

Table of Contents

Ship Systems	854
➤ Life Support	854
➤ Imperial Interstellar Scout Service	855
➤ Operational Flight Limitation (OFL).....	855
➤ Operational Supply Limitation (OSL).....	856
➤ Death Ship	856
Unobtainium	857
➤ No Blood for Uranium	858
➤ Scooping	858
Logistical Support Ships	860
➤ Sutlers not Settlers.....	860
➤ Take Your Protein Pills	860
➤ Empty Cans	861
➤ Running Outatime	861
➤ Running on Empty	862
➤ Limping Home	862
➤ A Hot Dinner.....	863
➤ The Cold Equations	864
➤ Hollow Logs	864
Blinded by the Light	865
Endnotes.....	865

See Appendix EPAT1 – The Existential Patents
See Appendix EPAT2 – Existential Patents Quick Summary

“At an intersection of pathways in slipstream space, both paths manifest the potentiality of being correct and incorrect. It’s only when the pilot chooses a specific direction that this potentiality collapses and one path becomes right, and the other wrong. For reasons still not completely understood, organic beings tend to choose the correct paths, or more precisely, the very act of choosing makes the path they have chosen the correct one.”

– The Andromeda Wiki article, “Slipstream,” captured May 28, 2018 ¹

Ship Systems: Ship Systems is an Existential Patent that represents the life support, crew accommodations, and general logistical aspects of interstellar flight. The practical limitations of interstellar flight are how much supplies the ship can carry, how quickly they are consumed, and the extent to which the ship systems can recycle supplies in interstellar flight and/or replace them from raw materials when they arrive in a system which does not have a supporting colony. Some items, such as high-end manufactured or refined items, especially those required for the operation of the Stardrive, will be impossible to replace without a supporting colony; the Stardrive is the single most complicated and finely-tuned device ever manufactured, and a piece of duct tape just won’t fix it. Without this patent, a ship has no turns of OFL/OSL (*ut infra*), cannot move away from a Supporting Colony and, *except for Scout Ships*, cannot even be constructed (because it’s system integral).

- ✓ GGDM *does not* begin with the assumption of any Star Trek like ‘replicator’ technology and even in Star Trek there are limits (e.g., see Star Trek: Voyager), especially if the ship is damaged, and even in Star Trek, there are damage levels that cannot be repaired without putting into a space station or orbital shipyard.
- ✓ There is a maxim which is old because it is worth repeating each generation: ‘Amateurs talk about tactics, professionals talk logistics.’² One of the endless litany of historical examples supporting the adage is the 12th SS Panzer Division’s operations in Normandy in 1944: Their battalion of Panther tanks ran out of fuel before reaching the battlefield due to sloppy staff work (see Moltke discussion, 5 Combat, p. 1008, *infra*) and logistic failure. The late-war 12th SS Panzer never cohered well.³
- **Life Support:** The Ship Systems Existential Patent is required for interstellar flight. The Ship Systems Existential Patent governs both Operational Flight Limitation (OFL or “offal”) and Operational Supply Limitation (OSL or “ossal”⁴), detailed in the following sections. The Patent contains turn limits for each individually, beginning at two Regular Turns each. The individual limitations may each be improved by means of a Continuous Operational Technology or Enhancement Technology Patents, with each improvement being no more than one turn for either the OFL or OSL, per COT or ET Patent.
 - ✓ The one Regular Turn per step improvement scheme is similar to improvement of Ship Speed (see Dog Star, 2 Stardrive, p. 792, *supra*). Each improvement of Operational Flight Limitation extends the range of ships by the current maximum Ship Speed at time of departure.

- Imperial Interstellar Scout Service: Scout Ships are *non-warships* with big sensors and small highly specialized crews that are designed to go anywhere, seeking out new life and new civilizations ... well, you know the official party line propaganda already ... but really they are more interested in claiming resources, powerful alien artifacts, rhinestone shades and cheap sunglasses, easy Earth girls, and living space first. See Scout's Honor, 1 Expansion, p. 879, *infra*, for full discussion of Scout Ships. With a small crew and a big/small self-sufficient ship, the supplies can last a long time. Scouts are the only ships that may be constructed without a Ship Systems Existential Patent. *With a Ship System Existential Patent*, Scouts have *two extra turns* of Operational Flight or Supply Limitations (OFL/OSL), and may depart for any destination system, without it, they have two turns of OFL/OSL.
 - ✓ There is also a distinct possibility that Scouts are drones or Von Neumann machines. But this then dives into arguments about sapient understanding and decision making vs. AI and whether the potential for First Contact should be handled by an AI Scout or a biological sapient. This is a finer issue for the participants, the game will only look at the issue when necessary. I recommend reading Fred Saberhagen's "Ber-serker" stories. See previous discussion in relation to Faculties use, Web of Night, 2 Colleges, pp. 477-478, *supra*. See also the AI Problem excerpts, Corporations, *infra*.
 - ✓ On the level of game design discussion, the rare position that does not begin the game with the Ship Systems Existential Patent, can at least vigorously Scout the local stars while getting the necessary Patent. But to do this, they must begin with the Generic Stardrive Existential Patent as no ships can be constructed without it. Scout Ships do not require an Orbital Shipyard to build.
- Operational Flight Limitation (OFL): Operational Flight Limitation (OFL) is the number of Regular Turns of interstellar flight that a ship can travel when making a Long Movement ***beginning from a system where there is a supporting colony***, regardless of whether there is a supporting colony at the destination. The basic Operational Flight Limitation is two Regular Turns. Operational Flight Limitation generally becomes less of an issue as ship speed improves, because the range of the ship is however far it can travel at full speed in the time allowed by the current OFL.

With higher ship speed, the frontiers open up impressively (however, note again that temporal Disturbance Modifiers are particularly troublesome to the OFL by adding turns to the flight). Because it is usually irrelevant whether the destination has a supporting colony, OFL applies to the conditions precedent of all Power Activations that initiate interstellar flight, not just activation of the Movement Power. Cargo Ships, which must have a supporting colony at the destination as condition precedent to moving, may use an **alien colony** for OFL if trading with the **alien colony** (see Cold Lunch, 1 Commerce, p. 1189, *infra*). COT Patent improvements in OFL technology will not affect ships *en route* at the time of the improvement.

- ✓ It is *imperative* that the initial Starlog contain 2-4 stars within two turns' movement of each starting position based on the movement formula and starting ship speed of the Generic Stardrive Existential Patent. Other stars should be reachable from there.
- ✓ The stark contrast between U.S. Navy submarines and Japanese Imperial Navy submarines in WWII demonstrates the long effect of Operational *anything* Duration. U.S. submarines had greater operational range and duration than cramped, smaller Japanese submarines, and were also more numerous, and once the problems with U.S.

torpedoes were fixed by reverse-engineering of Japanese torpedoes, U.S. submarines were operationally superior. Added to that was the fact that U.S. codebreakers had deciphered the Japanese communication codes (unknown to the Japanese) and a rapid increase in proficiency and improved tactics (e.g., Colleges in GGDM), tilted the underwater war against the Japanese, who took unsustainable losses to their vital merchant marine.⁵ Modern nuclear submarines can stay submerged for 3 months.

- Operational Supply Limitation (OSL): Upon arrival in a system with a supporting colony, the ship is automatically fully resupplied and may depart again with a fresh Operational Flight Limitation (OFL) or remain indefinitely in the system (this is an assumption purely for game purposes and may not accurately reflect the apparent facts).⁶ If the destination system does not have a supporting colony, then Operational Supply Limitation, *the amount of time a ship can operate without a supporting colony in the absence of supply from a Log Ship (ut infra)* – including subsequent interstellar flight to a system where there is a supporting colony – begins to run. While it is certain that the ship could replace some of its supplies from raw materials in the system, as outlined above, eventually there will be some problems. Log Ships are not themselves exempt from Operational Supply Limitations.

- ✓ OFL ends upon arrival in the destination star system, regardless of whether there is or is not a supporting colony. Unused turns of OFL *do not* convert to extra turns of OSL or toll OSL from running. OSL should always be equal to or greater than OFL in operational turns, so that the ship arriving in a system without a supporting colony can immediately retrace its route back to a supporting colony (running on OSL time). If a non-Scout Ship is going to a system without a supporting colony, *the owner should be prepared to drop a Scene there after arrival*. For each turn that OSL is greater than OFL, the ship might spend those extra turns in the unsupported system doing whatever it came to do (e.g., kidnapping Elvis) before being required to return to a supporting colony or leave on a longer trip. Planning is key.

It is thus possible to abuse OSL slightly to allow ships that arrive in an unsupported star system to make a second flight that is longer than would have been allowed by the OFL (for example, ‘bridging’ long distances between colonies by passing through an unsupported star system). OFL + OSL effectively makes the combined flight time of a ship to and from or through an unsupported star system. The OFL is still the limitation on the first leg of the journey, and the second leg *must go* to a destination with a supporting colony, not off into the night.

- Death Ship: Does it need to be said? Absent creative Concierge Intervention (did the term “divine intervention” jump to mind?), a ship which has exhausted its Operational Flight and/or Operational Supply Limitations and/or has not arrived at a supporting colony or has failed its Supply Roll (*ut infra*), will perish and may be removed from the universe (if in interstellar space), or left there to be rediscovered later as a floating derelict. Maybe the elderly remaining crew or their bones will be found by beacon on a local planet or moon?
 - ✓ “Death Ship” is the name of a Season 4 episode of the original Twilight Zone, starring Jack Klugman and Ross Martin that is memorably peculiar even by that show’s standards. Seasons 4 and 5 featured three classic spaceship crash episodes, “Death Ship,” “On Thursday We Leave for Home,” and “Probe 7, Over and Out.”

“Unobtainium is engineering jargon for, ‘a material that would be perfect for our purposes, if we could get it, which we can’t.’ Sometimes an object that actually exists, or existed at one time, becomes unobtainium because it’s unavailable now. When used in the realm of fiction, Unobtainium is usually the exotic material that is needed to make the Applied Phlebotinum of a given story work. Without it, all your nifty machines and plot-enabling gadgets quit functioning.

Some forms of unobtainium are based on real physics, but beyond the current scope of human engineering, such as room-temperature superconductors; they would revolutionize just about every form of technology, but they are not in and of themselves dangerous or based on some exotic physics-bending principle.” – from TVTropes.com, “Unobtainium”

Unobtainium: Meanwhile, back at the space station...

- ✓ “Phlebotinum is the versatile substance that may be rubbed on anything to cause an effect needed by a plot. Examples include but are not limited to: nanotechnology, magic crystal emanations, pixie dust, and Green Rocks. In essence, it is *plot fuel*.” – from TV Tropes.com, “Applied Phlebotinum” (emphasis added).
 - See full quote, Assumptions of Light, 1 Stardrive, p. 781, *supra*.

Although fuel might more properly be a consideration of the Stardrive Patent, it is assumed under the OFL/OSL of the Ship Systems Existential Patent. The game makes no separate or specific accounting for fuel other than OFL/OSL. In most cases, it is assumed that the Stardrive is also the power plant providing energy to the rest of the ship for all other systems. If participants want, they can track fuel separately and this could add another layer to the game as not all colonies will have available refined fuel for Starships, fuel would need depots.

- ✓ See Large Convenient Energy Source (LCES) feature quote (“Abusing the Kardashev Scale”), Research Areas, 2 Technology, p. 701, *supra*.

Thus, if participants want to guarantee that wars will occur in their game, they could possibly do no better than to introduce scarce fuels into the game that are vital to interstellar movement, creating the feedback loop:

- ✓ A 15-minute movie criticism video published in April 2016 by Media Zealot titled “6 Advanced Sci-fi Civilisations Too Stupid To Really Exist (Part 1)” makes this same point with regard to the humans in Avatar, which the video criticizes as too stupid to have advanced to interstellar civilization. The video points out that the humans are in a feedback loop; they must expend fuel and resources to find more fuel, and choose to go to war with the indigenous natives on Pandora, ignoring and destroying countless scientific wonders and potential advances, to get fuel – instead of finding sources located on uninhabited planets. Humanity in the movie is cognitively one-dimensional, they see only profits. The other civilizations roundly criticized are the Engineers from the Alien franchise and the alien invaders in Battle: Los Angeles (movie, 2011).

This also assumes that such fuel is naturally occurring throughout the universe and no one has devised a way to manufacture it; e.g., like crude oil on Earth in the 20th Century. Manufacture of

any such fuel would require more energy input – since the fuel is simply an energy storage device – than could be obtained from the fuel when used (unless extradimensional). Thus, manufacture of advanced fuels, other than those that can be produced biologically, has eluded us.

➤ No Blood for Uranium: Oil is the “Applied Phlebotinum” of modernity, *it is the plot fuel of the 20th Century*. Imagine warfare with coal-fired, steam-driven Panzers in 1939?

- ✓ “In the spring of that year Guderian had his first experience of commanding a panzer force during the annexation of Austria. The mobilization was chaotic, tanks ran out of fuel or broke down, and the combat value of the formation was non-existent. Had there been any real fighting Guderian would certainly have lost. He stood beside the Führer in Linz as Hitler addressed Germany and Austria in celebration. Afterwards, he set about remedying the problems that the panzer force had encountered.” – from Wikipedia article, “Heinz Guderian,” captured November 19, 2019.

Some in this oil-driven, oil-crazy world might consider it a serious design flaw in the game to have excluded fuel tracking from the calculations.

- ✓ “Despite the effort put into developing a fleet capability to execute the drive across the Pacific called for in War Plan Orange, the first major large-scale assault conducted across an ocean without a forward operating base occurred in the European theater – Operation Torch, the invasion of North Africa. More than 100 ships were refueled by five oil tankers and four *Sangamon*-class escort carriers that were converted *Cimarron*-class oilers.” – Commander John A. Lukacs IV, USN, “A Century of Replenishment at Sea,” CNO Naval History Essay Contest 2017, pub. August 8, 2018 on www.history.navy.mil.

In 1961, the USS Enterprise (CVN-65), the first nuclear-powered aircraft carrier was launched, and the USS Nautilus (SSN-571), the first nuclear-powered submarine, had been launched in 1954. Nuclear powered ships could run for 20-30 years on the initial fuel (the former was decommissioned in 2017 and was last refueled in 1994, the latter was decommissioned in 1980), thus effectively putting off to the next generation, the problem of refueling these ships when it may have been assumed that they would either be obsolete or that technology would have advanced such that the process would be less difficult. This provides a frame of reference for the amount of energy contained in a tiny bit of uranium. Thus, the problem is one of scarcity and consumption rate; I have not yet seen any protestor signs that say “No blood for uranium!” though it may be coming.

➤ Scooping: Science-fiction writing has been very inconsistent on the issue of starship fueling.

- ✓ In the Traveller RPG and in the movie *Magellan* (2017) starships can get fuel from gas giants (skimming/scooping) or from water worlds, or in the case of the movie *Magellan* (2017), a fuel line was run to a frozen hydrogen-nitrogen ocean. In Traveller RPG, massive battle fleets would refuel at local gas giant planets and I wondered if eventually a gas-giant planet in a busy system might have all of its atmosphere taken by starships? In the series *Stargate Universe*, the ancient alien ship *Destiny* scooped from the surface of a star. Incidentally, in *Songs of Distant Earth* (1986) by Arthur C. Clark, the space-ark ship *Magellan* wasn’t stopping at the colony for fuel, but for water to make ice to rebuild its forward shield against interstellar dust and rocks.

- ✓ In Battlestar Galactica, the fuel used is a very rare metallic ore Tylium (Battlestar Galactica Wiki); one must assume that the Twelve Colonies had a supply source somewhere (according to BattlestarWikiClone, it was not native to the Twelve Colonies), but it makes starship operation very expensive. In the original series, I do not believe the fleet ever ran out of Tylium (the wiki said it was hardly mentioned in the original series), but in the reimaged series, the writers couldn't resist the easy 'plot fuel' temptation (arguably, FTL must be a massive energy drain thus it takes time to recharge the FTL), so the Colonials had to attack the Cylons in the "Hand of God" (2005) to obtain Tylium from an asteroid.
- ✓ Conversely, in other science-fiction settings, such as Star Trek, the ships were powered by matter/anti-matter reactions (Deuterium/anti-Deuterium). The particulars of anti-matter (anti-Deuterium) generation were never discussed (since anti-matter theoretically cannot exist – BOOM!) except to say the obvious, that there would always be more matter than anti-matter. The flow reactions were controlled by fictional dilithium crystals (not to be confused with the real dilithium) which was a component as critical to the system as anti-matter to prevent the ship from exploding, thus two of the three items needed for Warp Drive were *unobtainium*. This was plot fuel for a few episodes that were *parodies* of Cold War oil tensions. Notably, Star Trek limited dilithium crystals to starship propulsion and didn't it make into Applied Phlebotinum.
- ✓ However, in the Stargate universe, a magic-everything mineral called Naquadah, "a rare, super-dense mineral," which is also a superconductor, is used for every possible purpose: explosives, fusion reactors to power ships, small generators, as armor, as a blood supplement, can be liquefied to work in small handheld weapons, to make star-gates, ship hulls, and as currency in interstellar exchange (from Stargate wiki). Naquadah is the combined Unobtainium and Applied Phlebotinum of Stargate.

Arguments that fuel consumption should be included in GGDM logistics are really arguments for the introduction of 'plot fuel' to the game, if the participants do not already have enough to drive the story. Even when couched in 'realistic' terms, as a necessary realism to make the GGDM (or any sci-fi) setting credible, what is actually meant, is that the game needs 20th Century plot fuel. TV series writers, still living in the 20th century and not yet comprehending the consequences of nuclear-powered submarines and carriers, cannot resist adding 20th Century plot fuel.

Yes, there are two paths you can go by (snorting dilithium crystals or drinking liquid naquadah), but once a game of GGDM is started, it will be difficult to change the road you are on. For design simplicity and from the comprehensive view, GGDM chose not to track fuel. But participants can add it if they wish another layer of complexity.

"In late 1944, Admiral Raymond Spruance had begun preparing to bomb the Japanese Home Islands to eliminate the air threat to the planned invasions of Iwo Jima and Okinawa. He realized that the primary hurdle to keeping his 12 aircraft carriers and associated escorts on station would not be fuel but rather ammunition. It would take only three days for the ships to expend their ordnance, after which they would have to make a 2,000-nm, 12-day sail to Ulithi Atoll and back – meaning only six days of bombing could occur per month.

Admiral Spruance directed the development of a method for transferring ordnance and stores at sea, ultimately approving the Burton Method (named for the development team's leader, Captain Burton Biggs), an adaptation of the pier-side process that used existing cargo winches on both the delivery ship and aircraft carrier. On 23 February 1945, the USS Shasta (AE-6) conducted the first underway ammunition replenishment, by breaking ammunition out on deck by hand – including rolling bombs across the deck – and then levering it to the USS Bennington (CV-20)."

– Commander John A. Lukacs IV, USN, "A Century of Replenishment at Sea," CNO Naval History Essay Contest 2017, pub. August 8, 2018 on www.history.navy.mil ⁷

Logistical Support Ships: Ships which are in a system without a supporting colony may be supplied from Log Ships if they are carrying *Supplies*. "Log Ship" is short for Logistical Support Ship, and Log Ships may only be constructed after successfully acquiring or prosecuting the Logistical Support Ship Existential Patent. Log Ships cost 15 RPs each to build, Orbital Shipyard required; they are constructed in the same way as any other starship.

- ✓ Log Ships may never use anything they are carrying except *Supplies*. Log Ships are never required to use *Supplies* to extend their own OSL.
- **Sutlers not Settlers:** The Logistical Ship rules are written on the assumption generally that they are owned by the government and are part of a regular, controlled supply system of a modern naval force or army. See Nationalist Armies discussion, 4 Colleges p. 502, *supra*. For most of history, however, soldiers were often required to supply their own kit and bring or purchase their own provisions; sutlers were merchants who followed the army and sold provisions to the soldiers (just as legend has it that "hooker" as a name for a prostitute came from those who followed General Hooker's army in the American Civil War, and who is to say there wouldn't be a class of professional ship prostitutes?⁸). However, should Logistical Ships and/or supply become the operation of a Corporation (see Corporation Games, 1 Corporations, p. 1243, *infra*), they might be considered sutlers in GGDM. On the other hand, positions in GGDM represent the government and Native Population Type nearly inseparably, so anything built or owned by the position *might be said to be owned both by the government and the civilization*.
 - ✓ If players believe and treat GGDM Regular Turns as representing multi-generational periods, Combat Rounds may represent a generation and each warship and Log Ship may be also a seed ship, familial generation ship of sorts, hatchery, or regeneration chamber. Luckily, Supplies do not 'age-out.'
- **Take Your Protein Pills:** Log Ships may carry four types of items: *Supplies*, Fighters, expendable Enhancements, and Ship Missiles. *Supplies* is a generic term that is used to abstractly represent all of the types of items that a starship needs (including replacement crew), except replacement Fighters and Missiles, and expendable Enhancements.

The capacity of a Log Ship to carry Supplies, Fighters, Missiles and Enhancements is measured in the RP value of what it can carry, and their initial capacity is detailed on the Logistical Support Ship Existential Patent. Like other PIT Patents, the 20 RPs capacity of 1st Era Log Ships are capable of being improved by use of COT and ET Patents and it is also possible to create specialized classes of Log Ships that carry only one type of resupply item and/or

possibly perform additional services. Log Ships may not load or transport RPs, those may only be transported by Cargo Ships,⁹ nor may they be used to transport population.

- ✓ Log System Boats and Log Tenders are possible, see System Boats, 3 Construction, p. 677, *supra*. Their practicality may be circumstantial.

- Empty Cans: Log Ships *may not be used* to supply Colony Transports or any sort of Colony Ship or ship carrying population (other than Ground Units, see Beans, Bullets & Bandages, 4 Combat, p. 988, *infra*); it is just beyond their capacity to provide that much supply. Non-supply of Colony Ships is a rule for game convenience and to keep the logistics somewhat realistic.¹⁰ Beyond this is a maze of ambiguities about the time length represented by Regular Turns, how much a population factor represents, and the technologies and capabilities involved in Colony Ships (e.g., are they in stasis? are they eggs?), OFL/OSL and Log Ships. Though it might be possible to eventually allow Log Ships to supply Colony Ships, this ability should be developed at great cost and consideration.

Page | 861

The primary purpose of Log Ships is to supply warships in systems without a supporting colony; *they are the symbol of the financial cost of power projection in GGDM*. OFL represents the operational range of warships and colony ships not going to destinations with a supporting colony. Warships can remain indefinitely in a system as long as Log Ships provide *Supplies*.¹¹ However, Log Ships also carry and deliver enhancements (from Enhancement Technology Patents, e.g., Fighters, Missiles) to any eligible ship, base, colony or installation.

- ✓ If nobody builds warships, nobody needs to build Log Ships. Right?

Colonies are assumed in GGDM to be self-sufficient, so whether a Log Ship can supply a colony is a moot question and no rules are provided for it. However, should the drama of the story unfold so that a colony needs to be supplied (*à la* the Berlin Airlift), Log Ships might keep a small colony supplied below domestic subsistence levels for a short while, and the participants will need to wing it on the rules for this.

- ✓ My mother used to call empty jugs and large bottles, “dead soldiers” when I was young. She is the only one I have ever heard use that term. But if you Google “dead soldiers definition,” the result comes up in Wiktionary and a half-dozen non-mainstream dictionary sites.

- Running Outatime: Transferring *anything* from Log Ships may only occur if both the Log Ship and the other ship or colony are in the same system *at the beginning of the Regular Turn*. Recall that ships conducting Short Movement (or ‘heroic movement’) arrive in the destination system on the same Regular Turn they departed the origin, that is, before the beginning of the next turn. So they could begin the Regular Turn in the same system as the target ship or colony.

Ships making Long Movements arrive before the first Power Activation of the turn, but would not be in the same system as the target ship or colony *at the beginning of the turn* of their arrival. See Long Jump, 2 Movement, p. 851, *supra*. However, arrival before the first Power Activation still allows Log Ships to receive Supplies and Enhancements from colonies using the Construction Power Activation (see Costly Resupply and Transfers, 3 Construction, pp. 679-680, *supra*) or perform other tasks.

- ✓ Hugh de Cressingham, a French-speaking knight serving as the King’s Treasurer in Scotland, accompanied the English army commanded by the Earl of Surrey in 1297 to

put down the Scottish revolt led by Wallace and Moray. Hugh was hated by the Scots and not liked by the English.¹² One of the stories surrounding the English defeat at the Battle of Stirling Bridge, is that Sir Hugh was impatient with the *cost per day* of keeping the English army (plus Scottish defectors) in the field, and he convinced the Earl to make an ill-advised, tactically disadvantageous attack across the wooden bridge against Scottish infantry on the heights on the other side of the river. Hugh was upset with the Earl's delays and wanted the matter concluded quickly; he was killed and his body mutilated while leading the attack across the bridge while the Earl remained with about half of the English force on the other side of the bridge. As the Earl retreated south after the battle, many of the Scottish defectors reverted to the Scottish side and attacked the English supply train at The Pows marsh.

Time is important not only in timing, but in cost per Regular Turn to keep ships, boats, and Ground Units supplied. It is probable that most situations will be decided by supply and cost considerations in equal or greater measure than other factors of the moment, combats will be short and brutal, colony sieges will be expensive and time consuming.

- Running on Empty: The transfer of anything from a Log Ship never occurs automatically in a non-combat situation (thus, the position that fails to submit Actions may lose ships), and it occurs before the first Power Activation of the Regular Turn, and should be included in the position's Regular Turn Actions when submitted to the Concierge.
 - ✓ Transferring anything *from* a Log Ship does not require a Power Activation.
 - ✓ Transferring anything *to* a Log Ship *from another ship* does not require a Power Activation.
 - ✓ Transferring anything *to* a Log Ship (or any other ship) *from a colony* requires an activation of the Construction Power for the purposes of Ship Supply (see 3 Construction, Costly Resupply and Transfer, pp. 679-680, *supra*).
 - ✓ Ships receiving Supplies from Log Ships do not have to make a Supply Roll if they have exceeded their OSL on the Regular Turn they receive Supplies (*ut infra*).
 - ✓ Log Ships will automatically consume their own Supplies to avoid Supply Rolls if they have exceeded their own OSL unless otherwise indicated, and all Supply Rolls are made after Supplies are distributed to other ships, so Log Ships could be forced to make Supply Rolls to keep other units supplied.
 - Taking job applications for Log Ship crew positions...

If a Log Ship can give up all of its *Supplies* to prevent three other ships from making Supply Rolls for a Regular Turn, but the Log Ship then has to make a Supply Roll that might not be a bad bargain.

- ✓ “Underway replenishment was the U.S. Navy’s secret weapon of World War II.” – Fleet Admiral Chester Nimitz, U.S. Navy.
- Limping Home: Nothing can be transferred or supplied to other ships while in interstellar flight, transfers may only be accomplished when the ships are in a starsystem together. However, Supplies may be transferred at any time before Operational Supply Limitation expires and the early transfer and consumption of supplies *tolls the running* of the OSL limit for the supplied ship for that turn (that is, the turn in which the supplies are transferred to the other

ship does not count against the OSL), such that it becomes possible for the ship(s) to make it back to a supporting colony before their OSL expires. In short, Supplies buy extra OSL. A Log Ship may only transfer one turn of supplies to each ship each Regular Turn and cannot leave supplies (or anything) in cold, irradiated system space to be picked up; a Log Ship cannot dump and run; however, this is an area that might be improved by Colleges or Patents.

A ship in an unsupported system that has expired OFL and OSL can be kept alive indefinitely turn by turn by being supplied by Log Ships. Supplies are transferred at the beginning of the turn, so the ship would need to be able to reach a supporting colony in one Regular Turn of movement (a Short Movement) before having to make Supply Rolls in flight. Log Ships cannot transfer Supplies by accompanying the ship during movement. At some point, a ship with expired OFL/OSL will either need to be abandoned, or a colony established in the system, or it will need to take chances on Supply Rolls to reach a supporting colony.

➤ A Hot Dinner: No ship may transfer remaining Regular Turns of OSL (or OFL) to any other ship, and only Log Ships may transfer *Supplies*. Cargo Ships cannot transfer RPs to other ships (or System Boat) to be used as *Supplies* (or for any other use). The RP cost of supplying a ship for one *Regular Turn* is 10% of the base construction cost of the ship plus the *current* RP value of any Fighter Complement (or System Boats). Transfer of Supplies *are never required or allowed* during Combat Rounds; this should not be confused with Combat Re-supply of Fighters, Ship Missiles and Enhancements described in 4 Movement, p. 868, *infra*.

- ✓ A 1st Era Log ship fully loaded with *Supplies* (20 RPs) can support 200 RPs of ships, boats and fighters for a Regular Turn beyond their OSL.
- ✓ This is a completely arbitrary value and not based on any real world data, though it would be interesting to see, for example, how much it costs the U.S. Navy per year to operate the USS Little Rock II as compared to its \$440 million USD construction cost. That said, GGDM is rather fuzzy in many areas – such as actual time – and is a science-fiction setting, many things are assumed to occur for accounting purposes, without cost, so the 10% of value is not a huge stretch and should not be reduced quickly or easily by Patents or other means.

System Boats on Tender Ships could be treated as Fighter Complements for this purpose; that is, while the Tender is within its OSL, the System Boats are assumed to be supplied by the Tender, but if being supported by Log Ships, the System Boats are supported at their base construction cost in RPs (and System Boats are a lot cheaper than starships so this is an interesting option in logistics). System Boats whose supporting colonies have been destroyed or captured require supply from a Log Ship or they will perish, as they have no inherent OSL. See System Boats, 3 Construction, p. 677, *supra*.

- ✓ A Log Ship that, at the *beginning* of the Regular Turn, supplies units in any ongoing combat, except Ground Combat, will automatically join the combat, see Victuals & Vitals, 3 Combat, p. 975, *supra*, unless it initiates interstellar movement on the same Regular Turn (possible when arriving by Short ‘heroic’ Movement – arrive end of previous turn, supply, jump out).

The supplies are subtracted from the Log Ship at the beginning of the Regular Turn. An empty Log Ship still has its own OSL, and does not need to make Supply Rolls until its OSL expires, but cannot transfer its remaining turns of OSL to any other ship.

- The Cold Equations: The Concierge will (attempt to) keep track of the Operational Supply Limitations of ships; player assistance and honesty would be appreciated if the Concierge misses any detail (likely, this bookkeeping can be better performed by a computer assistant).

Since a ship (theoretically) may never leave for a destination star whose travel time in Regular Turns exceeds its Operational Flight Limitations (and there is no FTL resupply) including known Temporal Disturbance modifiers, there is no need to track the OFL of a ship.

Scouts should be used for exploration (having two extra turns of OFL), but it is possible that sometimes a non-Scout ship may run out of OFL and perish going to an unexplored system that has a Temporal Disturbance Modifier.

- ✓ Any ship which has exceeded its Operational Supply Limitation (*including* during interstellar flight to a supported system) must make a Supply Roll on one ten-sided die prior to the first Power Activation of each Regular Turn, if the die roll result is less than or equal to the total number of rounds the ship has been out of supply plus 2, it is destroyed instantly for lack of supply. Note that an unlucky ship can be destroyed on the first Supply Roll if the result is ‘1,’ ‘2’ or ‘3.’
- ✓ Any ship, except Scouts, which departs from a system without a supporting colony may only have a destination system assigned which has a known supporting colony.
- ✓ If all supporting colonies in the destination system are eliminated or captured prior to the arrival of the ships *en route* from an unsupported system, those ships must make Supply Rolls on subsequent turns if they have exceeded their OSL and are not supplied by Log Ships. The ships may automatically initiate combat (at the discretion of the Concierge, based on the situation) without the need for a Combat Power Activation, if the ships (or System Boats) are capable of combat, to try to liberate the supporting colony (if it still exists).

There is a dynamic between OSL and Log Ships; the longer the OSL, the less need there is for Log Ships. Exceptional OSL capabilities later may render early game Log Ships obsolete. On the other hand, some positions may determine that it is cheaper or better to build new ships than to keep supplying unsupported ships, or that they will take their chances on Supply Rolls each turn. Log Ships cannot help or extend OFL but benefit from it.

- ✓ “The Cold Equations” is the title of a classic brutal two-people-in-a-room sci-fi short story by Tom Godwin,¹³ published in *Astounding Magazine* in 1954. It was made into a not-well-received TV movie in 1996, from a 1989 *Twilight Zone* episode that was based on the short story (neither of which I have seen). I found the complete short story available free on the internet in PDF or in webpage format, on several sites in June 2018. I read it an anthology long ago and recommend reading it.
- Hollow Logs: You never know what you will find inside a hollow log, but the list of things you won’t find is fairly short and to the point. Empty Log Ships may be refilled at any eligible colony by activation of the Construction Power at that colony for the purpose of Ship Supply during any turn which the Log Ship began the turn in the colony’s starsystem.¹⁴

“Long ago, the peaceful population of the planet of Krikkit, unaware of the rest of the Universe due to a dust cloud that surrounded its solar system, were surprised to find the wreckage of a spacecraft on their planet. Reverse engineering the vessel, they explored past the dust cloud and saw the rest of the Universe, immediately taking a disliking to it and determining it must go. They built a fleet of ships and robots to attack the rest of the Universe in a brutal onslaught known as the Krikkit Wars, but were eventually defeated. Realizing that the Krikkit population would not be satisfied alongside the existence of the rest of the Universe, it was decided to envelop the system in a Slo-Time envelope, allowing Krikkit to survive long after the rest of the universe has ended; the Wikkit Gate was the key to the envelope.”

– from Wikipedia article, “Life, The Universe, and Everything,” captured August 15, 2019¹⁵

Blinded by the Light: Creatures evolved in the eternal brightness of the center of the galaxy would not – from our perspective, know darkness (unless they went underground). They would not be able to make out much of the other stars around them and would not be able to see beyond the glow of the galactic core; they would for the most part, be ignorant of the existence of other galaxies, the Big Bang, and the vastness of the cosmos. Science-fiction literature has not much discussed species evolved in the center of the galaxy – and the question of whether or not anything is even remotely possible has never been explored in any story (TTBOMK); instead, space-opera fiction assumes creatures like ourselves who evolved in the spiral arms of the galaxy. Likewise, galactic empire science-fiction trope dances around the core of the galaxy; it is never quite clear whether or to what extent the supposed galactic empire includes the core of the galaxy. Galactic Empires in fiction (including GGDM) can be largely assumed to exist around the rim, spiral arms of the Milky Way Galaxy.¹⁶

“Light thinks it travels faster than anything, but it is wrong. No matter how fast light travels, it finds that darkness has got there first, and is waiting for it.” – Terry Pratchett

Endnotes.

¹ Citation: See wave function collapse discussion, Peek-a-Boo, 2 Expansion, p. 893, *infra*.

² Commentary: There is a saying commonly attributed to Sun Tzu that circulates freely around the internet: “*The line between disorder and order lies in logistics.*” I thought it was odd when I read it because while they must certainly have had an idea of supply sources and supply lines, I doubted that a concept comparable to modern logistics (similar to retroactively applying technology to prehistoric times) existed. I thought at the most, he might have said supplies and someone adulterated the phrase by putting in ‘logistics.’ It turns out he didn’t say either one:

- ✓ The quote in question appears to originate from a loose translation of a phrase from Chapter 5 Verse 4 of Sun Tzu’s book, which deals with coordination. Specifically, the relevant verse reads:

*‘Amidst the chaos of a sea of flags in the battlefield, order must be maintained. Even when the view is unclear, adherence to an army’s formation will ensure it cannot be defeated. Yet, **disorder can arise from order**, fear from bravery and weakness from strength. **Orderliness can be fostered (or instilled) via coordination**, bravery via the impetus of a situation and strength via training. A commander may stir an enemy (i.e. disrupt its formation) by misleading it with an enticement of a false advantage, from which point the enemy can be defeated by troops lying in wait.’*

Hence, the specific phrase that deals with order/disorder is in reality linked to the notion of coordination among the various combat units of an army, rather than the notion of logistics.” – S.H.G. (a logistics professional), “‘The line between disorder and order lies in logistics.’ Did Sun Tzu really say that?” LinkedIn Pulse, December 28, 2018 (italics and bold in original).

³ Citation: Information from Wikipedia article, “12th SS Panzer Division Hitlerjugend,” October 5, 2018, citing to opinion of historian Marc Milner.

⁴ Commentary: “Ossal” is the German word that translates as “osseous” in English, which means boney or ossified. You can read whatever meaning you want into it in relation to Operational Supply Limitations, but mainly, it just was similar to “offal” that represents OFL, Operational Flight Limitations.

⁵ Commentary: What is presented here has been the classic historical analysis. There are many articles on the subject on the internet. There may be some revisionist arguments on small points, for example, regarding the Japanese 1st Class Submarines, and that codebreaking and industrial capacity had more to do with the U.S. submarine successes than individual submarine superiority. But the overall results were significant and undeniable.

⁶ Commentary: OFL/OSL is the basis of Arthur C. Clarke’s personal ♥ novel, The Songs of Distant Earth (1986) which he took nearly 30 years to develop from the 1958 short story. This was a sci-fi trend of the early 80s, I bought (and still have) four Foundation books in hardback when Foundation’s Edge was published in 1982, 30 years after the original three Asimov novels. Maybe this is the ‘way’ things of this sort work, had GGDM been published as a short story in 1992-1993, the final version of GGDM in 2020 would be the novel over 25 years later.

⁷ Commentary: In 1988, I watched U.S. Navy ships practice transferring casualties from ship to ship underway between Okinawa and the Philippines.

⁸ Commentary: Perhaps something like the “furniture” in Soy lent Green?

⁹ Commentary: A rather arbitrary distinction to be sure, but at the negotiations for the Sirius-Proxima Treaty of 13,013 GE (approximately 2,500 B.C. on Earth), the Log Pilot’s Union sought to avoid having Log Ships mistakenly shot at as Cargo Ships. In return, the Cargo Pilot’s Union negotiated a clause that allows warships to use heavy weapons and missiles on properly identified Log Ship targets, but not on Cargo Ships. It was this same treaty that, unbeknownst to our ancestors, made Earth the property of Deep Green. The Earth is primarily blue from space, of course, but the little green men are working hard to change that by guiding us toward industrial technologies that produce greenhouse gases and emissions that cause global warming. Their objective is to replace us with an advanced and enlightened global consciousness algae civilization.

¹⁰ Commentary: I may be just a paralegal, but I won one in front of a judge by a practical legal logistics argument. We were defending a petition by the opposition to remove the case to New York courts. One of the prime witnesses in the case had refused to appear for depositions and had refused to cooperate even with his own counsel, despite being threatened with sanctions by the judge. I suggested an argument based on the difficulty of getting this indispensable, uncooperative, belligerent witness to appear in court in another state. The attorney who was then writing the response brief said, ‘Hey, that’s a pretty good argument.’ He included it in the brief as the third or fourth argument; when the judge issued an opinion and order, the very first reason he cited to denying the petition was my argument. The attorney said afterward, “Yours was the winning argument, it was the first argument the judge cited.”

¹¹ Citation & Commentary: “Napoleon recommended all soldiers to ‘read and re-read’ the campaigns of Turenne as one of the great captains. His fame as a general rivalled that of any other in Europe ... for his military character epitomized the art of war of his time.... Strategic caution and *logistic accuracy*, combined with *brilliant dash in small combats* and constancy under all circumstances – of success or failure – perhaps emerge as the salient points of Turenne’s genius for war. Great battles he avoided. ‘Few sieges and many combats’ he used as his own maxim. And, unlike his great rival Condé, who appeared as brilliant in his first battle as in his last, Turenne improved day by day. Napoleon said of him that, his genius grew bolder as it grew older.... In his personal character Turenne showed little more than the nature of a simple and honourable soldier, endowed with much tact... Thus, though Condé’s genius appeared far more versatile, Turenne’s genius best represents the art of war in the 17th century. For *the small, costly, and highly trained regular armies*, and for the dynastic warfare of the age of Louis XIV, Turenne functioned as the ideal army leader.” – from Wikipedia article, “Henri de La Tour d’Auvergne, Viscount of Turenne,” October 2, 2018 (emphasis added). Logistic accuracy is vitally important in GGDM operations, ships are expensive.

- ✓ “There was nothing spectacular about such methods as compared to the bloody onslaughts of the past decade. Where other generals strove to duplicate the victories, Turenne had studied in detail the troop movements of Maurice and Gustavus. Avoiding encounters unless he possessed an overwhelming advantage, he relied upon caution, surprise and logistic precision to manoeuvre the enemy into wasted territory while retaining his own sources of supply... He was, in short, a painstaking master of small war; and in 1648 his strategy brought the struggle to a close with an almost bloodless triumph of manoeuvre.” – Lynn Montross, *War Through the Ages* (3rd Ed., 1960), p. 292.
 - Note, Maurice of Nassau was Turenne’s uncle to which he was apprenticed as an *aid-de-camp* in 1626, rising from private to colonel in five years on merit alone (*Id.*, p. 291). Sort of like a ‘coaching tree’ in modern sports.
- ✓ Losing a conflict due to maneuver (e.g., see also discussion of the Battle of Angora, 1402 A.D., 3 Carriers & Fighters, EN 4, p. 1076, *infra*) is like losing a game of Mahjongg due to the set up – you have lost the game before you play off the first pair of tiles and there is nothing you can do or could have done! Most infuriating are the games where, in order to make any progress, you must play off a pair of tile X, only to find later that the other pair of tile X is at the bottom stacked on top of each other – and you lose due to something you could not have possibly seen in advance. Yeah, it’s like that.

¹² Commentary: Granted that the Treasurer’s job is a thankless job in most times and places, especially in a foreign-occupied kingdom. But it was the road that Sir Hugh chose to personal power, as the King’s financial enforcer, and he seems to have been arrogant about it and also inhumane toward the Scots.

- ✓ The fact that he was a knight (back when knights were knights), that is, a soldier, and *de facto* co-commander of the English forces (and the Earl of Surrey wasn’t a strong personality), while also being the King’s Treasurer demonstrates the perils of the failure of Unity of Command (Clausewitz) and of the blurring of military and civil office (see The Fog of Lützen discussion, 4 Colleges, p. 510, *supra*). In addition, Hugh had also been involved in law enforcement as the Bailiff of Haverford, was a King’s Justice in the northern counties, and had held clerical administrative positions as rectors and was receiving clergyman stipends (*prebends*) from several churches. The Church stipends would have come from the donations and tithes collected from the poor masses, and it is not certain for what services he was being paid the stipends – to modern sensibilities, this seems like appalling entitlement and corruption.

¹³ Commentary: Author Tom Godwin should not be confused with the originator of Godwin’s Law, attorney and author Mike Godwin.

¹⁴ Commentary: About 1988 or 1989, I heard about a space-opera empire-building video game (I had an Atari 1040 ST at the time) which was logistics heavy; that before each military campaign, it was important to spend years/turns storing supplies, setting up the political and propaganda side, and moving stuff into position at frontier colonies. I do not now remember the name of the game and I never played it, but I am sure it was not Sun Dog, or Captain Blood, two other games I heard about at the time but also never played (we played lots of Colonial Conquest, Lords of Conquest, and Time Bandit on Atari STs). Nonetheless, the concept stuck in my mind and I believe it influenced my design project as did the following memory: I also recall hearing of another game around that time, which again, I never played and cannot recall the title, where the larger an empire gets the more it loses to corruption, thus slowing the growth of interstellar empires. Maybe they were the same game? I like concepts, ideas.

- ✓ In historical reality, the same occurred before the Ottoman Turks attempted to capture Vienna in 1683 A.D.: They spent a decade building up supplies, troops and cannons on the frontier before moving. Because of the experience of the previous siege of Vienna in 1529 A.D., the Ottoman commander bypassed fortresses and cities to reach Vienna in mid-July 1683 A.D. – the previous attempt in 1529 A.D. failed mainly because the Ottoman army didn’t arrive at Vienna until very late September and was able to maintain the siege for only two weeks. This may have been the inspiration behind the game mentioned above.

¹⁵ Commentary: I think I read *Life, The Universe and Everything* (1982) when I was young (in the late 1980s) but I don’t seem to remember this. Maybe I only read part of it. Whatever I read didn’t leave an impression.

¹⁶ Commentary: Conversely, creatures evolved in a galaxy located in a super void would also possibly not be aware of other galaxies beyond their own due to the fact it takes light up to a billion years to reach across a super void area. Science-fiction also avoids voids and super voids, though some have noted small local ‘rifts’ and ‘empty expanses.’