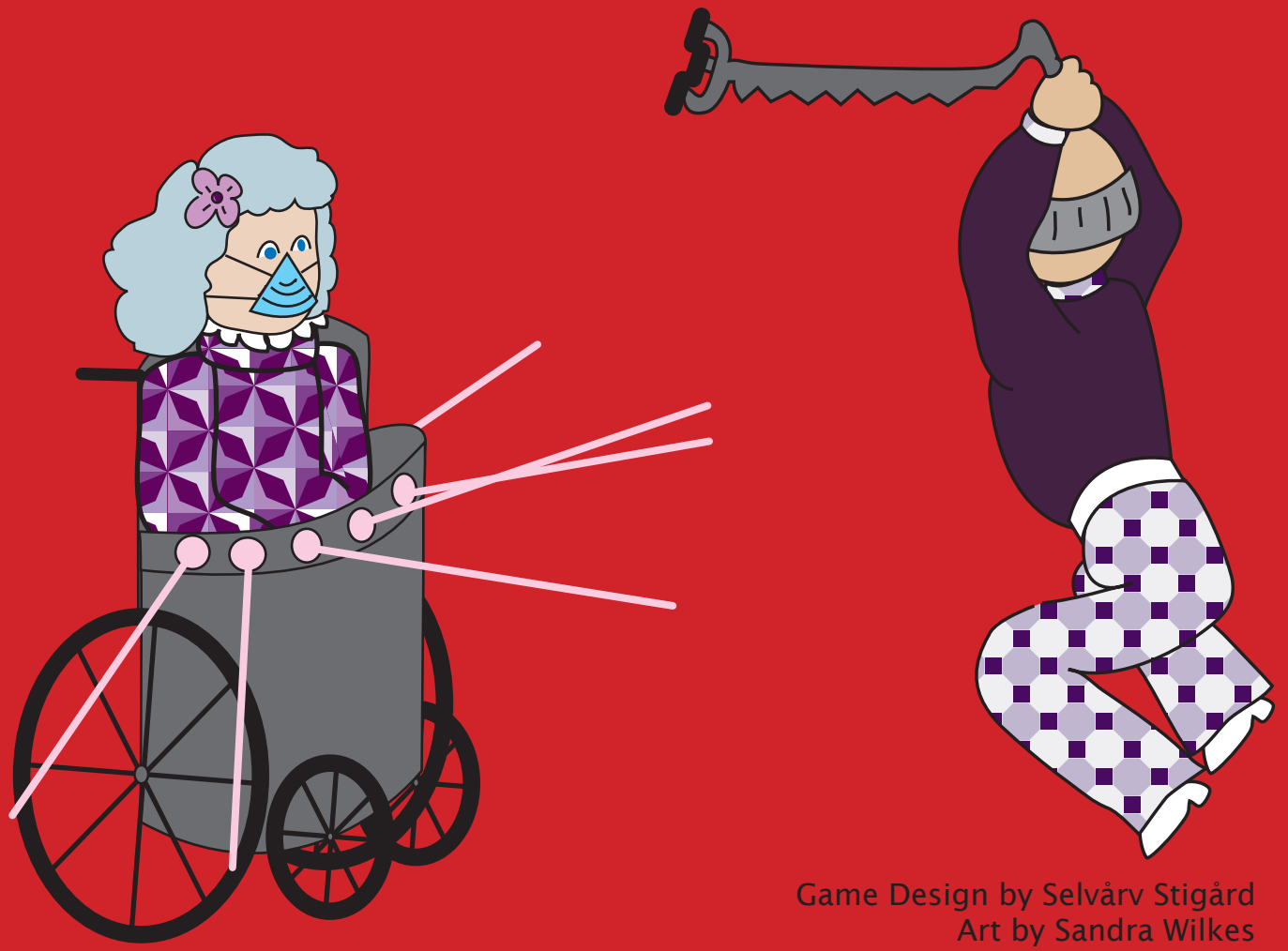
Retire to Mars!



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Retire to Mars!

At the end of the 21st century spaceflight reaches a new era, with space elevators that connect to interplanetary shuttles, but Earth faces an overpopulation crisis. As the world population exceeds twelve billion, the challenge of providing food, water, shelter, energy and medical care, even to those who can pay for it, proves impossible. Finally, a harsh decision is made by leaders across the world: send retirees to the existing Martian colonies, to complete the planet's terraforming and build the cities of the future. Of course, Mars is even more scarce of resources than Earth, and the speed at which those resources can be acquired is limited. The race is on as rival retirement homes compete for water and minerals on a desert planet.

Retire to Mars! is a cartoonish real-time strategy game where the player sends mobs of elderly colonists to take and defend resources from rival factions while harvesting the environment to build a more successful colony. It is expected to appeal to those gamers who are familiar with StarCraft or Command & Conquer, and have a fairly macabre sense of humor. One element that particularly drives the dark humor is that unlike most RTS games where each minion is an investment of resources, in this game the colony receives money for each new retiree, encouraging the player to be wasteful with their workers.

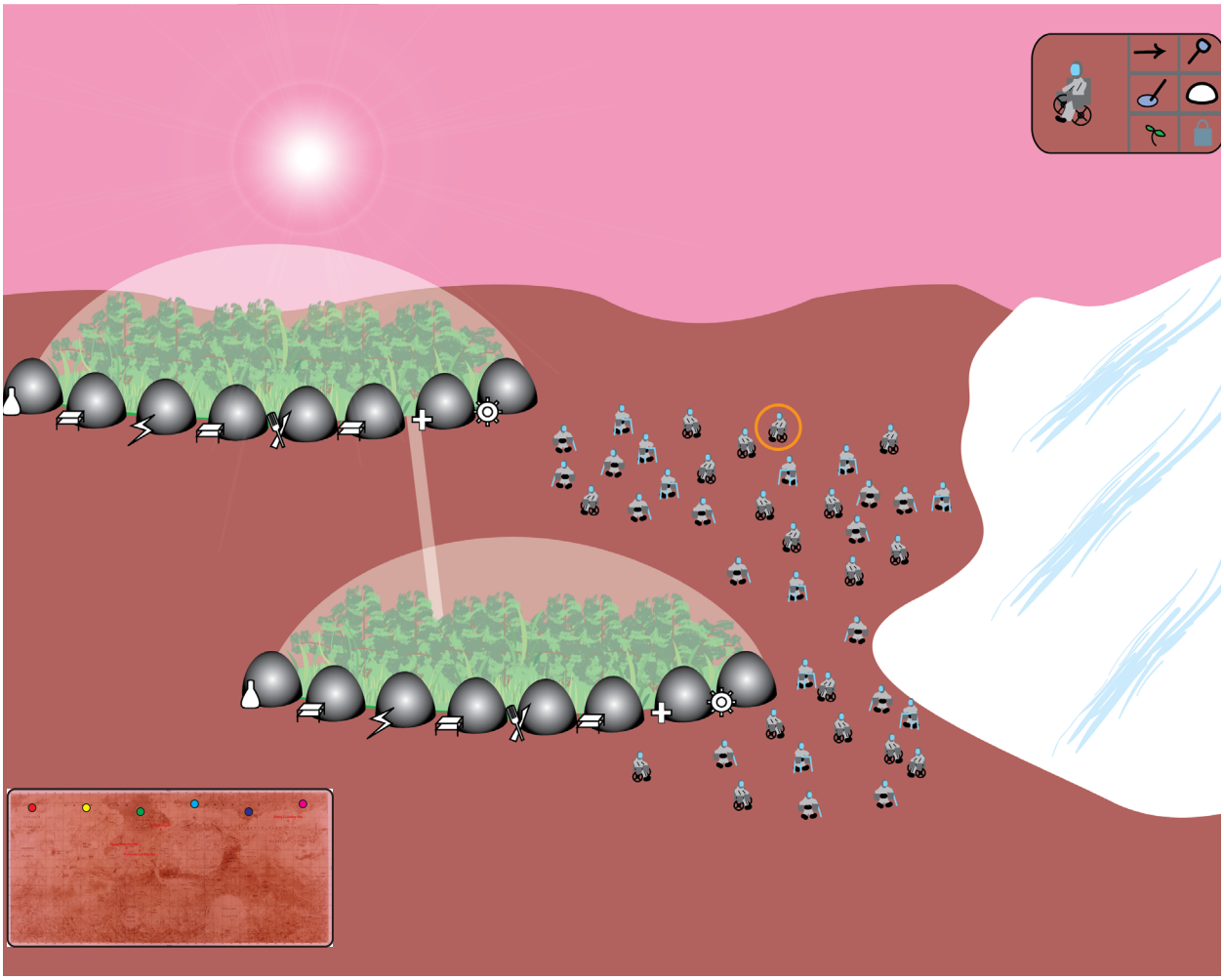
Game Overview

The storyline of Retire to Mars! is driven by the process of terraforming, consisting of a tutorial and four levels which represent the stages in changing the Martian landscape to one that can support Earth life. During the tutorial, the player has one year of game time to build up from an initial colony of six to twenty people so it can handle at least 2000 retirees. Representatives of the original crew are introduced as six animated personalities who offer advice on how to run the colony: a botanist, a technician, an engineer, a geologist, a pilot and a reality star. They provide tips on how to expand the colony with several types of enclosures: greenhouse, barracks, hospital, cafeteria, power station, science lab and fabricator. (The original colony consists of a relatively small greenhouse and a single enclosure that can perform the function of all other enclosures at one-third efficiency.) At this point, the only units are rovers, which can be used to test the regolith (martian dirt which needs to become soil), treat the regolith (with bacteria, archaea, moss and fungi), plant crops, build enclosures and harvest resources. In later levels, worker actions also include go/carry, scan for resources and attack. The resources available are ice, silica, iron, aluminium, titanium, chromium, magnesium, rare metals and crops.

After the end of the tutorial comes the first in a series of cartoons that play off the currently planned Mars One mission as a reality TV show, by having a cliché reality show personality as part of the colony, interacting with the retirees. Then level 1 begins, when the goals are to manage the retirees, exploit local resources and run an efficient colony. There is some terraforming, but it is almost incidental. The player must scan for minerals nearby to collect, build more enclosures to support a larger population, and turn more regolith into soil for farming, this time with thousands of

retirees as workers instead of a few rovers. Once a colony has grown large enough to optimally exploit the nearby resources, the player will need to build another colony using a portable fabricator, and then another, continuing throughout the game. At some point in this expansion the player will attempt to harvest the same resources as an opponent, and the retirees will automatically fight over control of that tile, swinging their canes and pushing their walkers at each other. After the first combat of the game ends, the engineer will introduce the design screen, so the player can give intentional weaponry to the retirees. The game now has all the main elements of a traditional RTS, which are maintained for the rest of the game, although some elements change in each level.

Once the player and AI opponents are fully exploiting the northern polar ice cap, level 2 begins as new colonies are built to harvest the ice and minerals in comets that have been directed to impact on the northern plains. While the ice from a comet is more limited, these colonies are needed to take the next step in terraforming. They must construct drills capable of probing kilometers into the crust in search of the cryosphere, a layer of underground ice that hypothetically should exist based on the geology of Mars. Upon reaching this layer, the drill hole is used to pump hot water into the cryosphere, to melt portions and hydrate the ground from beneath. The incidental terraforming from level 1 has created a greenhouse gas layer in the upper atmosphere,



Suggested Gameplay Screenshot

gradually warming up the planet. A layer of liquid water soaking through the dirt continues this process, although the temperature remains below freezing across most of the surface. At the end of level 2, this is changing at the lowest altitudes, and the colonies on the northern plains have a limited time left before they are in danger of flooding. The sky is also changing from pink to purple as a thicker atmosphere develops with traces of moisture. The air still is not breathable, as it is mostly carbon dioxide.

During level 3, the player and their opponents will colonize the southern ice cap. While it is larger than the northern ice cap at the beginning of the game, very little of it is water ice, with about 80% of it composed of frozen carbon dioxide. By this stage, the planet is too warm for dry ice to stay frozen, even at the poles, and it has sublimated to leave a much smaller ice cap, but made entirely of water. With the colonies growing and limited amounts of ice remaining to harvest, the factions must become more aggressive to secure ice, as water gets more scarce before it becomes plentiful. The desired situation, of liquid water readily available on the surface, is driven by mass treatment of all remaining regolith on the surface. Fortunately, proteobacterial and archaeal treatment is the exception at this point, and only needed in isolated regions, while most of the planet is ready for cyanobacteria and subsequent fungal distribution. Once large areas of land are covered this way, and the cryosphere is rapidly melting and forming a northern sea over the plains, mass planting of ferns and kelp will complete the basic terraforming. This is marked by the sky turning from purple to blue, although much darker than the sky blue of Earth.

Level 4 begins when the basic initial terraforming is complete, and colonies are no longer dependent upon ice harvest for survival, as most water on the surface is now liquid. Crops are maintained by rising ground water and rain. Colonies can be built anywhere with fertile soil and close access to mineral resources, and greenhouses do not need to be enclosed, although oxygen masks are still used. If the player is not close to a victory condition at this point, they will need to be extremely aggressive to dominate the AI opponents militarily or economically, or otherwise broker peace for all of Mars.

The game ends when a victory condition is met, or when the game clock reaches year 2200. The three victory conditions are:

Conquest: Defeat all opponents

Economic: Have all opponents dependent upon the player for resources

Diplomatic: Broker peace between all opponents

Factions and Options

There are eight available factions in the game, that have slight variations to encourage different strategies:

· ***Mars One***, the original settlement partially funded by a reality show. They set the tone of televising the colonists in their struggle to survive in an alien environment. They have the advantage of the largest crew at twenty, already well into their second generation with a third being trained, and the most experience dealing with Mars. They also have the oldest equipment at the start of the game, that requires the most maintenance and repairs, but this does not apply to anything built new after the start of the game. They do not have a supply of retirees as readily available as the national colonies, and must solicit other retirees away from Mars Inc. and Liitolafisi, the other colonies in the same situation. Soliciting is done indirectly, by creating conditions of higher morale than other colonies, and accepting a lower fee per retiree housed. Their

retirees tend to have lower expectations about life on Mars, and therefore easier to please, but sometimes are unprepared for combat.

· ***USA***, the second-oldest and best funded colony, at least at the start of the game. However, the retirees have the highest expectations of what the conditions on Mars will be, and therefore the lowest morale when those expectations are not met. On the other hand, these retirees are more violent than most, and have slightly improved combat statistics.

· ***EU***, the next colony in both age and funding after the USA. The equipment is in good repair, although the retirees have slightly higher expectations than average. They are average in combat.

· ***Russia***, despite being a newer colony than the EU is larger, but with more erratic funding. The retirees have low expectations, high morale and the best combat abilities. However, the existing equipment at the start of the game is in the worst repair, and the early game is more difficult for efficiency setbacks.

· ***China***, designed to be the most average colony for the variable settings. The original colony is at an average level of upkeep and funding. The retirees have average levels of expectations and morale, and average combat abilities.

· ***India***, the most minimal colony, with one crew member for each of the six roles, and the most basic funding. However, retirees have the lowest expectations and are easiest to keep with good morale, with average combat abilities.

· ***Mars Inc.***, a corporate venture designed to find ways to profit by exploiting the Martian environment. Like Mars One and Liitolafisi, they must indirectly solicit retirees by keeping high morale and weighing their fee per retiree carefully against their costs. Their retirees have low expectations for their living conditions, and are poor at combat. The starting colony is in excellent upkeep, and requires minimal maintenance.

· ***Liitolafisi***, a non-profit exploratory group named after a Zulu legend of Mars. As with the other two colonies not tied to a nation on Earth, they must solicit their retirees, who tend to be the most variable of any colony. They have all ranges of expectations and combat ability, and this can make them the hardest to predict, although due to random distribution this will also result in some elite units. This colony is fairly new, requiring little maintenance, but also has the least initial funding.

After selecting a faction, the player then selects how many AI opponents, from two up to all seven other factions. Then, the ease of terraforming has four possible difficulties: normal, challenging, hard and realistic. The last option will come with a warning that winning, or even having a successful colony, is extremely demanding, and becomes exponentially harder for each opponent added. Finally, the overall amount of support from Earth is set to minimal, sufficient or generous. While this strongly affects the overall difficulty of the game, the setting is applied equally to the player and the AI opponents, not just making it easier for the player.

With these parameters, the game begins with the player and a random selection of opponent factions distributed in a roughly even fashion around the northern polar ice cap. The colonies are not spaced perfectly evenly, as a more important factor is ease of access to ice and other resources. An iron-rich tile will be within 3 spaces of the start location, and at least one other random resource will be rich in a tile within 8 spaces of the start location.

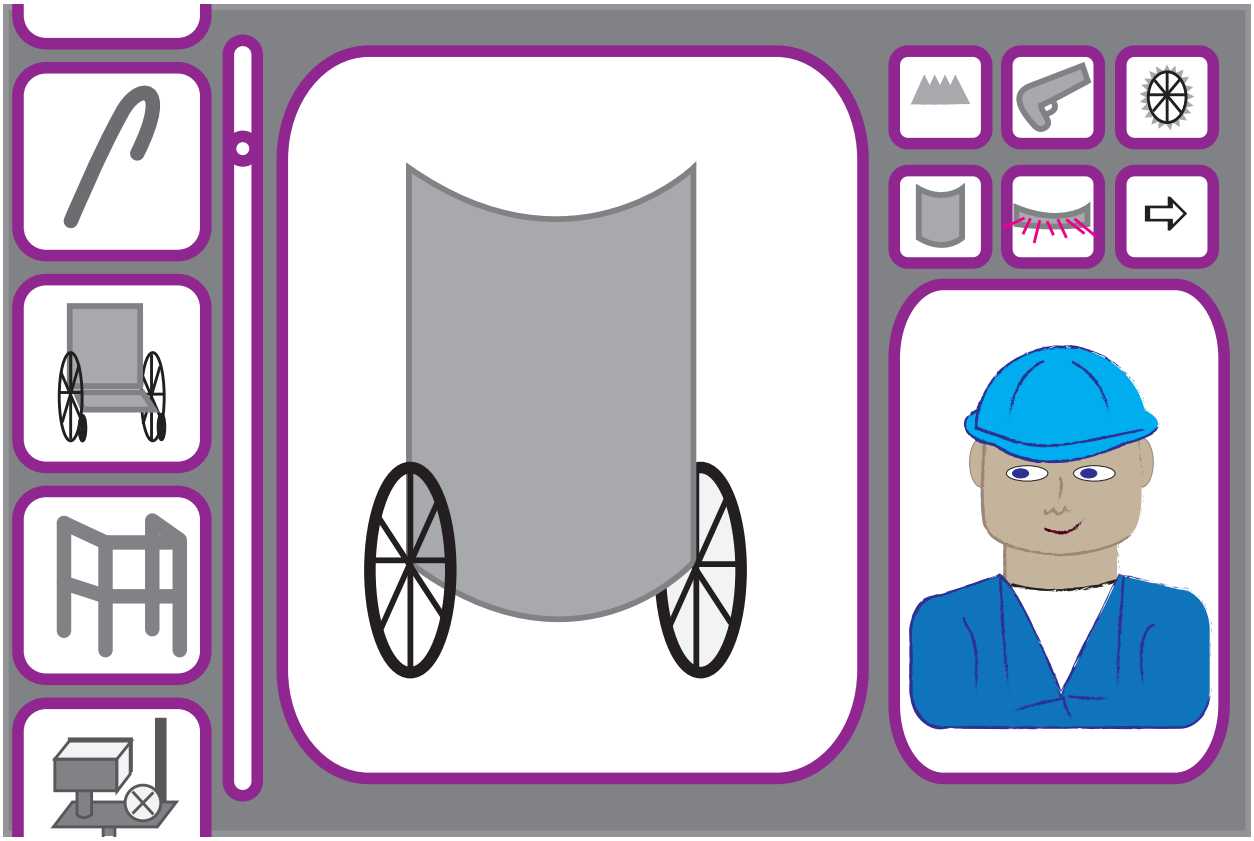
Enclosures and Additional Modes

In addition to the primary mode, a view of enclosures and units on the Martian landscape, there are several other screens in Retire to Mars! accessed through the different enclosures:

· The greenhouses do not have a build queue, but a gardening screen where the player can select which plants are grown and how to arrange them, and a side area for a nursery. Optimal ratios and placement of fungi and legumes will manage the nitrates in the soil for high yield food plants and the ferns that produce most of the oxygen. If the player does not enjoy a gardening mini-game, greenhouses can be set to auto, and will produce at 85-90% efficiency.

· While the fabricators have a standard build queue, there is also a design screen where upgrades to units can be made. The standard units are canes, walkers, wheelchairs, rovers and transports. Canes and walkers can have blades, spears, guns and lasers attached. Wheelchairs have those options available, but also can be upgraded to mecha-wheelchairs with armor. Rovers were intended for exploration, scientific testing and construction, but in addition to a better drive system and protection, weapons can be mounted instead of conventional tools. Transports are designed to protect passengers and cargo, and can handle multiple upgrades.

· Instead of a standard build queue, the science labs have a layout where the player can determine how much of the lab is dedicated to growing proteobacteria, cyanobacteria, methanogen archaea, mosses and fungi. Any of these organisms can make up the lab's "grow queue" at the player's chosen ratios, with a lag time between increasing the space provided for a particular organism and its increased production.



Fabricator Design Screen

· Opening the original colony displays the advisor screen, with representatives of the crew who will provide hints on game-play:

¤ A botanist, who advises on greenhouse gardening strategy and warns when food or air supplies are in danger.

¤ A technician, who advises on building strategy and warns when enclosures do not have enough power or support.

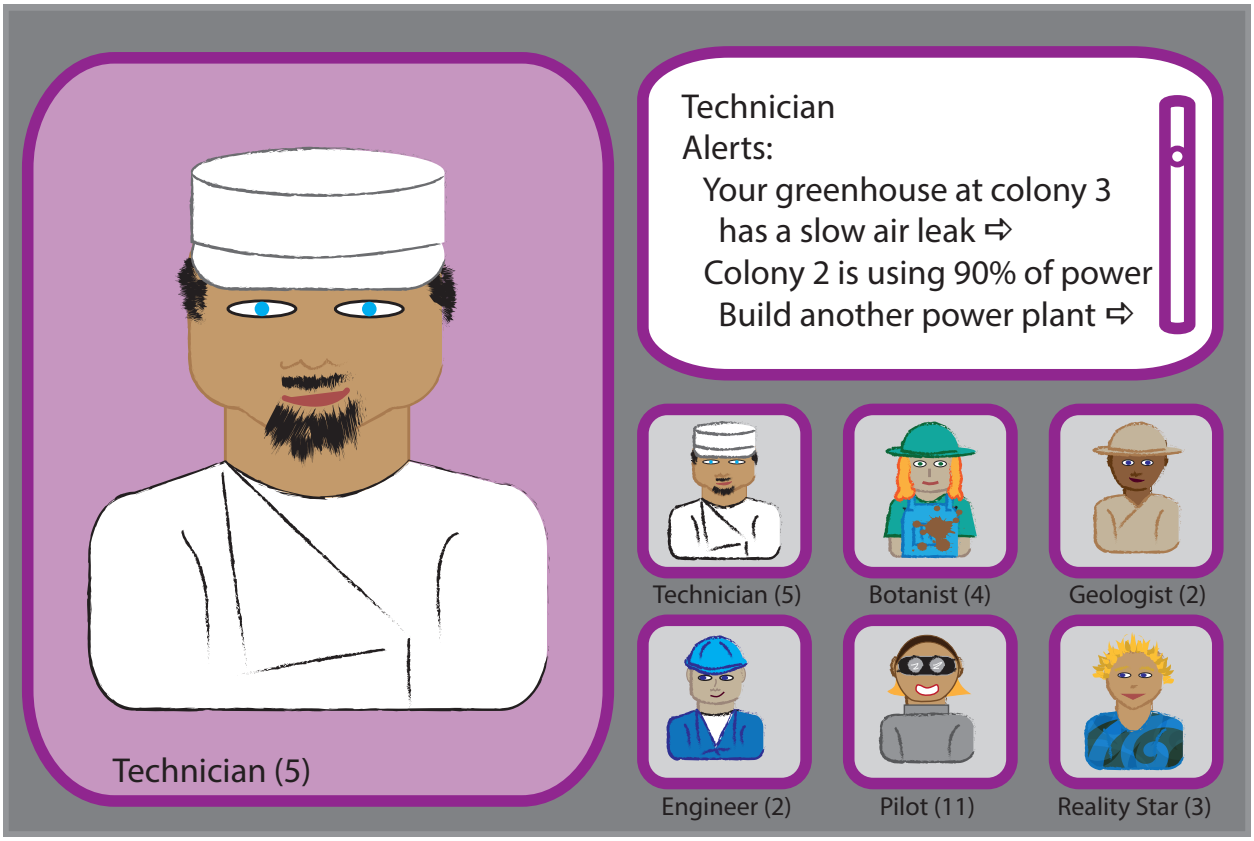
¤ A geologist, who advises on terraforming strategy.

¤ A engineer, who advises on fabricator design and warns when mineral resources are insufficient for a colony's needs.

¤ A pilot, who advises on exploration and military strategy.

¤ A reality star, who advises on morale, diplomacy and finances, as TV antics by the reality star can boost income. While other members of the crew should be kept inside the original colony, protected not only from opponents but from the retirees as well, reality stars may go to other enclosures and interact with the retirees. This increases the possibility that they will do something that turns out to be popular with the TV audience back on Earth, but depending on the (random) personality of the reality star, this can potentially increase or decrease morale in the retirees. If the antics of the reality star decrease an already low morale, it is possible the retirees may turn violent and kill them. This will provide a huge boost in ratings - and income - but kill one member of the crew, which is a major setback when trying to raise enough botanists, technicians and pilots in the next generation to support a larger colony.

The player may have multiple settlers assigned any of these roles, which will be shown next to that advisor's animation. One botanist can manage up to two square



Advisor Screen

miles of greenhoused land (1280 acres). One technician can manage up to 20 acres of enclosures, not counting greenhouses. More than one geologist or engineer will not be needed at a time, but replacements must be trained as settlers will grow old and die. One pilot is needed for each transport being remote controlled simultaneously, as well as for each rover engaged in combat. Each additional reality star will increase the chances of an income boost from TV ratings.

The other enclosures - barracks, hospitals, power stations and cafeterias - do not have build queues, there are simply requirements to have enough to support the colony's population. All enclosures except greenhouses cover a single tile that represents one acre. Greenhouses can be as large as needed, but their size should be somewhat limited to mitigate the possible damage of a breach.

· Each acre of greenhoused land can support 20 people, so that any colony will need at least a hundred acres of greenhouses, and large colonies will have thousands of acres growing vegetation.

· A barracks can house 2000 people, by sleeping in shifts.

· A hospital, including exam rooms, testing labs, pharmaceutical production and facilities for laundry and bathing, can keep 6000 people healthy - at least enough to work.

· A cafeteria can prepare enough food to feed 6000 people.

· A power station, drawing power from 40 acres of solar panels can provide the power needs for eight acres of enclosures, not counting greenhouses, which are unpowered.

· The one other structure that can be built is a drill. It can only be used to search for the cryosphere, and pump warm water once it is found. This is critical in terraforming the planet, but is the drill's sole function.

Enclosures must receive a certain amount of maintenance and repair as the environment damages them. They also need repair when damaged by enemy attacks. The technicians will manage all of this with rovers assigned to them, but they will cut into mineral supplies as needed to do their job.

Units and Objects

There are three different units available: retirees, rovers and transports. All retirees require one of three possible objects to move faster than a crawl, and which object they use depends on how much health they have. There are three health levels that correspond to using one of those object: a cane, walker or wheelchair. Newly arrived retirees will be a random selection of health levels. When a retiree receives a hit in combat, they are reduced by one-third full health. A retiree at full health will drop their cane if hit, and crawl to the closest available walker. A retiree at 2/3rd health will release their walker if hit, and crawl to the closest available wheelchair. A retiree at 1/3rd health will die if hit, and fall over out of their wheelchair.

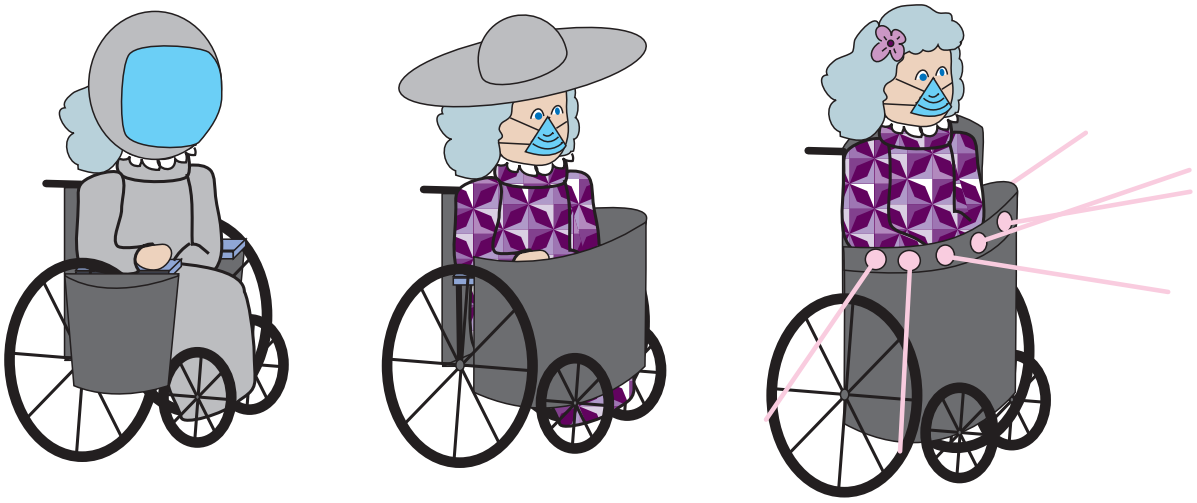
A single retiree unit with these health levels represents multiple actual retirees, the number of which grows at each level. This allows the scale to increase while maintaining the same aesthetic and keeping combat simple. In level 1, each unit represents 10 retirees. In level 2, each unit represents 50 retirees. In level 3, each unit represents 200 retirees. In level 4, each unit represents 1000 retirees. The requirements of enclosures needed to support the total population, and resource requirements for building the objects for them to use, are based on the actual number of retirees, not the number of units shown. The increased scale is explained in the transition between levels.

A retiree has a success rate directly tied to their health. A cane will succeed at their action 90% of the time, a walker will succeed at their action 85% of the time, and a wheelchair will succeed at their action 80% of the time. This is modified by an individual unit's attributes. In addition to the visible attribute of health, there are hidden attributes for each unit, that the player can only guess at, that can vary from x0.9 to x1.1 the base success rate for each action: movement, combat and resources, which covers scanning, planting and harvesting. Additionally, each retiree also has an expectations score and a morale score, which are related to that colony's conditions score. All are measured on a scale of 0 to 1. The expectation score is what the retiree wants conditions to be, in order to have full morale. Their morale is equal to the conditions of that colony, divided by their expectations. In the unlikely cases where conditions are higher than expectations, morale does not go above 1. The player does not see any particular unit's expectations or morale, but can inspect a colony to see its conditions, the average expectation level of the retirees, and the content rating, being the ratio of retirees with a morale above 0.8. All the numbers between 0 and 1 are expressed as a percentage in the interface.

For the trip to Mars, the retirees were placed in cryonic suspension and kept in that condition until the colony is ready to house them. They are then revived and sent to the surface in landers that can hold 10 units, along with supplies the colony has ordered. The first task for the retirees is to break down the lander for parts and materials while the colony sends a transport to retrieve them. This is done automatically without any action from the player. These landers can miss their target zone by up to 2 km, so all target zones must be at least 2.1 km from the colony. The orbital stations will not send more retirees than the colony can support, and will not send landers faster than the colony's transports can recover the retirees.

Rovers are initially designed for the tasks involved in building and maintaining a colony, with two actuator arms ending in a tool, and storage space that normally holds soil testing and treatment equipment, resources being harvested or objects being transported. Prior to accessing the design screen, one arm will end in a drilling tool that can take regolith samples and deposit microbes, spores or seeds. The other arm will end in a gripping hand that can build enclosures and harvest resources.

Transports can carry 10 retirees or rovers in addition to a large storage space,



The development of a "wheelchair grannie" through the levels of the game

that can hold a portable fabricator, the parts from a lander, or a crew member with all of their gear.

Retiree actions include: go/carry, plant crops, scan for resources, harvest resources, build enclosure and attack. Rover actions include all retiree actions, plus test regolith and treat regolith. Transport actions are limited to go/carry and attack.

Once the design screen is introduced, the rover and transport units can receive upgrades, as can the objects of canes, walkers and wheelchairs. The available weapons are blades, spikes, guns and lasers. Once upgraded canes, walkers and wheelchairs are available, a retiree will drop what they are using if a better version of the same object is on the ground in the same tile. If they are not under attack, they will go to an adjacent tile to pick up an upgraded object. If opponent retirees spot the same object, they may fight for it, if they reach it at the same time before either one can pick it up.

Available upgrades will include:

· A cane can have blades placed along the length, or a large spike at the end, either of which double the damage it will do. Alternately, a cane can have a gun or laser built into the handle, which allows two shots of ranged damage before being reloaded by returning to an enclosure or transport.

· A walker can have blades placed along the bars, or spikes sticking out from the front, either of which double the damage from pushing. Alternately, a walker can have a gun or laser mounted on the front, which allows three shots of ranged damage before being reloaded.

· Wheelchairs can handle multiple upgrades. A variety of wheels and drive systems can be added, with increased speed and traction on the Martian terrain. Several degrees of armor are available, up to making a mini-tank. Small cannons, machine guns, laser turrets, ramming spikes, wheel blades and any other weapon the design team can come up with to fit onto the chair, are all options to be added. Ranged weapons have ammunition or batteries fit into the chassis, allowing for ten shots (or ten bursts for machine guns) before being reloaded. Once two or more upgrades have been added to a single chair, it is considered a mecha-wheelchair, and if it becomes available, any retiree will try to take it. Even a retiree at full health will drop their cane and climb into an available mecha-wheelchair. The biggest reason to not add as much as possible to a single chair is that the retiree inside can be killed, after any armor is depleted, and then will still simply fall out of the chair, allowing an opponent retiree to climb into it.

· Rovers can have either or both tools replaced with weapons, and storage space filled with either ammo for a gun or a battery pack for a laser. Like wheelchairs, rover weapons have ten shots before being reloaded. They can also receive upgraded wheels and drive systems like the ones on wheelchairs, and the same degrees of armor.

· Transports can have a single cannon or laser cannon in a turret, and are large enough to not worry about storage for ammunition or batteries, and can be used to recharge lasers and supply ammo for guns used by retirees and rovers. Ramming spikes can also be mounted on the front.

Regolith and Resources

Mars does not have proper soil, which is a mix of dirt and organic matter that acts as the medium for the nitrate cycle necessary to support plant growth, but instead has regolith, a mix of silica rocks and dirt, dust of various other minerals, and small crystals of ice, dry ice, frozen ammonia and perchlorates.

Perchlorates are toxic salts that could potentially be used to make fuel and fertilizer, but mostly need to be stripped from the regolith as quickly and completely as possible if any terraforming is going to succeed. Fortunately, several strains of proteobacteria found on Earth feed on perchlorates to excrete chloride compounds such as table salt, and can thrive in anaerobic environments. Because the Martian regolith is such an ideal growth situation for these proteobacteria, once they have been introduced it is entirely likely that within a few decades, they will spread to every connected tile of regolith on the planet. Only tiles of solid bedrock and exposed mountains will impede their growth. However, it is always possible that the regolith in a particular area has too high of a concentration of water ice or dry ice, and the proteobacteria can die out before stripping out the perchlorates. It is always important to run chemical tests before attempting to grow plants, as any perchlorates that reach the food supply will be poisonous to both the retirees and the crew.

The next stage in regolith treatment is to add a combination of methanogen archaea and cyanobacteria (which is also known by the misnomer of “blue-green algae”). These two micro-organisms will simultaneously feed on carbon dioxide, frozen in the regolith as dry ice, and to keep either one from starving out the other, a mix of them is required. The methanogen will also consume frozen ammonia as it produces methane, while the cyanobacteria will produce oxygen. Methane production is required to create a greenhouse gas layer over Mars that can help to trap oxygen and moisture in the atmosphere, if there is any breathable air for that layer to trap. Further, as the oxygen levels increase, the anaerobic methanogens will die out and the cyanobacteria will continue to grow. An even mix, or a little heavier on the methanogens, should produce a burst of methane followed by a longer period of oxygen production. While this treatment has been taking place, the walls of the greenhouse enclosure should be built, and when the methane production dies off for oxygen production, the roof should be placed to trap the oxygen inside.

At this point, the regolith will be stripped of dry ice and frozen ammonia but with most water ice remaining, and a concentration of carbon (from the various dead microbes) that will help the next stage of soil treatment. With the roof placed on the greenhouse and the oxygen production of the cyanobacteria, the temperature will rise above the melting point for water, to subsequently moisturize the moss and fungal spores that are now added. These will begin the nitrate cycle, and finish the process of turning regolith into soil that can be used to grow plants.

Meanwhile, regolith is also being shoveled into fabricators, which heat it up to break down the components. Carbon dioxide, water and ammonia will cook out at different temperatures and be captured separately, then the remainder is heated further to separate the base components. Most of what is collected this way is silica, which becomes the main building material as glass, followed by iron and trace amounts of the other mineral resources. The captured carbon dioxide can be catalyzed into methanol fuel for the fabricator’s separation system. The ammonia will be needed as a cleanser for a retirement home with a population in the thousands. The carbon dioxide and ammonia are therefore assume to be used as quickly as acquired, unlike the eight resources held as supplies: water, crops, iron, aluminium, titanium, chromium, magnesium and rare metals.

If any resources are needed in greater quantities, rovers and retirees can be sent to explore and scan for high concentrations. Exploration is only for information on resources, as there is no “fog of war” on the map. When the game takes place, dozens of satellites are in orbit around Mars, both automated and staffed, and the

entire surface is monitored, with the player and opponents having access to the same information. Once tiles with high resources are found, workers can harvest that resource to take back to the fabricator. This will always include a constant stream of ice to be melted into water and minerals for supplies. In addition, concentrations of iron, titanium and aluminium ores will be readily available, while concentrations of chromium, magnesium and rare metals will be less common. Everything that goes into the fabricator will be collected for later construction.

In addition to the naturally occurring elements, comets that have been directed to the surface of Mars will have moderate amounts of iron and water ice, as the force of impact should provide enough heat to evaporate almost all frozen ammonia and carbon dioxide. Asteroids that have impacted on the surface can have any or all mineral resources, with equal odds of both common and rare minerals. One good asteroid could have all the resources necessary to build an army of armored rovers, transports and mecha-wheelchairs to conquer a nearby colony.

Salvage from combat and landers can be used directly as items, if undamaged, or become parts for repair and maintenance if lightly damaged, or be put into a fabricator to be broken down into resources. In addition to the objects left behind from combat are the bodies of the dead, which along with those retirees who die from medical problems, must also be considered a resource. The player has a very simple decision, of the soylent variety: the meat can be ground up into the mushroom burgers at the cafeteria, or it can be part of the composting for next season's mushrooms.

Various items for fabrication, whether enclosures, units or objects, have different building materials which may be required or optional:

· Enclosures require mostly silica for building material, but the frame must be made of iron, titanium, aluminium or their alloys. Enclosures designed for people - barracks, hospitals and cafeterias - must use chromium alloys over the glass to protect from radiation.

· Fabricators and portable fabricators require iron, titanium, aluminium, silica and rare metals.

· Solar panels require silica, a frame made of iron, titanium or aluminium, and conductive elements using rare metals, or chromium for a lower efficiency.

· Canes and walkers can be made from aluminium, titanium or their alloys. If they are mostly iron, retirees will have difficulty swinging them as weapons. Aluminium will lose in direct conflict against titanium or an alloy. Canes and walkers with blades or spikes must be made from titanium or an alloy.

· Rovers, transports and mecha-wheelchairs can be made from iron, titanium or alloys using them. Rovers and transports have circuitry that require rare metals.

· Guns can be made from iron, titanium or alloys using them. Ammunition is made from iron, magnesium and aluminium.

· Lasers can be made from iron, titanium, aluminium or alloys using them, and also require silica, chromium and rare metals.

· Outdoor clothing, is made from inedible cellulose from harvested crops. During the first two levels of the game, the clothing consists of radium suits with chromium alloys sprayed on for protection. During the third level, a retiree can get away with wearing a chromium alloy sun hat. In the fourth level, retirees can get away with wearing sunscreen.

· Drills require a large amount of iron and titanium to build, with some magnesium and rare metals.

Type	Building Metals			Glass	Fuel	Reflective	Cellulose	Circuitry
Material	Iron	Titanium	Aluminium	Silica	Magnesium	Chromium	Crops (food removed)	Rare Metals
Greenhouse (per acre)	10 units, any combination			20 units				
Populated Enclosures (Hospital, Barracks, Cafeteria, Science Lab)	20 units, any combination			10 units		10 units		1 unit
Power Station	30 units, no more than 10 aluminium			2 units	5 units			2 units
Solar Panels (per acre)	10 units, any combination			20 units		5 units		1 unit
Fabricator	30 units		10 units	2 units				2 units
Portable Fabricator	20 units		15 units	2 units				2 units
Drill	200 units	50 units			20 units			10 units
Cane	2 units, no more than 1 iron							
Walker	4 units, no more than 1 iron							
Wheelchair	6 units, any combination							
Mecha-wheelchair	6 units							
Rover	4 units			1 unit				1 unit
Transport	20 units			2 units				1 unit
Armor	2 units per level							
Spike/Blade	1 unit							
Gun	1 unit				2 units			
Laser	1 unit			1 unit		1 unit		1 unit
Radiation suit						2 units	1 unit	
Clothing							1 unit	
Sun hat						1 unit		

Space, Time, Movement and Combat

For game simplicity, mapping Mars onto a two-dimension space is done with a Mercator projection, with the last few miles at the poles cut off. With hexagonal tiles representing one acre each, the total map is 160,000 tiles north to south, and 330,000 tiles east to west, wrapping around, with a total map of 52,800,000,000 tiles. However, until stage 4, the vast majority of the planet is considered uninhabitable, even using enclosures. In stage 4, about 35% of the map is underwater, and an additional 25% of the map is still uninhabitable due to terrain difficulties. If in stage 4, the player and AI opponents manage to achieve maximum growth and exploitation of the planet, the game could need data for a maximum of 21,120,000,000 tiles. However, at maximum zoom, the screen will never show more than a few thousand tiles at a time, and even on the busiest colony, most of those tiles will be greenhouses, solar panels or unused Martian terrain.

At the standard speed setting, one year is represented in 12 minutes of play time. The tutorial starts operating at one-half speed and gradually speeds up to normal

speed by the end of play, to take 16 minutes total. This gives a maximum possible play time for one game at just over 20 hours, not counting time spent in alternate mode screens, paused or during movies. There should be an introductory movie, movies between levels, and alternate movies for win conditions or for a few different ways of losing, including failing to terraform Mars before running out of resources.

Units operate with a turn of 2 seconds. In that time, retirees and rovers can move one tile, or perform one action within that tile. A retiree has a chance of failure, spending that turn falling and getting up, or trying to pick up a resource and dropping it, or trying to attack another retiree and missing. As discussed, a cane has a base success of 90%, a walker of 85% and a wheelchair of 80%, with individual attributes of x0.9 to x1.1 the base chance for three attributes: movement, combat and resources. A wheelchair can be upgraded with improved wheels and drive systems, which move at 1, 2 or 3 tiles/turn at a 100% success rate. A rover starts with the lowest of those systems, but can be upgraded. A transport can carry up to 10 other units, in any mix of retirees and rovers, and moves at 25 tiles/turn.

A retiree carries enough air to survive 30 turns away from a colony or transport. On turn 31, they will die. If directed to do so, a cane will not travel more than 10 tiles to perform another action and return, a walker will not travel more than 9 tiles, and a wheelchair (without upgrades) will not travel more than 8 tiles. A wheelchair with upgrades will travel up to 14, 28 or 42 tiles away to perform another action, depending on the drive system. Statistically, nearly one-tenth of retirees will still die if they harvest resources at the maximum allowed distance for their health level.

While a success rate for movement or collecting resources, rather than an automatic success, may seem frustrating at first, this has a distinct advantage for the player. Failure will increase the odds of death for the retirees, which in turn leads to being sent more retirees and higher income. Additionally, a retiree will typically run out of air on their way back to the base, after performing their task, and other retirees or a rover can be sent to collect the body, equipment and any resources being carried.

A retiree works less than half the time. After a maximum of 30 turns of work, they will stop what they are doing and head to the cafeteria. They will spend 3 turns at the cafeteria, followed by 18 turns at the barracks and another 3 turns at the hospital. If it takes the retiree more than 30 turns to make these rounds due to travel time, the additional time will come out of the following 30 turns of work. The retiree will not take on work that will likely take them past the end of their day. If they fail more often than expected on their movement, they will stop what they are doing and travel back to the cafeteria 58 turns after they left it. No matter how little work they accomplish, each retiree will try to keep their 60 turn cycle. Placing enclosures effectively close to each other and to resources is necessary to keep a colony efficiently enough to continue operating.

Retirees from opposing factions can pass through the same tile, but if they attempt to harvest the same tile, they will engage in combat. The first time this happens to the player, the engineer will introduce the design screen, to allow arming the units for future combat. Once a unit has a weapon added to their cane, walker or wheelchair, they can be directed to attack as their action. The attack will be the base success rate of 90%, 85% or 80%, with that unit's individual attribute for combat, ranging from x0.9 to x1.1 the rate. If they hit, they reduce their target by one health level, or two health levels if hitting with a blade or spike. If the target loses health, they drop their object that provides mobility and start crawling in search for the new object they will need. The exception to this is that any retiree will take an available

mecha-wheelchair, and stay in it until they die. If the attacker misses, and their weapon is aluminium opposed by a weapon of iron or titanium, it may get bent and become useless. If the target does not go down a health level, whether from a miss or armor, they will attempt to attack in return, with their calculated success rate. With all attacks having a maximum success rate of 99% and minimum success rate of 72%, some battles may consist of a few misses before much damage is done.

Rovers and transports have 95% odds of hitting in combat. Rovers have one health level, and start with one level of armor. Transports have ten health levels and start with one level of armor, but lose 20% movement rate after losing one-half their health.

Economy and Diplomacy

Retire to Mars! uses MarsBucks as the currency, which can be used to buy supplies from Earth, such as minor luxuries for the crew, and rare metals that are needed for circuitry, if they are not being found on Mars. They can also be used to exchange for goods with opponent AIs, potentially even creating regular trade relationships that could become alliances.

If an opponent AI has a large supply of a resource, such that they are accumulating it faster than they are using it, they will be willing to trade with the player (or failing that, other AIs) for resources they are lacking, or credits. If a few of these exchanges work out well, the AI will be willing to enter a trading schedule, to be renewed on a regular basis. Once a trade relationship is established, that AI will deliberately avoid provoking combat between its units and the player's units. Once a trade relationship has been renewed at least once, if the partnered AI is engaged in open hostilities with another AI, it will ask the player to cut all trades with the hostile AI and possibly a military alliance. If that degree of trade relationship exists and the player is engaged in open hostilities against a different AI, the partnered AI will consider such requests made by the player.

These two related mechanics allow for the two victory conditions other than conquest. If during stage 4, the player is engaging all opponent AIs in trade, such that each AI is receiving a resource without which they could not continue to operate their colonies, they win an economic victory. If during stage 4, the player uses diplomatic efforts to arrange all opponent AIs in partnership with all other AIs, such that military action can be ended, they win a diplomatic victory.

User Interface

The UI for Retire to Mars! is intended to be simple and easy to use. In one corner is a mini-map of the planet the player can use to move the screen quickly. In another corner is a selection pane, that shows the unit or group of units the player has clicked or collected in a drag-and-drop frame, at which point the appropriate action bar appears. These elements can be moved between the corners for ease of play. The player clicks or uses a quick key for an action, selects the object of that action, and continues onto the next unit, group of units, or enclosure. If an enclosure is clicked, it is shown in the selection pane, with basic information on production values and degree of repair. If a fabricator is selected, its build queue appears for the selection screen. If a fabricator is double-clicked, the design screen is displayed. If a greenhouse is double-clicked, its gardening screen is displayed. If the science lab is double-clicked, its grow space screen is displayed. If the original colony is double-clicked, the advisor screen is displayed.

The camera is oriented low compared to the high angle of most RTS games, between 30º and 40º above a horizon view. This is to get a better side view of the retirees, and allowing the player to zoom in to watch combat. Also, this places a bit of sky in the background, which helps to mark the level and advancement through terraforming Mars.

There should be a non-intrusive electronic soundtrack in the background, that innocuously adds to a science fiction atmosphere.

Art

The aesthetic of Retire to Mars! should be light. The story in the game has a dark humor and part of the way it remains fun, not uncomfortable, is to have a cartoon art style. If done right, the player will be laughing when asked whether they want to turn the bodies of the dead into mulch or soylent green.

The art of the game could also include a few easter eggs. Famous fictional figures of Mars, such as Marvin the Martian, John Carter or the invaders from Mars Attacks! could make brief appearances in the background. This could be done in pastiche if copyright holders are not interested in allowing a brief appearance of their character.

Practicalities

Retire to Mars! is expected to run on standard hardware, as well as somewhat outdated machines. With RTS packages for Unity 3D being readily available and licensed at reasonable prices, the mechanics of this game could even be written into a previous version of Command & Conquer. The greatest limiting factor on performance is the expectation of using a photographic map of Mars with a potential of 21 billion one-acre tiles. However, given the limit of how many tiles will be displayed on-screen at once, this will affect drive space more than processor performance. The size of the map could be symbolically scaled down if that many tiles proves to be problematic.

By intentionally keeping the game elements and art style simple, this game could be completed in six months with a team of four: one full-time designer, two developers who can assist with design, and an animator/illustrator. Sound effects, music, localization and compatibility testing would be contracted. The expected budget is $250,000 for the team and their overhead, and another $150,000 for contracted work, for a total of $400,000.

By keeping the scope of the game small, this allows for a low price point on a purely digital release, such as a starting price of $30 on Steam. With a standard 30% cut going to Valve, this requires a little more than 19,000 sales to break even and start to become profitable.