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See Appendix CEX – Combat Example
See Appendix CST – Combat Shifts & Situations Tables

Ender Wiggin: *All fighters fall back and surround Petra's ship!*

Copy that.

Ender Wiggin: *I want rings within rings. Layers upon layer. Every fighter we have!*

Dink: *Ender, you're gonna leave our transporters defenseless!*

Ender Wiggin: *If we're gonna win this battle, Dink, it's all or nothing now! When the outer layer is hit, the wreckage will continue to drift with us, like a shield. Do it now!*

Mazer: *He's abandoning his entire fleet.*

Col. Graf: *He's in command. There's no stopping him now.*

– Ender's Game (2013)

Combat Screening: Combat Screening is a formation where one or more ships, Fighter Complements, System Defense Boats, or System or Orbital Defense Bases are assigned to protect another unit by intercepting any attempt to attack the protected unit, or at least placing themselves between the attacker and the target.

- ✓ Orbital Defense Bases may only Combat Screen Orbital Cities, Orbital Defense Bases, Orbital Shipyards, keels (i.e. unfinished ships) and ships that have taken shelter at the colony.
- ✓ Fighters may Combat Screen anything.
- ✓ Warships may only Combat Screen other ships, including Cargo Ships and Colony Ships attempting to reach a Besieged Colony.
 - The *premier* Combat Screening action of WWII in Europe – the Battle of the Barents Sea in December 1942 – involved no carriers, and few aircraft and submarines. The heavier German surface ships were unable to attack the merchant ship convoy, being successfully intercepted in all directions.
- ✓ Cargo Ships, Colony Ships, Log Ships, Scout Ships and unarmed System Boats, or any ship or unit with no attack ability (i.e. *ability to initiate combat*), may never Combat Screen another ship or Defense Base because they pose no credible threat to the attacker.
- ✓ Combat Screening of or by Ground Units and Fighters in Ground Combat was discussed previously in Dropping In, Ground Combat Resolution, and Air Attacks in Ground Combat, 4 Combat, pp. 991, 993, 996, respectively, *supra*. Obviously, the unit screening another unit must have the *ability to initiate combat in the theater of operation* (see Keep Your Friends Close, Your Enemies Closer, 3 Combat, p. 972, *supra*), thus Ground Units cannot Combat Screen units in non-Ground Combat situations.

Prior to resolving the first Fighter Attacks, the Concierge (or computer assistant) will need to look at the orders issued by each position and determine which units are being Combat Screened and by whom on each side. Thus, the order in which Combat Screening actions are

listed should not matter in the round, but it would probably be best practice to group them near or at the top of the position's Combat Orders.

- Bugs on the Screen Door: All Combat Screening assignments must be included in the Combat Orders sent to the Concierge each round; Combat Screening assignments do not carry-over from round to round, therefore, the Concierge must be informed of Combat Screening assignments each Combat Round.

A ship, Defense Base or Fighter Complement assigned to Combat Screening cannot do anything else for the Combat Round; they cannot attack (except with Ship Missiles, see First Fire, 4 Carriers & Fighters, p. 1080, *infra*), or attempt a retreat (exception, Fighters Combat Screening their retreating Carrier, see Carrier Operations, 1 Carriers & Fighters, p. 1050, *supra*): their assigned target for the round is the unit they are protecting. All Combat Screening actions must include the specific unit (*not group, type or class, not "I am screening all Log Ships"*) that is being protected, generally, specific Carriers, Tenders,¹ Troop Transports (especially those joining a Colony Combat), Cargo Ships, Colony Ships, and Log Ships, orbital platforms, boats, and keels will be protected by Combat Screening. A unit assigned to Combat Screen *cannot be itself Combat Screened by other units!*

- ✓ This would be an interesting tactic though, layers of Combat Screens, but, eventually, someone has to attack (Combat Screening other *Combat Screeners* may be the GGDM equivalent of the 16th Century caracole cavalry tactic, but using Fighters and Ship Missiles²). The initial prohibition above is premised on the idea that the unit performing the Combat Screen must have absolute freedom of movement, other than being tied to the unit it is screening. High-level training and computer modeling (i.e. College faculties, Doctrinal Templates, technologies) could nullify the prohibition.
- Fighter Screens: Fighter Complements may either Combat Screen one target and Intercept two attackers per Combat Round, or may divide to Combat Screen two targets and each part will only have one Intercept for the Combat Round. Fighter Complements cannot target other Fighter Complements normally, but Fighter Complements intercepting attacking Fighter Complements results in a Dogfight (p. 1072, *ut infra*) between Fighter Complements (resolved one *sortie* at a time). As in Fighter Combat (see Blacksheep, 2 Carriers & Fighters, p. 1054, *supra*), Fighter Complements executing Combat Screens are resolved separately by sorties, however, the combat action of the Fighter Complement for the round is to Combat Screen, i.e. a Fighter Complement cannot divide its two sorties, with one Combat Screening and one attacking normally, it is doing one or the other.
- Buddy-Buddy: Carriers are not prevented from launching their Fighters to attack targets by being Combat Screened by others. One form of Carrier fleet tactics might be a 'buddy system' where one Carrier's Fighter Complement Combat Screens another Carrier whose Fighter Complements attack the enemy or screens other units.³ Regular ships also might protect the Carrier from non-Fighter attacks while its Fighters attack the enemy.
 - ✓ When a target is being Combat Screened by both Fighter Complements and non-Fighter units, the Concierge (or game program) will do his best to assign the best protector to each attacker as they come in order. For example, if a Fighter Complement and one other warship is protecting a Carrier, the warship would not be sent to intercept an opposing Fighter Complement trying to attack the Carrier. If only Fighter

Complements attack the Carrier, the warship may never have an intercept opportunity. There are some decisions, such as Interceptions, that may be made by the Concierge (or game program) during processing, without consulting the position players.

- Colony Screens: A colony may be Combat Screened as one unit by Fighter Complements only against Raids or Strike Combats. All attacking Fighters will be automatically intercepted by the Fighter screen and the interception will be resolved as one Dogfight (p. 1072, *ut infra*). Half of the attacking Fighters that survive the Dogfight may immediately execute the Raid or Strike on the colony.
 - ✓ Defense Bases may not Combat Screen a colony, but may Combat Screen things in orbit at the colony. Ground Bases may not Combat Screen but may be Combat Screened by Fighters only in Colony Combat. Orbital Bases may only Combat Screen other orbital platforms and ships and boats at the colony planet (p. 1067, *ut supra*). System Bases may only Combat Screen ships and boats at the colony. Defense Bases cannot intercept Fighters.
- Normal Interception: A ship, Defense Base or Fighter Complement assigned to Combat Screen a target will move to Intercept the first unit *that it is capable of seeing and hitting* that attempts to attack the target. T-Ships in Ambush Mode *may not be Intercepted*, see Ambush-whacked, 7 Combat, p. 1038, *supra*, unless the Interceptor has a Temporal Sensor.

In an Interception situation, the Interceptor will fire first, regardless of status as the attacker or defender in the combat.

- ✓ Interception is being used loosely here, and the normal mental picture may not always fit the circumstances. For example, a System Defense Base is screening a Cargo Ship in combat. ‘Moving to Intercept’ in that case is more likely the Cargo Ship moving behind the System Defense Base than the System Defense Base moving out to challenge the attacker. What is the difference? The attacker has to come close...
- ✓ In July 2019, five speed boats of the Iranian Revolutionary Guard naval forces attempted to divert a British tanker in the Strait of Hormuz. A British Royal Navy frigate which had been trailing the tanker (was the tanker bait?) came up behind during the incident and ordered the Iranian boats to bugger off. The frigate is armed with automatic 30mm deck guns expressly for the purpose of repelling small boats and probably had air support coming up. The Iranians veered away.

If the Interceptor successfully attacks the attacking unit (in ship or base vs. ship, a “hit”; in Fighter Complement vs. ship, an “Engaged” result), the attacker is stopped and may only fire at the Interceptor (the attacker’s Combat Orders will automatically be changed to fire at the Interceptor), which may be sacraf... expendab... uh, destroyed. If the Interceptor does not successfully attack the attacker, the attacker has broken through the Combat Screen and may fire at the target. However, the target receives one Defensive Shift due to the efforts of the Interceptor. All attacks on the target are resolved together after all Interception attempts.

- ✓ Attackers Intercepted by an Orbital Defense Base receive one Defensive Shift against the attack of the Orbital Defense Base (due to mobility disparity).

There is *no die roll* for Interception, it happens automatically; the only criteria is whether the Interceptor could credibly threaten the attacker with destruction. Thus, Enlightenment will

never be used to cause or avoid an Interception, nor will Interceptions be prevented by pre-Interception Engaged results on the attacker from Fighter attacks, but of course, a second Engaged result from Intercepting Fighters will not only stop the attack, but destroy the attacker. Enlightenment rerolls may play a critical role in successful Interception by increasing the Interceptor's chance to hit the attacker and protect the target (*if* Fighters were allowed to use Enlightenment that round), while pre-Interception Engaged results against the Interceptors will lessen their chances of hitting. There are many combined arms dynamics at work.

- ✓ Because both sides issue Combat Orders independently before the Combat Round is resolved, regular warships assigned to Combat Screen other ships may be attacked before or after (depending on the order of processing) moving to Intercept other attacking regular warships (but it's all simultaneous, so it doesn't matter anyway). Regular warships assigned to Combat Screen other ships may also be attacked by Fighters and Engaged during the Fighter portion of the Combat Round, which reduces their chance of a successful Interception of regular ships. But they will get a Close-in Defense Fire at the Fighters in any case. This whole process can be very dynamic.
- Second Interceptions: A ship or base that fails to Intercept the first attacker may attempt to Intercept a second attacker against its target unit, *if the target unit of the screening has not been destroyed*. A Fighter Complement that is not divided between Combat Screening two separate targets, may always attempt to Intercept additional attackers until it successfully Intercepts a second attacker. A Fighter Complement that is assigned to Combat Screening may never use both of its *sorties* on the first Interception. Therefore, the only possible result of a successful Interception by a Fighter Complement is an Engaged result stopping the attacker.
 - ✓ This is the point to remember that Combat Orders are processed in the order listed. The Interceptors act automatically, taking the first comer and the second comer if they are able. They may be drawn off by smaller ships before the big ship punches through to attack the target. There is, of course, a cost to this and tactical circumstances where that option will not be available. And a tactical counter – an entire fleet can be set to protect one or two ships if they think the attacker is going after them.
- Nolo Contendre: Regular ships (incl. Carriers) and bases assigned to Combat Screen a target may not intercept attacking Fighter Complements. The fast, agile, numerous Fighters just spread out and go around the lumbering interceptor (like you trying to intercept a swarm of bees). Only Fighter Complements may intercept attacking Fighter Complements.
 - ✓ Massed fighter combats in space on the big screen have classically been portrayed as cavalry-like affairs where the forces charge at each other firing wildly, pass, come back around and do it again until the affair devolves in a big swirling dogfight between individual fighters.⁴ Other times, as in Babylon 5 battles, the fighter screens may pass through each other firing, then each proceed to attack the big capital ships behind the fighter screen. Critics of space-opera movies find this somewhat absurd, but this is what the participants will surely envision and GGDM's fighter rules are built on that premise. The main criticism of it all is that space fighters in movies act like aircraft on Earth, but still, it is difficult to imagine that tactics would change greatly or that fighters would just sit and shoot, even if they properly acted as spacecraft (e.g., Babylon 5's Starfuries).

“This paper extends its author’s earlier use of Joseph Tainter’s theory that a tendency toward diminishing returns on investments in complexity is the source of the collapse of complex societies to analyze the current trend of international economic life, and its implications for international security.

Specifically it contends that the post-World War II international economic order, particularly from the 1970s on, has grown increasingly complex (as the level of integration, information flows and the structure of economic activities indicate), while offering diminishing returns on that complexity, and with it, shrinking slack making for a system that is both more stressed and more fragile (evident in slowing growth and increasing indebtedness). The paper also identifies some of the possible causes for this trend (like technological stagnation and natural resource depletion).”

– Nader Elhefnawy (Miami-Dade Community College), Abstract of “Rising Complexity, Diminishing Returns, Shrinking Slack: Revisiting the Evidence,” pub. on SSRN, March 17, 2018 ⁵

Survey Says: The 2016 board game *Blueshift* (which also uses an abstract tactical combat system like *GGDM*) contains an *automatic* combat screening rule: Ships that hit in combat can only hit ships of equal or smaller size unless there are no remaining targets, at which time they may hit the next largest ship. Thus, small ships screen larger ships from other small ships, but not larger ships. The designer also collapsed the ideas of fighter carrier and troop transport into the colony ship, making a super-utility ship that can carry any combination of interceptors (i.e. fighters, cannot exist without a ship or planet) and infantry, up to four units, meaning it can sometimes be a carrier, sometimes a troop transport, or any range in between, and once or twice a game, it works as an actual colony ship at uninhabited planets.

- ✓ *Imperium* (1977), a Traveller RPG board game, required that each defending unit must be met by at least one attacker. After all defenders have been paired with attackers, if extra ships remain on either side, that side can use the ships to double or triple on any ships from the other side. Any ships not so used are considered ‘screened’ from the combat and may not participate in the combat or be attacked. Thus, unless forced to the line, carriers and troop transports may be screened automatically, or their owner may choose to risk them on the line to get extra attacks. Thus, the game provides for a limited *automatic* combat screening.⁶

‘Slack’ in the case of *GGDM* game design might be equated to the amount of complexity available for development by the participants through the story, while ‘efficiency’ then equates to the amount of complexity in the participant’s mental space and the game’s ‘Public Space’ that is already taken up by the rules such that the addition of in-game developed complexities is curtailed.

- ✓ Complexity may be an issue in boxed games, but slack is not generally – where the entire game exists within the box, there is no room for improvisation or in-game additions by players. Complexity vs. slack first surfaced as an issue in writing RPGs where the explicit intent of the rules is to allow players freedom to create and improvise; RPG adventures and source books always contain adventure ‘hooks.’

GGDM's combat screening rules, below, are much more complex. The question is, what was gained by additional complexity (being free of a tabletop game board) and do you think it was worth it? Are wooden, automatic rules better by being simpler? Is the option to choose not to combat screen, to go all in on the attack (which the Imperium board game, *ut supra*, allowed), is that flexibility alone enough to justify complexity? Is the ability to penetrate to attack combat screened ships worth the extra complexity (which Imperium did not allow)? Is the ability to intercept any size attacker better than the Blueshift rule?

Commodore Glen Van Ross: *I'll be a son of a bitch if I go to your funeral, Ty.*

Lt. Col. Tyrus Cassius 'TC' McQueen: *Yes you would sir. But we'll talk about your mother when I get back.*

[Colonel McQueen is about to go kill Chiggy Von Richtofen,
the enemy's ace flyer]

Priest: *Colonel. Colonel! Colonel McQueen! Do you need to make peace with your maker?*

Lt. Col. Tyrus Cassius 'TC' McQueen: *My maker was some geek in a lab coat with an eyedropper and a petri dish. What do I need to make peace with him for?*

Priest: *In times of war we must all make peace with our maker.*

Lt. Col. Tyrus Cassius 'TC' McQueen: *Well, I don't think our maker wants to hear from me right now. Because he knows I'm going to go out in this plane and I'm going to remove one of His creations from His universe. And when I get back, I'm going to drink a bottle of scotch as if it was Chiggy Von Richtofen's blood and celebrate his death.*

Priest: *Amen.*

– Space: Above and Beyond, “The Angriest Angel” (1996) ⁷

Dogfighting: Dogfighting is just “close in defense” combat between Fighter Complements. Opposing Fighter Complements only meet head-on during Combat Screening when one Fighter Complement intercepts the other (that is, when they are pinned down to attacking and defending a specific point in space).

- ✓ A Fighter Complement assigned to Combat Screen automatically Intercepts an attacking Fighter Complement, and since Fighter attacks are resolved first, this may soak off the Fighter screen for other attacks on the target later in the Combat Round.
- ✓ Combat Screening Fighter Complements may intercept up to two attacking Fighter Complements (i.e. *sorties*), and each will be separately resolved as a Dogfight, but the Screening Fighter Complement will be divided in half.
- ✓ Upon assigning a Fighter Complement to Combat Screen, the owner of the Fighter Complement may instruct that, in the case of a Dogfight, the Combat Screening Fighter Complement only engages in one Dogfight at full strength, thus giving up the “second intercept” ability for that Fighter Complement in the current Combat Round.

- **Two Eyes:** Dogfights are resolved in sorties; the RP value of the incoming Fighter Complement's sortie vs. the Intercepting Fighter Complement's sortie. Thus, a single sortie of intercepting Fighters cannot Dogfight both sorties of a Concentrated Attack from a single or combined Fighter Complement. However, it is possible that both sorties of a Concentrated Attack might be met – individually – by intercepting Fighters in Dogfights.
- **Four Fangs:** Fighter Complements engaged in a Dogfight automatically hit each other, it's just a question of damages. Each side rolls one ten sided die for every 10 RPs worth of Fighters *on their side* (i.e. not the value of opposing Fighter RPs like in Close-in Defense Fire) at the beginning of the Dogfight. The sum of the die roll results is the amount of RP damage done to the opposing Fighter Complement. Obviously, the larger Fighter Complement is usually going to get more die rolls and will probably do more damage (i.e. get in more licks). One RP of damage is added to each die roll by the higher Era fighters for every Era difference between the Fighter Complements engaged in the Dogfight and damage can exceed 10 RPs per roll (note, this is different than regular Close-in Defense Fire).⁸
 - ✓ For example, an attacking *sortie* of 50 RPs of 1st Era Fighters is met by a Combat Screening *sortie* of 30 RPs of 2nd Era Fighters. The Fighters automatically intercept, no roll is made to see if they hit (i.e. they automatically hit). Because of the automatic hit by both sides, the attacking Fighter Complement's attack on the target *is stopped* and diverted to the Dogfight. The attackers will get 5 die rolls for damage and the interceptors will get 3 die rolls for damage but add one to each die roll; each *attacker die roll* will do a minimum of 1 RP damage to the interceptors, each *interceptor die roll* will do a minimum of 2 RPs damage to the attackers.

“The most remarkable operational development of the [16th] century was the relatively abrupt change in the strategy and tactics of naval warfare, both of which had been relatively static for approximately 2,000 years. During those millennia, control of the seas had been exercised near the coastlines by war fleets of short-ranged row galleys. By the end of this century the row galley had been displaced in most parts of the world by sailing ship, with its heavy broadsides of long-range cannon.”

– R. Ernest Dupuy and Trevor N. Dupuy, The Encyclopedia of Military History, 2nd Rev. Ed. (1986), p. 448

Areal Weapons: A weapons system is designed to apply energy, mass or space change to introduce adverse entropic effects on the target.⁹

- ✓ “And even at this early date, we have an example of the timeless horror of new fighting tools, resulting eventually in the prohibition of the crossbow by several popes.... Despite this abhorrence of military change, no restriction has ever succeeded in abolishing a weapon which once proved its worth on the battlefield.” – Lynn Montross, War Through the Ages (3rd Ed., 1960), p. 134.
 - See related Montross feature quote regarding use of “poison gas” in WWII, 4 Combat, p. 997, *supra*.

Ninety-percent of the video-game and movie space combats are fought with massed fleets firing point-to-point weapons. It looks pretty on film. The underlying assumption of the game's combat system is that combats are fought using point to point energy or projectile weapons, and/or small area burst weapons.¹⁰ But suppose someone invented a weapon with an effective radius that covers a significant volume of system space; a weapon with a bursting radius of ten or twenty times the size of Jupiter or the Sun? That would swallow planets. Overnight, closely massed fleets (and planets) become a target, unless they have shielding or defenses.¹¹

“Areal” is an adjective form of “area” and thus means an expanse of space:

- ✓ Merriam-Webster online dictionary at *area*: **4**: a particular extent of space or surface or one serving a special function: such as: **a**: a part of the surface of the body, **b**: a geographic region.
- ✓ In 2011, the National Weather Service changed “area warnings” to “areal warnings” without comment.
- ✓ Merriam-Webster (*Id.*) also has an entry for “areal linguistics,” which is in the bottom 10% of words.

Thus, “areal weapons” seems like a good term for the significant space area burst (SSAB) weapons discussed here. In the volume of system space, a nuclear weapon, devastating on Earth, is just a firecracker. When filmed from space, a nuclear blast on the surface of the Earth is but a momentary point of light. One of the first areal weapons in science-fiction literature was the famous “Sphere of Annihilation” featured in Arthur C. Clarke’s 1951 short story, “Superiority.” The implementation of the Spheres did not win the war for Earth, it lost the war.

- ✓ The first rule of nuclear warfare is force preservation. Those on the ground cannot do anything about a nuclear weapon if it is not stopped in flight or before launch; for the local forces and civilians, it is simply best not to be there when it hits.¹²
- End of the Age of Sail: It is usually taught in grade school that the appearance of ironclad warships during the American Civil War (1860-1865) ended the Age of Sail’s (1571-1862, see Dupuy & Dupuy feature quote *ut supra*) broadside-firing, multi-mast warships. This is only true in the very final sense, but is a case of confusing cause with symptoms. The beginning of the end of the age of wooden ships began with the invention of the Paixhans gun in France in 1823, the first naval gun to fire flat trajectory shells; the Paixhans gun solved the problem of the shell fuse which was ignited upon firing and burned just long enough to allow the projectile to lodge itself in the side of a wooden ship before exploding.
 - ✓ Echoing Dupuy & Dupuy, the Paixhans gun might be the most remarkable development of the early 19th Century warfare! But the 19th Century saw many innovations.

It was at this point that metal armor became imperative, the French equipped the first ship with Paixhans guns in 1841, the U.S. Navy followed in 1845; in 1853 the Russians annihilated a Turkish fleet using Paixhans guns. In 1849, John Dahlgren in the United States improved the Paixhans gun’s range and accuracy with shells and the Dahlgren gun could also fire inert solid shot, which the Paixhans gun could not. In the intervening decades between the invention of the Paixhans gun and the American Civil War, steam power developed in parallel to the point of reliability acceptable in naval design so that sails could be entirely dis-

carded in new casemate and turreted ironclad warships. Naval gun turrets were invented independently in Britain and the United States in the 1850s, bringing together the elements leading to the ironclad revolution in naval warfare.

- Spinal Mounted Ship Weapons: Bearing – how many weapons can be brought to bear in any sector without moving – is an important consideration in warship design. Historically, the mechanical turret has supplanted the old style broadsides of the sailing era because of the turret’s economy of weapons bearing.¹³

- ✓ The transition to broadside-armed sailing ships marked the beginning of the naval warship as the most expensive and concentrated single unit of firepower in the military arsenals of the world, each was, in 17th and 18th Century terms, equal to a small or medium land fortification in most respects. That trend continues; for example, a new, small U.S. warship, the USS Little Rock II, cost \$440 million to construct and spent the first couple of months of its maiden voyage stuck in the ice in Montreal, Canada.

As such, most space-opera stories envision ship weapons that can fire in large arcs, sometimes using turret technology (some ships in Traveller used tracked turrets that could move around the ship’s hull), while most small fighters are made to fire forward only, but have agility and speed such that having only a single weapon bearing is not a liability in combat.¹⁴

- ✓ Weapons bearing is irrelevant to GGDM ship combat – which uses an abstract tactical system – unless players and the Concierge add something to the game where weapons bearing on ships matters.

Conversely, Traveller RPG imagined “Spinal Mounted Weapons” which were ship-sized weapons that formed the spine of the ship – that is, the weapon was built first, and then the ship was built around the weapon. In the case of Spinal Mounted Ship Weapons, which only had forward bearing on a limited arc, space warfare returned to the days of sailing ships, when the crew aimed the ship and the gunners fired the weapons. The most Traveller-like examples of spinal mounted weapons on the screen are the Wave Gun on the Space Battleship Yamato in Starblazers (both animated and live action versions), the main gun on the Battlestar Pegasus (note, a Carrier) in the reimaged Battlestar Galactica series (seen in the escape from New Caprica), and in Ender’s Game, where it was used to destroy a planetary civilization. Another variety of ‘focused beams’ ship weapon was shown on the Death Star in the original Star Wars movies and on the new Excalibur heavy cruisers in B5: Crusade.

In nearly all science-fiction settings where Spinal Mounted Weapons are used, they draw tremendous ship power and as such, firing them is either a one shot event, often leaving the ship disabled, or they fire continuously, but at a slower rate than conventional weapons, unless the ship is of a very high, usually ancient alien technology. This should be noted if players wish to introduce the concept to the game via Patent.

The Spinal Mounted Weapon may or may not be a Technological Device (TD) operational technology, as discussed in 2 Patents, p. 741, *supra*. A TD can be somewhat relative; the first of its kind might be a true TD in the universe, but the Third Imperium had hundreds of Spinal Mounted Weapons ships (and tens of thousands of other ships), built over centuries at dozens of huge naval ship yards. The Third Imperium in Traveller had over 11,000 colonized worlds and lasted over 1,100 years, so they had the economies of scale to build massive

fleets of such massive ships. The 1981 Traveller Supplement 9 Fighting Ships included the Tigress Class Dreadnought, a spherical ship – suspiciously Death Star-like except for the clunky looking propulsion and launch bays at the back – coming in at 500,000 tons, and spinal mounted with a pair of Factor-T Maeson guns (like an old Civil War monitor).

- ✓ As noted previously, weapons bearing is irrelevant in GGDM. However, the attraction of the Spinal Mounted Weapon (and Area Weapons) in GGDM combat might be their massive punch, for example, if the game technology develops to where units can take multiple hits from regular weapons before being destroyed or where Era multipliers and differentials become problematic.

Gunnery Chief: *This, recruits, is a 20-kilo ferrous slug. Feel the weight. Every five seconds, the main gun of an Everest-class dreadnought accelerates one to 1.3 percent of light speed. It impacts with the force of a 38-kiloton bomb. That is three times the yield of the city buster dropped on Hiroshima back on Earth. That means Sir Isaac Newton is the deadliest son-of-a-bitch in space....Damn straight! I dare to assume you ignorant jackasses know that space is empty. Once you fire this husk of metal, it keeps going till it hits something. That can be a ship, or the planet behind that ship. It might go off into deep space and hit somebody else in ten thousand years. If you pull the trigger on this, you're ruining someone's day, somewhere and sometime. That is why you check your damn targets! That is why you wait for the computer to give you a damn firing solution! That is why, Serviceman Chung, we do not 'eyeball it!' This is a weapon of mass destruction. You are not a cowboy shooting from the hip! – Mass Effect 2 (2010) ^{15, 16}*

Endnotes.

¹ Citation: See previous discussion of Combat Screening retreating Carriers and Tender starships, Carrier Operations, 1 Carriers & Fighters, p. 1050, *supra*.

² Commentary & Citation: The caracole cavalry tactic, in the modern usage, is a peculiar and debated development of the tactically fluid 16th and 17th Century land warfare in Europe. Most will not have heard of it, and it's not as exciting in movies as the full gallop, sabers-drawn, lances-down cavalry charge.

³ Commentary: It might be possible to develop types of Fighters that are superior at interception or attacking ships. Thus one 'buddy' carrier loaded with specialized Interceptor Fighters (superior closing speed and sensors) might protect itself and another Carrier that is loaded with anti-Ship attack Fighters.

- ✓ “The MiG-25's sustained speed of between 2700 and 3000 kph at altitude was equal to and above the short period sprint speed of any fighter – this is as true today as it was in 1972 when this remarkable aircraft entered full service.” – from 2014 poster created by Bharat-Rakshak, an Indian Defense Forum (open intel).
- ✓ The MiG-25 is the classic example of the interceptor. Its game was speed and altitude, guided to the target by ground controllers. The cockpit had limited visibility, but the frame was built for speed and could outrun most missiles. The MiG-25 is obsolete now for many reasons, even in its photoreconnaissance role.

⁴ Commentary: The Battle of Angora in 1402 ending in a huge Ottoman rout by the Tartars, is the largest cavalry battle in history, with cavalry accounting for well more than half of the approximately 225,000 combatants. Imagine such numbers in galactic space-opera fighter battles? *Although this is more likely to be the scale at which interstellar empires wage battles*, it is rarely depicted (or anything even close) in space opera movies because of the limited human ability to *grok* such scale; the unmatched scale and numbers of combatants, material, and civilian victims of the two World Wars in the 20th Century were difficult for the people of the time to grasp. Then came the Bomb.

- ✓ “It was thus an enormous and polyglot host of Asiatic horsemen that Timur brought to the battle of Angora in 1402 against equal or perhaps superior numbers of Turks under Sultan Bajazet. Probably no greater cavalry battle has ever been recorded in history, for it does not appear that weapons of gunpowder had anything to do with the outcome. Timur virtually won the day by manoeuvre before striking a blow. After devastating the Turkish lands near Angora, he placed Bajazet in such a position that the sultan had to attack in order to secure water at the river Halys. His troops were half defeated by thirst as they went into action, both men and horses being tortured by the dust rising from the plain. Treachery played a part when a number of squadrons went over to the enemy, and the struggle ended in a disaster for Bajazet, who died in captivity.

So complete was the rout that the Ottoman state seemed on the way to a collapse as dramatic as its beginnings. Civil war followed invasion as Bajazet’s sons disputed for the succession, and rebellions of conquered subjects broke out in Syria and the Balkans. *The [Ottoman] empire escaped ruin only because of boons such as fate has seldom extended to a prostrate power.* Timur’s death three years after his great victory was followed immediately by the disintegration of his conquests. At this same period Christendom entered upon the Hussite crusades that were to drain the energies of eastern Europe for a generation. *The combination of these timely circumstances gave the next two Ottoman sultans a respite* which they used to advantage in building up a new tactical system. Fifty years after Angora the Turks were stronger than ever before, and Constantinople fell an easy prize to their great siege train.” – Lynn Montross, War Through the Ages (3rd Ed., 1960), p. 219 (emphasis added).

- ✓ According to Wikipedia article, “Battle of Ankara” (aka Battle of Angora, both Montross and Dupuy & Dupuy call it the “Battle of Angora”), the Ottomans had about 140,000 and the Tartars about 85,000. This is a reversal of the claim made by Montross, who indicated (above quote) that the Turks outnumbered the Tartars. Captured January 5, 2019. However, a significant number of Ottoman levies defected *en masse* to the Tartars during the battle.
- ✓ The Crimean Tartars remained a significant entity into the late 17th Century and played an important part in early modern Russian, Polish and Lithuanian histories.

⁵ Commentary: “Slack” in this case refers to the available resources to meet unexpected contingencies (“buffering capacity,” *Id.* at p. 5). Slack is the opposite of “efficiency,” see Joseph Tainter feature quote and Conquest by Entitlements, 5 Culture, pp. 429-430, *supra*.

⁶ Commentary: For the record, I did not read the Imperium rules until 2019 (bought the game at a silent auction for a couple of dollars in about 2015), about 25 years after Combat Screening was introduced into GGDM. But the concept was clearly out there before I bought my first wargames... though I do not remember playing any games in my youth that had anything like combat screening. I had not heard of Traveller RPG until at least 1986, possibly 1987; I started with the D&D Basic Set in about 1982.

⁷ Commentary: “Chiggy Von Richtofen” was the name the Humans gave to the alien enemy ace (you get the reference?). He was flying a prototype advanced alien fighter, probably the only one they had; probably intended as a reference to German *wanderwaffen* and an indication that the Chigs were starting to lose the war. The humans sent an *In Vitro* (i.e. artificially gestated humans, with no childhood) ace pilot of their own to destroy him. The episode is very existential.

⁸ Commentary: The primary memorable scene of the 1980 movie, The Final Countdown, is the sight of two Japanese Zeros (Second Generation Fighters) being buzzed and engaged by a pair of F-14 Tomcats (Fourth Generation Fighters) near Hawaii in December 1941. Downing the second one by gunfire, dogfight style, was unnecessary.

⁹ Citation: “The English were the last important European nation to adopt officially gunpowder small arms. After prolonged debate, a Royal Ordinance of 1595 banned the longbow as the basic weapon of the militia train bands. Each soldier now had to supply himself with an arquebus, caliver, or musket. This did not end the debate in England, however, since archers frequently proved that they could shoot faster, farther and more accurately than most musketeers.” – Dupuy & Dupuy, Encyclopedia of Military History (2nd Rev. Ed., 1986), p. 450.

- ✓ Likewise, the Native American bow, especially in North America, was superior to the European muskets initially, and was much more suited to the environment of the East Coast and Appalachian Mountain forests in the initial stages of the European invasion. Thus, in strict terms, success is not always (and not frequently) solely a result of superior weapons.

¹⁰ Commentary & Citation: It is not certain when the exploding artillery shell was invented, by whom, or under what circumstances. However, Christoph Bernhard von Galen, Prince-bishop of Münster, who became known as ‘Bombing Bernhard’ was rather enthusiastic about using them to accentuate the ‘word of god’ upon his enemies. He appears to have, from recent archeological finds (see Matthias Schulz, “Excavated Bomb Suggests Early Start for Artillery,” *spiegel.de*, June 17, 2011), had or invented the first ‘modern’ type of self-igniting explosive artillery shell, which he used enthusiastically to sow terror on Protestant dissenters in the early 17th Century, mainly in the Netherlands. Previous shells had to be lit manually, then fired out of a cannon or mortar, a very hazardous task.

¹¹ Citation & Commentary: **The War Doctor**: Don’t sit on that! It’s not a chair, it’s the most dangerous weapon in the universe! **Rose Tyler** (bad wolf avatar): Why can’t it be both? – Dr. Who, “The Day of the Doctor” (2013). The writers of the Dr. Who television series have been particularly prodigious in inventing various technological devices with near divine powers such as the Pandorica, The Reality Bomb, The Moment, and of course, the oddly sapient TARDIS, and creatures such as the evolved Daleks, Space Whales, the Ood, or the creature in the Pit – that are probably beyond the scope of the nascent interstellar civilizations in the game, and any similar sort of ideas should be introduced, if at all, under the *sublimely wise* control of the demigod Concierge.

- ✓ “The galaxy eater. The final work of the ancients of Gallifrey. A weapon so powerful the operating system became sentient. According to legend, it developed a conscience.... How do you use a weapon of ultimate mass destruction when it can stand in judgment on you?” – Gallifreyian General, “The Day of the Doctor.”

¹² Commentary: We knew it, anyone who had half a brain and gave it any thought knew it (not all Marines qualified for either criteria): Okinawa would be nuked if the balloon went up. If we were still there, we were all dead. It was the only chance the Soviets had in the Pacific – if they had any ambitions in the Pacific and the Pacific theatre is noticeably absent from 95% of Cold War fiction, much less WWII fiction. If it involved the ChiComs and Taiwan, we were dead for sure. The Japanese would be blamed afterward by the attackers for having U.S. military forces stationed in their territory. We were young, you shake off the thought and most of the guys buried themselves in partying on BC Street. A couple of them ended up in Naha Penitentiary for a long time.

¹³ Commentary: On land, the key weapons system advance of the early gunpowder age was the ... bayonet ... which allowed land units to instantly double or triple their combat power by replacing pike men with muskets while retaining the ability to defend themselves in close combat. Few other inventions in military history have instantly doubled the combat power of units, with the best candidates being the modern hand grenade and machine gun.

- ✓ On the seas, it was the mid-19th century invention of the turret which allowed ships to carry fewer and larger guns (the American Civil War Union monitors carried two 16 inch muzzle loading smoothbores that each fired a 400 lb. ball with 30 lbs. of powder and required steam power to load, shown in contemporary drawings of the inside of a turret), and bring all of them to bear on any target on either side of the ship, replacing static broadsides from the Age of Sail. Later in the American Civil War, the Union had four 16 inch guns on double turret monitors (i.e. industrial superiority), the ancestors of the early 20th Century seagoing turreted warship.

¹⁴ Commentary: The ultimate in star fighter agility on the screen was Babylon 5’s Star Fury; conversely, the Hammerhead fighters from Space: Above and Beyond series (1995-1996) featured a top-mounted remote turret gun.

¹⁵ Commentary & Citation: Or as we used to say in the Marines, an artillery shell in flight has the ultimate right of way. In England in 2019, two skydivers in freefall at 120 mph were almost hit by a pair of U.S. F-15s that passed under them at 345 mph.

- ✓ “U.K. Airprox didn’t specifically determine how close this near-miss was but said there was ‘Go-Pro footage filmed from the helmet of one of the parachutists’ that showed the jumpers ‘could clearly see the F15s passing beneath.’” – David K. Li, “Two skydivers in freefall were nearly hit by U.S. fighter jets,” NBC News, September 12, 2019.

¹⁶ Commentary: It’s odd that the Cylons never thought of this weapon, the Battlestar Galactica would have been riddled.

- ✓ The Concierge should consider potential ‘inadvertent’ and ‘accidental’ collateral damage to a colony planet and orbital facilities in any colony combat situation, especially if the colony’s defenses consist solely or primarily of Ground Bases and Orbital Bases. Because how can anyone be sure they aren’t just eyeballing it?