Planet almost exactly like earth with cities

Planet Being Terraformed has hubs of shielded cities and arcologies and parts of violent weather

Hostile Planet raw planet with arcologies

Asteroid bascially a very big rock with mining bases

Figure 2: terrain types colour schemes

5.1. Overhad maps

Overhead maps are hand made. The comprise of a map of hexes. Each planet has its style of hexes but functionally they share the same set.

Hexes have outlines and don't need to connect to others smoothly. The hexes are 3D models of the tile. Each tile has a set of visually varied tiles.

- urban developed
- urban regular
- urban destroyed
- plains
- craters
- hills
- swamps
- mountains
- canyons
- volcanic
- sea

Each can be overlaid with a base, river or road.

5.2. Local maps

Maps are are generated by randomly assembling handcrafted tiles. Tiles are picked from pools which are restricted to what is on the hex (eg. only hilly tiles, or only urban tiles).

Maps can have different styles - different sets of terrain textures, depending on the type of planet/asteroid. They share some of the same sets of tiles - only textures are exchanged.

5.3. Tiles

Tiles are laid out to overlap at the edges and are blended together. Maps can be as big as 9.6 km across (100 smallest tiles). Tiles can be as small as 1 km. The overlap is always at least 128 metres (almost as big as the camera coverage) or 16 pixels. Bigger tiles have bigger ovelap. The smallest tile is is 128 pixels, biggest 512. Tiles are mixed into a composite image first and then converted into a terrain. Maps with buildings are persistant - others are created on entering the map each time.

- City (regular, coastal, river, base)
- plains (regular, coastal, river, base, road)
- hilly (regular, coastal, river, base, road)
- mountainous (regular, river, base, road)
- River delta (regular, base, road)
- swamp (regular, base, road)
- craters (regular, base, road)
- volcanic (regular, base, road)
- canyons (regular, base, road)

The mix of tiles is based on the type of the hex and the hexes next to it.

Each tile type needs a couple of unique designs. The base tile needs a flat area at a specified place for the base buildings.

Each tile needs several layers:

logic layer each channel maps a different characteristic: R - traction, G - hardness, B - conductivity, A - kinetic resistance (inverted - black meaning impassable), this layer is generated automatically from the terrain type layers

height layer A as height, RGB generated automatically and used for the precomputed normals

terrain type layer a fixed pallette PNG with each terrain type being assigned a colour

6. HUD and UI elements

6.1. HUD textures

3 HUD styles, each has to implement a full set of HUD elements. Multiple HUD versions of the same style are needed to accommodate special needs of some crusaders.

6.2. Item icons

Icons for all crusaders, weapons and anything that can be bought.

7. Characters and cinematics

Cinematics are a graphic novel.

Some uniqe characters exist, even if the story mode is not enabled.

Most crusader pilots have random portraits.

Part III.
Technical Structure

8. Classes overview

8.1. Classes for physical objects

All physical objects existing in the world with a position and a collision mesh are part of the master class hierarchy.

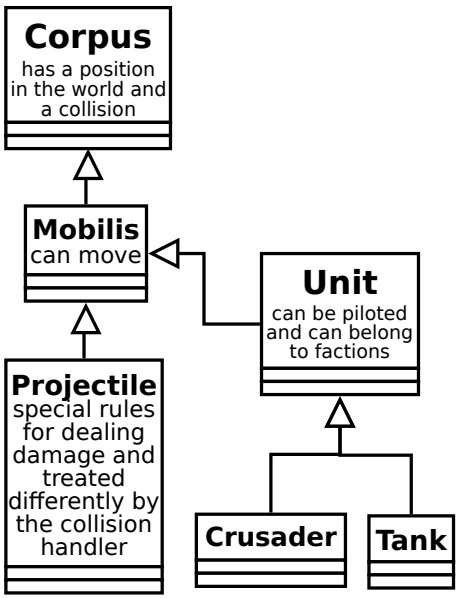

Figure 3: Master Class hierarchy

All classes within this hierarchy chain the constructors and each expands capabilities of the previous. Everything in the world that can be collided with is part of this hierarchy.

Corpus is used for indestructible scenery, buildings and other structures that do not move and can be as big as needed.

Mobilis is used for objects in the world that can move and can be destroyed, also for stationary things like destructible buildings.

Unit is abstract and generalises objects that are active agents, vehicles that can be piloted - either by an AI or a controlling player. Crusader and Tank are concrete classes with the Tank being a very simplified unit, meant to be used as cannon fodder.

Projectiles are a special case of Mobilis with a short lifespan, extended damage processing and simplified collision and targeting, with their apparent movement speed warped.

8.2. Subsystems

Game main class that instantiates everything else and contains the inner loop

Arena the class that contains lists of all the objects on the current map, current map may also be the global map

FilesHandler reads and writes configs, designs, etc.

InputHandler reads input from OIS and passes it on to the game

CollisionHandler finds colliding bodies and dispatches them so that they can deal with collisions themselves

Hud everything that's drawn on screen is governed by it, including menus

TextStore serves strings read from the game_text file

Timer keeps track of local time, allowing for pausing and slowing down and speeding up of time.

9. Collision

Each corpus registers itself on the arena object (additionally to the collision handler object for Mobilis) at the beginning of its life and unregisters itself when it disappears (only Mobilis). The arena is divided into cells to aid finding objects local to a point and limit the number of objects checked against for potential collisions by the collision handler. Objects that move update their position in the grid of cells. When checking for possible collisions you only need to check the current cell and its 8 closest neighbours. If a bounding sphere's radius of the object is greater than the width of the cell it must register itself with more cells. This is mostly only limited to immovable objects.

9.1. Collision mesh

Each object's mesh is contained within a bounding sphere. For some small objects that is enough. Bigger objects also contain up to 32 individual collision spheres and up to 8 exclusion spheres. Exclusion spheres are used to speed up checking large numbers of small spheres and to approximate flat surfaces. Exclusion spheres are checked against first and if the potentially colliding sphere is outside the exclusion sphere of the other object then all child collision spheres of that object can be ignored. Each collision sphere can be a child of multiple exclusion spheres. Figure 4 on page 19 shows how you can use exclusion spheres to approximate a flat wall.

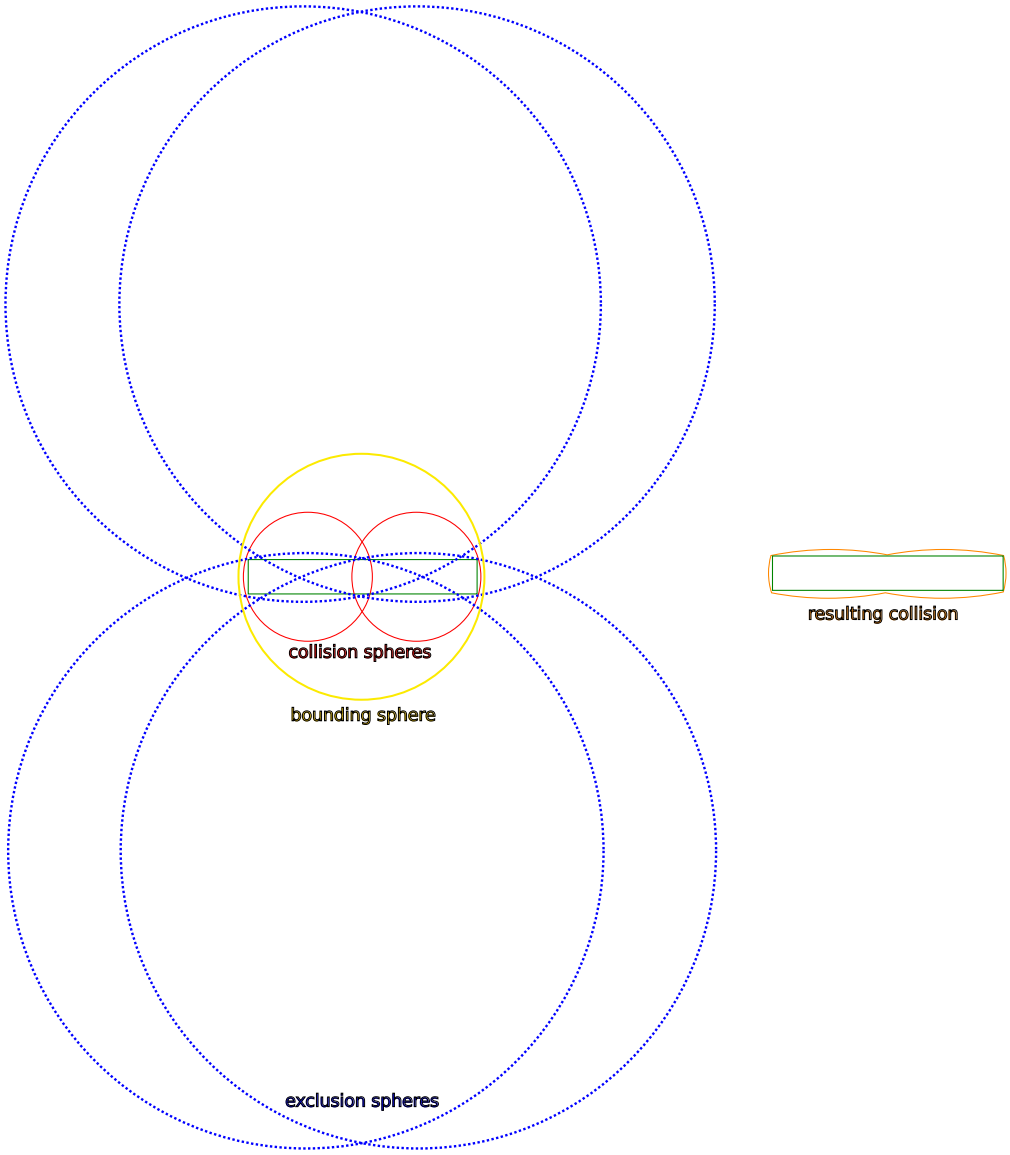

Figure 4: Collision spheres used with conjunction with exclusion spheres to approximate a box.

9.2. Collision detection

Collision detection is handled the same for all objects except Corpus is not checked against other Corpus since it cannot move. Each object checks against collision with other objects based on its bounding spheres to find potential collisions.

When the bounding spheres intersect and a collision is possible following checks are made to determine possible individual colliding spheres:

- Check bounding spheres of one against the exclusion spheres of the other.
- Exclude all collision spheres contained in the exclusion spheres that do not intersect with the bounding sphere.
- Do the same for the other way around.

Now for each sphere in one of the objects that has not been eliminated do the following:

1. Check against exclusion spheres that have not been eliminated by the bounding sphere.
2. Eliminate collision spheres based on eliminated exclusion spheres.
3. Check the sphere against all remaining spheres.

Each found pair of spheres is added to the collision.

9.3. HUD

9.3.1. MFD

Idea scraps:

- sonic weapon, no piercing, just large mass stopping the crusader - trail of dust shows the invisible 'bullet', you have to keep pumping the wave and it accelerates as it gets further away, used to damage the core by the force of the shock