

HIGH FRONTIER *Colonization Expansion Living Rules*

Second edition expansion for **High Frontier** for 1 - 5 players

By Philip Eklund phileklund@aol.com

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See the High Frontier Living Rules in the Files section of the High Frontier Yahoo Group.

<http://games.groups.yahoo.com/group/HighFrontier/>

Also see the download section of www.sierramadregames.com

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Playtesters: Larry Abbandando, Pablo Klinkisch, Chuck Parrott chuckparrott@earthlink.net and Erich Vereen Belirahc@yahoo.com, Eric Hehl Raid1280@hotmail.com and Kristof Newman <Newmankj@middough.com>, Nicolai & Vivi Broen Thorning (report received), nicolai_thorning@hotmail.com

Rules Editors: Dan DiTursi ditursi@gmail.com (report received) Wulf wulfc@wulf.demon.co.uk and Andrew Graham (rules editor) agraham2410@yahoo.co.uk, Gunther Schmidl gschmidl@gmail.com, Daniel Eliot Boese datapacrat@gmail.com, Alan Hench aahench@aol.com, Michael Gouker michael.gouker@gmail.com, Francisco, fcolmenarez@gmail.com, Sam Williams sam@samuelw3.com (report received), Peter Fröhlich tarwin@tarwin.de (report received), harry.halmartin@gmail.com and james jthec@rocketmail.com (report received)

Active: Alan B alanmb777@hotmail.com, Tamas Kiss, Keith "Kilo" Watt subs@keithwatt.org, David Harris davidharris314@gmail.com, David ci915@ncf.ca (report received), Nate Rethorn, Stephan Woll steve_woll_2003@yahoo.com sandswoll@gmail.com, and Sean Bryan seanmemphis@yahoo.com (Report received), clemensdaniel@gmx.de, Paul-Michael pma@agapow.net, Chirs Farrell c_farrell@me.com (report received), Glen Oberhauser gwober@gmail.com, Charlie Mote charlie.mote@gmail.com,

Bernal/Colonist Card Layout: Darryl Tan and Francisco Colmenarez

Interstellar Solitaire: Neal Sofge, Cole Wehrle cwehrle@gmail.com

14.0 INTRODUCTION TO THE 2nd EDITION EXPANSION

The thriving space infrastructure has hundreds of specialists working in space colonies orbiting Earth. These provide services such as antimatter manufacture, beamed solar energy, cyclor satellites, space pharming, maglev bus service on launch loops, and of course, the local tax office. New Bernal, Colonist, Freighter, and GW Thruster modules allow you to move your base of operations further afield in the High Frontier. The promoted side of many of these cards includes new paths to victory called Futures.

Note: This expansion requires the 1st or 2nd edition High Frontier to play. Terms being defined are listed in bold, terms defined elsewhere in the rules are italicized. Easily missed rules have a black backdrop.

14.1 HIGH FRONTIER COLONIZATION COMPONENTS

1 This rulebook.

1 Cover Page (with List of Operations).

1 End Page (Tracks and Tables, cut out or copy from this rulebook).

1 Expanded Map, from Jupiter to the trans-neptunian objects {TNOs}.
 10 Hemispheres (two of each of five colors) for Bernal Tokens.
 5 10mm Cubes (one of each of five colors) for Freighters.
 15 Disks (three of each of five colors) for Claim Disks.
 10 Yellow Disks for Outposts and 3 Black Disks for Busted Sites.
 32 New Cards for the four Card Modules.
 28 Support Cards (24 legacy and 4 new cards).

Note: You may wish to purchase a “High Frontier Colonization Poster- Map” from Zazzle that combines the basic and expanded maps. Go to Zazzle of the nation you live in, and search “High Frontier Colonization”.

14.2 WHAT'S NEW?

This second edition High Frontier expansion contains everything in the original expansion plus rules, cards, and game pieces for seven new **operations**, one new **movement**, four new **card modules**, and one new **endgame module**. It plays with the legacy expanded rules, except for the amendments listed in 14.7, and features the following:

- Multiple spacecraft (Rocket, Bernal, Freighter, and mobile factories).
- Gigawatt thrusters 100X more powerful than the legacy MW ones.
- Multiple Outposts (up to two per player, 14.7).
- Multiple Products from each factory (using 3D printer capacity, 14.6).
- Multiple Operations (one per colonist), with a variable order of play.
- Freighters that carry multiple products plus a 3D printer (18.2).
- 12-year sunspot cycle with biennial (every other year) events (14.3).
- Triangle burns that “inspire” rather than generate events (17.0B).
- Expansion Map extended out to the inner Oort Cloud at 550 AU.

A. FOUR NEW SUPPORT CARDS. The support cards include all the legacy supports plus four new ones. Two have special rules:

- Marx Capacitor Bank Generator. This “pulse” generator requires an “electric” generator as a support. If researched, remember to draw the generator card beneath it as well per 5.2 (last bullet).
- Magnetocaloric Refrigerator Radiator. This radiator also needs an “electric” generator, and as noted it can cool its own supports.

B. FOUR COLONIZATION CARD MODULES. Each **card module** contains a set of cards: **Freighters**, **Bernals**, **Colonists**, and **GW Thrusters**. Except for the Bernals, each forms its own patent deck available for research. Any or all of these modules can be added independently to an expanded game of *High Frontier* as desired.

- Freighter Module. This allows you a second spacecraft for hauling stuff. If promoted, it allows all your factories to move independently, and provides a special victory condition called a *Future*.
- Bernal Module. The Bernal Token represents an orbiting Bernal Sphere space colony, basically a mobile upgraded version of your orbiting water depot that accommodates your WTs and colonists.
- Colonist Module. This allows you to recruit and boost hardy pioneers giving you additional abilities, votes, glitch protection, specialized operations, and sometimes *Futures*.
- Gigawatt Thruster Module. GW Thrusters allow rapid transport of colonists or Bernals to sites as distant as the TNO's (Trans-Neptunian Objects). They also provide *Futures* if promoted.

C. SEVEN NEW OPERATIONS. *Digital Swapping* (16.1), *Promote* (16.2), *Suffrage* (16.3), *Recruit* (16.4), *Hostile Recruit* (16.5), *Activism* (16.6), and *Anti-Trust* (16.7) supplement the legacy operations 5.1 through 5.9.

D. NEW RESOURCE EXPLOITATION TRACK. This replaces the legacy *Resource Exploitation Track*. Note that the new values are 10, 8, and 6 VP (victory points).

- **D** sites are no longer wild (exception to 5.7C). Instead, **D** sites form a fifth spectral-type column following the rules as for the other four spectral types.**

E. THE MOST IMPORTANT NEW RULES.

- You enjoy your legacy Faction Privilege, but except for Player Red lose it during War or Anarchy, or (Bernal module) per 19.3A. If you promote your Bernal, you gain an additional *Bernal Privilege* (19.5A), active as long as it remains promoted with a working generator.

- Your moves and operations can be taken in any order (17.0). Each of your crew and colonist cards can perform one operation, but if using a colonist this costs 1 WT and the colonist must be boosted.
- As in legacy, a hand card is played to its white side (if boosted from Earth) or on its black side (if ET-produced in space). However, the face-up color or orientation of a hand card is no longer significant. A black hand card no longer reflects a space product, and retooling of factories and hand cards is no longer necessary (14.6).
- As part of their move, rockets, freighters, and Bernal's can use factories to land or lift-off of sites without paying the lander fuel penalty, but this is risky (17.1).
- Except for your Crew and Bernal Cards which cannot be sold, hand cards can be sold with a Free Market Operation for the "Free Market" price shown on the Politics Diagram, see 14.4A.
- Freighter, Bernal, Colonist, and GW Thruster Cards have a purple (upgraded) side. To promote a card to its purple side, see 16.2. For summaries of these four optional modules, see 18.0, 19.0, 20.0, and 21.0.

14.3 NEW SOL SUNSPOT CYCLE.

High Frontier Colonization uses a new twelve-spot **Sol Sunspot Cycle** (end page), which is advanced after all players have taken their turn. This game round is called a **year**, and the Sunspot Disk (3.2A) acts as the year-marker. If the Sunspot Disk passes an event threshold (14.3A), it triggers an *Event Roll* (14.3B). This occurs every other year.

- Turn Sequence. During a year, each player takes his operations/move phase, starting with the first player (15.0A) and going clockwise.

A. EVENT THRESHOLDS. An Event Roll is made whenever the Sunspot Disk bypasses an **event threshold** (it's labeled "event") on the Sunspot Cycle. An Event Roll is not made when entering a *triangle burn* (instead see 17.0B).

- Order of Decision-Making. Rarely, an *event* (8.5B) or *combat initiation* (8.3F) requires an order-significant decision from multiple players simultaneously. If so, the first player makes his decisions first and then go clockwise around the table.

Example: A Pad Explosion is rolled. The first player has two mass 5 cards in his LEO stack, and chooses one to decommission. Then the next player clockwise chooses.

B. SOL EVENT TABLE RESULTS (See end page). Unlike legacy, each event potentially impacts all players. There is no phasing player.

- Extropy. Put the topmost card of each patent deck (including the colonist deck) on the bottom.
- Glitch. This decommissions the heaviest card in each Rocket Stack, or an Outpost Stack if you have no rocket. Ignore a **glitch** if the stack is collocated with a promoted Bernal, cube (big or small), or human crews or colonists. If multiple cards are equally heavy, choose one.
- Election Auction. This event generates an election auction per 16.6A.

Note: All cards collocated to a promoted Bernal except its support radiators are immune to events (glitches, pad explosions, & solar flares).

14.4 NEW SPACE GOVERNMENT

The end page includes a **Sol Space Government** similar to legacy (8.6).

- In Power. Seven spots on the Space Government, called **polities**, are colored with a faction color (see end page). You are **in power** if the *political disk* (3.2A) is on a polity of your faction color.
- Policies. Except for Player Purple, if you are in power you must enforce the policy specified: Capitalism, Anti-Nuke, Egalitarianism, Paleoconservatism, Nationalism, or Press Gangs. This last policy, replacing "Militarism" for Player Red, allows him to *hostile recruit* (16.5) any colonist, regardless of *loyalty*. See also 8.6.

A. FREE MARKET FOR HAND CARDS. Instead of being sold for 3 WT per 5.3, a hand card is sold for a number of WT equal to the current **free market value**. This value, ranging from 2 to 6 WT, is found on the Space Government according to the current position of the *Political Disk*. All hand cards other than your Bernal and legacy crew cards can be sold.

B. FREE MARKET FOR NON-HAND CARDS. A boosted white or purple card cannot be sold. A black card in LEO, including freighters and GW thrusters, can be sold for the price as specified in 14.2D.

- A black card can also be sold to a promoted Bernal per 19.5C.

Exception: Cards with the legend "Free Market sale as hand card only" cannot be sold in LEO or at

Bernal.

Example. A player has built a black card. He can move it to LEO or a Bernal and sell it for 6 to 10 WT, or he can decommission it and sell it from his hand for 2 to 6 WT.

14.5 DIRTSIDE, LAB, PUSH, AND LUNAR FACTORIES

A claim disk topped with a cube (large or small) is called a **factory**, and the site is said to be **industrialized**. There are four special types:

A. DIRTSIDE. Each of your factories on sites *adjacent* to your Bernal Token (19.1B) is called a **dirtside**. See 19.4 Example.

- Foreign Factories. You cannot use an opponent's factory as a dirtside.
- Adjacency. A site hex is **adjacent** if there are no burns or intersections in-between, see 5.6B. A *Crash Hazard Space* (6.4E) does not count as a space when determining adjacency (even if it is a burn).
- A Bernal must land on a *synodic comet* (8.5C) to use it as a dirtside.

Example: If there are red factories on the martian moonlets Phobos and Deimos, a red Bernal on the burn between them has both as dirtside. Factories on Mars would not be dirtside, since the aerobrake paths to the martian surface do not indicate adjacency.

B. LAB. A factory at a **TNO science site*** (the yellow star- microscope icon*) is called a **Lab**. A promoted Bernal with at least one *dirtside* on a science site is also a **Lab**.

- Labs are required to promote a Colonist, Freighter, or GW Thruster (16.2).
- Eureka. If you are the first to land on Eureka (the trojan moon of Mars), immediately roll 1d6. There is a 50% chance of it not being a science site.

C. PUSH FACTORY. A factory on Mercury, Venus, or Io** is called a **Push Factory**. For Player Green, a promoted Bernal in its *start orbit* or with a *dirtside* is also a **Push Factory**.

- Benefits. A Push Factory adds one to the speed of freighters (18.4) and lets a Bernal use solar-powered supports as far out as Saturn (19.5).

D. LUNAR FACTORY. A factory on Luna is possible only in the 5-player game (see 3.2C). If a lunar factory is built, the faction that is in power (14.4) can as an operation seize control of that factory by swapping its cube for a cube of the new owner's color. The claim disk is not swapped, only the cube. If nobody is in power,, the claim-holder can use an operation to reclaim his factory.***

- The Orange Bernal starts adjacent to Luna, allowing Player Orange to prospect it from his Bernal, or use his lunar factory as a dirtside.

14.6 CHOOSING FACTORY PRODUCT

Because factories now use 3D Printer technology, delete legacy rules *Choosing Factory Product* (5.7B) and *Retooling* (5.7D). You no longer flip a hand card to its black side to track the number of factories you have. A factory can build the black side of any card or cards in your hand that matches the factory type. Retooling is obsolete because any factory can now build the black side of any card in your hand with the corresponding product letter.

- Bid Limits. Because hand cards are no longer stored on any particular side (white or black), as an exception to 5.2A your crew card is **the only hand card that does not count against your hand limit**.

Example: Player Green has a V factory on Mercury. Performing a total of three engineering operations (ET Production), he produces three different black cards of product letter V from his hand.

14.7 ERRATA TO THE SECOND EDITION LEGACY GAME

These changes are recommended for all *High Frontier* games, not just *Colonization*:

2.3B (Third bullet): The ESA Powersat privilege is effective for Bernals and MW thrusters, but not GW thrusters or freighters. (Fourth & fifth bullets): Felonious actions are free actions performed at the location of any of your Crew or Human Colonists. (5th bullet): War is declared at the start of your turn. (6th bullet): The UN gets 1 WT for each factory cube or claim disk placed, but doesn't receive anything for claim jumps.

2.7B (Second bullet): Stacks are combined at the start or end of your Spacecraft Movement phase. This includes *coalescence* (6.7D), *jettisons* (8.3D), and *digital swapping* (16.1).

3.1B (Set-up note): The number of black disks is unlimited. Use replacement pieces if you run out.

5.6B Atmospheric worlds include Uranus, and worlds with buggy roads include Triton.

5.8 If you produce a product, the card goes into a stack, either a Bernal, Freighter, Rocket, or Outpost

- Stack. If you have no stacks available there, you cannot produce it. See 19.4A.
- 6.1A (Open-cycle cooling): Afterburners can be used for cooling at any point in a move, see 8.9 Year 2. Afterburners can be used to cool missile robonauts during prospecting, if they have expended the afterburning fuel that turn.
- 6.7 A decommission can be during any part of your turn.
- 6.7A (Dry mass adjustment): Items cannot be picked up mid-move, and if dropped off during a move the dry mass is not recalculated until the next move.
- 6.7D (Outpost): A yellow disk indicates an outpost. You are allowed two Outpost Stacks instead of one, but must keep track of which Outpost Card Stack belongs to which yellow disk on the map.
- 8.3E (Footnote): Dirt cannot be used as water, see 17.0D.
- 8.4C (Add to note): If an Outpost stack contains a buggy while on a site hex, the modified thrust is equal to 4 minus its ISRU. In all other cases, the modified thrust is 0.
- 8.6 (Second & third bullets): During Anarchy and War, all players except Player Red **lose their Faction Privileges** (2.3B).
- (Fifth bullet): Egalitarianism steals 2 WT instead of 1 WT.
- 8.8 (Year 9): The rocket stack returns to LEO with a step of fuel, not dry.
- 8.9 (Year 24): Returns to LEO with 3 steps of fuel, not 2.

15.0 SET-UP

High Frontier Colonization Set-Up is per 3.0. If the 1st edition support cards are available, you may add them to the three support decks.

- (Bernal-Colonist Module): Your hand starts empty, but your crew and Bernal cards start in a Bernal Stack (19.2). You also start with the hemispherical token of your color in its start orbit (19.1C).
- (GW-Thruster, Freighter, and Colonist Modules): Decks for the GW-Thruster, Freighter, and Colonist Cards are in addition to the six legacy research decks. Stack them purple-side down.
- (Freighter Module): The big cube of your color starts in your reserves.

Note: In the Set-Up for a Shorter Game (3.3), you can end up with nine extra cards.

A. **FIRST PLAYER.** Randomly determine the **first player** at the start of the game, then proceed clockwise. When all players have taken their turn, advance the *Sunspot Cycle* (14.3).

B. **QUICK-START SET-UP.** This variant starts the players with a hand, and thus gets you into Colonization quickly. It plays with all four new card modules.

- Players start with 10 WT, located at their *Bernal Stack* (19.2B).
- **Idea Turns.** The first few turns, called **Idea Turns**, are used to build up a player's hand. Starting with the first player, each player for his turn may pay 1 WT and take the top card off one of the patent decks (including the colonist deck). *Exception: The first player pays 2 WT for his first card, to offset his advantage in drawing first.*

Note: The card drawn comes without supports. During Idea Turns, there is no hand limit and the Sunspot Cycle is not active.

- **Ending Idea Turns.** If for your turn you decide to perform a standard operation instead of an Idea Turn, you become the new **first player** for the rest of the game. No further Idea Turns can be played.

16.0 OPERATIONS

During your turn, you are allowed to perform one *operation* (5.0) for each crew or colonist you possess.

Choose from the list of operations listed on the cover page; also see 5.1 to 5.7.

- You can perform operations in any order before or after your move.
- You may perform the same operation multiple times using different crew or colonists.

Exception: You are only allowed one card auction per turn.

- The *Space Tourism Space Venture* (7.2) allows your legacy crew to perform two operations instead of one.

A. **COLONIST OPERATIONS.** An operation performed by a colonist (20.2) differs from one performed by your legacy crew in three ways:

- **Location.** Unlike your legacy crew (who can perform operations either in your hand or in space), a colonist must be in space to perform an operation. It cannot perform the operation the same turn it is boosted or built. However, it can be in any stack, and does not need to be located at the site where the operation is taking place, unless it uses its ISRU ability.
- **Cost.** Each operation performed by a colonist costs 1 WT.

- Specialty. A colonist can only perform the operations corresponding to its *specialization icon* (20.3A). See the cover page.

Note: A few (robotic) colonists do not have a specialization, and allow no extra operations. Some colonists have more than one specialization, and you may choose which one to use each turn.

Example: Player Purple holds the Microgravity Pantrophists card (microscope icon) in his rocket stack. For the price of 1WT, he can perform an extra science operation.

B. EPIC HAZARD OP. Certain *Futures* (22.0A) call for an operation marked with a skull icon. This operation is called an **epic hazard op**. Either the colonist containing the future must perform it, or a colonist collocated with the card containing the future.

- Epic Hazard Roll. Make a 1d6 roll, which cannot be modified by *Failure is Not An Option* (6.4G).
- Failure Effects. If a "1" is rolled, then all cards in the stack containing the performing colonist are decommissioned (except Bernal's and promoted Freighters). If on a site, the site itself is destroyed (place two black disks to indicate this). Bust the *Futures Star* (22.0A) with a black disk stacked on your disk, indicating that although the future was not met, the game is one step closer to ending, and you still get 3 VP for the notoriety (22.3).

16.1 DIGITAL SWAP OPERATION (Engineer)*

This operation allows you to decommission one or more cards from a stack and then replace the card(s) with one black side card from your hand (which can also be any one of the cards just decommissioned).

- 3D Printers: The cards being swapped out must be collocated with your big cube, so this operation may only be used with the *Freighter Module* (18.0). If your freighter card has been *promoted* (18.6), all of your cubes, big and small, can be used for digital swapping. (Thematically, the cube uses its smelter to melt down old products, and its 3D printer to upload a new product of the same mass and materials.)
- Product Letter. The cards being swapped must have the same product letter **C, M, S, V** or **D**, as the spectral type of your Freighter Card.
- Limits. You cannot digital swap using the *HIIPER Beam-Rider Freighter* (18.3B). You cannot digital swap your Freighter Card itself.
- Conservation of Mass. The stack must not end up with more mass than before, (i.e. the combined mass of the decommissioned stack card(s) must be greater than or equal to the mass of the black-side card replacing it).
- Dry Mass. If your rocket stack ends up with less mass, adjust the *dry mass* per 6.7A.

Example: Player Red has a Z-Pinch Fusion Freighter ("S" type, Mass 5) carrying the H-B Cat Inertial robonaut ("S" type, Mass 2). He performs a Digital Swap operation, decommissioning the robonaut, and replacing it with a Von Neumann Santa Claus Machine refinery ("S" type, Mass 2) from his hand.

Technical Note: During a Digital Swap, the instructions for printing the part are sent to a 3D printer, which prints the part up layer-by-layer using its supply of "ink". The ink is manufactured by melting down and separating the elements of the card being replaced.

16.2 PROMOTE OPERATION (Science)

Besides a white side (i.e. boosted from Earth), or a black side (i.e. built in space), some cards have a **purple side**. A card is turned to its advanced purple side only by **promotion**.

- Promotion has no effect on a card without a purple side.
- In order to **promote** a Bernal Card to its purple side, see 19.5.
- In order to **promote** a Freighter, Colonist, or GW Thruster Card to its purple side, you must bring it to a Lab (14.5B) and perform a **Promote Operation**. This flips the card over. The spectral type of the Lab does not matter.

Note: you can promote at an opponent's Lab with his permission, or as a felony if it is undefended by humans.

- If a promoted card is decommissioned, its promoted status is lost (i.e., hand cards are "colorless").

Example: Player White sends a robonaut to Huya (a science site) and succeeds in his prospect roll. After sending Refugee Colonists to Huya, he uses his legacy crew operation to promote them.

16.3 SUFFRAGE OPERATION (Science)

To perform this operation, you must be *in power*, and at least one robot colonist must be boosted (by any player). If so, roll 1d6. If the result is less than the number of cards in play on their purple side (including Freighters, Bernal's, Colonists and GW Thrusters), you become the **Robot Emancipator**.

No other player can become the Emancipator for the rest of the game.

- Emancipation Effects. If emancipated, robots are treated exactly as humans except they still do not count against your *Maximum Human Colonists In Space* (20.4). They prevent glitches and in peacetime have *loyalty* (20.3B) to the Emancipator. Because consciousness is not fungible, neither humans nor emancipated robots can be *digitally swapped*.

16.4 RECRUIT OPERATION (Finance)

If your hand size is less than four cards, this operation allows you to remove the top three cards from the Colonist Deck (revealing the fourth), select one of the three and return the other two to the bottom of the deck. The chosen card is then *auctioned* (5.2).

- The Player Orange Privilege (Shimizu Research) allows him to perform the Recruit Op regardless of hand size.

16.5 HOSTILE RECRUIT OPERATION (Finance)

This operation allows you to woo colonists owned by other players during peacetime. The targeted colonist is moved to your stack in the same location.

- Max Colonists. You must have enough *dirtside hydration* to support the targeted colonist (20.4).
- Collocation. The target is an opponent's boosted colonist that is collocated with one of your stacks.
- Peace Loyalty. The targeted colonist must have *loyalty* (20.3B) to you. No hostile recruiting is allowed during War.

Example: Player Purple moves his freighter to Player White's Bernal containing the Vatican Observers (owned by White but loyal to Purple). Purple pays 1 WT to perform a hostile recruit with one of his financier colonists (who can be anywhere in space), stealing the Observers who are transferred to his freighter.

16.6 ACTIVISM (Finance)

If the Sunspot Cycle is in the blue sector, use this operation to initiate an **Election Auction**. This is held per 8.5B, except the auction is blind and ties are decided by the faction in power (14.4).

- A. ELECTION AUCTION. *Colonization* uses a **Blind Auction** for elections. All players make an outstretched fist containing their secret bid, and simultaneously reveal their bid. Each WT = 1 vote.
- Maximum Ballot Stuffing. Your secret bid cannot be greater than **10 WT**.
 - Votes (War). During war, each of your colonists you own in space gives you one vote per *ballot box icon* (20.3B). Robots cannot vote unless emancipated.
 - Votes (Peace). Except during war, colonists in space with an *election button* (20.3B) of your faction color add to your election bid per 20.3B, regardless of ownership of the Colonist Card. Robots vote for their *emancipator*, if any.
 - Ties. If two or more winning bids are tied, the player in power decides. If nobody is in power during an election tie, then all election bids are paid to the pool, and the *polity* remains unchanged.
 - The player with the most votes moves the political disk by one spot.

Example: An election occurs in peacetime, and both players reveal their bids. Player Orange spends 1 WT for one vote, and Player Red spends nothing but receives one vote from the Juiced Cosmonauts owned by Player Orange (who vote for Red because they have a red election button with one ballot box). The tied vote is decided by the player in power, and if no one is in power, Orange's bid would be lost.

16.7 ANTI-TRUST OPERATION (Finance)

To perform this operation, you must be *in power* (14.4), and must have a victim with two or more hand cards of the same category (thruster, GW thruster, robonaut, refinery, generator, radiator, reactor, freighter, colonist). If so, your victim must choose one of the excess hand cards to surrender to your hand. It does not matter how many cards are in your hand.

Example: Player White is in power and performs an Anti-Trust Operation on Player Red, who has two radiator cards in his hand. Player Red chooses a radiator to surrender to Player White's hand.

17.0 SPACECRAFT MOVE

Kzinti Lesson: "A rocket's efficiency as a weapon is in proportion to its lsp."

Summary. In any order, move any or all of your **spacecraft** on the Map, including your rocket figure, your big cube, your *promoted Bernal* (19.5B), and (if you have *promoted* your Freighter Card, see 18.6) all your small cubes. Each of these figures may take their movement once per turn only.

- You may move each spacecraft or take each operation in any order. You cannot move a spacecraft that was carried as cargo by another spacecraft earlier in the turn, except to land on sites defined as

adjacent (14.5A).

Example: Player Red performs an operation with his legacy crew, moves his rocket, performs operations with each of his two colonists, and finally moves his freighter.

- During its move, a figure can decrease (i.e. jettison) but not increase its dry mass. For instance, you cannot move one spacecraft to another, combine their stacks, and move with the combined stack.
- Combat. Your units can attack after all your units have moved. All non-outpost units (including cubes and Bernal Tokens) defend as factories if on a site and as rockets when off-site. For purposes of *buggy combat* (8.4C), all humans are treated as “Crew”, all robot colonists are treated as “robonauts”, and all purple cards are treated as “black cards”.
- Increased Maximum Dry Mass. In order to move, your Rocket Stack using a GW thruster and your dirt-propelled Bernal Stack are limited to a **maximum dry mass of 20**. Their performance at a dry mass of 14 to 20 is as indicated on the lowermost dry mass row on the Rocket Diagram (i.e. treat the “14-15” row as if it stated “14-20” instead).
- In order to move, a freighter’s cargo is mass-limited by its load-limit (18.4).
- Stack Capacity. If not moving, all your stacks can contain any number of cards, including colonists.

A. SPACECRAFT MOVE PROCEDURE (unchanged from legacy, except for factory-assist).

- 1) Choose Thruster & Make Afterburn Decision. In your Bernal, Rocket, or Freighter Stack, activate (17.0D) one card with a thruster triangle and all necessary supports to be the thruster (2.6D). If you decide to afterburn, reduce fuel per 6.1.

Note: Afterburn fuel is expended before reckoning modified thrust!

- 2) Lift-off (if on a site hex). Rockets and dirt-propelled Bernals adjust fuel figure per 6.4D. If landing or lifting off of a factory, spacecraft may use *factory-assist* (17.1). If a site is bigger than size one, freighters cannot land or lift-off unless they use *factory-assist*, and Bernals cannot land or lift-off at all.
- 3) Compute modified thrust. For Bernals or Rockets, it must be at least one, see 6.1. Freighters must have a cargo mass not exceeding their *load limit* (18.4), and they can move one burn.
- 4) Move spacecraft. For Bernals and rockets, adjust fuel figure for burns per 6.2B.
- 5) As you move, roll for *hazards* (6.4E and F).
- 6) After you have moved over the desired number of burns, you may coast (not entering any burns or making any pivots) until you wish to stop or land. If landing on a site with a modified thrust is less than or equal to the site size, your spacecraft must either *aerobrake* (6.4F), land with *factory-assist* (17.1), or adjust fuel figure per 6.4C.

B. INSPIRATION. **Immediately after moving** your Rocket or Bernal Stack, you may without cost perform an *exotropy* (14.3B) on one deck for each *triangle burn* (2.2A) that it crossed in its move.

- Choose any patent deck (including the colonists) for the exotropy.

Example: Player Green’s rocket moves through two triangle burns. For the first burn, he chooses to move the top radiator card to the bottom. For the second, he chooses the colonist deck for his exotropy. Assuming he has not yet done his operations this turn, he may research or recruit the freshly-revealed cards. Thematically, he has inspired new entrepreneurship and the new generation.

C. ADDING FUEL VS. BURNING FUEL (unchanged from legacy). There are two distinct ways to move the fuel figure: **fueling** and **burning**. Fuel is always added in **tanks** and burned in **steps**. Tanks are the blue stripes on the rocket diagram; steps are each spot in a row. When fuel is transferred (rather than burned or jettisoned), it is discharged as tanks (extra steps not equal to a full tank are lost).

Always add fuel tank-wise rather than step-wise, and always burn fuel step-wise never tank-wise.

D. HYBRID ROCKETS. A rocket stack can have multiple thrusters, including freighters, MW thrusters, GW thrusters, and dirt-propelled Bernals. At the beginning of your turn, place the active thruster on top of the stack.

- A hybrid rocket is always your rocket stack.
- A hybrid rocket can activate a GW thruster only if it had completely *isotope-refueled* at the proper spectral type (21.2) at its last refueling.
- A hybrid cannot activate anything but a *dirt-propelled Bernal* or a *dirt rocket* (8.3E) if it had dirt-refueled at its last refueling.
- A hybrid rocket cannot activate a freighter unless the dry mass of the rest of the rocket is less than or equal to its *load limit* (18.4).

Example: A rocket stack contains both a legacy crew with a 9•6 thruster and a GW thruster (“fuel isotope” = M). It loads up with 8-tanks of dedicated fuel at an M factory, and flies to a size 9 world. The

9•6 thruster may be used to land on this world, using the dedicated fuel for its afterburn.

17.1 FACTORY-ASSIST LANDING AND LIFT-OFF

When landing or lifting off an industrialized site (14.5), a Rocket, Bernal, or Freighter Stack can avoid the *lander fuel penalty* (6.4C) by using **factory-assist**. This entails a *Crash Hazard* (6.4E)!

- A spacecraft using factory-assist to lift-off can continue to move.
- Factory-Assist does not negate the effects of burns or hazards entered.
- If your Freighter Card is promoted, your cubes can use factory-assist to land or lift-off claims (18.6A).

Example: A rocket on a Martian factory can lift-off per 6.4D without risk (but spending 10 fuel steps if its modified thrust is too low) or can use factory-assist. In the latter case, assuming it survives the Crash Hazard or pays the 4 WT programming fee, it moves into the adjacent burn (spending fuel for the burn but not for the Ascent Stage Lander).

18.0 FREIGHTER MODULE

Summary. When using this module, freighters are no longer produced with the same op that produces factory product. Instead, research freighters from their own patent deck, and build them with an ET Production Operation according to their product letter.

- **Stack.** Producing a Freighter Card generates a Freighter Stack represented on the map by your big (10mm) cube. Just as in legacy, freighters do not track fuel and move one burn per turn. The freighter can carry card(s) of any type up to a mass equal to its load limit.
- **Promotion.** Promoting your Freighter Card allows all your cubes to be simultaneously freighters and factories, and gives you access to Futures VP. A promoted Freighter Card cannot be decommissioned.

18.1 FREIGHTER CARD SET-UP

Freighter Cards are black on one side, and purple on the other. They form their own patent deck, and are researched and produced (on their black side) like any black support card.

18.2 FREIGHTER RULES COMPARED TO LEGACY

If not using this module, then freighters are exactly as in legacy, except you use your big cube to represent your freighter. If using the Freighter Module, note the following rules changes from legacy:

- **Freighter Deck.** Freighters are researched from the **Freighter Deck**.
- **Industrialization Perk.** If you are the first to *industrialize* (5.7) a spectral type, in the same turn you may draw a **free card** from anywhere in the Freighter Deck into your hand. The product type of this Freighter Card must match the spectral type of the site. If you build at **Mercury, Venus, or Io**, you may optionally draw the HIIPER Beam-Rider freighter card.
- **Production.** If using this module, you must make a separate *ET Production Operation* (5.8) to build the Freighter Card (on its black side, see 18.3). (If not using this module, an ET Production Operation at a factory creates both a Factory Product and a Freighter Cube to carry it, just as in legacy.)
- **Big Cube.** At the factory where the Freighter Card is built, place a big cube of your color (instead of a small one). The location of this cube indicates the position of both your freighter and your Freighter Stack.
- **Production Limit.** You may only have one Freighter Card built at a time, and only one Freighter Stack.
- **Glitch Protection.** A stack collocated with a cube (e.g. an Outpost Stack at a factory, or a Rocket Stack carrying a mobile factory) is immune to the *glitch event* (14.3B). (Thematically, a Smelter-3D printer recycles old parts into new ones.)

18.3 BUILDING A FREIGHTER

A. **FREIGHTER BIG CUBE.** Use the *ET Production Operation* (5.8) to build a Freighter Card and place the big cube of your color on the factory site. This is a **freighter** of the mass, rad-hardness, and load limit as specified on the Freighter Card.

B. **PRODUCT LETTER.** As in legacy, the *product letter* of the Freighter Card must match the Spectral Type of the factory site where it is built.

- The product letter of your Freighter Card determines the type of *digital swap* (16.1) it can facilitate.
 - The *HIIPER Beam-Rider Freighter* has no product letter and can only be built at a Push Factory (i.e. Mercury, Venus, Io, or, for Player Green, a promoted Bernal, see 14.5C). This Push Factory adds one to its movement. As noted, the HIIPER cannot be sold on the Free Market.
- C. **FREIGHTER STACK**. As the final step, move the Freighter Card from your hand to the slot for your **Freighter Stack** (2.7B).

18.4 FREIGHTER MOVEMENT

- A freighter moves per 6.6. It can use *advanced rocket maneuvers* (8.3). Fuel is not burned or tracked on freighters. If you promote your Freighter Card, all your cubes can move as freighters per 18.6.
- Pushed Freighters. Add one to your freighter's speed for each *Push-Factory* (14.5C).
 - Freighter Landing and Lift-Off. Freighters may land on sites larger than size one only by using *factory-assist* (17.1).
 - Load Limit. The Freighter Card specifies a **load limit**, indicating how much mass the freighter can carry as cargo.
 - Combat. All cubes fight per 8.4D if on a site, but per 8.4A,B, & C otherwise. If captured, swap the cube with one of the victorious player's color.

A. **FACTORY LOADING ONLY**. A freighter with the **cargo ship icon** (labeled "Factory Loading Only") is not allowed to add any cargo anywhere except at a factory or a promoted Bernal (but can drop off cargo anywhere). Furthermore, it is never allowed to add cargo in LEO.

B. **CRUISER BONUS**. Some freighters (i.e. Z-pinch, fission fragment and HIIPER beam-rider) receive a number of *Hohmann Pivots* (6.3) as a free movement bonus as specified in the **cruiser icon** on the card.

Example: The magnetic mirror freighter gets a bonus of +3 Free Pivots. Its freighter stack is at the termination shock point en route to Sedna. It moves through the next 3 Hohmanns free, then coasts past the heliopause (and the Voyager Easter Egg) to stop at the fourth pivot just beyond.

18.5 ON-BOARD NUCLEAR REACTORS & GENERATORS

Certain Freighter and Colonist Cards contain the "On-board Nuclear Reactor" ability and/or the "On-board Nuclear Generator". The former signifies the card can be used as a reactor card, either neutronic (**(n)**), burst plasma (**(o)**), or exotic (**(x)**), as specified. The latter signifies the card can be used as a generator, either pulsed (**(ll)**) or electric (**(e)**), as specified.

- Anti-Nuke. All of these cards except the Beam-Rider are considered reactor cards during the *Antinuke Policy* (8.6).

18.6 FREIGHTER PROMOTION

To flip a built Freighter Card to its purple side, bring it to a *Lab* (14.5B) and perform a *Promote Operation*. **Promotion is permanent.**

- A. **MOBILE FACTORY FLEET**. Once promoted, your Freighter Card converts all your cubes (big and small) into **mobile factories**. Each may move as a freighter during your turn, using the specifications on your Freighter Card.
- You are still limited to a single Freighter Stack (located at your big cube).
 - Factory Establish or Abandon. If a cube lands on a claim, it can produce stuff just as a legacy factory. This can even be an opponent's claim if allowed to *claim jump* (6.4B). Moving a cube on or off a claim immediately establishes or abandons a *factory* (14.5), adjusting the relevant Exploitation Track a step (to a maximum of 10 VP or a minimum of 6 VP).
 - Factory-Assist. A cube may use *factory-assist* (17.1) to enter or leave a claim. It uses itself as the factory.
 - Mass. All your cubes have a mass equal to your Freighter Card Mass. This is relevant if the cube is taken as cargo in a rocket or freighter.
 - Small Cube Creation. You may create a mobile factory cube in any location by performing an ET Production Operation and decommissioning a working robonaut and refinery. You do not have to be on a claim.
- B. **FREIGHTER FUTURES**. If playing with the *Endgame Module*, the *Future* (22.0A) listed on the promoted side of the Freighter Card may be used.

- Planet Hunt Future.* Place disk in a Futures Star if you have a factory in Sedna (upper left corner of the map).
 - Beehive Ark Future. Place disk in a Futures Star if you *emancipate the robots* (16.3) and industrialize a **D** site.
 - Spacefaring Future. Place disk in a Futures Star if you have five or more colonists in space. (Tip: Orbits with a potential dirtside hydration of 9 or more include Pluto, Puck L1, and Haumea).
 - Antimatter Creation Future. Place disk in a Futures Star if you perform an operation on a factory on a TNO science site (i.e. a Lab) using a promoted colonist with the engineering specialization. As denoted by the skull icon, this is an *epic hazard op* (16.0B).
 - Climate Mirror Terraform Future.** Place disk in a Futures Star if you perform an operation at a promoted Bernal manned with at least two humans with an *atmospheric* dirtside (5.6B). As denoted by the skull icon, this is an *epic hazard op* (16.0B).
 - Star Wisp Future.*** Place disk in a Futures Star if you have a freighter cube in both the EM and neutrino sunlens points on the map, plus a *Push Factory* (14.5C) and a *TNO factory* (14.5B).
- Example: You promote your HIIPER freighter, move mobile factory cubes to the two sunlens points, and industrialize Quaoar, thus accomplishing the Star Wisp Future. As the first player to complete a Future, place your disk in the leftmost (12 VP) star on the end page (upper right corner).*

18.7 FREIGHTER DECOMMISSION

If your unpromoted big cube is decommissioned, return it to your reserves (where it can be rebuilt per 18.3A), and decommission the Freighter Card into your hand. Once promoted however, rather than decommissioning your Freighter Card or big cube, perform a *Big Cube Swap* (18.7A), and decommission instead the small cube swapped.

- Cargo. If the freighter had cargo that survived, convert it into an Outpost Stack (replacing the big cube with a yellow disk to indicate the Outpost).
- If a small cube is decommissioned, return it to your reserves. A new one can be built per 5.7A, 18.6A, or 20.6.
- The Freighter Card itself, once promoted, cannot be decommissioned voluntarily or involuntarily.

A. **BIG CUBE SWAP**. If your Freighter Card is promoted and your big cube is decommissioned, you may swap it with the location of any of your small cubes that have not yet moved. If you have no small cubes left, then restart your big cube in LEO. You may then move the big cube.

- A **big cube swap** does not require an operation. (Thematically, your mobile factory uses its 3D printer to add a cargo hold to its chassis.)

Example: You have a promoted Freighter Card and a fleet of 3 cubes. A solar flare destroys your big cube and one of your small mobile factory cubes. You swap your surviving small cube for your big cube.

19.0 BERNAL MODULE

"Oh give me a locus where the gravitons focus, where the 3-body problem is solved, where microwaves play down at three degrees K, and the cold virus never evolved." Home on Lagrange (The L5 Song), Higgins and Gehm.

Summary: Your faction's Crew Card and Bernal Card start boosted in your Bernal Stack, and your Bernal Token in a start orbit at a faction- specific lagrange point. Your boost operations are upgraded so you can boost directly to your Bernal for the cost of boosting to LEO. Your WTs are stored at your Bernal if it's still in its starting orbit. If it leaves, your WTs are stored either in LEO or an "Ersatz" Bernal. Promote your Bernal using a working generator. This protects the cards from space debris, gives you an extra privilege, and allows the Bernal to self-propel as a dirt rocket. Moving it to an L-point adjacent to one or more factories allows boosting additional human colonists at a card limit equal to half the combined hydration of those factories.

19.1 BERNAL CARD AND TOKEN SET-UP

- A. **BERNAL CARD**. Bernal Cards are white on one side and purple on the other. They are marked in the five faction colors, and one is given to each player along with his starting Crew Card.
- Your Bernal Card and legacy Crew Card start boosted in a special stack called the *Bernal Stack* (19.2).
- B. **BERNAL TOKEN**. Place a Bernal Token of your color into your *start orbit* (19.1C) on the map. This half-sphere represents an O'Neill-style orbiting colony used to support colonists in space.

C. START ORBIT. Player White starts in Earth-Luna L5, Player Orange starts in Earth-Luna L2, Player Green starts in GEO, Player Red starts in Earth-Luna L3, and Player Purple starts in HEO.

- On the poster-map, a seven-pointed star icon indicates a **start orbit**.

19.2 BERNAL STACK

The stack of cards with the Bernal Card (supports, visiting colonists, etc.) is your **Bernal Stack**. Keep these cards in the LEO stack slot on your Rocket Diagram. Your Bernal Token indicates its map location.

- Event Vulnerability. A Bernal Card is indestructible, has no rad-hardness, and no events (glitches, pad explosions, flares, etc.), or combat can be applied to them. Furthermore, if your Bernal is *promoted* (19.5), all collocated cards except its support radiators in active use are immune to events and solar flares.
- Hazards and Combat. A Bernal Card cannot be decommissioned or captured. If it crashes (by a crash hazard, factory-assisted lift-off, etc.), the other cards in the Bernal Stack are decommissioned, but the Bernal Card remains in the accident spot (but if promoted it unpromotes). In combat, the other cards in a Bernal Stack can attack and be attacked as if rockets (if orbiting) or factories (if on a size 1 site).

A. BOOST ENHANCEMENT. If you have a Bernal in its start orbit, your boost capacities are enhanced, so that a Boost Operation (5.4) gives you the option of boosting any white card or cards to either your Bernal Stack or LEO. You can even boost partly to LEO, and partly to your Bernal in a single operation.

- VAB. If a boost goes through Earth's Van Allen radiation belts, the **modified thrust is considered to be three**.

Example: Player Orange boosts three cards to his Bernal in L2. He rolls a "6" for his radiation roll going through the VAB. The sunspot cycle is in the red sector, so two is added to this roll. With a modified thrust of three, the radiation level is $6 + 2 - 3 = 5$. One of the cards boosted has a radiation level of four, and is returned to his hand.

B. BERNAL WT STORAGE. As long as you have a Bernal Token in your start orbit, it acts as your *Water Tank Orbital Depot* (2.4B) where your WT's are stored and where your MW rockets must be refueled instead of LEO. If you have no Bernal or Ersatz-Bernal in your start orbit, your WTs are stored in LEO instead.

19.3 MOVING YOUR BERNAL

Your mass-10 Bernal can be moved as cargo in a MW or GW rocket. If promoted, it can also self-propel per 19.5B. If moved to a new L-Point (i.e. orbit, see 2.2B) that is *adjacent* (14.5A) to one or more factories of yours, you can support additional colonists (20.4).

- Once a Bernal moves out of its start orbit, its stack is no longer kept in the LEO slot. Instead, place it alongside your rocket stack.
- As soon as a Bernal moves into a new orbit with at least one dirtside, spacecraft in its stack may deploy to land on adjacent sites (including aerobraking or factory-assist).
- You may use rayguns in a Bernal to prospect *adjacent* sites.

A. PRIVILEGE LOSS. Moving your Bernal out of its start orbit shuts down your *Faction Privilege* (2.3B), *Boost Enhancement* (19.2A), and *Bernal WT Storage* (19.2B), but not your *Bernal Privilege* (19.5A).

Example: Player White uses his GW rocket to move his white Bernal Token to Ganymede. He stops collecting launch fees, and must boost to LEO instead of L5.

B. ERSATZ-BERNAL. If your start orbit has no Bernal Token, as a *Boost Operation* (5.4) you can pay 10 WT and boost a replacement Bernal there. Indicate this replacement, called an **Ersatz-Bernal**, with your second Bernal Token (or a claim disk if your second token is in use per 19.5B) in your start orbit position.

- The Ersatz-Bernal is promoted and functions as the original one did (except it can't be moved). It restores your Faction Privileges, you can boost to its location, and you store your WTs there. It adds one colonist to your *Maximum Human Colonists in Space* (20.4).
- Assuming they survive the radiation roll, cards boosted at the same time or after your Ersatz-Bernal is boosted always end up at your Ersatz-Bernal. They are stored in the LEO slot.

19.4 BERNAL DIRTSIDE HYDRATION

The sum of the waterdrops in all the *dirtsides* (14.5A) of a Bernal is called its **dirtside hydration**. You

can have half as many Human Colonist Cards in space (20.4) as your dirtside hydration (round down).

Example: Your Bernal in Mars LMO has a dirtside hydration = 7 if you have industrialized both the buried glaciers and the caves of Mars, allowing you 3 human colonists. The third factory is not adjacent.

A. BERNAL PRODUCTS AND WATER. If you perform an *ET Production Operation* (5.8) using a dirtside factory, the product appears either at the factory or in the Bernal Stack, as desired. If you perform a *Factory Refuel* (5.5B) using a dirtside factory, the MW thruster can refuel either at the factory or the Bernal, as desired. GW thrusters refuel at Bernals per 21.2. (Thematically, dirtside refineries catapult rawstuffs to be zero-gee processed in shirt- sleeve conditions into final space products or isotope fuels.)

- Hazards. During ET Production, ignore *Crash Hazard Spaces* (6.4E) between the Bernal and its dirtside.

Science Note: There are four reasons for locating a Bernal in a lagrange point of one or more dirtside factories: (1) Rawstuffs and water can readily be electromagnetically catapulted from the surface to the Bernal for processing and assembly by humans in shirtsleeve conditions, (2) the freighter traffic between the lagrange and cislunar space can be conducted with low thrust rockets. (3) Humans can control dirtside robonauts without the problematic time lag that teleoperation from earth would entail. (4) Production of the final space product can be performed at zero-gee, allowing unique materials and processes not possible dirtside (or back at Earth). A Bernal at L5 has been the goal of the L5 Society, of which I have been a member since its founding.

19.5 PROMOTING A BERNAL CARD

If your Bernal Stack contains a working generator and is at its start orbit or has a dirtside, you may flip your Bernal Card to its purple side by performing a *Promote Operation* (16.2). For the Orange Bernal, you need a reactor (any type) instead of a generator.

- Solar-Powered Bernals. If your promoted Bernal is in the Ceres Zone or beyond, its generator (or the supports for the generator) cannot be solar-powered. Exception: If you (or a cooperating player) have a *Push Factory* (14.5C), then your Bernal can use solar-powered supports as far out as the Saturn Zone.
- Unpromotion. A Bernal remains promoted even if it moves away from its start orbit or dirtside. However, if a Bernal loses its generator function (e.g. its radiators are decommissioned by an event), it becomes unpromoted. Flip the card back to its white side. You can re-promote per 19.5.

A. BERNAL PRIVILEGE. For as long as it remains promoted, a Bernal gives you the following **Bernal Privileges**:

- Extra Colonists (all factions). A promoted Bernal allows additional human colonists in space per 20.4.
- Event Protection (all factions). All cards in the promoted Bernal Stack except radiators are immune to events and solar flares.
- NASA Science. Any colonist in the promoted Bernal can perform a Research Operation (limit is one card auction per turn per 16.0).
- Shimizu Marketplace. Any colonist in the Bernal can perform an Income Operation to gain 2 WT.
- ESA Push Factory. The promoted People's Bernal in either its start orbit or with a dirtside gives Player Green a *Push Factory* (14.5C).
- PRC Antimatter Production. The promoted Military Bernal gives Player Red the additional privilege to have one free *Hohmann Pivot* per move (18.4B) for all of his spacecraft (rockets, freighters, and Bernals).
- U.N. Diplomatic Immunity. The promoted Political Bernal gives Player Purple the additional privilege to ignore the effects of an opponent's *policy* (14.4).

Example: The current polity is Egalitarianism. As long as Player Purple has a promoted Bernal, no matter how rich he is players may not draw income from him.

B. DIRT-PROPELLED BERNALS. A promoted Bernal can fuel and move as a *dirt rocket* (8.3E). It uses all *thrust-modifiers* per 6.1A (including wet mass modifier, thrust-modifying supports, solar power, and ESA beamed power) and can use *advanced rocket maneuvers* (8.3).

- Maximum Dry Mass. A dirt-propelled Bernal is limited to a total dry mass of 20. Its performance at a dry mass of 14 to 20 is as indicated on the lowermost dry mass row on the Rocket Diagram.
- Fuel Figure and Refueling. Use a Bernal Token to act as the fuel figure for the dirt-propelled Bernal. If a Bernal is in its starting orbit or in an orbit with a dirtside, refuel all its tanks by performing a *factory refuel operation* (5.5B). (Note that it can fuel its tanks for free in its start orbit. Thematically, it is using an electric dirt rocket and sacrificing its own regolith radiation shield as propellant. The mass of this shield is at least 5X the rest of the Bernal. It will replace the shield with new dirt at its destination.)

- Orange Self-Propelled Bernal. Because this Bernal uses a NERVA engine instead of an electric dirt rocket, Player Orange must use WTs or water to fuel it as an exception to the above.
 - A dirt-propelled Bernal may land or lift-off worlds exactly as other rockets (6.4 & 17.1), except the maximum size site is one.
 - A dirt-propelled Bernal can factory refuel using one of its *dirtsides* per 19.4A.
 - You can convert WTs into fuel tanks for your dirt-propelled Bernal, but except for the Orange Bernal you cannot convert them back into WTs again (since the market in LEO is for water, not dirt).
- Remember: Your Bernal can't refuel, claim, or prospect. So don't fly to Pluto with just a Bernal and colonists and forget to bring an ISRU unit, such as your legacy crew.*

Example Mission to Callisto: Player Red has a promoted Bernal at his L3 start orbit with an in-core thermionic generator supported by a dual mode fission reactor and a heavy microtube radiator. Together with his legacy taikonauts, the dry mass = 15. Without any fuel, it has a modified thrust of $3 - 1 + 1 = 3$. (The +1 modifier comes from its dual-mode fission). Initially traveling along route yellow, the dirt-propelled Bernal travels through the Sol-Earth L3 and lands on the small asteroid Mjolnir. Because it meets the movement requirements of 6.1B, it executes this move without any fuel on-board. The Hohmann Pivot executed near Khufu is free because of the Red Bernal's privilege. At Mjolnir, the taikonauts dirt-refuel the maximum of 6 tanks of dirt, moving the fuel marker into the Tug Class with a modified thrust of 2. Blasting-off of Mjolnir, the Bernal goes through Sol-Earth L3 and Sol-Mars L4, taking route purple to land on the small asteroid Gaspra. All 6 tanks were emptied going through two burns, so the taikonauts break out their shovels again. From Gaspra, the Bernal takes the green route for a near-suicidal flyby of Jupiter. Trying to aerobreak to reach Callisto, the Bernal is struck by a superbolt of lightning, vaporizing everything except the Bernal shell. However, the demoted Bernal takes its four free burns from the flyby to reach its destination orbit, a highly eccentric orbit around Callisto. Mission accomplished, and Player Red will replace its lost heroes and equipment later.

Example Mission to Mars: Player Red has a nuclear-powered Bernal stack with a dry mass of 15. It factory refuels in its start orbit with its 6 free tanks, giving it a modified thrust of 1. Red's antimatter ability allows his dirt-propelled Bernal to travel from L3 to Deimos in one turn, expending 4 steps of fuel (three for the burn, the last for landing fuel). Unfortunately, the intended destination of LMO is two burns distant from Deimos. This will expend all six steps of dirt it is capable of carrying, but it will need one more step just to blast off Deimos. Red must lighten its dry mass to 13, possibly by replacing his reactor or generator with a lighter version.

- C. INTERPLANETARY TRADE. A black card moved by rocket or freighter to a promoted Bernal with a dirtside can be sold for the same price that it would be sold in LEO (i.e. perform a Free Market Operation to receive WT equal to the VP value of the card's product letter as shown on the Exploitation Track, see 14.2D).
- Market Saturation. If you sell to your own Bernal, the card sold must be returned to the bottom of the deck. If you sell to an opponent's Bernal, **the card sold goes to your hand, but one WT from the sale must go to the owner of the Bernal.**
 - The Product Letter of the card being sold cannot be the same as the Spectral Types of any of the Bernal's dirtides.

Example: Player Green has a factory on Deimos, the only "D" type factory in this particular game. Player Green performs an ET Production operation to produce the Rotary Dirt Launcher (a "D" type freighter), launches it with factory-assist, and moves it to Player White's Bernal in Mars LMO. Because this Bernal has only C dirtides, Player Green may sell the D Freighter Card, which is decommissioned. Player Green receives 9 WT, and Player White receives 1 WT.

Technical note: Once promoted, a Bernal metamorphoses from a dumbbell into a 250m sphere with a capacity of 10,000 souls. The structure is 453 mass points, the atmosphere is 250 mass points, and the shield is 2320 mass points. It rotates at 3-rpm for 0.7-gees.

20.0 COLONIST MODULE

Summary. Colonists are researched or recruited from their own deck. The main advantages of a colonist are the extra operation it confers and its special ability. Some have thrusters, on-board reactors, ISRU, and Futures. There are two types: **human** and **robot**.

20.1 COLONIST CARD SET-UP

Colonist Cards are either white or black on one side, and purple on the other. They form their own

patent deck, the **Colonist Deck**.

20.2 HUMAN AND ROBOT COLONISTS

Human colonists are white and purple; robot colonists are black and purple. Both are procured into your hand during a *research* (5.2) or *recruit* (16.4) operation. However, humans are then *boosted* per 5.4, while robots are produced by *ET Production* per 5.8.

- **Human colonists** are limited to one boosted per player at the start. However, if playing with the Bernal Module and you move your Bernal, you can boost additional human colonists per 20.4. Human colonists vote according to their ideology, except during war when they vote for their employer. Their presence provides protection against the glitch event and prevents felonies.
- **Robot colonists** can only be built at factories, and cannot be boosted from Earth. They don't count against your *Max Human Colonists in Space* (20.4), even if *emancipated* (16.3). Robot Colonists do not prevent glitches unless emancipated (16.3).

Note: Your Legacy Crew is Human, but not a Human Colonist.

20.3 COLONIST CARD DESCRIPTION

If in space, a Colonist Card has the attributes shown below:

A. **SPECIALIZATION**. Each colonist depicts one or more icons denoting its **specialization**: wrench (engineer), microscope (scientist), and handshake (financier). Each specialization allows certain extra operations to be performed in your turn, as follows:

- **Engineering**: Income (2 WT), Boost, Site and Factory Refuel, Industrialize, ET Production, and Digital Swap.
- **Science**: Research, Prospect, Promote, and Suffrage.
- **Finance**: Free Market, Recruit, Hostile Recruit, Activism, and Anti-Trust.

Note: Since a colonist uses teleoperation to perform the Prospect and Site Refuel operations, you must have a card with an ISRU rating at the site, and you use the ISRU rating of the unit on the site.

B. **ELECTION BUTTON**. Each colonist has a colored **election button** depicting a number of *ballot box icons*.

- **Loyalty (peacetime)**. When not in War, the **loyalty** of a colonist is indicated by the faction color of its election button. A gear-shaped button indicates the colonist is robotic with loyalty to the *Robot Emancipator* (16.3), if one exists. Loyalty is used during *Hostile Recruiting* (16.5) and peacetime *elections* (16.6A).
- **Loyalty (wartime)***. During War, all colonists have **loyalty** to the holder of their card (e.g. their employer). Nevertheless, colonists cannot be used to attack player factions they are loyal to.
- **Votes**. Each **ballot box icon** represents one vote during an *election auction* (16.6A).

C. **PLATFORMS AND ISRU**. Some colonists have platforms and *ISRU ratings* (2.6E).

D. **THRUST TRIANGLE**. A colonist with a Missile Platform has a *thrust triangle* (2.6D) and can act as a megawatt thruster.

E. **SPECIAL ABILITIES** as listed in the white field on the card. If the ability says "In Bernal", then the colonist must be in a Bernal Stack to perform this ability. These abilities can be rented to others (5.9).

F. **ON-BOARD NUCLEAR REACTOR**. Colonists with this capacity can act as a reactor card per 18.5, and can act as the reactor card support when establishing a factory per 20.6. They are affected by the *Antinuke Policy* (8.6).

G. **INTERSTELLAR**. The icons in the green border (right side of the card) are only used with the *Interstellar Solitaire Game* (24.0).

20.4 MAXIMUM HUMAN COLONISTS IN SPACE**

You are always allowed one human colonist in space (plus your crew). If playing with the Bernal Module, additional human colonists may be boosted into space if your Bernal is promoted (19.5). If so, the maximum number of human colonists allowed in space is equal to half the dirtside hydration (19.4) of your Bernal (dropping fractions). For instance, if you have industrialized the entire Pluto system (4 x 4 = 16 drops), a Bernal there can support 8 human colonists in space.

- An *Ersatz-Bernal* (19.3B) allows one extra human in space.

- Robots (both emancipated and unemancipated) and Legacy Crew do not count against this limit.
- Falling Limits. If at your maximum, and your dirtside hydration falls for some reason (e.g. your Bernal moves away from the dirtside), then you do not have to decommission colonists to reach your lower limit. Instead, you simply cannot boost new human colonists until your limit rises again.

Example: Player White has a Bernal in LEO, and one human colonist in space. He moves his Bernal as shown in Example 9.4, where he has industrialized two martian sites. Since his dirtside hydration is 7, he is free to boost a second and third colonist.

20.5 COLONIST CARD PROMOTION

To flip a boosted Colonist Card to its purple side, bring it to a *Lab* (14.5B) and perform a *Promote Operation* (16.2).

- If promoted, the abilities on the facedown side are then lost.

Note: Your Crew Card cannot be promoted, and goes into your hand if decommissioned.

Example: Player Orange sends a robonaut and refinery to Hi'iaka (a TNO science site), succeeds in his prospect roll, and subsequently industrializes the site. After sending the Islamic Refugee colonists to Hi'iaka, he may perform a promote operation to flip them to their purple side.

A. COLONIST FUTURES. If playing with the Endgame Module, the *Future* (22.0A) listed on the promoted side of six of the Colonist Cards may be used.

- Revolutionary Future. Place a disk in a *futures star* (22.0A) by performing an *epic hazard op* (16.0B) while the politics is in the "War" polity, and you have at least three human colonists in space.
- Pan-Sapiens Future. Place a disk in a futures star if you *hostile recruit* (16.5) two colonists using the Group Mind Immortalists. Both of these operations are *epic hazard ops* (16.0B).
- New Venus Future. If you have industrialized a *synodic comet* (8.5C) with a collocated TW thruster, you can announce your intention to crash the comet into Venus, bringing enough water to create a new Earth. Unless the factory or thruster on this comet is destroyed, you get a futures star 12-years later.
- Uplift Future. Place a disk in a futures star if you have *emancipated* the robots (16.3) and your scientist at a lab performs an *epic hazard op* (16.0B).
- Von Neumann Future. Place a disk in a futures star if you have emancipated the robots (16.3) and perform an *epic hazard op* (16.0B) at a factory of yours using the Neumann Turing Colonists.
- Supreme Cult Leader Future. Place disk in a Futures Star if there are at least six *votes* (20.3B) of your faction color in space (regard- less of who owns the card). If you have *emancipated* the robots (16.3), robotic votes count as your faction color if you own them.
- Footfall Future. If you have industrialized a *synodic comet* (8.5C) with a collocated *TW thruster* (21.4), you can announce your intention to crash the comet into Earth, causing an apocalyptic impact winter. Unless the factory or thruster on this comet is destroyed, the game will end 12-years later, and you claim a futures star. Combat is allowed during these 12-years, regardless of the position of the political disk.

20.6 COLONIST CARD DECOMMISSION

It is felonious to voluntarily decommission **humans** (i.e. crew, human colonists, and emancipated robot colonists) anywhere except in LEO or per the two bullets below. If a human colonist or emancipated robot colonist is decommissioned, put it into the **bottom** of the *Colonist Deck* (20.1). Your robot colonists and legacy crew go into your hand if decommissioned.

Note: A crew card is human, but not a human colonist.

- Robotic ET Factory. During *Industrialization* (5.7), robot colonists can be decommissioned in place of robonauts to start a factory.
- Space Colony. Humans can be decommissioned to start a *Space Colony* per 6.7B. If upon decommission they have an on-board reactor (20.3F), this can act as the reactor card for the refinery and/or robonaut support. If you promote your Freighter Card, a colony cube becomes a mobile factory (18.6).
- Colony Disbandment. A colony cube can be only converted into a crew card per 6.7B, even if a colonist was used to create it.

21.0 GW THRUSTER MODULE

Jon's Law: "Any interesting interstellar drive is a weapon of mass destruction."

Summary. A Gigawatt (GW) Thruster cannot fuel using WT's; it may only fuel at a spectral site matching its fuel isotope. If used to afterburn, spend one fuel step to gain one therm cooling plus the thrust addition listed in the afterburn icon. Otherwise they move and burn fuel as legacy MW rockets.

21.1 GIGAWATT THRUSTER DECK SET-UP

Gigawatt thrusters are black on one side and purple on the other. They form their own deck, the GW Thruster Deck, and are researched and create rocket stacks like the legacy (megawatt) thrusters. They are produced on their black side by an *ET Production Operation* (5.8).

You may only have one GW Thruster Card built at a time.

21.2 GIGAWATT THRUSTER FUEL

A Gigawatt Thruster can only fuel at sites of the spectral type specified on its card. This includes ISRU or factory *refueling* (5.5A,B). It can also factory refuel at a promoted Bernal if it has a dirtside of the specified spectral type.

- **Factory Fueling Limits.** During factory refueling (5.4A,B), a factory **can supply a maximum of one tank per turn to a GW thruster.**
- **Bernal Fueling.** If refueling at a Bernal with multiple dirtside of the correct spectral type, the refueling rate is one tank per dirtside.

Example: A GW Dense Plasma Focus rocket sits on a factory at Hydra, a D spectra moonlet of Pluto. A "blue goo" science colonist with ISRU 1 is also there. Since Hydra is a wet world (appropriate given its name!), by performing an ISRU refuel the colonists extract $1 + 4 - 1 = 4$ tanks of fuel. This is 4X faster than if instead a factory refuel is performed. Note that if the player has an engineer in space (and thus has an extra engineering operation), he could spend 1 WT and perform both the factory refuel and the ISRU refuel, gaining 5 tanks altogether.

- **Dedicated Fuel.** A GW Thruster runs on pure fuel isotopes and cannot use water propellant. Legacy MW thrusters and robonauts can use GW dedicated fuel, but a GW rocket can only use fuel that is loaded from a site matching its "fuel isotope" spectral type. A *hybrid rocket* can activate a GW thruster only per 17.0D.
- **Zubrin.** The legendary Zubrin Drive (from the legacy game) has additional fuel limitations when using this module. It uses dedicated fuel (see previous bullet), and must be fueled at **S** sites, exactly as if it were a GW rocket. (The design burns $^{235}\text{U}\text{Br}_4$ fuel at over 400-GW thermal power).
- **Scoop.** Like factory refueling, an *atmospheric scoop* (6.4F) refuels a GW thruster only if at the matching spectral site, at 1 tank per turn per scooping unit.

Example: Player Green builds a Spheromak GW thruster on Memphis Facula of Ganymede (type S). The dry mass of the rocket is 12 (including its supports), and during factory or ISRU refueling the rocket is loaded with 7 tanks of S isotope fuel (helium-3). The rocket is now tug class, so even with afterburning the Spheromak modified thrust ($11 - 2 = 9$) is insufficient to lift-off Ganymede (size 9). Therefore the rocket uses factory-assist to lift-off.

A. STARSHIP THRUSTERS. Some GW Thrusters (and all TW Thrusters) have such a high specific impulse (Isp) that their fuel consumption is zero. Two promoted freighters (Beam-Rider and Antiproton Sail) are also ultra-high Isp. Rockets with these cards active are called **starships**.

- **Synodic Sites.** A starship can enter a *synodic comet site* during any sector (exception to 6.4A).
- **During combat,** a starship can be used as a raygun per 8.4A.

*Note: The starships have a small thrust triangle or beehive icon at the lower center of the card. These are only used in the *Interstellar Solitaire Game* (24.0).*

Example: A rocket stack contains a 8•0 thruster, with a "thrust +5" afterburn. If the modified thrust is 8, this starship can expend zero fuel and move 8 burns, or one step and move 13 burns.

*Science Note: In order to achieve their remarkable Isp performance, GW thrusters burn pure nuclear fuel with no added propellant or open-cycle coolant. Thus the burned fuel becomes the propellant (in this they are like chemical rockets). The fusion or fission fuels are rare isotopes, which must be purified by isotope separation. The game makes the following assumptions on where to find these rare isotopes: The fission fuel curium-245 on **M** worlds, lead antimatter thermalizer is also found on **M** worlds, the fusion fuel lithium-6 on **V** worlds, the fusion fuel boron-11 on **D** worlds, and the fusion fuel helium-3 on **S** worlds. **S** worlds also have tritium for the Vista drive and uranium-235 for the Zubrin drive.*

21.3 GIGAWATT AFTERBURNERS (Open-Cycle Cooling)

If you employ *open-cycle cooling* (6.1A) by expending an extra step of fuel, increase the thrust by the value indicated inside the afterburner icon. This rejects one therm of heat.

Example: A Spheromak GW thruster has a $6 \cdot 1/10$ thrust triangle with an afterburning modifier of +5. It is transport class, so the wet mass modifier is -1. By expending the minimum one step of fuel, it may move up to its modified thrust (5 burns) plus land on a world of size 4 or smaller. If it afterburns a second step of fuel, it may move up to 10 burns plus land on a world of size 9 or smaller.

21.4 TERAWATT THRUSTERS

To flip a built GW Thruster Card to its purple side, bring it to a *Lab* (14.5B) and perform a *Promote Operation* (16.2). The promoted GW Thruster, called a TW (terawatt) Thruster, follows all the rules for GW thrusters.

Note: The spectral type of the lab does not matter.

A. FUTURES. If playing with the Endgame Module, the *Future* (22.0A) listed on the TW Thruster Card may be used.

- Mini-Black Hole Creation Future. Place disk in a Futures Star if you perform an epic hazard op (16.0B)* on a factory on a size 1 S site containing a colonist with the science specialization.
- Protium Fusion Future. Place disk in a Futures Star if you perform an epic hazard op (16.0B)* at a site with 4 promoted cards, including a colonist with the scientist specialization.
- Lithiated Ammonia Starship. Place disk in a Futures Star if your operational rocket contains the Solem Medusa thruster and three colonists, one of each specialist.
- Enzmann Starship. Place disk in a Futures Star if your operational rocket is fully fueled and contains the Colliding FRC thruster and three colonists, one of each specialization.
- Mass Beam Future. Place disk in a Futures Star if you industrialize Mercury, Venus, and Io (i.e., the three push-factory sites).
- Daedalus Future. Place disk in a Futures Star if you have factories on the sites labeled “saturn aerostat” and “uranus aerostat”. (Thematically, the Daedalus starship needs 1350-tanks of ³He-D, wrested by aerostat-mining from the atmospheres of gas giants.)

22.0 ENDGAME MODULE

This optional module adds perhaps 2 hours to the game. If not using it, ending and winning the game is per legacy rules (7.3).

A. FUTURES. Certain promoted Freighter, Colonist, and GW Thruster Cards list a **Future** with conditional victory points (VP) indicated by the **white star icon**. This icon means “if this card is promoted and operational, and if you meet all the listed requirements, place a disk of your color on the **futures star** icon on the end page”.

- You are limited to one Freighter Future, one Colonist Future, and one GW Thruster Future.

Note: Only one disk per future, and once placed, it can't be removed.

22.1 ENDING THE GAME

The game ends on the next event after either of the following occurs:

- If the number of Futures occupied by disks is one less than the number of players. For instance, in a 2-player game the game ends the event after the first future disk is placed. (But either player can take additional Futures before the game ends.)
- Twelve years (one solar cycle) after a *Footfall* is announced (20.5A).

22.2 ENDGAME ELECTION

At the end of the game, perform an *election auction* per 16.6A.

2.3 VICTORY POINTS

At the end of the game, receive 1 victory point for each claim disk, Bernal, rocket, and cube of your color on map spaces. Also receive VP for ET factories, Space Ventures, Glory, Science Sites, and Space Governments per 7.1. Receive additional Victory Points (VP) as follows:

- Glory. You must decommission crew or colonists in LEO (not your Bernal) to receive a glory cube (7.1).
- **Heroism star** (optional), found in the *Glory Arena* of recent edition maps = +3VP. Place a cube here on behalf of another player if he has accomplished an epic rescue, suffered an undeserved catastrophe, or something similarly legendary.
- Each **Lab** (i.e. industrialized TNO science site or dirtside science site per 14.5) = +4 VP.
- (Freighter, Colonist, and/or Gigawatt Thruster Modules). VP as noted for a claim disk on a *futures star* (22.0A). A black disk denotes an *epic fail* (16.0B) = +3 VP.

A. TIE-BREAKER. In case of ties, the one with the most WT wins.

22.4 WERNER'S STAR, A 2 HR. SOLITAIRE VARIANT

Little Werner dreams of becoming an astronaut (or cosmonaut, taikonaut, etc.) and traveling to another star. Can this dream come true? Werner is represented by your legacy crew, and wins if he attains a TW thruster future before he dies of old age. Play with all modules and events.

- A. **COLONIST CARD SENILITY.** In this variant, each Human Colonist has a number of blue disks on them showing its age. (Use black disks if you run out of blue.) Each **Age Disk** is 12-years. Every time the Sunspot Disk passes the **Senility Threshold** (12:00 position in the Sunspot Cycle), add one Age Disk to all Human Colonists in space, and then for each of them roll a 1d6 Cancer Risk.
- **Cancer Risk.** If a Human Colonist needs to make a **Cancer Risk**, roll 1d6. Discard the card out of the game if the roll is less than his **age** (i.e. number of blue disks).
 - **Starting Age.** All Human Colonists and Werner acquire two Age Disks when boosted. You lose if Werner is decommissioned.
 - **Hazardous Duty Wages.** Performing an operation with a Human costs a number of WT equal to the colonist's age (instead of 1 WT). Legacy crew continue to be free, and robot ops continue to cost 1 WT.
 - **Self-Promotion.** A Human Colonist can spend 1 WT to perform his own operation and roll 1d6 to attempt to flip his own card to its purple side. This operation is successful if the roll is less than his age. Since this represents the maturation of the original humans, self-promotion preserves their Age Disks.
 - **Auctions.** Since there is no competitive bidding, you obtain cards during Research or Recruit for no extra cost.
 - **Irradiation.** A Crew or Human Colonist is not decommissioned if it fails a radiation roll (from flares or radiation belts). Instead, it acquires one Age Disk and then rolls a Cancer Risk.
 - **Parenthood.** A Crew or Human Colonist in a Bernal may attempt to become a parent by performing (and paying for) its operation and rolling 1d6. If the result is greater than the parent's age, then draw a random Human from the Colonist Deck into your Bernal Stack (adjusting dry mass). This is the next generation. It starts with zero Age Disks, and cannot be moved from the Bernal Stack nor perform any operations until it receives its first Age Disk.

Note: Emancipated robots are sterile.

- B. **VICTORY.** Win if you attain a *TW thruster future* (21.4A) before Werner becomes 60 years old (i.e. before he attains his 5th Age Disk).
- C. **INTERSTELLAR VICTORY.** If you have the Interstellar rules and map (24.0), send Werner off as a passenger in a starship. Win if his son reaches a habitable or living planet.

23.0 ANDY GRAHAM'S FLIGHT PLAN (a strategy guide)

(also contributions from Wulf, Tarwin, Francisco, Sam)

Rule one is to have fun. You can have a great game of Colonization without getting anywhere near winning. Especially when that mission to distant Pluto look much more exciting than just building another factory. But whatever your goal, having a plan helps you get there! So here is my plan to help launch your game of Colonization (all modules assumed).

- A. **PIONEER COLONIST.** Earlier is better when boosting colonists. Financiers are best in the early game, and scientists in the late game.
- Get a generator boosted and your Bernal promoted. This activates your Bernal ability, and gives you a protected location for your colonists and rocket. But generators are in short supply, so don't delay. Remember that three of the freighters provide generators. If the generator requires radiators, you will be needing to replace them unless they are high-enough rad-hardness to survive events.
- B. **ROBOTIC PROSPECTING.** Often your first robonaut determines your strategy.
- Buggies give you the best chance to prospect a site, especially missions to Hertha or the Trojans.
 - Rayguns might save you landing and can even prospect several sites at once. With a working ISRU 2 raygun robonaut, go blanket-prospecting or try space ventures (more so for the UN).
 - Missile robonauts save you taking a separate thruster card. If you can get a fuel factory going with just a missile robonaut, you can bypass step C below and go straight to setting up a GW thruster.
- C. **THRUSTER.** Try to get a thruster with supports that match your robonaut. But don't waste time on perfection either; get your mission going with whatever you can throw together. Remember you can have more than one thruster on a rocket, such as high thrust crews for that landing on Vesta. Crews are also handy against glitches.

- Never get too attached to a specific card or a specific spectral type. Change plans if you fail a key prospect or card acquisition.
- D. **PLAN YOUR FIRST MISSION.** You will be getting technology and throwing together a mission opportunistically. But do not fail to check the black side of each card and be thinking, “where can I build this?” Early missions include:
- Join the race to Mars [Assuming it doesn’t start busted]. From most Bernals, Mars is only a burn away, but has the problem that others may be thinking the same thing.
 - A quick dash for Glory. With just a crew card and a thruster you can be out of the gate first. A solar sail is great because it needs no supports and only enough fuel for landing and lift-off. If its a race, don’t forget that you can save a burn by parachuting to LEO, and you can still get Glory from a busted site.
 - The **W** class asteroids. Lutetia and Hertha (both “wet metallics”, see footnote on page 3) have 3-drops and with a buggy have a 75% shot of bagging the hard-to-get **M** spectral class.
 - The minor planets. Ceres and Vesta are both big enough to make prospecting a sure thing, but you need 4 burns to reach them plus 6 steps of landing fuel. Save fuel by landing on smaller worlds in the same family (like Minerva and Eichsfeldia, see 8.9 year 18), and refueling for the larger worlds if prospecting does not work out. Or bring along a high thrust chemical rocket for landing.
 - The Galilean Moons. The four big moons of Jupiter have science, certain prospects, and enough water to support 4 colonists should you move your Bernal there. Callisto is 5-burns away from most Bernals, so you will need a fairly good rocket or lots of WTs. The moon Io, although radioactive, hazardous, and dry, is a push factory site of spectral class **M**.
- E. **SET-BUILDING.** Always strive for cards that match the product letter of your claims. Unlike legacy factories, the factories in Colonization spit out an entire range of products, if you have the right hand. So while you are making your first claims, get that hand ready and have your refinery boosted. It is often better to leave the robonaut at your claim as an outpost and head back to pick up your refinery. You may find that after building your first factory your rocket is no longer functional due to losing supports. Sometimes you can rescue it by ET production, digital swap, or another mission. Other times its simpler and quicker to scrap your first rocket back to your hand and to boosting it again. Or just take an additional support with you.
- Helium-3. Early claiming a **S** site is worth the trouble since **S** is the most valuable, followed by **M**, **C**, **V**, and finally **D**.
- F. **RETURN ON INVESTMENT.** Money is still important in the midgame. So right after establishing that factory, build all your black cards of that product letter and ship them to LEO or another player’s Bernal. If you are the first to industrialize a product letter, you get a free freighter that you can build and use for shipping. Or just move it to LEO and sell it. Be sure to check if its future is interesting.
- G. **GOING FOR BLACK.** Start stockpiling factory products needed for the game win.
- A GW thruster can get you to the science sites, grab a space venture, or move your Bernal. But it takes a long time to fuel one, and don’t forget that you need enough fuel to return to your fuel factory.
 - Robot Colonists are not limited by your dirtside hydration so are worth having. Except for the Smart Pets, this requires a D factory.
- H. **HEAVY HAULAGE.** If by now you have at least one claim in one of those sweet spots with 6 to 8 drops of combined hydration, or at least 4 drops and science, then its high time to move your Bernal!
- If using a MW rocket, you are limited to a dry mass of 15. You will need a lightweight rocket with a thrust of three or more, and will need three trips to bring the Bernal and its supports and your colonists.
 - If using a GW rocket, you may be able to share supports.
 - If you move your Bernal on its own dirt power, a glance at the rocket diagram shows that something this heavy will have a maximum range of two burns. Take your lightweight legacy crew or an electric robonaut for refueling, and move from one rock to another. Your first rock is often in the Mars zone: Deimos, Didymus, Oljato (wet and metallic!), or Toro (science!). But it is possible with two burns to get into the main asteroid belt as well. To go anywhere except Venus or Mercury, it will need nuclear power, as solar power has insufficient thrust and range.

- I. HOME ON LAGRANGE. If all is per plan, you should have the capacity to recruit and boost more colonists. Remember, colonists need only to be in space to do work. They don't have to be on the Bernal.
- Lab Work. You will need a Lab to promote cards and have access to futures. If your Bernal is not at a science site, you will need a GW thruster to industrialize a TNO science site.
- J. LOOKING TO THE FUTURE. The endgame consists of promoting cards and grabbing futures.
- When promoting colonists remember that they change their politics, and only some have futures
 - Abandon claims, glory or factories if something better appears.
 - Futures are not the only way to victory. You can win on factories and space ventures. Robot emancipation and politics are more a means to an end than an end in themselves.
 - Once your freighter is promoted, swap your big cube with your small cubes as required. For instance, manufacture a black card then swap the big cube and use it to move the product to where it is needed. And the reverse is true when needed your big cube can be a factory.
 - If politics is important for you, watch out for the game-ending moves of your opponents and keep a lot of WT for the endgame election.

"Having a one page strategy guide in High Frontier is like having a page of suggestions included with a jumbo box of Lego blocks." Phirax

24.0 HIGH FRONTIER INTERSTELLAR (Solitaire Variant)

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Rules & Playtesting: Francisco Colmenares, Andrew Graham, Wulf Corbett, Daniel Eliot Boese, Paul-Michael Agapow, Dan DiTursi, David Harris.

"The Drake Equation, used to determine how many interstellar civilizations exist, indicates the determining factor in whether there are large or small numbers of civilizations in the universe is the civilization lifetime, or in other words, the ability of technological civilizations to avoid self-destruction."

At the end of a *High Frontier Colonization* game, players may attempt extra VP by playing a solitaire "postscript" game of *High Frontier Interstellar*. You can also play this as a solitaire game independent of *High Frontier Colonization*.

A. NEEDED TO PLAY. You will need the free rules on googledocs, write to phileklund@gmail.com for access. You also need a copy of *High Frontier* and its expansion: *High Frontier Colonization*. Finally, you need a copy of the **Interstellar Map**, available at Zazzle. This includes the Starship Government, Event Table, and Rocket Diagram.

As a tyrannical Dark Age descends upon the Solar System, you flee looking for a new world in a new star system. Since each turn is 12-years, this is a long trip. You will need enough fuel "decatanks" (i.e. fuel tanks ten times normal mass) to speed up to cruising speed, usually one or two spaces per turn, and enough to slow down to a dead stop at the destination. To keep the starship running, you need the right "dream team", a mixture of military captains (badge icons), eggheads (microscope icon), entrepreneurs (handshake icon), and technicians and miners (wrench icon), pilots (brake icon), explorers (buggy or missile icons), and ecologists (terraform icon) to survive the long passage.

Unlike traditional spaceships, your starship can be reconfigured while underway. The basic pattern: the scientists dream up new ideas, and the engineers incorporate the improvements into the design, using 3D printers and nano-configuration refineries. The idea is to lighten the hull enough so that additional impulses are available for going faster or stopping. If a breakthrough in protium fusion is made, the mass saved can be such to power protium rockets for braking thrust. Pilots have the special ability to brake the starship without using fuel, by drogue braking at gas giants, heliopause bow shock surfing on the Local Interstellar

Cloud (LIC), using antimatter-fueled beam-core rockets, or using interplanetary magnetic fields.

While underway the engineers are constantly repairing damage by meteoroids, dust, and radiation, while the businessmen are keeping the passengers sane with products and services. Raygun crew are able to beam-push ultralight probes, either to potential destinations or back to earth for help. Buggy and missile crews fix punctured radiators and land on planets to explore them. However, the humans both age and accumulate stress as they operate. Poorly disciplined humans under stress and not aligned with the politics are apt to mutiny, harming themselves or others. Overstressed humans should be sent to the vats for stress relief. A breakthrough in cancer research will make your passengers almost immortal.

A. NEEDED TO PLAY. Besides these rules, you need a copy of *High Frontier* and its expansion: *High Frontier Colonization*. You also need a copy of the **Interstellar Map**, which also includes the Starship Government, Event Table, and Rocket Diagrams. This map is available at Zazzle.

B. TERMINOLOGY. *In these rules, Colonist Cards as well as legacy Crew and Robonaut Cards are referred to as “passengers”. Human and emancipated robot passengers are referred to as “humans”. Bernal Cards, housing the families of the human crew, are passengers and yet are not considered human. XXX A **starship** is any spaceship with a thruster or freighter with a starship thrust triangle (24.1E), and a **beehive** is a rocket-powered comet using a thruster with the beehive thrust icon (24.1F). If in a starship, a Bernal does not need to be at a dirtside to be promotable. Cards in your hand are considered in your **vats**. This includes crew in hibernation vats, and equipment blueprints stored in the ship’s library. There is no hand limit.*

24.1 SET-UP.

There are three ways to start a game of *High Frontier Interstellar*:

- Quick Start, i.e. starting a fresh one-player game, either with a *starship* (24.1A) or a *beehive* (24.1B).
- Colonization Start (i.e. as a postscript to a *High Frontier Colonization* game, which can involve one or more players trying to get additional VP.) To enter the Interstellar Map during or after a *High Frontier Colonization* game, either move your rocket (using *High Frontier* rules) to one of the three *Sol Exits* (24.1D) and convert it into a *starship* per 24.1E, or else convert it into a *beehive ark* per 24.1F.
- Colonization Cooperative Start. At the end of a Colonization Game, two or more players can join resources for an interstellar starshot. If this cooperative effort succeeds, the participating players can all combine their scores into one grand final score. For example, two losing players reaching a new star in a joint venture might overtake the VP leader.

Note: For Interstellar, separate the robots into a separate deck from the humans, even if they are emancipated.

**Science Note: The game starts with a Kardashev I civilization, when individuals have terawatts of energy available. (Today’s global energy output is about 15 terawatts.) Operations are undertaken by reproducing machines, and products become cheap and plentiful. Due to the “tyranny” of the rocket equation, mass continues to be expensive on rockets.*

A. STARSHIP QUICK START. Choose a faction. Your starting hand can either be your

Legacy Crew Card (plus 35 WT). or your Legacy Crew and your Bernal Card (plus 25 WT).

- Start by performing Idea Turns per 15.0B, but first remove the two *beehive engines* (24.1F) and the solar-powered generators and reactors from their respective patent decks. All cards drawn cost 1 WT to go into your hand, and a second WT to go into your starship.
- Building the Starship Stack. In Quick Start, cards go into the Starship Stack on their black side, except that GW Thrusters go into the stack on their promoted (i.e. TW) side, and Bernals and Colonists go into the stack on their unpromoted sides. You may put only one *starship-capable* thruster (24.1E) into your starship. The cards you do not use remain in your hand for possible use later (representing the ship's library of ideas).
- Starting Dry Mass. When you decide you are finished with Idea Turns, figure out the Dry Mass of your starship, and place a fuel figure into the empty position in this row on the Starship Diagram.
- Starting Decatanks. Then convert all your remaining WT's into tanks of fuel, where each decatank costs 2 WT. Set up a fuel figure on the Starship Diagram in the correct Dry Mass Row, and move it to the number of decatanks purchased.
- Choose one of the three *Sol Exits* (24.1D). This sets your *starting speed*.

Note: Human Colonists in your hand are in the vats, and can be revived with a decant operation. Unemancipated Robot Colonists and other equipment in your hand can be put into the stack by using a digital-swap. See 24.10 for suggestions on how to start a starship.

B. BEEHIVE QUICK START. Choose a faction. Your starting hand is your Legacy Crew, your Bernal Card, one of two *beehive thrusters* randomly selected (24.1F), plus 18 WT. Your starting dry mass, decatanks, and Sol Exit are pre-determined per 24.1F.

- Start by performing Idea Turns per 15.0B, except that all cards drawn cost 1 WT to go into your hand, and a second WT to go into your beehive. The solar-powered generators and reactors should be removed from the generator and reactor decks. Your goal is to get a pair of starting colonists and then slowly grow the population to the point where it can eureka and manufacture stuff.

C. STARTING POLITICS AND AGE. Place a disk in any desired polity on the **Starship Government** (to the left of the Interstellar Map). *If using a Colonization Start or a Colonization Cooperative Start (24.1), you may steal all Colonist Cards that have loyalty to the chosen polity. You may steal any cards in space belonging to any opponent not going to the stars.*

- *Starting Age. All humans in your stack start with two blue disks on them, or four disks if promoted (showing they are 24 and 48 years old respectively, see 24.7A).*

D. SOL EXIT. A starship may choose one of three exits to enter the Interstellar Map. In all three cases, place your standing rocket map figure in the center of the Interstellar Map, in the space labeled "Sol start".

- Sol Exit Neptune. This exit, using a high-thrust periapsis burn at Neptune, is on the map edge between Neptune and Uranus. Place a clear red disk into the "dead stop" leftmost spot on the **Speed Track** (i.e. the row on the top of the Starship Diagram); this is your **speed disk**. Although this exit starts the slowest, it does not suffer the risks and limitations of the other two.
- Sol Exit Oort. This exit is in the map corner near Sedna, and your speed disk starts where indicated in the Speed Track. If you take this exit during a Quick Start, you must make two radiation rolls and two event rolls on the first turn. (This represents the extra turn required get all the way out to the inner Oort Cloud. If taking this exit during a Colonization game, only make one radiation and event roll as usual).

- Jupiter-Sol-Jupiter Exit (Jovian Flyby). This exit is at the Jupiter flyby spot, and your speed disk starts where indicated in the Speed Track. This exit represents a close pass to Jupiter, then Sol, and then Jupiter again. (All three close passes use the Oberth effect to accelerate the starship.) To represent the three close passes, roll 3d6 and take the highest roll as the radiation level. Place a *stress disk* (24.2A) on all cards in the Starship stack below this radiation level.

E. CONVERTING YOUR ROCKET INTO A STARSHIP. If at the end of a *High Frontier Colonization* game you have a *starship-capable* rocket or freighter, you can gain extra points by moving it (using *High Frontier* rules) to one of the three *Sol Exit locations* (24.1D) on the expansion map. Choosing from both cards in your hand and in your stacks, add the crew, colonists, thrusters, Bernal's, robonauts, refineries, thrusters and supports you think you will need for the trip, and save up a lot of WT's for your fuel.

- Starship Engine. A thruster or freighter card is **starship-capable** if it has a **starship thrust triangle**, i.e. a small thrust triangle to the right of the main thrust triangle. It is bordered in green; see Diagram YYY. A rocket with one of these thruster or freighter cards is called a **starship**.
- Starship Diagram. For the starshot, move your fuel marker from the Rocket Diagram to the **Starship Diagram** to the left of the Interstellar Map.
- Futures. For each *Future* (18.6B) you have completed, you may choose one Colonist Card from the unused deck to add to your hand or Starship Stack. In addition, you if completed the *Planet Hunt Future*, choose a Star Site and make an *Exploration Table Roll* (24.8B) before you start. Plus, if you completed the *Protium Fusion Future*, start with a disk in the "Protium Fusion Breakthrough Disk" spot per 23.3B.
- Dry Mass Row. You may also bring a Bernal Sphere and, if you have promoted a Freightier Card, you may also bring *mobile factory cubes* (18.6). A Bernal Sphere is mass 10, and each cube is mass 5. Set a Fuel Figure in the "!" (empty) position of the Dry Mass Row obtained by adding the masses of the cards and cubes in the Starship Stack.
- Buy Starship Fuel. Pay 2 WT or two fuel tanks for each *decatank* of starship fuel. The correct position is shown by the lavender vertical columns. Note that some of the columns are double decatanks, as shown by the double decatank icon.

Example: If you pay 18 WT for 9 decatanks of fuel, this falls between the 8 decatank and the 10-decatank columns, so use the 8-decatank column and waste one decatank. See Diagram YYY.

NOTES: Because of fuel compatibility problems, starships are allowed only one thruster. A Bernal on-board a starship does not have any privileges. Your starship is unlimited on how many passengers it can carry.

Example: Your rocket stack with a dry mass of 25 (including its TW thruster) exits the map using Sol Exit Neptune. Place its rocket figure on the Sol spot on the Interstellar Map, and its fuel figure on the "23-27" dry mass row on the Starship diagram. Place a speed disk on the "Sol Exit Neptune" spot. Suppose your rocket has two tanks of fuel (equivalent to one decatank), and further you pay 12 WT for 7 decatanks of fuel altogether. Since this is more than the 6 decatank column, but less than the 8 decatank column, the fuel figure is placed on the 6 decatank column.

F. CONVERTING YOUR ROCKET INTO A BEEHIVE ARK. At the end of a *High Frontier Colonization* game, if a player has a Bernal plus a thruster with the *beehive thrust icon*, plus

their supports, he may create a **beehive ark** by moving them to an industrialized *synodic comet* (8.5C) on the map. (Imagine a ball of heavy water ice, with the humans tunneling antlike inside, feeding the tailings into deuterium fusion engines, and you have something of a picture of a beehive ark).

- **Beehive Thrust Icon.** Certain thrusters have the **beehive thrust icon** adjacent to the thrust triangle. This icon is shaped like a beehive, see Diagram YYY. A rocket with this icon, which has landed on a *Synodic Comet* (8.5C), is called a **Beehive Ark**.
- **Dry Mass Row and Decatanks.** The beehive fuel figure always starts at the lowermost dry mass row (35-42) on the **Starship Diagram**. This is regardless of how many cards and cubes you bring along. Because it uses the cometary substrate itself as propellant, it always starts with its full 8 tanks. These are free.
- **Starting Speed.** The starting speed of a Beehive is always a “dead stop”; so place a clear red **speed disk** in the leftmost position of the Starship Speed Track.

Science Note: A beehive ark is of vastly greater mass than other starships. Each mass point is one million tons (instead of 40), and each mass point is 10,000 people. So imagine that each card and unit in a beehive stack is a large number of units.

24.2 INTERSTELLAR SEQUENCE OF PLAY.

For your turn, perform A through C below. Then go to the next turn; twelve years have elapsed.

A. **OPERATION.** During this phase, choose and perform operations one by one. For each operation attempted, place a *stress disk* on a passenger that is of the correct **specialization** (as indicated by the scientist, engineer, business, pilot, explorer, wisp, or terraformer icons, see 24.3A through F), then roll for *Mutiny* (24.4). Passengers can perform multiple operations in a turn.

- **Stress Disk.** **Stress disks** (stress for short) are black disks placed upon **humans** to show their workload. If you run out of disks, use any other tokens to indicate stress.
- **Mandatory Retirement, Robot.** A non-human passenger (i.e. robot or robonaut) is decommissioned to the vats as soon as it performs one operation.
- **Mandatory Retirement, Human.** A human may perform up to four operations, which can be in one turn or over several turns. As soon as it reaches four stress, it is automatically decommissioned to the vats right after its *mutiny roll*. *Note: If the Starship Government (24.1C) is in the Orange Polity, humans can take eight stress instead of four.*
- **Human Colonists in vats (24.4D)** cannot perform operations.
- **Legacy Crew.** These differ from other humans only in that they are killed (removed from the game) if demoted or decommissioned. As indicated on their card, they have either the *explorer* (24.3E) or *wisp* (24.3F) specialty.
- **Abilities.** The special ability that colonists have in *Colonization* is applicable to *Interstellar* if it is described in green font. Abilities applicable only in *Interstellar* are in the green frame (XXX).

Example: XXX

B. **MOVE STARSHIP.** Burn fuel, adjust speed, and move your starship per 24.6.

C. **STARSHIP EVENT TABLE.** Make a 1d6 roll, then apply this roll to the *Radiation Row* (24.7A) and the *Event Row* (24.7B) of the Event Table on the Interstellar Map.

24.3 OPERATIONS

Operations are performed by passengers, either human, robonaut, or robot. Passengers can

only perform an operation if they have the correct **specialization**: Engineer, Scientist, Business, Pilot, Explorer, Wisp, and Terraformer.

- **Robotic Breakdown.** If a robonaut or unemancipated robot has one or more stress, it cannot perform operations.
- **Human Breakdown.** Humans (including emancipated robots) automatically go into the vats (as a free action) as soon as they reach 4 stress.

A. ENGINEER OPERATIONS (Wrench Icon).

- **3D Print.** Move a black hand card to the ship's stack. It cannot be an emancipated robot. *Physics Note: The 3D Print Operation seems to violate the law of conservation of mass by adding mass to the starship. To avoid this violation, I have assumed that the advanced technology of the new products reduces the mass of the other components on the ship by a corresponding amount. Because the mass of each card is assumed to change mass with redesign during the voyage, the dry mass of the starship is equal to the mass of its cards only when it embarks.*
- **Cube Nanofactory.** Discard a refinery card and a robonaut **or robot** card from the ship's stack and replace them with a factory cube. The ship's stack must include the supports required by the refinery and robonaut, although they can share supports between themselves or with the starship's thrusters or Bernal.
- **Nano-Reconfigure Hull.** By discarding a factory cube from the Starship Stack, decrease the fuel marker by one dry mass row per 6.10C. If you have achieved a *Protium Breakthrough* (24.3B), this gives you one *Impulse* (24.6). In either case, roll a *gray goo risk* (24.5).

Note: With the exception of the nano-reconfigure hull operation, a starship's dry mass does not change once launched. New Colonists will never mass more than the resources used to feed them, so mass is always conserved. You can still Nano-Reconfigure the Hull even if you have reached the lowest dry mass row.

Example: A starship with dry mass 35-42 and 1 decatank undergoes a nano-reconfiguration. One of its cubes is discarded, and its fuel figure is moved up diagonally one row, staying in the "1 decatank" line. The dry mass is now 28-34. The starship politics are left wing, so no gray goo risk is rolled. If the ship undergoes a second nano-reconfiguration, the fuel figure moves directly up one space, still following the "1 decatank" line. It is still Goddard Class, but now has two instead of one impulses left before it is dry.

B. SCIENTIST OPERATIONS (Microscope Icon).

- **Promote.** To flip a card to its purple side, roll 1d6. Success if the result is less than the age (24.7A) of the scientist. If promoting using an SOS Wisp (24.3F), the chance of success is 50%.

Note: To promote a Bernal Card, it must have a working generator.

- **Decant.** Recommission a colonist or Bernal from your hand to the ship's stack. A card cannot be decanted if it went into the vats earlier in the turn. A colonist can perform operations on the turn it is decanted. A colonist can self-decant, but this is risky (the colonist is stressed and has a 50% chance of death).
- **Eureka.** Take the top card of a patent deck into your hand. You cannot draw a Colonist Card.
- **Explore.** If at a dead stop at a Star Site or LIC, make a 2d6 exploration roll (24.8B).
- **Breakthrough.** Roll 1d6, and subtract one if you have a promoted Bernal. If the result is less than the Age of the colonist, then place a disk in one of the two Breakthrough Spots on the map. You have a choice: discover the secret of protium fusion (useful during Nano-Reconfigure, see 24.3A), the energy of stars, **or cure cancer** (24.7).

*Example: An alchemist scientist, **aged 3-dozen years**, attempts a Protium Research. A “2” is rolled, so the attempt is successful and a Protium Fusion Breakthrough Disk is placed. The alchemist can also act as an engineer, and in the same operations phase performs a nano-reconfiguration of the hull. This moves the fuel disk one row lighter (without expending any fuel), and gives one free impulse which the player uses to speed the starship one step. Both operations place a stress on the alchemist, and the second additionally requires a gray goo roll.*

C. BUSINESS OPERATIONS (Handshake Icon).

- Service Industry. Remove one stress from all other non-business humans (including those in vats, but not the one suffered by performing the operation). If the *Starship Government* (24.1C) is in the Orange Polity, then remove two instead of one.
- Activism. Move the politics one space in any direction.
- Suffrage. Roll 1d6. If the result is less than the number of promoted (purple) cards on the starship, then **emancipate** the robots. If successful, roll for a *gray goo risk* (24.5).

Note: The only difference between a human and a robot in High Frontier Interstellar is that the human can operate up to 4 stress, while the robot can operate up to one stress and removes stress only with the “repair equipment” operation. If the robot is emancipated, then it is always treated exactly as a human.

D. PILOT OPERATIONS (Brake Icon).

Passengers with one or more brake icons on the interstellar segment of their card may perform one **brake operation**. There are five kinds of **brake icons**: mag-sail brake, surfer brake, drogue, drogue scoop, and beam core. Each kind can be used only once per turn, but all types can be used together in any chosen order.

Note: Brakes are not allowed while the starship or beehive remains in the Mayflower and Goddard wet mass classes; see the Starship Diagram.

- Braking Mass Limits. Starships in the Goddard or Mayflower Class cannot use braking. Remember that Beam-riders must use brakes to slow down, while the other starships can burn fuel to slow down.
- Braking Speed Limits. The Starship Speed Track shows at what speeds the different kinds of brakes are effective. (The Drogue/Scoop brakes for slow speeds, the Beam-Core brakes at all speeds, the others at high speeds).
- Mag-Sail Brakes. You may slow down a number of steps up to your current numeric speed.

Note: Because steps are not equal to speed, a mag-sail cannot be used to slow to a dead-stop. For instance, a starship moving at speed 4 can slow down 4 steps, which takes it to a speed of 2.

Science Note: Because it uses the interstellar plasma as a gradual friction force, the mag-sail works best between the stars. Further, the slowing force varies with the square of the velocity, so the mag-sail is only effective at higher speeds. Mag-Sail Brake rules research courtesy David Harris.

- Surfer Brakes. If on or adjacent to an *LIC* site (blue space), you may slow down by one step. (This technology surfs on the energized plasma ribbon on the heliopause bow-shock).
- Drogue Brakes. As noted on the Starship Speed Track, if you are at site hex containing a gas giant, you can slow down one step with a drogue brake. This is risky, as you must roll a *crash hazard risk* (skull icon, see 6.5D) and a *radiation risk* (indicated by the radiation icon) as noted on the passenger card. The **radiation risk** consists of rolling 1d6 for

radiation level, and placing stress on all passengers and equipment that fail. Your speed does not affect this roll.

Note: Performing a drogue brake at an unexplored site makes a Exploration Roll per 24.8B. The braking fails if no gas giant is located.

- Scoop Brake. This is identical to the Drogue Brake, except if used to come to a dead stop, gain one tank of **S** fuel. (This technology scoops and liquefies the gas giant atmosphere).
- Beam-Core Brakes. You can slow down by one step by decommissioning cards or cubes that mass at least 10 and reducing the dry mass by one row per 6.10C. (This maneuver assumes the starship has stored antimatter that is consumed in a beam-core rocket).

Note (Fargo Tactic): If you brake by decommissioning humans (jargon for tossing them into the antimatter hopper), the surviving passengers survive, but lose their humanity (and the game).

- Desperation Star Dive Brake. Even if you have no Pilots, any passenger at a Star Site can brake at any speed by plummeting through the star itself. Make a **desperation die roll** where only a “6” will slow your starship one step, placing a stress on all support cards, and all other results will destroy the Starship and kill all the passengers. For beehives, a “4”, “5” or “6” is successful and all others destroy the ship and passengers.

E. EXPLORER OPERATIONS (Buggy or Missile Robonauts, Crew, or Colonists).

- Patch Radiator. **Move a radiator from your hand to the stack on its black side.** The performing card suffers a radiation roll per 24.7A.
- Explore. If at a dead stop at a star, make an *explore roll* per 24.8.
- Refuel. If at a dead stop at a fuel planet, gain fuel decatanks equal to five minus the ISRU value of the performing card. You must roll a *grey goo risk* (24.5).

Note: If you have a thruster requiring S fuel, you can refuel only at a gas giant.

F. WISP OPERATIONS (Raygun Robonauts, Crew, or Colonists). Launch an expendable wisp to a destination up to 12 spaces away. There are three types:

- Exploration Wisp. If the destination is an unexplored site, make an *explore roll* per 24.8.
- SOS Wisp. If the destination is Sol, this allows you to perform any Engineer, Scientist, or Business Operation (because you receive the latest in entertainment, science, and psychology from Earth).
- Ship to Ship Wisp. If the destination is another starship (assuming a multi-player game) with wisp capacity, the exchange of information removes a stress (from any card) from each ship.

Note: The 6-lightyear range of the SOS Wisp is marked on the Interstellar Map.

Science Note: Since each space on the Interstellar Map is half a light year, the speed of light is 24 spaces per 12-year turn. I cut this in half to allow for time spent for two way communication between source and destination. A trade or SOS wisp can move at light-speed because while in transit it is not a physical thing, but only a code that can be translated into a message or product at the receiving end. Exploration wisps move slower (perhaps 50% light-speed).

G. TERRAFORMER OPERATION (Terraform Icon)

- Decant. See 24.3B.
- Bio-Engineering. If on a beehive, or if dead-stopped at a habitable or living world, draw a random Colonist Card into the Starship Stack and roll for a *gray goo risk* (24.5). These new Colonists are still immature, so they cannot perform any operations until next turn.

Science Note: This represents the next generation, enabled by a terraformed ecosystem

utilizing lichen dusted with miRNA for genetic modification. miRNA is small non-coding RNA ubiquitously expressed in unicellular to multicellular eukaryotes.

H. HUMAN OPERATION ("Humans On Board" Icon)

- Self-Decant. A human can bring himself out of the vats, but this stresses the card, and has a 50% chance of death (discard to the bottom of the colonist deck).
- Vats. A human self-decommissions and (after adding the stress for this operation) removes half its stress (rounding up). See 24.4D.
- Parenthood. A human may attempt to become a parent by rolling 1d6. If the result is greater than the parent's Age (24.7A), and the ship's stack includes a promoted Bernal, then draw a random Human from the Colonist Deck into your vats. This is the next generation, who can perform operations once it acquires its first Age Disk. Note: Emancipated robots are sterile.
- Self-Promote. Roll 1d6. If the result is less than the human's Age (24.7A), then flip its card to its purple side.

24.4 MUTINY

If a human is not *politically-correct* (24.4A), make a 1d6 **Mutiny Roll** after it performs an operation. If you roll less than the number of stress on its card, the human mutinies and you must choose one human to *demote*. If the mutiny happens during war or anarchy, all the humans demote. The human demoted can include the mutineer, or humans in vats. You must also move the politics disk one space, so as to be closer to the polity color of the mutineer's *election button* (20.3B).

- If the *Starship Government* (24.1C) is in a White Polity, then add one to the Mutiny Roll.
- Because the mutiny roll follows the operation, a mutiny never prevents the operation from occurring.

A. POLITICAL-CORRECTNESS. A human is **politically-correct** if it has an election button with a color matching the politics on the *Starship Government* (24.1C). Legacy Crew are politically-correct if the politics matches their color. Robots are always politically-correct.

B. DISCIPLINARY RE-ROLLS. If you fail the mutiny roll, you are allowed a number of rerolls equal to the number of *badges* (24.5A) on its card. Any success cancels the mutiny.

C. DEMOTION. If because of *mutiny* or *EM-shield failure* you are forced to **demote** a human or Bernal, you must choose one of these methods:

- Regress. If the human or Bernal is on its purple side, flip it to its unpromoted side.
- Vats. **Decommission the card into your hand**. In the case of humans, this removes half its *stress disks* (rounding up).
- Vat-Death. Discard a human or Bernal in your hand **to the bottom of the deck**.

D. VATS. Cards in your hand are considered to be in the **vats**, i.e. in the ship's hibernation vats for human or Bernal cards, or in the ship's library if non-human. A card going into the vats preserves its orientation **and age**, and (if human) half of its *stress disks* (24.2A).

- A card in the vats is killed if *demoted* (24.4C).
- All of a card's abilities, extra operations, on-board reactors, etc. are inactivated in the vats..
- Going into the vats ends a card's turn. He can perform no further actions and cannot be decanted until next turn.

24.5 GRAY GOO RISK

Certain operations (nano-reconfigure, suffrage, refuel, crop-dusting) entail a risk of a laboratory escape of a reproducing machine or lifeform. If required to make a **Gray Goo Roll**, roll 1d6 and subtract the number of *badges* on all passengers who are not in vats. If the result is positive, make this many *demotions* (24.4), choosing from among the passengers (including Bernals and those in vats).

- If the *Starship Government* (24.1C) is in a Green Polity, then you do not have to roll for the gray goo risk.

A. PASSENGER BADGES. The badge icon indicates the discipline level of the passenger, useful during bail-outs, high stress, and mutinies as well as gray goo outbreaks.

- If the *Starship Government* (24.1C) is in the Red Polity, then **add one badge to each human**.

Example: A player attempts to refuel his starship using an explorer on a fuel planet. For his gray goo risk, he rolls a "6". His starship has two passengers with badges, three badges altogether, so the number of demotions is three. He applies all three demotions to a single promoted colonist, first flipping it to its unpromoted side, then sending it to the vats, then killing it off.

Science Note: The Gray Goo Problem, originally formulated in macroscopic form by John von Neumann and in nano-form by Eric Drexler, describes a doomsday scenario of out of control self-replicating robots.

24.6 STARSHIP MOVE

Burn fuel and move Starship per 24.6A and 24.6B.

A. INTERSTELLAR BURN FUEL. The first number in the *starship thrust triangle* (24.1E) or the *beehive thrust icon* (24.1F) is the **starship thrust**. This is the maximum number of **impulses** you can make each turn. The second number is your fuel consumption. This is the number of steps of fuel consumed for each impulse you take (rounding up, in the case of fractions).

- **Speed Change.** Each impulse advances or retards your *speed disk* (24.1D) one step on the Speed Track.
- **Ballistic Starship.** If the Starship thruster or its supports are stressed, or if all the passengers are in the vats, you cannot burn fuel and can change speed only by braking. You may still choose turns at intersections.
- **Pushed Beam-Rider.** A mass beam generated from Sol pushes the Beam-Rider Starship. Its thrust triangle states: "1•0 no decel", which means it can accelerate by one without expending fuel, but cannot use its thruster to decelerate (relying on brakes to stop the starship).

Note: The starship thrust and fuel consumption are not modified (i.e. are unmodified by wet mass modifiers, solar power modifiers, or thrust- or fuel consumption-modifying supports).

Example: A Daedalus thruster has a starship triangle of 7•2. Starting from a dead stop, it could expend 7 impulses, bringing it up to 2 spaces a turn (9.5% the speed of light). This costs $7 \times 2 = 14$ steps of fuel. On its next turns, if it does nothing, it continues to travel at 2 spaces each turn. Upon reaching its destination, at this high speed it will have trouble stopping, even with really good pilots and hull-configure architects.

B. INTERSTELLAR MOVE. The top row on the Starship Diagram is the **Speed Track**. The red speed disk on this track indicates how fast your starship travels, from a "dead stop" to

15% the speed of light. You must move it the number of spaces indicated, with no U-turns. At any intersection, you may choose which direction to go (but not back the way it came).

C. HALF-SPEED. If your *speed disk* is in a space labeled “1/2” on the Speed Track, each time your starship moves a space, lay its map figure on its side. For its next move, it stands up instead of moving one.

*Science Note. A half-speed starship travels about 1.3%*c*.*

D. HAZARD SPACES. Entering a space marked by a red hazard skull is *hazardous* per 6.5D. However, if the hazard is a flare star, and you previously successfully explored it without busting it (for instance, you sent a wisp and rolled a 2 through 6 in the Exploration Roll), then the flare star is inactive and safe to enter. (This security comes from having explored the system and knowing its flare cycle.)

Note: You cannot use “Failure is Not an Option” to avoid Interstellar Hazards.

24.7 STARSHIP EVENT ROLL.

The **Starship Event Table** is found on the Interstellar Map. Make a 1d6 **event roll** to determine first the *radiation level* (24.7A), and then the *event* (24.7B).

A. RADIATION ROW. The *event roll* equals the **radiation level**, which is applied to every card not in the vats, including thrusters, supports and passengers. *However, if the ship has a promoted Bernal, all cards other than radiators are unaffected by radiation.*

- **Equipment Radiation.** Decommission each non-human card with a rad-hard less than the radiation level.
- **Human radiation.** Place a blue disk on each human in the stack, or two blue disks if the human has a rad-hard less than the radiation level. These disks are *Age Disks*.
- **Age Disks.** These blue disks are called **Age Disks**, and they show the **age** of a human. Each disk = 12-years (although humans age faster with radiation and not at all in the vats). Older humans are more likely to promote, make a breakthrough, or get cancer, and less likely to have accidents or children, or survive bail-outs.
- **Cancer Risk.** Roll 1d6 for each human, including those in the vats. Demote the human if the roll is less than its *Age* (see next bullet). *All your units are immune to this risk if you have achieved a Cancer Cure Breakthrough (24.3B).*

B. EVENT ROW. The *event roll* determines the event, according to if the ship is a starship or a beehive.

- **Design Flaw (Starship only).** Remove one cube (if any) and decommission one support card (radiator, generator, or reactor). The decommissioned card goes into your hand, where it can be rebuilt later with a 3D Print Operation.
- **Alzheimers.** Roll 1d6 for each human (both in the stack or in the vats) and demote if the result is less than the colonist's *Age* (24.7A).
- **Meteoroid.** A meteoroid decommissions the heaviest radiator card (if any).

Note: Radiator cards remain on their heavy or light side throughout the voyage.

Science Note: On a beehive, the radiators additionally represent sulfur lamps used as the energy source for the lichens.

- **EM Shield Fail.** If the starship includes a Bernal, *demote* it (24.4C). If not decommission the heaviest support card (radiator, generator, or reactor) if any.

Technical Note: The EM (electromagnetic) shields are the starship's primary defense against interstellar erosion. The secondary defense is physical shielding: layers of c-nanotube composite and aerogel. Aerogel is mostly gas, weighs next to nothing, and particles will vaporize upon contact like meteors. Some of the aerogel and C60 will vaporize also. The

vaporized gaseous matter will be deflected by the protective magnetic field. Ionizing bow lasers and shield vehicles are also used.

- Accident. Demote a human with more than one stress disk. If there is more than one such card, choose one. If no card has over one stress, there is no effect.
- LIC Dust Erosion. If the starship is in the Local Interstellar Cloud (LIC, see 24.8A), it collides with a cloudlet, **decommissioning the heaviest freighter, thruster, or support card.**

Science Note: Several thousand years ago Sol blundered into the "Local Interstellar Cloud" (LIC), one of several nearby clouds composed of warm, low density (~0.3 atoms/cm³) dust and hydrogen blowing at us from the direction of the Scorpius and Centaurus constellations. The difficulty with this cloud is that the material is electrically neutral and thus passes undeflected through the ship's primary EM Shield. Once safely outside the LIC, the starship enters the "local bubble", where the only material is ultra-low density hot plasma (<0.001 atoms/cm³).

- Runaway Ecology (Beehive only). Roll 1d6 and subtract the number of terraform icons on passengers who are not in the vats. Demote this number of humans.

24.8 INTERSTELLAR EXPLORATION AND VICTORY.

A. STAR SITES AND LOCAL INTERSTELLAR CLOUDS. The ovals on the map are called **spaces**. A red space indicates a **Star Site**. The blue space indicates an **Local Interstellar Cloud (LIC)**. To explore either one, either send a wisp or come to a dead stop on its space.

B. EXPLORATION TABLE ROLL. Each Star Site has a **Exploration Table** listed on the map. During a Wisp or Exploration Operation, roll 2d6 and place a **Claim Disk** of your color on the number rolled. Thus, the position of this disk indicates the planets discovered. A failure busts the entire site with a black disk.

- A **gas giant** is a world where **S** fuel isotope (e.g. helium-3) is available during a *refuel operation*; also drogue and scoop braking may be performed.
- A **fuel planet** is a world where **M**, **V**, and **D** fuel isotopes are available during a *refuel operation* (24.3E).
- A **habitable planet** is a world where a human migration colony can be founded. Each surviving human (including in vats) at a dead stop at a habitable planet is worth 1 VP per mass point (24.8F).
- A **living planet** means that the habitable planet is also a living planet with ET li 23weforms, which doubles your colonizing VP (24.8B).

Note: As indicated by the brackets, some rolls indicate multiple planets are found.

Example: A "3" is rolled while exploring Tau Ceti, so a Claim Disk at "2 - 3" is placed. As indicated by the bracket, a living planet, a habitable planet, a gas giant, and a fuel planet have been discovered.

C. EXPLORING LIC. Exploring in the *LIC* (24.8) is successful if a "2", "3", or "4" is rolled on 2 die (2d6), indicating a *fuel planet* (24.8B) is found (among the Oort and Nomad Bodies in the Local Interstellar Cloud). If successful, leave a claim disk on top of the LIC Site. A failure busts the site with a black disk.

D. BAIL-OUT. If the starship is dead-stopped at a world, or destroyed while drogue-braking or scoop-braking, the passenger may opt to bail-out. (This simulates parachuting in high-gee liquid-immersion crash suits.) A passenger may bail-out to avoid demotion from mutiny (but not accidents). If the starship has no Explorers, then a bail-out is the only option to start a colony.

- Risk. If a passenger bails-out, roll 1d6, where a “6” saves the passenger, and all other results kill him. Each passenger is allowed a number of re-rolls for success equal to the number of his *badges* (24.5A) **minus his Age (24.7A)**.
- Exploration. If the passenger survives a bail-out into an unexplored system, make an *Exploration Roll* per 24.8B.

E. ENDING THE GAME. If you are dead-stopped at a Habitable or Living Planet, you may optionally perform a *bio-engineering operation* (24.3G) with each of your Terraformers, then count VP. (The new Colonists created this way represent the first generation born on the New World.)

- The game also ends if you fly off the map, or cannot move any further.

F. INTERSTELLAR VICTORY CONDITIONS. You receive Victory Points (VP) for each *Claim Disk* (24.8B), plus one VP for each human mass point on a habitable planet. Note that robots do not count unless emancipated. Double your score if on a living planet.

- 0-1 VP = Major loss discouraging future attempts, leading to near-term human extinction.
- 2-5 VP = Loss. Negative growth leading to eventual extinction.
- 6-12 VP = Flat. Colony birth rate equal to colony death rate.
- 13-25 VP = Victory with linear growth of human populations.
- 26+ VP = Major victory with exponential growth and an unstoppable human presence in the galaxy.

24.9 INTERSTELLAR EXAMPLE MISSIONS. (Daniel Eliot Boese)

A. UNMANNED SEED STARSHIP. Engine: Antimatter sail; Fuel: 1 decatank; Passengers: Neogens; Dry mass: 1. RadHard is 6, so take the Jupiter flyby exit, as radiation's not a problem. Mission profile: Accelerate 1 step to speed 1; at destination, decelerate 4 steps to dead stop; use Terraformer Op to draw a Colonist Card, representing breeding people from gametes or even digitally-stored DNA info. (Insert any squeaky imagery you wish about neogens using various sorts of artificial wombs and raising children.)

- Complications: Most events don't have an effect, so you hope to avoid rolling a Dust Erosion. With no way to reduce stress, it's a one-shot launch - if Dust breaks the engine, or there's no good planet at the destination, the whole expedition fails.
- Diaspora Variant. You are in competition with a non-player-controlled faction who has used his 30 WT to build 10 of the seedships described. On turn one all 10 embark to the 10 closest star systems, each moving one space per turn and rolling for dust knocking it out. When they arrive, they Terraform Op their own humans into existence, denying the player the use of that system (and those colonists from the draw deck). You win if you score higher than your NPC opponent.

24.10 STRATEGY ADVICE (Francisco Colmenares)

There are many ways to tackle the interstellar game. Regardless of which cards you choose to form your starship some base considerations apply to all interstellar missions regardless of its configuration:

Any starship thruster can get you through the game, consider it part of the challenge. I recommend just taking the top card and obtaining its supports (assuming it's just a single card or two). The Beehive start will allow you to choose between two thrusters. Otherwise it's not worth the WT to go fishing for a specific thruster. As a house-rule you can try choosing the a specific thruster (this adds to the replayability of the

game).

If a thruster requires many supports (more than 2) you can get by merely drawing one or two of them and then depend on your scientist crew to use the eureka operation to draw the remaining supports. You can use the different flyby options to get the starship going (even at $\frac{1}{2}$ space per turn). Remember its ballistic; as long as it has speed it will keep moving even if the thruster doesn't work yet.

It's imperative that you include more than one crew member in your starship, because there will be times crew need to be placed in vats and you need a second crew to get them out. This means some combination of scientist and/or terraformer abilities distributed among more than one crew member.

During your idea turns it's more fruitful to spend the majority of your WT rifling through the colonist deck. Good crew composition is your number one priority, even if you don't end up taking all the colonists with you. Consider the colonists you draw a pool of candidates you are evaluating to take with you.

Keep all the robots you draw but remember they are black cards, so don't spend scarce WT loading them onto your ship. You can digital swap them into your starship later (assuming you take an engineer with you, which you absolutely must!)

If you don't draw a scientist (or decide not to take one) then you WILL have to draw any other cards and supports you think you will need for your trip (though not necessarily put them into your starship immediately, at least just your hand). Obviously getting all the necessary thruster supports is absolutely mandatory, but a robonaut can be useful if they fill a gap in your crew abilities (exploration/wisp).

Don't fret over the political affiliations of your crew. While having them all of the same polity can make it easier to maintain a space government, it makes it more difficult to manage stress since one advantage of mutinies is that the crew will go into the vats and remove half its stress *rounded up* (unlike going into vats which requires an operation, and only removes half the stress *rounded down*).

Don't fret over fuel too much. There will be opportunities to refuel during the voyage, but there are also alternatives to spending fuel to increase/decrease your speed. Protium breakthrough can allow you to nano-reconfigure the hull causing an increase/decrease of your speed. Pilot abilities can allow you to brake and slow down (and even stop). Combination of these two can allow you to boost your speed and then brake without spending precious fuel in the process.

The wisp ability is so useful I don't consider a voyage without one: the ability to explore at a distance makes sure you don't make fruitless stops and risk brakes/spend fuel over worlds with no habitable planets or fuel.

As you assemble your stack and examine your options you can boil it down to three basic profiles: A light-weight starship with no bernal and some crew, a heavy starship that includes the bernal and a various crew specialties and a beehive ark that breeds future generations and grows as it moves to its destination. Each poses its own challenges but it's part of the game to discover how to overcome them.

No-Bernal Configuration: This gives you a full 30 WT to go through the decks. This can allow you to be fairly selective with crew, cards and supports. The big takeaway is that you won't be able to promote crew. Usually promoted crew have more abilities and higher rad-hardness which is convenient and useful but not indispensable.

Bernal Configuration: This reduces your budget to 20 WT, so with a bernal configuration crew composition becomes even more important. If you can include a scientist you can

always eureka any non-crew cards you will require later on. Aside from crew promotion Bernal's increase rad-hardness of every card which can significantly reduce vulnerability to the radiation rolls you will go through for the duration of your voyage (saving you many operations in the process). If you do include a scientist, a promoted bernal can make protium research easier.

Beehive Ark: Your budget is reduced to 18 WT which can seem a terrible constraint, since you will have to spend 1 WT to get the thruster another to put it in the starship and spend 1 more to include the Bernal. Leaving you with just 15 WT to get the rest of the cards you need. However, consider that the beehive can draw *Colonist* cards, which makes crew composition less critical, obviously you absolutely need at least one crew with terraformer abilities (preferably 2), but you can GROW your population in a beehive. As such you can slowly gather the abilities and cards required for the voyage. Also consider you will start with a full complement of fuel tanks.

The above tips refer primarily to the quick-start interstellar options of the game. Note that if you decide to play interstellar as part of a continuation or epilogue of a High Frontier Colonization game your options will be constrained to whatever crew, thrusters and supports you managed to obtain during your regular game. As such, unless you make really long term plans, you might not have an ideal starship configuration.