Cepheus Journal

Issue #005

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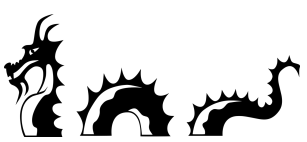


From The Editors

Welcome to this, the fifth issue of Cepheus Journal, the free PDF based fanzine dedicated to all things Cepheus Engine related. We, the editorial team, are humbled to see issue #001 has been downloaded almost 1200 times, with the other issues going strong as well. We hope you will enjoy this issue just as much.

As always, we want to thank you, our readers, for all the feedback we get, especially this time around the important point Adam Dray pointed out, that is we were missing our Product Identity statement. That is now included as part of the OGL at the end of each issue, as well as a global statement on the fanzine's website. The editorial team is always happy to receive feedback, even critical ones, if it means our fanzine will get better and be of greater value with each issue.

In our fifth issue we have more great articles. There are plenty of articles for those of you looking to continue in CE's original lane, from one end of the scale with high tech clothing by Neil Lucock and jump theory by Joseph Jaquinta, to articles on exotic atmospheres and the chemical hydrazine. Near space continues to get its exploration with Randy McDonald on Epsilon Indi, another star famous in science fiction. Sword of Cepheus and Modern gets some love with an article on fighting the undead by Bob Weaver and British cold war tanks by Ewan Spence.

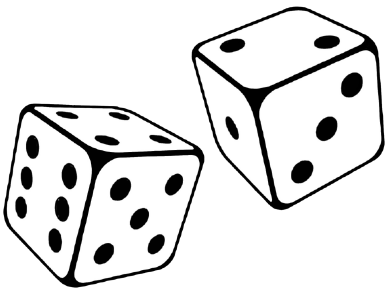
A note now on new releases, Barbaric was recently released by Stellagama Publishing and we hope to dedicate the next issue to the Barbaric genre! Neil Lucock, one of our contributors, has release a title called Grozhny Class Corvette and is worth checking out. Actually, March was a big month for releases. Michael Brown released Battle Amber, Evensong, Burst Transmissions vol 5 & The Markoss Dossier, OSRP released A Death in Space & More Skills for the Frontier of Space, Zozer Games released Explorers, Independence Games release Lion-class Battlecruiser and Azukail Games released The Recovery Job. Phew!

There is also a nice review of Cepheus Journal in the current issue of Freelance Traveller, thanks Jeff! Go check it out if you haven't already.

We're aiming to keep Cepheus Journal coming out regularly but understand that you may feel like checking in between issue. To that end, CJ has a group on Facebook as well as FB alternative MeWe where you are all welcome to hang out.

Please enjoy issue five and keep those dice rolling!

Brett Kruger.



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High Tech Clothing

By Neil Lucock

Motorcycle clothing is a good example of how clothing has changed with new technologies. People originally wore whatever they had. Clothes used by military people (who spend a lot of time outdoors) were usually wool 100 years ago. Wool doesn't really keep the water out, but you're still warm even if you're wet. The major change was in the Victorian period, when vulcanised rubber meant you could make waterproof Wellington boots. The age of dry feet had finally arrived.

The military went over to cotton and poly-cotton uniforms around WW2, as it could be woven tight enough to keep the rain out and was cheap. Motorcyclists bought surplus military clothing. Flying jackets and RAF style boots are effective ways of keeping warm for longer. Waterproof rubberised cotton jackets and trousers actually kept water out, so your woollen jumper and socks became more effective. Waxed cotton and woven nylon fabrics were other useful solutions before Goretex (and other types of waterproofing) became common.

Modern boots and jackets now have waterproof layers under the leather or textile outer shell. You can buy a motorcycle hoodie or lumberjack shirt with a layer of Kevlar and Goretex waterproofing inside. It might look like a hoodie or a thick shirt, but it is a world apart from the version sold 20 years ago.

Most RPGs pay little attention to clothing unless it's body armour or space suits. High tech clothing should have features that are not possible at lower tech levels. Here's a few ideas to make the future different to the present.

Heat retention.

A fabric detects the difference in temperature between the body of the wearer and outside and changes its insulating properties. So, if it's -20 centigrade outside, it becomes a very good insulator. It might look like you're wearing tights and a long-sleeved T-shirt, but you're warm. If you are in the desert, it stops insulating and radiates heat. If you fall into the fire, it prevents burns, although the heat would still damage areas not covered.

Water proofing

Unidirectional materials are already present. We have materials that keep water out in one direction but allow steam to escape. How could this be improved? Imagine a sheet of material. If you use it in one direction, water easily flows through it, so you could use it as a filter. The other side is waterproof. Make a tent out of it, it keeps water off you. Make a ground sheet from it, and any water you bring into your tent soaks straight through it into the ground.

If you have trousers made of it and fall into the lake, the trousers will fill with water. It will drain out through the material. The idea of waterproof over-trousers that you put on when it's raining dies, they are just waterproof trousers you wear all the time.

Tactile qualities

You can program your clothes to act and feel like leather or silk, wool or hessian as you think best. You might decide you'd prefer your shirt to feel like running water, or warm sunshine on your skin. All clothes self-repair if required. Even the thinnest clothes give UV protection. Clothes could

become thicker or thinner as desired without changing their properties. A thin long-sleeved shirt would be warm enough in the arctic, if combined with a hood and gloves of the same materials.

Rigidity
Mix cornflour and water into a paste and it behaves in an odd way. It's a non-Newtonian fluid, sometimes called Oobleck. It becomes more rigid the faster you move it. You can run across it, but if you stop moving, it becomes liquid.

Clothes could have this property. Bullet-proof armour as light as silk, but instantly becomes rigid when hit by a pistol round or a sword blade. Fall off a grav carrier and your clothes instantly become rigid when you hit the ground, or when an explosion occurs near you. It could be programmable, so you tell the sleeve of a shirt to become rigid when someone's got a broken arm. Hole in the hull of your Scout-Courier? Push a shirt into it, then make the shirt rigid. All clothing acts as armour, if required. A hood becomes a crash helmet in an accident.

Clothes can have tiny gravitic motors built in. Want to look like you're underwater, or there's a strong wind blowing? Want to look wet without being wet? Your clothes can behave in whatever way you tell them.
Socks become shoes; you tell the material where it ought to be more rigid. Your ankle supporting hiking boots can become soft slippers once you get indoors.
Clothes might have areas where the material changes shape. If you wanted the 1980's padded shoulders, or a dress to look like a crinoline, you just tell the shoulders or skirt what shape to adopt.

Smell
High tech clothes could have deodorant qualities, they could also create smells. If you want to smell like new-mown hay, or fried bacon, you can. If dealing with alien races that have smell as a major sense, having the right smell programmed into your clothes could be beneficial.

Colours
Not only does your clothing stretch to fit, but you can also program the colours and designs you want. Want to have a black biker jacket? As long as you have something the same shape you can tell it to behave like leather. If you want transparent socks, just tell them. You might have invisible colours too. Ultra-violet tones that you can only see with special lenses.

Clothes can emit light of various colours. Your camouflage jacket can emit orange light to help someone see where you are in an emergency. Police can have blue and red flashing clothes when responding to an incident. Mauve shoulders indicate you support equal rights for a certain group, or perhaps show that you are a fan of a popular show. Bored? Watch the news on the sleeve of your shirt or display a video on your back.
Small holographic projectors built in can make it look like you're in the centre of a nebula or lightning storm, or you're on fire.

Recycling
Clothes are printed in standard (or paid-for) designs before you wear them each day. You drop used clothing back into the machine, it takes them apart and uses the materials for the next print.

Medical monitoring
Clothes could monitor and administer a range of drugs if required. They could give minor first aid, pain control and massage.
Your clothes could stimulate your muscles while you slept, so you get a full-body workout and wake up fit but exhausted. They could use the same procedure to give you a massage.

Clothes become space suits.
To help you survive in vacuum, your clothes detect the pressure difference and become rigid in a pre-programmed pattern (so you can still move). This is already present as the soft vacc suit. It would have to have a layer of radiation protection, you'd need to add a helmet, air supply and radios to make it work.
The fabric could detect high pressure and work in reverse, stopping the occupant from being crushed.

This has only talked about the properties available in high tech clothes, not the actual styles. You might have a revival of Elizabethan doublets and hose, but the clothes have a faint green glow in the dark and are actually fully waterproof and made of "silk" that will stop a bullet.

You might like to consider whether clothes will become redundant. If you live in a temperature-controlled habitat, the original function of clothing, to allow humans to live and survive in cold and inhospitable areas, might no longer apply. Your future culture may decide that clothing is just not worth the trouble.

By Neil Lucock

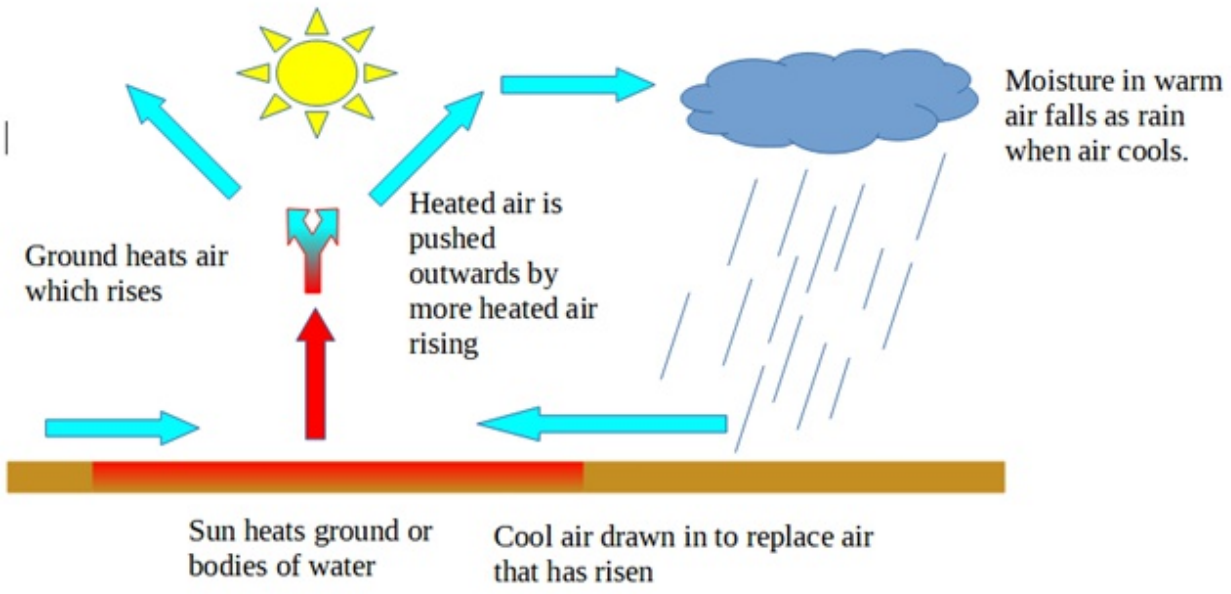
Sometimes the awkward dice rolls lead you to greater creativity. I was building a subsector using the Near Space data. Altair has a partial planetary profile of X-9A0000. What I was doing was rolling dice to give the worlds new population, government, starport, law and tech levels.
I rolled my dice and got 9A08AA with a TL of 9 and a C class starport.

So, I have a world slightly bigger than Earth, with an exotic atmosphere and no water. Sounds like an unappealing place to live. Yet my dice roll said that 400 million people live there and there's a Class C starport. That's roughly the combined populations of the USA and the UK. The question is, why?

The easiest thing to do is to reroll the dice to get a low population that you can explain as a science team or a few prospectors.
The hard thing to do is to figure out a justification. Something must make it worth their while staying there, otherwise they'd all leave. Let's figure out why they stay.

Altair is a rapidly spinning blue-white star, about 10 times as bright as the sun. With no water and an unbreathable atmosphere, my planet isn't going to be covered in happy farmers in log cabins. The place must have a resource that is cheaper here than in other locations. What about minerals and metals?

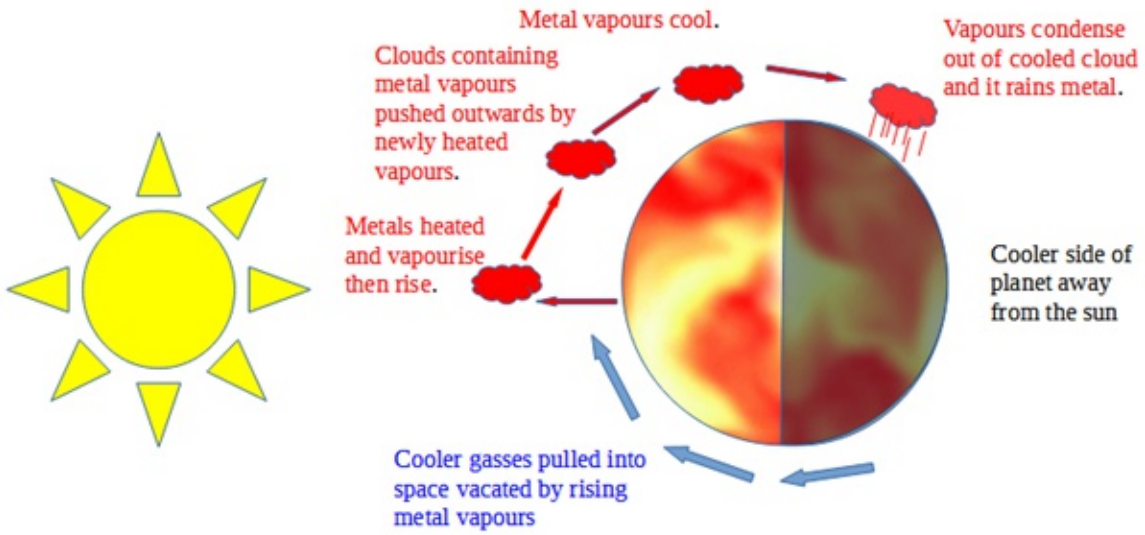
First, let's look at how our weather works.



Altair has no water, so this isn't going to work without a liquid. What if the star was so intense that metal and rock melted and vaporised? Iron, nickel, chromium, cobalt, copper and gold will turn into vapour by 2900 centigrade. This will rise and cooler air will be drawn in, forcing the metal bearing clouds outwards, exactly the same as water in our atmosphere. When they cool, it rains metal. How much it cools will determine what metals fall. Gold turns into vapour at 2800 centigrade, once the temperature drops below that, gold ought to fall as rain, but as tin vaporises at 2600 centigrade, it will still be in the cloud.

If we look on this process as a natural distillation of metals. By using sensors to determine the composition of a cloud of metals, we save the expense of digging it up. This could be the economic benefit that makes it worth living there. However, we can't just leave a container under a cloud of metal rain and wait for it to fill. The metal rain would cool once it reached the ground and fuse into one solid lump. It would also be very hot so our container may well melt. The trick is to avoid it ever reaching the ground.

I now have a reason for people to be there.



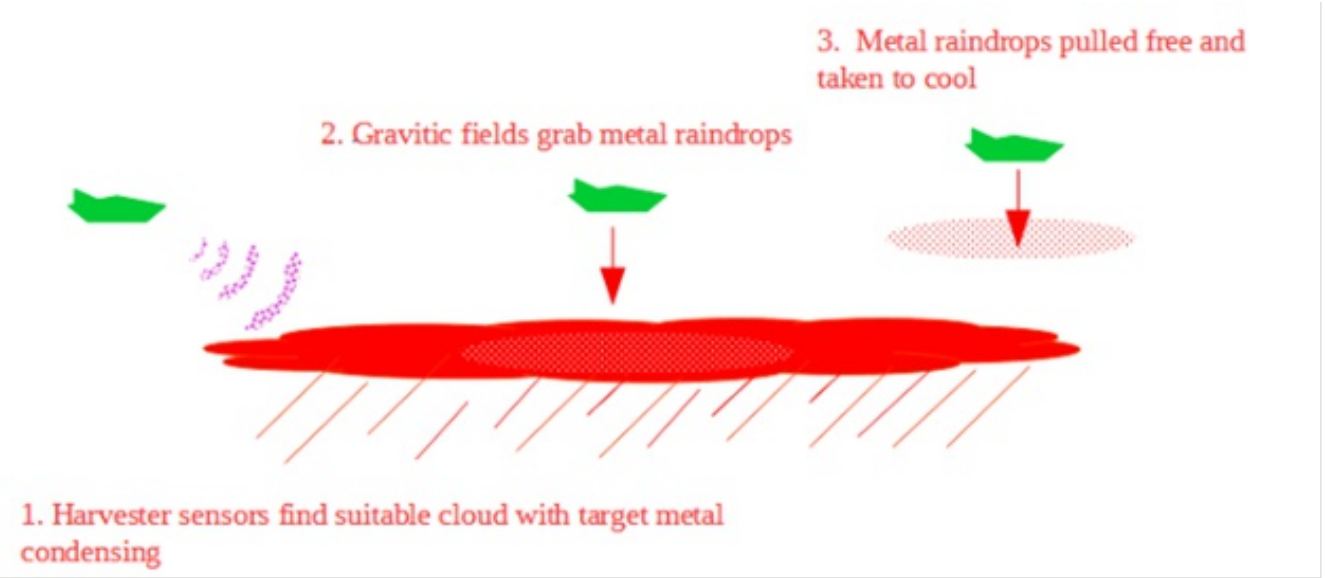
The surface of the bright side of my planet is between 2500 and 3000 degrees centigrade. The side away from the star is cooler but still hot enough to have semi-molten metals. It rains iron (or cobalt, nickel etc.) when the temperature in a cloud drops enough for the metal to form droplets.

How do you harvest this?

You do not go down to the planet and collect it. You fly above it in a large shuttle harvester with a load of sensors and a huge gravitic field generator. You stay high up on the dark side and never go to the bright side. You use your sensors to track what is in clouds and measure the fall in temperature. Once you know it's forming droplets of chromium in the cloud, (if that's what you are after) you use your gravitic generators to lift the droplets and wait for them to cool further. You then draw them into a cargo bay and carry them to the orbital factory (also in the shadow of the planet, where they are further refined and prepared for export).

So, my world has a reason to have millions of people there and a C Class port. Not everyone will be involved in metal refining, lots will be involved in entertainment, government, food distribution and supply and the other activities that make a society function. These people would live and work on a series of space habitats in the shadow of the planet. Some space stations would be industrial complexes dealing with specific materials, others would be residential or commercial. You'd have metal brokers and agents at the orbital starport. It's a terrible place, I decided to call it Enfer, the French word for Hell.

How can you incorporate these ideas into a game?



Players might be asked to investigate violations of assigned harvesting territory by the authorities. There could be jobs on the harvesters (well-paid work but hazardous, like oil rigs) as either pilots, sensor operators or engineers. They may be asked to do sight-seeing flights a client wants (but the authorities don't permit) to see the metallic rain. Engineering expertise might be required to help figure out why the cobalt has so much iron in it. What happens when a harvester crashes on the dark side? You might have three hours to find the crew before the heat defeats the shielding.

The idea for metal rain comes from a real planet called Wasp-76B which has iron rain as weather.

Jump Theory

By Joseph Jaquinta

Introduction

It is foundational in most Cepheus Engine settings that it takes a week to travel between the stars. By having the speed of communication equal to the speed of travel, an "age of sail" type culture follows which has very broad impacts on any game. But how do we look at that, relatively arbitrary, game mechanic from within the setting? This article examines that question. It does not attempt to introduce any new rules or changes that would perturb this fundamental constant. But rather to add internal nuance to it, as an aid in storytelling.

The Theory

Jump Theory itself is an insanely complicated branch of mathematics. Many cultures take several researcher's lifetimes to reach a Grand Unified Field Theory of physics, or even longer for a Theory of Everything. Those are just attempts to describe the universe as we perceive it. Jump Theory goes beyond that by using them as building blocks to create a practical framework that allows for the totality of the universe to be characterized and manipulated.

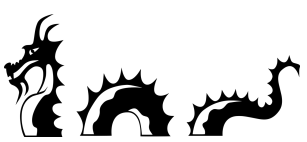
It encapsulates cascading events from the sub-quantum level to the macro level covering all dimensions of space-time. In order to do this, it creates many more quasi-dimensions and spatial tensors to interpolate the calculations through. They all fall away at the final result, just leaving concrete reality, but understanding just some of them adds considerable difficulty to comprehending the entire work.

The classical work, if printed, would occupy several bookshelves. With commentaries, the digital form takes up notable space on any storage system. It has been around for centuries and is in the public domain. It is available in a considerable number of languages, as the bulk of the work itself is language light and mathematics heavy. Many aspiring mathematical graduates (and even more cranks) have a willingness to devote their life to understanding it. And, yet, despite this, the number of people who can genuinely claim to understand the totality of the work is very few. Often estimated as single digits for the whole galaxy, at any point in time.

The Practice

The theory, at a pure level, describes a method for transporting any size of mass from any position in the universe to any other position in the universe, taking any amount of time. However, to do so perfectly, every position, orientation, magnitude and motion of every point of matter and energy in the universe needs to be exactly known, and the computation based on that data would take any theoretical computer longer than the lifetime of the universe to calculate.

At a less pure level, and where the bulk of the work of modern research is conducted, there are many approximations of the theory. Each of these reduce the quantity of information needed, and the complexity of the calculations. They make certain



assumptions, add certain boundaries, and produce results tinged with a certain amount of probabilistic uncertainty.

The most widespread of approximations that have been approved for commercial use follow the rule of thumb that jumps must take place beyond 100 diameters of the nearest high mass object and will take about a week to traverse one to six parsecs. Within these restrictions the algorithms work well, and rarely result in anomalous behavior. This is generally categorized as a "misjump" and can run the range of simple temporal displacement to rapid unplanned disassembly.

Edge Conditions

Considerable research has been devoted to improving upon established approximations, but coming up with revolutionary new algorithms has not been fruitful. There have been a number of specialty algorithms that have been useful in narrow or unique circumstances.

Most of these optimizations rely on trading one element off for another. Flat space makes for easier calculations. So the further one is away from gravity masses, the better. Low velocity for the pertinent frame of reference helps. The better understood the masses are in the departure and arrival systems the better. On the other side of things, accepting a higher approximation in travel time is one area things can be made less restrictive. Similarly the resulting position, orientation or even velocity can be less guaranteed. And, there is just always the raw chance that either nothing, or extremely bad things, will happen.

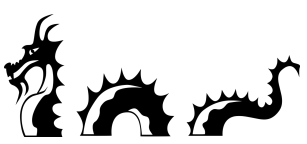
Most notably the military have their own approximations that have optimized arrival time at the expense of time of calculation, characterization of initial conditions, and added a slightly elevated risk. Using this allows fleets of ships to assemble, arrange themselves very precisely, process the calculations in parallel across all of their ship's computers, and then jump simultaneously, all arriving in the target system within a narrow timeframe. There are obvious benefits to this for military maneuvers, but such risk would be less tolerable in commercial circumstances.

Many megacorporations specializing in personnel and cargo transport go a different route. They boast of customized algorithms that are optimized for reducing risk, allowing those using them for trans-shipping to decrease their insurance premiums. Captains are given approximations tailored to specific models of ships, must maintain those ships within precise regulations, and must depart from specific travel lanes at low nominal velocities. Their ship's logs are inspected for adherence to these requirements and deviations are fined.

There are any number of services on the dockside offering to optimize a ship's jump algorithm. The more honest of these are just specialists who understand the standard official software well, and can dive into various options that better tailor it to an individual ship. This is wise to do especially after a refit or major work. The less honest promise greatly improved performance, or lower risk, and only tinker with fairly meaningless settings. The outright criminal have cracked versions of official software that allows for parameters beyond what is considered safe, or that their own mathematical geniuses have 'optimized' to put the users ahead of the rest. It is often hard to tell the difference between these outlets.

Plot Hooks

The above interpretation of Jump Theory does not fundamentally alter how travel between the stars works at a game mechanic level. The intrepid referee



might allow for a +/-1 dice modifier for exceptional circumstances, but the fundamentals should not be different. That does not mean that the implications of this can't be relevant to the game in other ways.

Knowing the Territory

The Scout service will generally always pay for high quality scans of planetary objects and systems. Part of the reasons for this is to keep the galactic almanacs up to date. Every ship has one, and updates to them filter across known space as people travel. Only the Scouting service can approve updates to them. Unknown to many is that the jump approximations on ships use these almanacs for their calculations. So keeping them up to date is vial for interstellar commerce.

If the players have travelled in less common regions, or in the outer reaches of more commonly travelled systems, they can usually pick up an extra Cr100 to Cr1000 by selling copies of their scans to a Scout representative at an official scout base. High bounties will be posted at actual Scout Bases for going to especially obscure locations. (Especially for ex-Scouts.) A referee can use this as a convenient way to get the players to a specific location, or going in a certain direction.

The military are also interested in optimizing their travel options. Their priorities are not always in line with commercial priorities. Consequently it is possible to pick up scan bounties at Naval bases. These often pay more, (especially for ex-Navy) but come with the requirement for disguising their activity as something else, and the contracts prevent them from taking other scans or selling the scans to others.

Dr. Doorling Duiters The All Knowing

During a moment of tension on the ship, trying to run away from an antagonist, escape a natural calamity, avoid a pitched naval battle, one of their passengers reveals themselves as Dr. Doorling Duiters, PhD from the Department of Mathematics in Noogeng der Aarede University, affectionately referred to as "The All Knowing" by their grad students and the local popular media. They are an expert in Jump Theory and, if given access to their computer and navigation software, can craft a jump solution to extract them from the situation they find themselves in.

No one else on the ship can vouch for them, nor does the situation give them the time to check references. They must choose to believe or not believe based on how well the good Doctor argues.

If they refuse the help, the Doctor will be seriously offended, and will not speak to them until they depart the ship. If the help is taken, the Doctor will root through the software, access many of the deeper menus labeled "qualified engineers only" and make myriad changes to settings before finishing with a great flourish saying the solution to all their problems lies in pressing the big red "initiate jump" button.

When they press it, jump is initiated. Their controls flash in colors not seen before (what exactly is mauve alert?) and any number of warning alerts go off. Once they are in jumpspace, a readout of the proceedings is hard to interpret. They were clearly able to leave whatever dire straits they were in, but the system recorded any number of other anomalies. Doorling will put these off as "ill written software" unable to appreciate their genius.

The rest of the jump can be as tense as the referee wishes to make it. Waves of nausea may inflect the players at times. They might notice their watches are out of sync depending on how they travel across the ship. Sensors may register other objects appearing in jump space where there should be nothing. Or the jump may continue right up to the high end of the normal period of variability.

Dr. Duiters, similarly, can either turn out to be a nutcase, or just an eccentric. Their story may slowly fall apart over the course of the voyage, with the only reference of Aarede University found in the records being of their outstanding Agriculture School. Or they can genuinely be a mathematical genius, but with a Cassandra-like flaw of never being believed because of their over-the-top mannerisms.

Either way the players emerge rattled, but not overly harmed by the experience. One just hopes they took a recent backup of their jump software settings!

Guinea Pig

The players are approached by representatives from a small research firm at a class-B starport that is conducting experiments with improved jump algorithms. They have a new algorithm that has been approved for experimental use that is perfectly suited for the size and mass distribution of the player's ship. They are willing to pay them a 1000Cr to 10,000Cr honorarium for any jump they take with the new algorithm, for which complete records are maintained and sent back to the institute.

It is up to the referee about how legitimate they want to make this. They may have the backing of a local megacorporation, who see it as a long shot, but worth investing in just in case. Or, unbeknownst to the institute, there may be criminal backing, and it really is just an elaborate money laundering scheme to funnel illegitimate money to guild ships.

Similarly the algorithm may be impreceptably different. The referee can make entertaining dice rolls after ominously asking which algorithm they are using. With no actual real change. Additional psychosomatic symptoms may be felt during jump. Or the referee can use it as an excuse for strategic mis-jumps to occur that get the players to places they are required to be for story purposes.

Either way, it can help plays on a low-margin ship make their monthly payments by taking on a bit of extra risk.

Convoy

In areas of high commerce raiding, or along critical supply routes, patrolling Navy ships sometimes offer to provide escort to groups of merchants. The Navy has specialized jump software that allows them to jump fleets in tandem. It is flexible enough so that they can assemble a civilian convey at jump range, get the specifics of each ship that is part of it, use their software to compute a jump solution, and pass it on to the ships for a synchronous jump.

It can take eight hours to a day for their computers to compute the solution. Any ship that signs up and changes their mind will cause the whole solution to be recomputed, delaying the rest of the convoy and pissing off the Navy. Any ship lying about its mass distribution also risks perturbing the calculations and throwing off the jump for the whole convoy (pissing off 10-20 merchants). So it's something that free-wheeling players might avoid. But it is also the sort of thing that an antagonist, seeking to avoid said free-

wheeling players, might join in to put them "under the Navy's wing" for at least a jump.

During a time of conflict, players might be hired specifically to spoof such a convoy and disrupt shipping. This could be as simple as a false manifest, or as complicated as having a last minute failure of their jump drive. Other ideas along this line would be antagonists who have booked passage on their ship specifically to sabotage their jump drive at the last minute and disrupt the convoy. Or, it might be an adventure hook that the players are told to book passage and sabotage the jump drive of a ship that is known to be going on a naval convoy.

The Tattoo

The players may have been enjoined by the local nobility on a relatively primitive world. Business (and politics) are all personal there and official duties are mixed with social ones. The young of the clan may be particularly interested in them for their off-world stories and tales of the larger universe. One of the more impressionable, who also happens to be politically important, is sufficiently star struck that they decide to get a tattoo of the fundamental essence binding the universe together: the Jump Theory Equation.

The problem is that there isn't really one equation that summarizes Jump Theory. And even a minimalist representation would require more skin than his whole clan possesses. This will not deter them and they will insist. On the surface this appears as willful ignorance. Through conversation, or possibly guidance by other elders, the true reasons for the tattoo are for proclaiming aspirations and connectivity between this young noble's ambitions and where the clan is going. It is not so much the substance of the tattoo, but what it represents.

So it is up to the players to decide the shape and form of the tattoo. The Jump Theory texts are easily acquired. They often adorn the bookshelves of people who are trying to look smart. If they don't have a copy easily accessible, they might be able to find one in the foyer of a local legal firm or even as set dressing. Hand the players a leftover book on college Physics or the equivalent web page and let them choose what they want, or make something up.

Ultimately they will be judged by how they present their result. The youth will have questions on the philosophical meaning and representation of each element of the design and as long as the players have satisfying answers, and don't appear to be trying to make fun of the youth, the culture, or their ambitions, they will be happy, and the characters will find their business on the planet will prosper.

Fighting Undead

By Bob Weaver

Fighting Undead in Sword of Cepheus, an Analysis.

Fighting with Magic

There are three White-class spells that are directed against undead creatures. Protection from Chaos does not harm them, it provides a defensive advantage to the caster.

Destroy Dead
1st Circle (White)
Range: 50m
Duration: Instantaneous
This spell destroys the bones or body of a single undead skeleton, zombie, or ghoul, which immediately crumbles to dust. If cast on an inanimate body or skeleton, it crumbles as well. This spell has no effect on the living or on any other undead.

Commentary: This spell has limited but guaranteed effect. This would help only slightly when facing a mob of zombies. This spell is a good option for a spellcaster who wants to stay out of melee.

Smite Undead
4th Circle (White)
Range: 75m
Duration: Instantaneous
This spell instantly destroys a number of undead creatures equal to three times the sorcerer's Sorcery skill. All undead must be inside a 20m radius sphere from a point of origin chosen by the sorcerer that is within the spell's range. Skeletons and zombies turn to dust automatically. Other undead must throw END 8+ or crumble to dust. Undead with the Sorcery skill, such as vampires, are immune to this spell.

Commentary: An area effect spell, but it can be countered. Even without the Sorcerer's Immunity clause, the magic-using Undead all have high Endurance DMs, so they would likely survive the spell anyway. Allips, Ghosts, Mummies and Shadows need to throw 4+/5+ to avoid its effects.
Good for clearing a room of skeletal minions, or cleaving a path to the Big Bad, but don't count on it to finish the job for you. Low-level spellcasters will only catch a handful of undead with this spell. Armies of undead can be winnowed out by a powerful spellcaster -but other area type spells can do this as well. Compare with Ice Storm, Starfall, or Pillar of Fire.

Dispel Evil
5th Circle (White)
Range: 10m
Duration: 1 turn
With this spell, all undead or summoned creatures within a 10m radius from the sorcerer must throw END 8+ or crumble to dust. Summoned creatures return to whence they came instead. Any creatures that successfully make their throw will flee the affected area instead. Alternatively, the sorcerer may direct the spell at a single monster, which will have to make an END 10+ throw or be destroyed. Additionally, Dispel Evil may remove a curse from a single creature or object in range; doing so ends the spell. The sorcerer must concentrate for the entire duration for this spell to work.

Commentary: Higher circle than Smite, but less powerful. Smite strikes off skeletons and zombies, no save. Here even they get a saving throw. Why? The most powerful undead still have a better than even

chance of shaking this off. This spell is more encompassing, but with less range. It will affect all within the range, regardless of Sorcery skill. In a sense, the Sorcerer must allow himself to be surrounded by enemies for maximum effect. Or can the center of the circle be up to 10m away from the caster? There should be guidance on how long an affected undead must flee or stay away, before the spell's effect ceases. Wights & wraiths are in effect immune to this spell with their high Endurance DM. Even if 'aimed', the Referee needs only a 4+ [92 %] to shake it off.

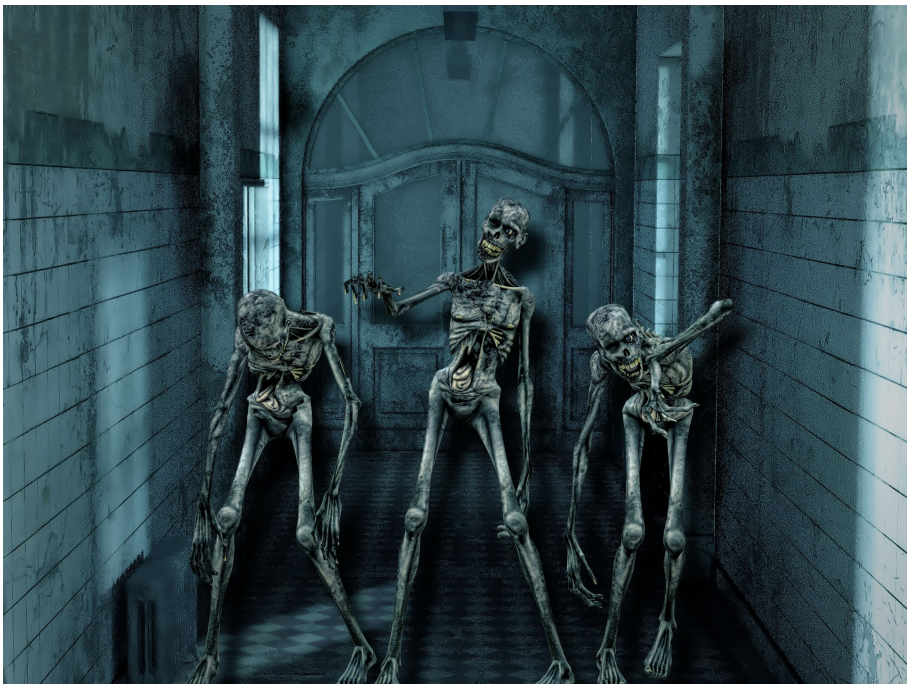
Conclusion: There are NO White-class spells that will take out a major undead with certainty. All three of these are most effective when facing minor undead. Magic items and magic weapons will be essential to handling powerful undead.

Fighting with mortal weapons

Only the weakest types can be slain by normal weapons. All the rest require at least Silver, and for the most powerful, magical weapons to do them harm.

Undead type	UPP	END DM	Affected by	Sorcerer?
Allip	CAG0A0	+3	Silver or Magic	No
Ghost	CAK0A0	+4	Silver or Magic	No
Ghoul	B89197	+1	Normal weapons	No
Lich	C9NPP0	+5	Magic only	Yes
Mummy	F6KAA3	+4	Magic only	No
Shadow	7A70A0	+3	Silver or Magic	No
Skeleton	6730A0	-1	Sharp weapons	No
Vampire	CBNC95	+5	Silver or Magic	Yes
Wight	C9P1A5	+6	Silver or Magic	Yes
Wraith	EAP9A0	+6	Silver or Magic	Yes
Zombie	777055	0	Normal weapons	No

Immune to Smite Undead
Affected by Destroy Dead

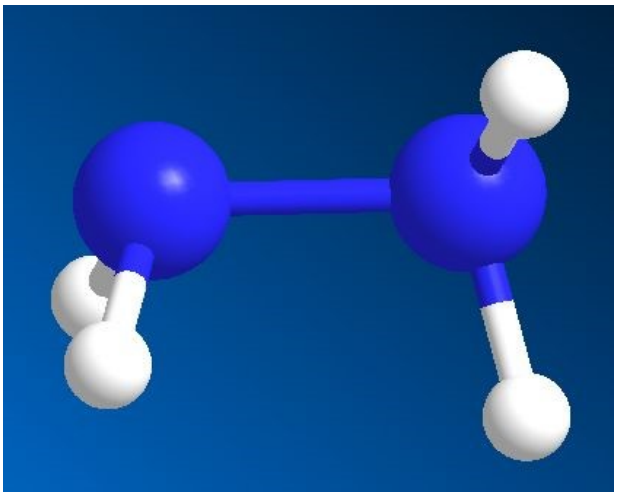


Exotic Chemicals

By Brett Kruger

A version of this article originally appeared in the May/June 2017 issue of Freelance Traveller and is reprinted here with permission from the author.

What's hydrazine you ask? Hydrazine is an extremely toxic and dangerously unstable liquid that smells a bit like ammonia - probably because it is made from two ammonia molecules joined together (with the loss of H2). Its formula is N2H4 and its structure somewhat resembles the skewed structure of hydrogen peroxide.



The following is an extract that's found on multiple web sites about car racing and kicked off my thoughts on how to use this chemical in my science fiction adventures. Here is hydrazine, the fuel enhancer.

It's the liquid so potent, so deadly, so illegal that those in Drag Racing who have unleashed its wrath dare not speak its name in public. In the pits, even to this day, it's known simply as H. Hydrazine has been around, and used as an "exciter" for nitromethane for as long as we've had Drag Racing. Actually, its use as a racing fuel predates even the Dry Lakes. Hydrazine is rumoured to have been used by the Nazi's as an additive in the Mercedes Formula 1 cars of the pre-war era.

Here's the basics of how it works. Nitromethane is a mono-propellant that carries its own oxygen supply. Hydrazine is an oxygen scavenging agent. When you combine the two…even with just a tiny percent of H in the mixture, you get an unstable fuel that is at war with itself. Insanely dangerous, yes…but internal combustion nirvana of the highest order is a guaranteed result.

Lakes era racers who experimented with H found that a stock 90 horsepower flathead would pump out better than 300 horsepower simply by sucking this stuff through its Stromberg. These same racers also discovered Hydrazine's major drawback for practical use. After running it through an engine, the carbs would start to cake up with a substance that resembled soap flakes. This nasty little by product was a shock sensitive explosive called the Methazodic Salt of Hydrazinium Acid, and was the result of allowing vapours from the Nitro/Hydrazine mixture to condense in a closed environment. Right, never mind this stuff will throw your crank on the ground after just a couple of runs, but if you happen to tap the carb with a wrench, it'll blow your face off. Let's go racing!

Hydrazine had its big moment in the sun back in 1960, during the height of the NHRA fuel ban. Barnstorming Top Fuel racers were all clustered together in the 180-mph range, when out of the blue, at a small track in Alton Illinois, the Greek shoved a big gulp of H down the throat of his Chrysler and ripped off an unheard of

204 MPH pass, boiling the hides and wheel standing right through the lights.

The Ramchargers were known for experimenting with all sorts of fuel, including hydrazine.

Several years later, during the dawn of the Funny Car era, many injected cars were known to brew up a batch in order to keep up with blown Fuelers. Shotgun like exhaust notes, bright green header flames and crewmen frantically draining fuel tanks in the shutdown area were tell-tale signs that H was in the house.

Even though Hydrazine has been on perma-ban by every sanctioning body that has ever existed, its use in times of extremely tight competition, or when a barrier is on the verge of being broken has continued right up to the modern era. We can remember one night-time qualifying session back when the 300-mph barrier was about to fall in Funny Car, when one of the cars in contention for the honour made a lap with those freakish header flames dancing up over its roof. It was so obvious that a sudden buzz amongst educated onlookers erupted. Even the announcer that night took note of the unusual site. Officially, it was played off as burning copper from a failed head gasket…but then, the very next pair of cars, there it was again. Eight bright green candles lighting up the night time sky, and yet another barrier crushed. Was it really hydrazine at work? Only the guys mixing the fuel that night know for sure.

Yeah, it's dangerous stuff. Handled improperly hydrazine will kill you in ways you can't even spell, but it's a glorious part of the history and heritage of the thing we call Fuel racing.

So, I cannot really use hydrazine as a fuel additive without messing up how space travel works in Cepheus Engine (or can I? maybe in a future article), so how is hydrazine used in space travel today? Well, as it turns out it is used quite a lot.

Hydrazine's use comes about due to the other important property it has, it burns very exothermically in the presence of oxygen (or oxygen-containing compounds) generating a lot of hot gases, which can be used to produce the exhaust thrust for a rocket. This was first exploited in WW2, when the German Me163B Komet became the world's first rocket-powered fighter plane. Various fuels were used including a 1:1 mixture of hydrazine and water (known as hydrazine monohydrate), "C Stoff" (57% methanol, 30% hydrazine, 13% water) and "T Stoff" (80% H_2O_2, 20% water), which were kept in separate tankers at opposite ends of the airfield and were always at least half a mile apart. These were highly explosive mixtures, so it is no surprise that more German pilots were killed in this plane by fuel leakages and/or explosions than were shot down by the Allies.

To lower (slightly) the risk of unwanted explosion, other variants of hydrazine have been used as rocket fuels, such as monomethylhydrazine (MMH), $(CH_3)NH(NH_2)$ and unsymmetrical dimethylhydrazine (UDMH), $(CH_3)_2N(NH_2)$. These are often mixed with dinitrogen tetroxide (N_2O_4) with the advantage being that no ignition source is needed - the two compounds spontaneously combust on contact. These mixtures are normally used in military, orbital, and deep-space rockets because both liquids are storable for long periods at reasonable temperatures and pressures, but not generally for civilian spacecraft due to the toxicity and explosion risks.

More often nowadays, hydrazine is used for manoeuvring thrusters or for slowing

spacecraft down on re-entry. Hydrazine-fuelled thrusters were used to land spacecraft on Mars, including the Viking spacecraft in the 1970s, the Phoenix lander (May 2008) and the Curiosity rover (August 2012). In these thrusters, an iridium catalyst, supported on an inert alumina matrix, decomposed the hydrazine to produce ammonia, nitrogen, and hydrogen gases. The reactions produce a very large quantity of gas from a small amount of liquid hydrazine, and the pressurised hot gas is expelled from the spacecraft producing thrust.

In the movie The Martian, Mark Watney (played by Matt Damon) explains how to make water using hydrazine fuel from the lander's fuel cells. For a rocket engine, hydrazine is passed through a catalyst which causes it to decompose into ammonia, nitrogen gas, and hydrogen gas according to the following reaction:
$N_2H_4 \rightarrow N_2 + 2\ H_2$

In the movie Mark Watney used that same reaction to produce the hydrogen gas and then, in combination with the oxygen in the habitat, he burned the hydrogen and made water. OK, I have read the articles and I know the scientific issues with this. First, hydrazine is incredibly toxic. In real life technicians who handle hydrazine wear full body safety suits. That is OK, as the standard Cepheus Engine PC takes risks getting out of bed every day. Second, decomposing the hydrazine into nitrogen and hydrogen is highly exothermic. It gives off a lot of heat, a real lot of heat, 800 degrees Celsius in a matter of milliseconds. But hey, this is Cepheus Engine and we handwave heat anyway.

So far so good, we have a highly explosive fuel additive, as amply shown in the movie by Watney's first attempt that nearly blows him through the side of the habitat. So how do we use hydrazine to make a game of Cepheus Engine more interesting? I think the key statement from the original drag racing story is Hydrazine is an oxygen scavenging agent.

Where do we want to scavenge oxygen in Cepheus Engine, why fuel processing of course! I give you the poor starship engineer's fuel purification plant.

Hydrazine, when mixed with a few other ingredients, makes the ideal quick and dirty fuel purification additive for those starships with fuel scoops and either no fuel purification plant or a faulty one. Just add the inline injector between your fuel scoops and your fuel tanks and the additive removes all those pesky contaminates from the water or gas giant gases you are sucking up for mis-jump free fuel.

Cost of Hydrazine Injector "Purifier"

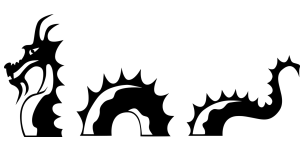
• 100 Kg inline injector – Cr20,000 at any class A, B or C starport.

• DIY install is Cr15,000 roll 8+ on 2D6 with a DM of engineer skill. Failure means the injector explodes the first time it is used, +5 for waste cartridge failure. Roll on the Injector Use Table for results.

• Hydrazine additive – Cr100 per litre.

• Waste cartridge disposal and replacement cartridge – Cr50.

One litre of hydrazine additive is enough to purify 1000 tons of fuel. For normal operation consult the use table below. After the litre of additive has been put through the injector the waste cartridge must be emptied. This can be done safely at any class C or better star port, if not consult the disposal table below.



Using the Hydrazine Injector "Purifier"

Roll 2D6, DM+1 for each 200 tons or part thereof of fuel put through injector, modifier is cumulative, additional DM+5 if waste cartridge used past one litre. Do not apply any other DMs. On a natural 12 (only), raw hydrazine is sucked into the power plant or jump drive, causing an explosion or mis-jump, damage at GMs discretion. If the modified roll is 11 or less, there are no untoward effects. Otherwise consult the Hydrazine Injector Use Table.

Hydrazine Injector Use Table

Roll	Result
2 - 11	Injector works as intended, no damage
12 - 14	Injector explodes, 2D6 damage to anyone within 6 meters
15 - 17	Injector explodes, 4D6 damage to anyone within 6 meters
18 - 19	Injector explodes, 6D6 damage to anyone within 6 meters, fuel scoops damaged
20 - 21	Injector explodes, 8D6 damage to anyone within 6 meters, fuel scoops destroyed
22+	Injector explodes, 10D6 to anyone within 6 meters, fuel scoops destroyed, fuel dumped to space

Hydrazine Waste Disposal Table

Roll	Result
2 – 3	6D6 damage as the cartridge explodes
4 – 5	4D6 damage as the cartridge explodes
6 – 7	2D6 damage as the cartridge explodes
8+	Waste cartridge successfully changed and disposed of

DM + engineer skill

Sources:

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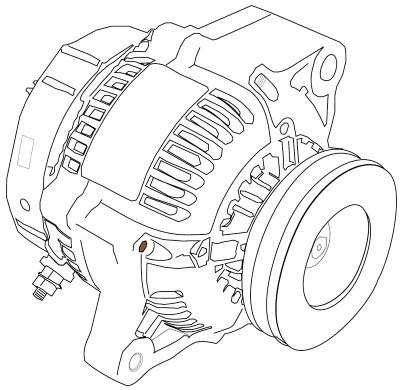


Abstract Wealth Rules

By Ben Gray

In Cepheus Engine, Credits are used for purchasing and selling items. Characters keep track of how many Credits they have, and the cost of any items that they buy is subtracted from their total. This is a simple and intuitive system, but it can require a lot of bookkeeping, especially when a crew have to pay a ship's mortgage and maintenance fees.

This article provides an alternative to the standard currency rules of Cepheus Engine, by abstracting the buying and selling of items in the form of Wealth Rolls. Rules are included for modifying the difficulty of these rolls based on the character's income, and making regular payments on crew salaries and mortgages. These rules are more mechanically complex than the standard rules, but should reduce bookkeeping in the long run and offer additional methods by which a Referee can reward their players.

Design Goals

The abstract wealth rules included in this article were initially designed for the upcoming Saturn's Gate setting, but should work fine for most Cepheus Engine games without any changes.

Saturn's Gate is a near-future science fiction game, set in Saturn's orbit in 2063, 40 years after the discovery of a wormhole connecting it to Earth. Characters in Saturn's Gate are usually in vast amounts of debt to the corporations that run the system, with the only opportunities to pay off that debt being through high-risk contracts set up by wealthy patrons.

The abstract wealth rules included here reflect the setting's focus on debt, and as such will probably need some changes in order to work in games centred around wealthy protagonists. However, they should still work for most games, with Debt representing regular expenses, the ship's mortgage, or both.

New Stats

Instead of tracking Credits, there are three new statistics that must be tracked for each character: Debt, Income, and Assets.

A character's Debt represents the combined cost of paying life support costs, general expenses, and interest on loans. A character's Debt score, usually between 4 and 12, is used as the difficulty for Wealth Rolls made to pay recurring costs.

A character's Income represents their regular income through work or other means, indicated by an Income modifier ranging from -2 to +3 that is added to Wealth Rolls. Income can vary week by week, as characters take on different jobs, and patrons will often provide characters with a temporary Income modifier for as long as they are working for them. If a character doesn't have an Income or isn't working when they make a Wealth roll, they suffer a -3 penalty to the roll as if they were making an unskilled skill check.

Assets represent cash in hand, and valuable items that are easy to trade. Any number of Assets can be spent after making a Wealth Roll to increase the result by that much. Scrip Tokens are a specific

type of Asset that can only be spent with the organisation that issued them.

Character Creation
Most characters start with a Debt of 8, and a number of Assets equal to the total of all Cash Benefit rolls made on Mustering Out (e.g. a character who rolled 1, 2 and 6 for their Cash Benefit rolls would begin play with 9 Assets). Each time a character takes on a significant debt during character creation, such as through medical bills, increase their starting Debt by 1.

Wealth Rolls
Whenever a character wants to purchase an item they must make a Wealth Roll. This is a standard 2d6 roll, adding the character's Income modifier, against a difficulty equal to the chosen item's Cost. On a success, the item is acquired successfully. On a failure, the character cannot locate the desired item or gather enough money to purchase it for now.

Regular Payments
Every half-month (or other standard period of time depending on the game), characters must make a Wealth Roll in order to pay regular interest and expenses, against a difficulty equal to their Debt instead of an item's Cost. On a success, they pay their bills for that period, and gain Assets equal to the Effect. On a failure, they face severe consequences, such as having some of their equipment repossessed or being harassed or arrested by security forces.

Modifying Rolls
Wealth Rolls can be modified in two main ways, after the player has seen the result. Firstly, Assets can be spent 1 for 1 to increase the result of the roll. Additionally, the player can increase their character's Debt by 1 to add 5 to the result.

Jobs and Income
Characters without a source of income get a -3 penalty to all Wealth Rolls, making even the cheapest items much harder to buy. As a result, most characters will want to make sure they have an Income of some kind.

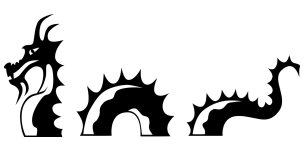
Characters that spend a significant portion of their time each week working a job have an Income equal to their Social Standing modifier or the level of the primary skill they used in that job, whichever is higher.

When hired for a specific job, characters will usually be given a temporary Income by their patron to help pay for expenses. The value of that Income will depend on how much the patron is willing to spend. Patrons that offer a higher Income will usually offer fewer rewards when the job is completed.

Some characters will have a basic Income even when they aren't working, as a result of pensions or investments. In this case, an Income of -2 might represent a monthly stipend from a family member, an Income of 0 might be a comfortable pension, and an Income of +3 might be the result of a particularly generous benefactor or a very successful investment portfolio.

Reducing Debt
Characters can spend 10 Assets at any time in order to reduce their Debt by 1. Given the standard costs of life support and expenses, Debt cannot usually be reduced below 4.

Rewarding Players
Patrons will usually offer significant monetary rewards upon job completion. In these rules, this is usually represented by giving the characters a number of Assets or reducing their Debt by a point or two. Characters should generally know what the reward for a job will be before signing up for it.



Some patrons will pay the characters in Scrip instead of Assets. Scrip behaves identically to Assets, except it can only be spent with a particular organisation.

Converting Credits to Cost

While the rules above provide a system for making purchases using Wealth Rolls, they don't tell you what Cost to assign to an item. This is partly intentional, allowing players to use the core system above however they would like. However, the following guidelines can be used to more precisely convert the cost of items in Credits to their Cost under this system.

An item with a Cost of 8, or a difficulty 8 Wealth Roll, is assumed to have a value in credits equivalent to Cr10,000. Increasing the Cost or difficulty by 1 doubles the credit value of the purchase, and decreasing the Cost or difficulty by 1 halves the credit value of the purchase. This is represented by the table below:

Cost/Difficulty	Approximate Value in Credits
2	Cr150
3	Cr300
4	Cr600
5	Cr1,200
6	Cr2,500
7	Cr5,000
8	Cr10,000
9	Cr20,000
10	Cr40,000
11	Cr80,000
12	Cr160,000
13	Cr320,000
14	Cr640,000
15	Cr1,200,000
16	Cr2,500,000
17	Cr5,000,000
18	Cr10,000,000

However, because Wealth Rolls represent the difficulty in finding an item and obtaining licences for it as well as purchasing it, certain items have their Cost increased above what might be expected based on their cost in credits. Add the relevant modifiers below, to get the item's final Cost. The Referee should feel free to ignore these guidelines and tweak costs as necessary to fit their game.

Item	Cost Modifier
Melee weapon	+1
Gun or other ranged weapon	+2
Sale of the item is subsidised	-1
Sale of the item is restricted	+1
Sale of the item is illegal	+2
Possession of the item is illegal	+3
Item is a local speciality	-1
Item is uncommon	+1
Item is rare	+2
Item is unique	+3
Item is consumable	-1 for a single item, +2 for a regular supply

Mortgages

Particularly expensive items with a Cost greater than 12, such as vehicles or spacecraft, can be made cheaper by taking on a mortgage or debt as part of the payment.

Obtaining a mortgage for an item requires a flat percentage of the item's value to be paid up front, reducing the effective Cost of the item by 3. However, if an item is bought this way, the purchaser must increase their Debt to make up the full cost over time. The character's Debt becomes equal to the item's Cost - 6 or is increased by 1, whichever results in a higher final Debt.

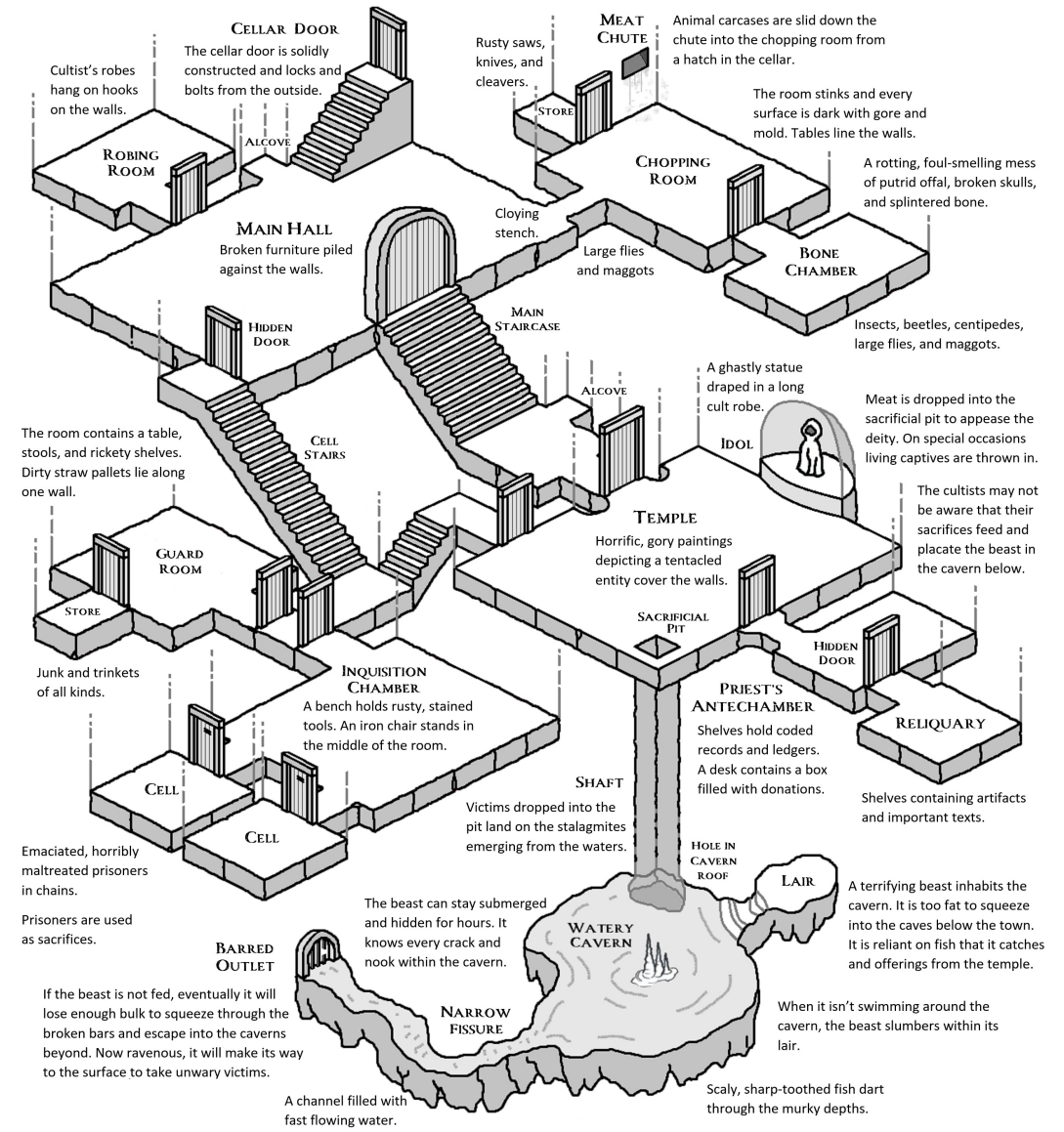
The Hidden Temple

A Generic Dungeon for 2D6 RPGs
By Ade Stewart

Below a large building in a quiet town is a temple dedicated to a bloodthirsty deity: the temple can be accessed from the cellar of the building. The temple lies above a large cavern that is home to a malevolent beast.

The temple contains guards, cultists, and priests. Its gloomy recesses may be home to swarms of rats, venomous insects, animated skeletons, or undead spirits. The threat of disease looms large within its fetid rooms.

No statistics for encounters are provided: it is left to the referee to determine the sorts of dangers that are met and the value of treasures that are found. These should be based on the ability of the characters and the nature of the chosen setting.



Epsilon Indi

Epsilon Indi in 2021
By Randy McDonald

Epsilon Indi is a nearby planetary system that has come to reveal complexities unimagined by earlier astronomers. Thought until 2002 to be a single star, a nondescript orange dwarf, recent decades of study have shown Epsilon Indi to be a complex multiple system, with a close-orbiting pair of brown dwarfs in its outer reaches and with a Jupiter analogue planet orbiting the main star, and with space for more worlds possible throughout.

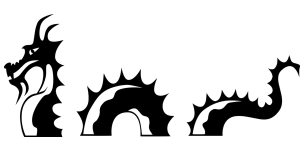
The Epsilon Indi trinary

The constellation Indus, only visible to observers of the sky based deep in the Southern Hemisphere, was mapped at a relatively late point, as Dutch navigators and cartographers creating the constellation Indus along with eleven others in the last decade of the 16th century. Indus made its appearance on its first start chart, the Uranometria, only in 1603. Over the 19th century, the high proper motion of Epsilon Indi as seen in the sky was recognized as an indicator that it was a star relatively close to our solar system, later work eventually confirming that Epsilon Indi was one of the stars closest to our solar system.

Epsilon Indi A is a K5 star notably smaller and dimmer than our own G2 sun. Epsilon Indi has a mass only 76% of the mass of our sun's and is less than 22% as bright, with a proportion of elements heavier than hydrogen and helium only slightly lower than that of our sun. Earlier estimates of its age suggested that Epsilon Indi A (and, thus presumably, Ba/Bb) was roughly as old as our Sun or perhaps even older, with an age of between five and six billion years based on its slow rotation and on its putative membership in a moving group of stars. Other measurements suggest Epsilon Indi A is a much younger star, perhaps only 1,.3 or 1.4 billion years old.

Epsilon Indi A was recognized in the mid-20th century as one of a collection of nearby broadly Sun-like stars, a relatively bright orange dwarf star lacking close stellar companions that was apparently sufficiently stable to potentially support Earth-like worlds. As a relatively low-mass star, Epsilon Indi A is expected to have a lifespan of 29 billion years on the main sequence before it evolves into a white dwarf, giving life on its worlds a potentially very long time in which to safely evolve.

Epsilon Indi Ba/Bb share an interesting discovery history. The first hint of their existence came in the announcement, made by Scholz et al. in a paper initially released to arXiv in 2002 and then formally in 2003, of the discovery of a single brown dwarf, a relatively cool T-class brown dwarf rich in methane with a mass equivalent to that of roughly 50 Jupiters. Follow-up observations later revealed that the supposed single brown dwarf was actually a binary pair, with estimated masses of 47 and 28 Jupiters for Ba and Bb. A recent 2018 study by Dieterich et al. suggests that Ba and Bb have masses of roughly 75 and 70 Jupiter masses, placing these brown dwarfs just below the mass threshold needed to be crossed to qualify a body as a star. Based on models of brown dwarf cooling, this paper suggests that Ba and Bb and by extension, the wider Epsilon Indi system would need to be very old, perhaps as old as ten billion



years, for these brown dwarfs to demonstrate the characteristics that they do.

At the time of their discovery, Ba and Bb were the closest brown dwarfs to our solar system known to exist. They are noteworthy even now, not only as a nearby binary pair (only Luhman 16 is closer) but brown dwarfs which orbit a nearby bright star. These brown dwarfs offer unique observational opportunities, especially for astronomers interested in how brown dwarfs would interact with a nearby Sun-like star and its worlds.

The planets of Epsilon Indi

The earliest searches for planets about Epsilon Indi A, conducted in the 1990s, excluded the possibility of massive planets in close orbits around A. Later studies conducted in the first decade of the 21st century suggested the possibility of a gas giant substantially more massive than Jupiter orbiting A at a greater distance than Jupiter does our sun. Finally, in 2018, Feng et al. confirmed the existence of the planet Epsilon Indi Ab, with a mass estimated at 3.25 Jupiters, with an orbit with a semi-major axis of 11.55 astronomical units, an eccentricity of 0.26, and an orbital period of 45.2 years.

Epsilon Indi A could plausibly support other planets. Recent analyses place upper limits on the masses of planets that could exist, one suggesting that there are no planets more massive than seven to nine Earths orbiting in Epsilon Indi A's circumstellar habitable zone, estimated in that study as lying between 0.47 and 0.87 astronomical units from A. This leaves plenty of space for planets comparable in mass to the rocky worlds of our solar system existing there, to say nothing of more massive worlds further out. Although Epsilon Indi is a relatively dim star, and perhaps most plausibly a relatively old star, the 2015 study by Leconte et al. suggests that planets orbiting in the circumstellar habitable zone need not be tidally locked.

The question of whether Epsilon Indi Ba or Bb support planets at all, never mind planets with Earth-like environments, seems not to have been discussed in the scientific literature. These brown dwarfs, separated from each other by an estimated 2.65 astronomical units, could each plausibly support planetary bodies in relatively close orbits, though only the most massive planets could be detectable by imaginable future observation. In a 2013 paper, Barnes and Heller describe an insolation habitable zone for brown dwarfs and white dwarfs, a counterpart to the circumstellar habitable zone of normal stars that differs in that the insolation habitable zone contracts over time as the brown dwarf or white dwarf becomes cooler and dimmer over eons. Even if a planet was located inside the insolation habitable zone for a time, it would orbit the brown dwarf very closely, so closely that it would need among other things an almost perfectly non-eccentric orbit to avoid overheating through tides and becoming a Venus equivalent. Worlds that moved inside the insolation habitable zone as it contracted might plausibly already have overheated, losing their water altogether. Analogues to Io, Venus, and Europa seem much more likely than analogues to Earth around any brown dwarfs. For Epsilon Indi Ba and Bb, dim brown dwarfs cool enough to contain methane in their atmosphere, worlds like Earth may be impossible.

Epsilon Indi and its neighbourhood

The stellar neighbourhood of Epsilon Indi hosts multiple stars of potential considerable interest to any civilization based there.

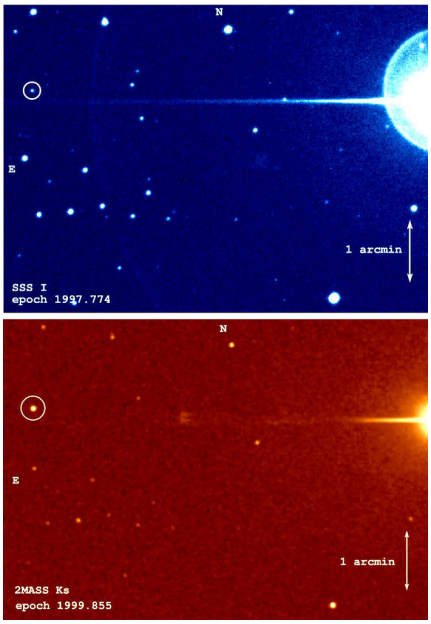
• Lacaille 8760, also commonly known as AX Microscopii, is a relatively bright single red dwarf star 4.3 light-years away from Epsilon Indi. The star was discovered to be a flare star only in the 1970s, perhaps a consequence of its flares being relatively minor and rare. Lacaille 8760 is not known to host any exoplanets, and its flares would pose serious challenge for Earth-like life on worlds sufficiently close to the star.

• Lacaille 9352 is another relatively bright single red dwarf star, 4.7 light-years away from Epsilon Indi. Unlike Lacaille 8760, Lacaille 9352 is apparently a stable star that does not flare; also unlike Lacaille 8760, Lacaille 9352 has been discovered in 2020 to host at least two exoplanets, two super-Earths that may be mini-Neptunes. There is debatable evidence for a third planet, another super-Earth candidate orbiting 0.21 astronomical units from its star, near the inner edge of Lacaille 9352's circumstellar habitable zone.

• Gliese 832, a flaring red dwarf star known by other catalogue names including CD-49 13515 and HIP 106440, is located 4.8 light-years away from Epsilon Indi. This planet is known to host at least two planets, Gliese 832b being a super-Jovian in a relatively distant orbit and Gliese 832c being a super-Earth orbiting near the inner edge of the star's circumstellar habitable zone. Gliese 832c might conceivably be Earth-like, although it may be at least as likely to be a Venus analog assuming a dense atmosphere.

• The red dwarf Gliese 1, just under 6.7 light-years' distance from Epsilon Indi, is perhaps most notable. A suspected variable and flare star, Gliese 1 is not known to host any exoplanets.

• The triple star EZ Aquarii, also known as Gliese 866, is a trinary star system a bit more than 8.2 light-years away from Epsilon Indi. Red dwarf flare stars A and C orbit each other in a tight orbit, with red dwarf flare star B orbiting the AC pair at a greater distance.



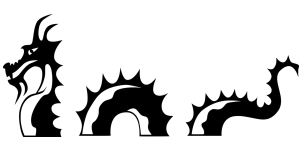
• The red dwarf star Ross 154, just under nine light-years' distance from Epsilon Indi, is notable as one of the stars nearest to our own solar system. This UV Ceti-type flare star is not known to have planets.

• At 9.2 light-years' distance lies the star Delta Pavonis, a relatively Sun-like yellow-orange dwarf star not unlike our sun that seems to be somewhat older than our own, with an age of a bit less than seven billion years. This star seems to be either on the verge of becoming a subgiant star, evolving off the main sequence, or actually is an early subgiant star. Delta Pavonis is sufficiently Sun-like to plausibly support Earth-like planets, though no exoplanets have been detected. Any hypothetical worlds in Delta Pavonis would at this time surely be undergoing great changes along with their parent star.

• 9.7 light-years' away lies the trinary star Alpha Centauri, the nearest star system to our own containing two broadly sun-like stars and at least two exoplanets orbiting the third component.

Epsilon Indi imagined

What could a system record for Epsilon Indi look like? Epsilon Indi A's system might look something like the table below.



Companion (in order from star)	Mass	Semimajor axis (AU)	Orbital period (days)	Eccentricity	Planet type
h	0.28 M⊕	0.11	15.3	0.08	Desert
e	1.34 M⊕	0.58	185 (0.506 Earth years)	0.27	Garden
f	2.51 M⊕	1.26	592.5 (1.62 Earth years)	0.17	Desert
g	1.71 M⊕	2.34	1499 (4.11 Earth years)	0.2	Icy
b	1029 M⊕	11.55	16498 (45.20 Earth years)	0.26	Gas giant
c	16.8 M⊕	22.14	43638 (119.5 Earth years)	0.19	Ice giant
d	21.4 M⊕	36.81	93550 (256.1 Earth years)	0.24	Ice giant

• Epsilon Indi Ah is a hot desert world, a more massive version of Mercury that differs from Mercury in being visibly geologically active, with continuing hot-spot volcanism. Water ice does exist in sheltered polar craters, in quantities sufficient to potentially support settlement.

• Epsilon Indi Ae is an Earth-like world, a planet somewhat more massive and with higher gravity than Earth that nonetheless supports a dense nitrogen-dominated atmosphere, extensive water oceans, and life. Although the Epsilon Indi system is older than our solar system, Ac's greater mass and the details of its mineral composition have allowed the planet to remain tectonically active, while the relative stability of Epsilon Indi A means that Ac—most unlike Earth—is not at risk of being edged out of its star's circumstellar habitable zone for billions of years. The life installed in the many diverse biomes of Ac, on the extensive rocky continents covering a third of the planet's surface and in the deep oceans and in the air, can expect to thrive for a very long time. From the perspective of an Earthly visitor, a key difference might be Ad's very long day-night cycle, with a 47-hour day.

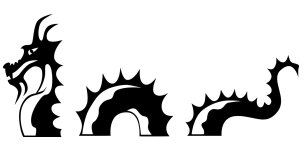
• Epsilon Indi Af is a rocky super-Earth that orbits outside even the most generous definitions of A's circumstellar habitable zone. Despite this, its relatively dense atmosphere containing carbon dioxide is enough to keep the planet relatively warm and hospitable, with temperatures in favoured equatorial areas nearing the freezing point. Sometimes the ice covering the surfaces of Ad's water oceans comes close to melting. Ad does support life, apparently related to the life of Ac, sheltered in the water ice oceans and in relatively hospitable locations on (or in) the land.

• Epsilon Indi Ag is a a super-Earth notable for its extensive crust of water ice, extending hundreds of kilometres down to the completely covered surface of the planet. This cold world, possessing only a thin nitrogen-dominated atmosphere, shines brightly in the night skies of the other inner worlds of Epsilon Indi A.

• Epsilon Indi Ab is a super-Jovian world, a gas giant with a mass equivalent to that of 3.25 Jupiters. Ab is somewhat colder than Jupiter, the heat produced by Ab's gravitational collapse no longer being enough to counterbalance the chill of Ab's location far from the warmth of Epsilon Indi A. Ab is notable for its brilliantly reflective set of rings, a consequence of a relatively recent impact that shattered one of what was originally eight planet-sized moons.

• Epsilon Indi Ac is an ice giant most comparable to Neptune, a cold world supporting an extensive collection of relatively small icy moons like the moon system of Uranus.

• Epsilon Indi Ad is an ice giant on the fringes of the Epsilon Indi A system, more massive than Ac and considerably colder,



receiving from Epsilon Indi A only a small fraction of the radiant energy received even by Neptune or Ac. Ad does host an extensive moon system, Ad's largest moon being an icy world comparable to Triton or Pluto in our solar system, but unlike either solar world all of Ad's moons are frozen solid.

• Epsilon Indi Ba and Bb each support a substantial collection of bodies, including a total of seven planets (three around Ba, four around Bb) and an abundance of rocky and icy bodies in their common system. Among the more interesting worlds in this part of the Epsilon Indi system are Ba I (a super-Venus orbiting just outside of Ba's insolation habitable zone), Ba III (an Earth-sized variation on Europa, with water oceans trapped deep beneath an icy crust), and Bb I (a highly volcanic world in a close orbit of Bb).

Epsilon Indi in fiction

Epsilon Indi has made regular appearances in science fiction from at least as early as the 1960s, if perhaps not as many as other similar stars lying at similar distances from our solar system like Epsilon Indi and Tau Ceti. Interestingly enough, frequently Epsilon Indi features as the location of civilizations that have been either devastated or destroyed outright by one antagonist or another.

• Epsilon Indi appears in the Star Trek universe, its most notable preference occurring in the 1966 original series episode "And the Children Shall Lead", Epsilon Indi was mentioned as a planetary system that was beset by marauders from the planet Triacus. Later non-canonical material, starting with 1975's Star Fleet Technical Manual, has tended to identify Epsilon Indi as the home system of the Andorians.

• In Larry Niven's Known Space universe, Epsilon Indi hosts the human colony world of Home. This notably Earth-like planet was depopulated in the 24th century by a genetically engineered plague and later resettled.

• In the Traveller game setting, Epsilon Indi is located in the spinward-trailing corner of the Meshan subsector, just a few parsecs from Terra. Its mainworld of Meshan was a low-gravity world with a thin atmosphere that nonetheless supported life. Neglected by the Ziru Sirka, it was colonized by the Terran Confederation after the Second Interstellar War, only for the Terran colony to destroyed at the start of the Third Interstellar War. Meshan was eventually resettled by the Terrans, and by the time of the Third Imperium had become a populous world home to billions and supporting a naval base.

• In the Elite video game franchise, Epsilon Indi is an independent system in the Core Worlds area of space that hosts two terraformed planets, Lee and New Africa. The system is known for its largely agricultural economy, the high-speed orbit of the moon Mitterand Hollow around New Africa, and its chief export of Indi Bourbon.

• In the 2300AD game setting, Epsilon Indi supports the garden world of Chengdu, a very Earth-like garden world but notable for somewhat higher levels of gravity. This thriving planet is the arguable central world of the so-called Chinese Arm, and receives substantial attention from its owning power, the Chinese state of Manchuria. Of note is how, in keeping with 2300AD tradition, Manchuria actively encourages immigration and even colonization of Chengdu by other countries, with Canada and Nigeria being directly involved, other Earth nations becoming major sources of immigrants, and the alien Sung species being considered as new partners.

• In the Battletech role-playing game setting, the planet Epsilon Indi I was one of the first colony worlds of humanity, an

early destination for sublight and then FTL settlement. The planet was later devastated by multiple wars and invasion from the 28th century on after the collapse of the Star League, to the point that by the 31st century the planet's viability was being questioned.

• In the television series Space Above and Beyond, the Epsilon Indi planet of Tellus was one of two worlds planned to be colonized by humans in the mid-21st century. Its dedicated colony ship was destroyed on arrival in orbit of Tellus by the hostile Chigs.

• In the Halo video game franchise, Epsilon Indi hosted the colony world of Harvest, a world with a primarily agricultural export economy that had the bad luck to be the place where humanity made first contact with the Covenant. Although most of its inhabitants were evacuated in time, Harvest was devastated by Covenant orbital bombardment.

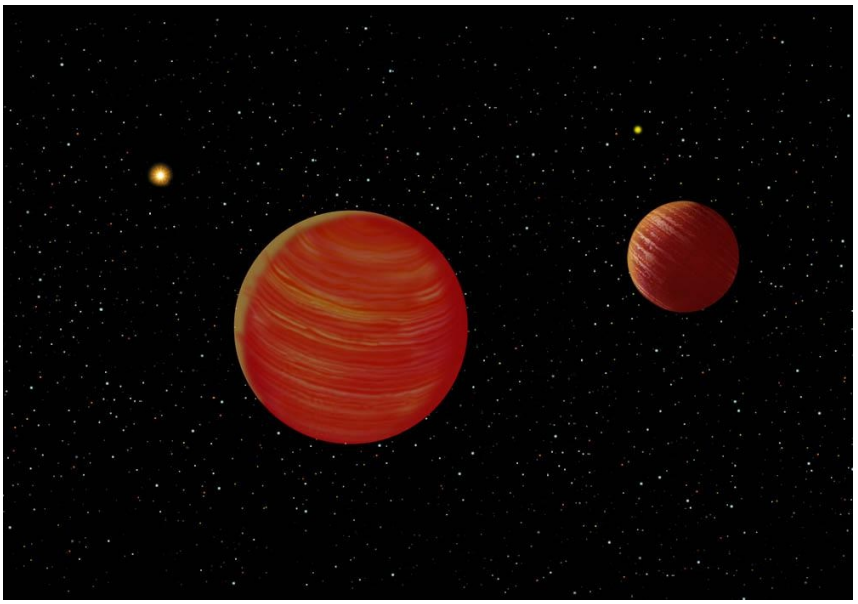
Resources

• The Wikipedia page on Epsilon Indi <https://en.wikipedia.org/wiki/Epsilon_Indi> and Sol Station's page on the star <http://www.solstation.com/stars/eps-indi.htm> each go into great detail about what is known about Epsilon Indi.

• In 2018, blogger Andrew LePage wrote in detail about the history of observation of Epslion Indi, concentrating particularly on on the Ba/Bb pair and on the exoplanet Epsilon Indi Ab <https://www.drewexmachina.com/2018/03/28/epsilon-indis-jovian-exoplanet/>.

• arXiv hosts multiple scholarly articles relating to Epsilon Indi. Some of the more notable include the 2002 announcement by Scholz et al. of the discovery of Epsilon Indi B <https://arxiv.org/abs/astro-ph/0212487>, the 2003 announcement by McCaughrean et al. that the singular B was actually the binary Ba/Bb <https://arxiv.org/abs/astro-ph/0309256>, the 2018 announcement by Feng et al. of evidence for Epsilon Indi Ab <https://arxiv.org/abs/1803.08163>, and the 2018 analysis by Dieterich et al of the masses and evolution of the Epsilon Indi system's brown dwarfs <https://arxiv.org/abs/1807.09880>.

• The study of Leconte et al. 2015 on tidal locking is summarized at Science <https://science.sciencemag.org/content/347/6222/632>, while the Barnes and Heller 2011 paper examining the habitability of worlds orbiting brown dwarfs is available in full online <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612282/>.



An artist's conception of the Epsilon Indi system

The Sche

By P-O Bergstedt

A race found in the Lemon and Gold Sector.

The planet Sche in Demosalia Subsector in the Lemon and Gold Sector is the home planet of the Sche, an amphibian race. The Sche weigh about 1600 kg and are about 6 m in length. They have a tough exoskeleton but are still very good swimmers. They use tentacles for manipulating objects and catching prey. You may find a few Sche on other worlds with water in this subsector.

Background

The Sche are evolved from a bottom-dwelling arthropodimorph that became predatory and started swimming and grew in size. They still needed to return to the bottom to reproduce and when their number grew, they couldn't find enough places for reproduction. In response they learned to use their tentacles for moving rocks and building new "homes". They also started to better-tolerate other members of their own species. All of this happened before they were sentient, but their society grew more and more complex and eventually the Sche acquired intelligence.

Society

The Sche are ruled by a paramount leader. When it dies another Sche that have worked closed to the leader takes the position as the new leader. There isn't too much work for a leader since the Sche are a very kind and peaceful race: for example, there are no records of them ever having a war. All Sche look after their

neighbors and share what they have. From a human perspective, this is an impossible utopia, but it works for the Sche. The population has been about 2 billion for a very long time, the precise number that their ocean planet can support.

Reaching for the Stars

Their first spaceships were launched. Since the Sche are not very comfortable out of the water and water is heavy, most exploration was done using probes and the ships were filled with air. Later ship design had a combination of watery and air-filled compartments.

When the Sche were contacted by Humans, they had already explored their own system, but the other planets in the system are not very hospitable. Only a few mining outposts had been built.

The name Sche is what the humans heard when asking them for their name of their race and planet. However, almost everything in the Sche language will sound like Sche to human ears. A computer is needed for humans communicating with the Sche. The Sche can understand human languages without any aid.

With the help of humans, mostly from the Neo Empire, the Sche now can be found on several planets with oceans in the Demosalia Subsector.

Each Sche will need 32 tons of ship space. Half of that must be filled with water.

The Sche as NPCs

The Sche doesn't work very well as player characters since they are too different, but one would make an interesting NPC. In Demosalia subsector the Sche may request transport from one planet to another, and the cargo hold may have to be filled with water for them to survive. They will trade rare metals that they can pick up from the bottom of the ocean where they live.

Adventure Hooks

1: A Sche delegation wants to have the PCs help to take them to a Gebbebem world (Gruak – Lemon and Gold 2929) to negotiate a lasting peace. The Sche truly believe that they can do this since they believe in universal peace.

2: A businessman has indications that metal nodules on the bottom of an ocean on a nearby planet (Naomilia – Lemon and Gold 2235) are very valuable. Now he wants the PCs help to recruit some Sche miners and transport them to Naomilia.

3: A Sche delegation wants the PCs help to help them colonize an unclaimed water world. (Arinene -Trans Dolovia 1116) One problem is that the shortest route there is through Gebbebem space.

British Cold War Tanks

For Modern War
By Ewan Spence

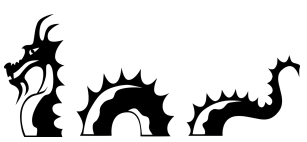
This article details the British tanks that saw service during the Cold War and were created using the Modern War: Conversion System (https://www.drivethrurpg.com/product/344234/Modern-War-Conversion-System) from Zozer Games.

During the Cold War Britain fielded a number of main battle tanks during the period 1945-1990 from the Centurion which saw action in the Korean War to the Challenger 1 which served in the 1991 Gulf War and the Balkans during the 1990s.

While the Chieftain never saw combat in British service it did see action in Iranian (and captured Iraqi) service during the 1980s Iran-Iraqi War as well as with Kuwait during the Iraqi invasion of August 1990.

FV-4003 Centurion Mk3							
AGILITY	-1	SPEED	34	RANGE	190	CREW / PASSENGERS	4 / 0
ARMOUR	40 / 27	HULL / STRUCTURE	14 / 15	MASS	52	CARGO	-
SWIM?	No	NAV DM	-	ECM DM	-	FIRE CONTROL	-
WEAPONRY	Turret	20 pounder MMG					
	Open	MMG					
DEFENCES	Smoke						
DESCRIPTION	This was the first version of the Centurion to see combat during the Korean War (1950-1953) and served with distinction. An incremental change gave us the Mk5 which saw combat with the Australians in Vietnam, with India during its wars with Pakistan, and with Israel in its various wars. The Centurion was also purchased by a number of European countries including the Netherlands, Denmark, Sweden and Switzerland.						

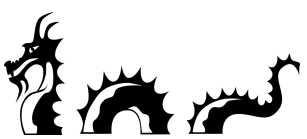
FV4017 Centurion Mk13							
AGILITY	-1	SPEED	34	RANGE	400	CREW / PASSENGERS	4 / 0
ARMOUR	48 / 32	HULL / STRUCTURE	14 / 15	MASS	52	CARGO	-
SWIM?	No	NAV DM	-	ECM DM	-	FIRE CONTROL	-
WEAPONRY	Turret	105mm Cannon MMG					
	Open	MMG					
DEFENCES	Smoke						
DESCRIPTION	The final version of the Centurion which by the 1960s had its main gun upgraded with the 105mm L7 rifled gun along with some other minor upgrades and additional armour as well as increased range. The Centurion was replaced in British serve by the Chieftain.						



FV 214 Conqueror							
AGILITY	-2	SPEED	34	RANGE	160	CREW / PASSENGERS	4 / 0
ARMOUR	50 / 33	HULL / STRUCTURE	14 / 15	MASS	64	CARGO	-
SWIM?	No	NAV DM	-	ECM DM	-	FIRE CONTROL	-
WEAPONRY	Turret	120mm Cannon MMG					
	Open	MMG					
DEFENCES	Smoke						
DESCRIPTION	The FV 214 Conqueror was a British heavy tank from the mid 50s till the mid 60s and was developed in response to the Soviet IS-3 and was used to provide long range anti tank support for the Centurion. It was only deployed to the BAOR in West Germany and was withdrawn from service when the Chieftain started to replace the Centurion.						

FV4201 Chieftain							
AGILITY	-1	SPEED	43	RANGE	500	CREW / PASSENGERS	4 / 0
ARMOUR	48 / 32	HULL / STRUCTURE	14 / 15	MASS	55	CARGO	-
SWIM?	No	NAV DM	-	ECM DM	-	FIRE CONTROL	-
WEAPONRY	Turret	120mm Cannon GPMG					
	Open	GPMG					
DEFENCES	Smoke						
DESCRIPTION	The FV4201 Chieftain was the main battle tank of the United Kingdom during from the mid 1960s to the late 1980s. In the mid 80s the Mark 10 was upgraded with fire control and Stillbrew Armour, this will increase AV to 58 / 38 and Fire Control is now +1. Designed by Paul Elliot.						

FV4030/4 Challenger 1							
AGILITY	-1	SPEED	56	RANGE	450	CREW / PASSENGERS	4 / 0
ARMOUR	58 / 39	HULL / STRUCTURE	15 / 16	MASS	62	CARGO	-
SWIM?	No	NAV DM	-	ECM DM	-	FIRE CONTROL	+1
WEAPONRY	Turret	120mm Cannon GPMG					
	Open	GPMG					
DEFENCES	Smoke						
DESCRIPTION	The FV4030/4 Challenger 1 entered service with the British Army in 1983 and first saw action during the Gulf War in 1991. It also saw service in the Balkans during the mid to late 90s before being replaced by the Challenger 2.						



Old-School Rethink

By Paul Drye

Welcome to the first installment of an on-going column for Cepheus Journal. "What's Old-School Rethink?" you might ask, and whether or not you actually did I'm going to tell you.

One of the basic premises of the OSR movement is to reproduce the free-wheeling feel of early roleplaying and running counter to that are many decisions that were made in those early days which have become set in stone. Players and referees don't think to challenge them because they've been "just the way it's done" for decades and in doing so miss an opportunity for some fun.

I'll give you an example: elves and dwarves. Just saying those two words (and putting them together) calls up a number of "facts" which are rarely challenged. The elves are graceful and civilized, inclined to magic and nature, while the dwarves are stubby and gruff, miners and dwellers of vast underground kingdoms. The two races (and they are races, variants on the human norm) do not get along, though there is a long tradition of individuals overcoming their differences to become friends.

You know these "facts", and you even know their original source. My point is that these were decisions made in the early days of RPGs and did not have to be this way. The list of things that are similarly constrained in both fantasy and SF gaming is long: star travel, magic, ocean planets, deities, alien adversaries and many more. Ironically, by sticking to the choices that our 70s predecessors made we're not following the spirit of the times. So, in this column I propose to revisit these tropes (or if you're less charitable, cliches) and see what other directions we can send them in. By doing so we'll re-introduce some of that sense of the new that gamers felt back when there wasn't a huge bed of canon to lie on.

Into the Deep

A population of unbound planets [exists] between stars…equivalent to 2000 objects from Moon to Jupiter mass per main-sequence star. –"Probing Extragalactic Planets Using Quasar Microlensing" by Xinyu Dai and Eduardo Guerras in The Astrophysical Journal Letters, Volume 853, Number 2.

Most SF roleplaying games use a very classical approach to planets, one that doesn't consider the slowly dawning discovery that our own solar system is not a good role model. Even compensating for detection bias, other star systems tend to have planets in more elliptical orbits than our own and—when they are as circular—more tightly spaced than around Sol. The number of gaming takes on hot Jupiters, for example, remains low despite more than a quarter century since the first one was discovered.

One place where games have been really conservative is the topic of rogue planets, planets that wander interstellar space without a sun to light them. These are still poorly known, with only about thirty of them currently suspected (many of which are probably brown dwarfs) but facts that are thin on the ground has never stopped science fiction before. There's no reason to change that now, if there's fun to be had.

Maybe the most interesting question about rogue worlds is how many there are. The good estimates vary by three orders of magnitude, but plausible numbers toward the top end are surprisingly high. The quote above is from a real scientific paper and it's worth thinking about carefully. In the Sun's neighborhood each star has about 250 cubic light years of space to itself (which sounds like a lot, but linear distance to the nearest star from any given star would be roughly the cube root of that, or 6.3 light years, which passes the smell test). If there are "2000 objects ranging from Moon to Jupiter mass per main sequence star" then that means there's eight rogue planets within a light year of Earth, or—at the going rate of 34.7 cubic light years in a cubic parsec—there's somewhere around 300 planets within the traditional SF game measure of one parsec!

The Nature of the Beast

If we went back in time thirty years and told an astronomer that rogue planets existed, their immediate reaction would be to assume that they wouldn't be very interesting—without a source of sunlight, they'd be frozen solid and quiet for billions of years. As discoveries like the complex surface and satellite system of Pluto have shown us, though, both internal warmth and tidal heating are enough to make for active worlds.

So, what are rogue planets like? It depends on how big they are.

At the top end we have brown dwarfs and Jupiter/Saturn-class planets. It's likely that there aren't many of these in our volume of space, with best estimates being ~1 and probably no more than ten or so. In most cases we'd have detected them by now using infrared telescopes, with only the busy area of sky in the direction of the galactic core being a place where one of them could lurk and not have been seen from Earth by now. However, there's room to maneuver here. Luhman 16 is a binary brown dwarf found just 2.0 parsecs from us and was only just noticed in 2013; as well as being in front of the Core, both are relatively cool at 1080 Celsius and 940 Celsius, and so less obvious than they might be to infrared astronomers. As it's suspected that brown dwarfs drop all the way down to a spectral class of Y—room temperature and down—the possibility exists that that's exactly what we'll find in close proximity to Earth (for interstellar meanings of the word "close"). While one of these wouldn't be of much interest to space travelers and colonists, they'd be prime candidates to have extensive systems of large moons that would be.

Ice giants are the next step down in size, worlds that resemble Uranus or Neptune. Such a planet could be the result of an ejection from an orbit close into a star. The current best model for our own Solar System's formation assumes a third ice giant between Saturn and Uranus which was flung into deep space during the early period where planets were still moving their orbits due to numerous encounters will small planetesimals. Apart from their possible unusual origin, though, one of these would be usable only in the same way as a larger rogue planet—as the parent of colonizable moons and a source of fuel if your campaign uses atmosphere skimming.

Things get a lot more interesting once we drop down into the super-Earth/Earth size range. These have two advantages. First, they are large enough to generate their own heat internally for long periods of time, which means they are not nearly as cold as one might expect. At the very least they have oceans of water under frozen surfaces, and if they formed outside the frost line of a star (most probably did),

these could be extremely deep, much more so than Earth's oceans.

The final type is the one we know a little about already, the Pluto-like objects that are larger in diameter than the Moon but either less- or as-massive as our satellite (being made of ices Pluto, as an example, has only one-fifth the mass of Luna despite being almost 80% as wide). We use these to fill up the spaces between the bigger worlds and can even use them to exceed our previously determined quota of 300 objects given that the bottom end of that survey was the Moon's mass. And as we've learned the last few years, they're anything but a boring afterthought: they have unusual terrain and might have a sub-surface ocean to explore or colonize.

As for how many of each type in our 300 worlds, a power law seems the likeliest way to break things down—the asteroids follow one roughly, for example, at a smaller range of sizes. The upper limit will be about Jupiter's diameter, including the brown dwarfs which are not much larger than that due to gravity compressing them. Bearing in mind that our categories are not evenly spaced in size this gives us something like this:

Approximate Size	Total #
Jupiter	~1
Uranus	5
Super-Earth	30
Earth	90
Moon	170

Personally, I'm inclined to fudge the top end to produce more of the interesting gas giants, but your taste may vary.

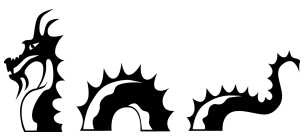
You can use all of the above to produce your own random tables if you like, but here's something like what you'll get: this map and a table of planets In Excel format and available for download from the Cepheus Journal website), Sol being the yellow dot in the center and the rest being our hypothetical rogue planets.(See map on next page).

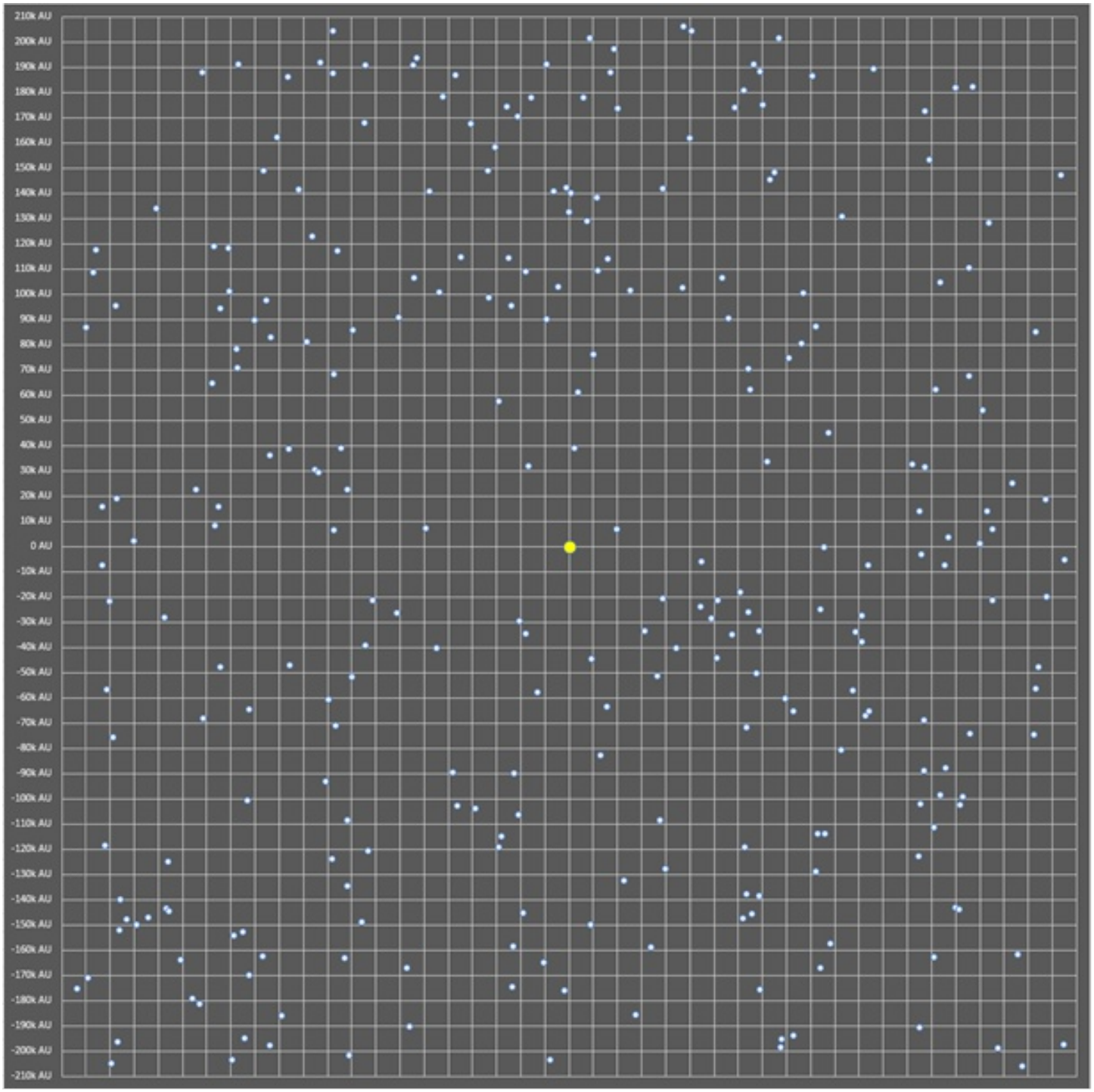
Incidentally, if you download the table, I suspect that some of you already know how to calculate the distance between any two of the worlds above, as it uses the same X, Y, Z setup as a vintage SFRPG as well as many 3D star maps on the web. If you don't, or just want the convenience, the spreadsheet contains a calculator for finding the distance between any two planets.

Altogether it seems like we have room for a radically different take on a hard space opera-style campaign, wouldn't you say? In the best tradition of OSR I'll recommend that you make your own setting within, but let me show you one—though, please, in the tradition of OSR, consider what you might do with it yourself.

Exodus+500

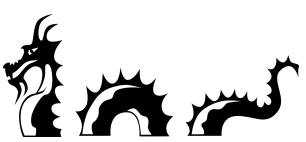
World War III was a lot different from what people expected. Instead of nuclear missiles or boots on the ground it was custom nanomachines—what each side thought was the latest and greatest thing that only they had but instead turned out to be ubiquitous. It wasn't even a grey goo attack like the first generation of those weapons, oh no. The long peace had let them be refined, made them infectious. After all, why indirectly try to make the other side stop resisting through fear or destruction when you could do it directly? The new microweapons could infect you, rebuild your body if they wanted to, but were more targeted rebuilding the brains. The poorer ones overwrote you entirely and made you a zombie, the better ones were an overlay on your original personality. You'd carry on being a productive citizen, it was just that your loyalties had changed.





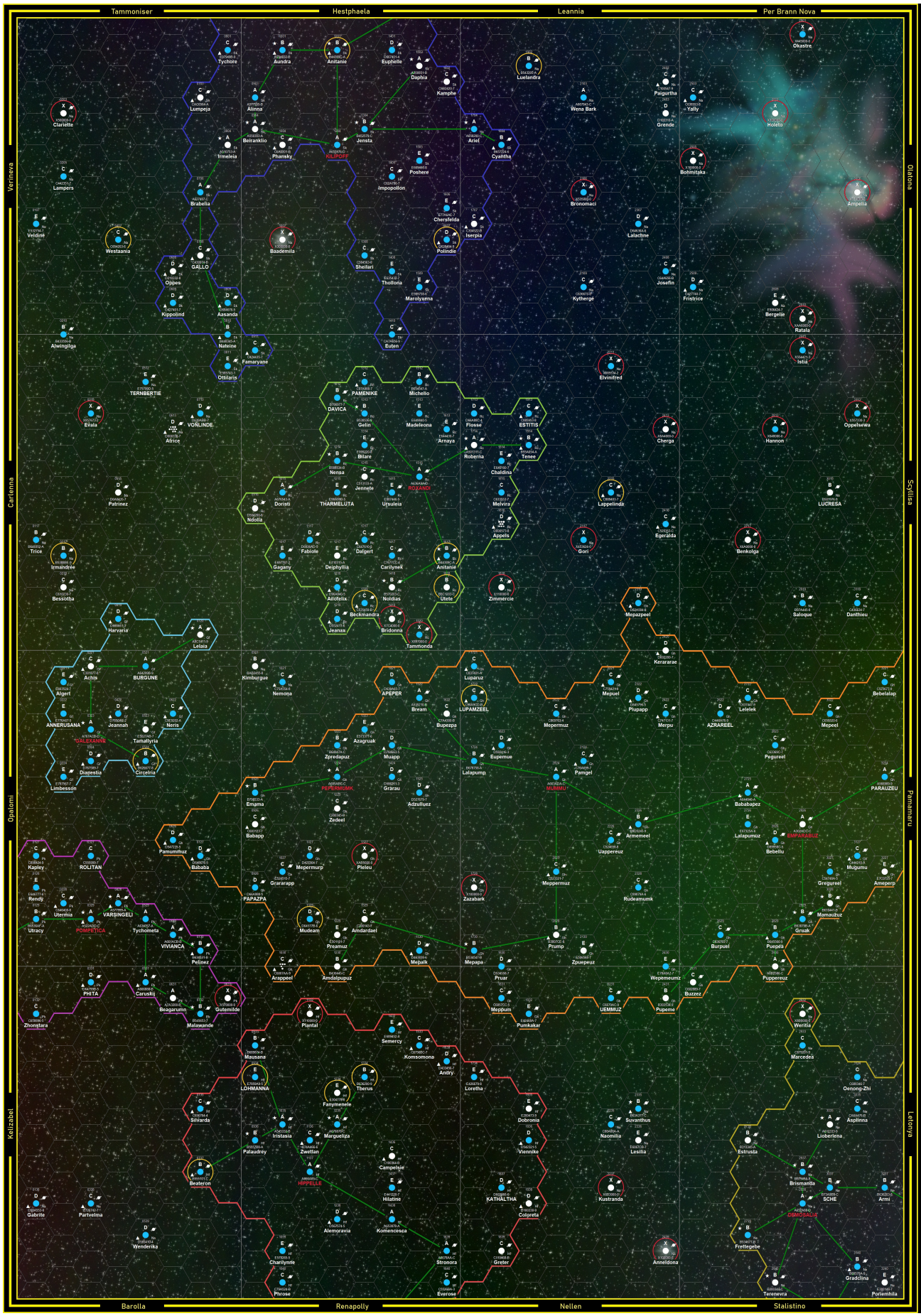
Inevitably they got out of control. The planet, and then the whole inhabited system was turned into a new pseudo-biological ecology with Grandpa Darwin sitting on top as dozens of varieties mutated through thousands of strains in competition for everyone's soul. Aleph won and nobody even knows who created it—it had mutated so far that Aleph didn't rewire you for China or the USA or the anarchists or anyone. Aleph was only for itself.

A few million people escaped the Solar System entirely. Some went for the nearby stars, but so far as anyone can tell that kind of leap was just a little beyond human capabilities and no-one's heard from them in many years. The survivors took over the previously unimportant rogue worlds between Sol and the rest of the stellar neighborhood, getting enough distance between them and Aleph to stay safe from the puppetheads. Some run Null, a counteragent of nanomachines whose



sole purpose is to occupy the body and brain and deny the ecological niche to anything else. Other run Boomer, which as its name suggests was originally designed to infect submariners and let them live in close confines for years on end without going insane, which is handy out in the Deep Refuge. A few have even taken advantage of the inherent ability of the nanoweapons to rebuild the whole body. The Angel infected can live and travel in open space, made into living spaceships, while Fathom makes people that dwell in the immense pressures of hydrogen-cloaked worlds between the stars and their almost bottomless oceans. A lot of people don't consider those any more human than the puppetheads. Travel between the worlds is not easy and requires, ironically enough, that humans freeze themselves to handle the months or years it takes to get to even the nearest of the next worlds over at constant acceleration, but the survivors slowly knit together a new civilization.

Five hundred years on the Deep is still evolving, as colonies created in a panic fail for one reason or another and the remainder fight over dividing their resources. There are old-timers who still remember Earth and the war, but the many generations of younger people have grown up in the strict confines of the outer worlds. All this goes on while Aleph continues its blandishments from the soft and warm confines of Sol, offering (quite literally) the Sun and the Moon to anyone who would listen. Life out in the Deep is sometimes about having to make yourself decide to live in the spartan, frigid cold for one more day rather than give in. Not that Earth's new ruler is averse to coming out into the cold and looking to make converts either, by subterfuge if need be.



LEMON AND GOLD

Just Another Sector from the Cepheus Journal

A	B	C	D
E	F	G	H
I	J	K	L
M	N	O	P

SUBSECTORS WITHIN A SECTOR

- A Brabelia
- B Kilipoff
- C Wena Bark
- D Palexanda Nebula
- E Vonlinde
- F Roxandi
- G Lappelinda Gate
- H Lucresa
- I Pomp and Galax
- J Pepermunk
- K Mummu
- L Emparabuz
- M Roundabout
- N Hippelle
- O Lesilia Bridge
- P Demosalia

Map Legend

World Types

- Water Present
- No Water Present
- Asteroid Belt

Bases

- Naval Base
- Scout or Patrol Base

Travel Zones

- Red Zone
- Amber Zone

Population

- MUCHADA Over 1 billion
- Underetti Under 1 billion
- World Names in Red are Capitals

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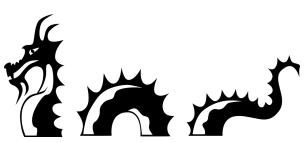

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