

[0.9.1a] A Guide to (AI-Friendly) Ship Loadouts

Fyi, this probably won't get updated until 0.95.1a or whatever since
a) I'm lazy and b) changes haven't really settled in yet.

- Most stuff is still accurate, but add higher weight for Hardened Shields/Expanded Missiles Racks/Heavy Armor since you can s-mod them
- Note to not worry so much about adding capacitors to heavily armored capital ships like Paragon and Onslaught. AI is much more willing to vent now so Resistance Flux Conduits and lower max capacity (for better vent times) is more reliable than before.
- Carriers are less reliable than before I think, so ignore advice about Converted Hangars

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Introduction

This guide will take the different aspects of loadout design and walk through them roughly in order of importance. The first section contains all the key concepts necessary to designing generally good AI ships, if not completely optimal ones. It should be accessible for beginners. The second section contains supplementary information on loadout designs, including expansions on previously discussed topics and some more subtle aspects or techniques that are worth consideration in your designs.

(And then there's some random junk in the appendix. I don't know, check the table of contents.)

TL;DR for the lazy: See the [IKEA Instructions](#).

Core Concepts

Capacitors/Vents

They're not flashy, but capacitors and especially vents are among the most important parts of a ship's loadout. Combat in Starsector almost entirely revolves around winning the flux war (that is, dealing more flux to your opponents ships than you take in return), and these two components directly augment a ship's performance in said conflict. The general way to contrast the two is that capacitors can be a better option if a ship is engaged (firing/being fired upon) for very brief periods, but vents are better options if the ship is involved in prolonged engagements. To greatly simplify the process of managing these stats, we can separate ships into two categories:

Ships that primarily use ballistics/energy weapons: **maximize** vents **before** fitting.

Phase Ships, (non-combat/Astral) carriers, missile ships: **prioritize** capacitors **after** fitting.

In fact, at this point in time you can keep it as simple as possible by maxing both your capacitors and vents for any standard warships before continuing with additional loadout changes. It's somewhat difficult to make a bad ship with maxed flux stats, but very easy to make an abysmal one with neglected flux stats. It's good to get in the mindset that these stats can be even more important than your weapon/strike craft/hullmod choices, and you can always remove them later if you need to squeeze in a little more OP.

(More specific information can be found in [Part II](#).)

Hullmods

Barring a couple of essential hullmods, a lot of the flexibility in designing ship loadouts comes from selecting hullmods. Almost all of them have some niche when it comes to AI use, so I'll cover them in depth later. For now though, we'll focus only on some generally high priority hull mods.

Essential Hullmods

These hullmods can basically be considered an automatic inclusion for most standard builds. Unless you're doing something fancy (e.g. Safety Overrides), you're best off adding these hullmods before you even think about adding weapons and strike craft.

*For cruisers and capitals: **Integrated Targeting Unit (ITU) / Dedicated Targeting Core (DTC).***

(Note: ITU is better than DTC in all aspects. The reason they are separate hullmods is that you start with DTC (so cruisers and capitals remain viable even early game), but you have to find ITU.)

Range is a key factor in fleet engagements. The further away you can shoot from, the less likely your ship will be in the crossfire of the opposing fleet. Range is effectively a required addition on any cruisers and capitals that emphasize the use of ballistic or energy mounts, both because these ships are generally slower and would otherwise be kited, and because the bonuses are quite large relative to their OP cost. Note that ITU/DTC do not increase the range of missiles

Exceptions: missile-heavy ships such as the Gryphon, dedicated carriers such as the Astral, and ships that are using [Safety Overrides](#).

*For carriers with $\geq 2/3/4$ decks: **Expanded Deck Crew (EDC).*** As the one hullmod that improves the combat effectiveness of carriers, EDC should be strongly considered on any ship that makes significant use of their bays. This is exacerbated by the fact that most carriers with sufficient decks are lousy war ships, so it's better to optimize what they're best at.

High Priority Hullmods

Unlike the "essential" hullmods listed above, these hullmods aren't so important that you should eschew using good weapons or strike craft to include them. That said, they are generally much more useful than hullmods that aren't in either list (which I would call "luxury" hullmods). With the typical OP budget of ships in Starsector, these hullmods will be sufficient for fitting the majority of ships available in vanilla Starsector. Along with capacitors and vents, you'll want to use these to use up your extra OP *after* adding your weapons and strike craft.

*For slow destroyers, destroyers using 800+ range weapons, and frigates using 700+ range weapons: **ITU**.* Extra range still provides decent value for most destroyers and, to a lesser extent, frigates - it's basically never a bad option. Furthermore, even a slight boost does a lot for the effectiveness of PD.

*For ships with too high weapon flux: **Flux Distributor**.* Most ships will outstrip the flux dissipation provided by their base dissipation and max vents, so every hullmod that can help alleviate this will be important.

*For ships with high shield upkeep: **Stabilized Shields**.* Similarly to Flux Distributor, Stabilized Shields will reduce the flux generated by a ship when its shields are up. Since ships don't always have their shields up and it doesn't help with active venting, the hullmod is less flexible than regular dissipation improvements, but depending on the ship it can provide a much larger reduction in flux usage per OP. The breakeven point with regular vents occurs at 60/120/180/300 shield upkeep, so the further past that a ship's shield upkeep is, the more valuable this becomes.

Note that some omni-shielded ships can instead use **Shield Conversion - Front**, which also halves shield upkeep. It's not always the superior choice, but it's worth considering if:

- a) You're already planning on using at least one of the Accelerated/Extended Shields hullmods.
- b) The ship has >180 degree shields, so that front shield conversion will give it complete coverage.

*For ships with high capacity: **Hardened Shields**.* The AI absolutely loves using shields, or contrapositively hates armor/hull tanking, so even with ships that you'd think are primed for Heavy Armor usage, you'll almost always want to use Hardened Shields instead. Once a ship has used up all its capacity in hard flux it's effectively out of the fight, so delaying that as long as possible is important. The point at which Hardened Shields breaks even with additional capacitors is at 3600/7200/10800/18000 flux capacity - any higher increasingly favors Hardened Shields. There are some additional considerations on whether or not to use this hullmod around this point:

- a) Hardened Shields also reduces the probability of EMP piercing arcs from weapons like the Ion Beam and Tachyon Lance.
- b) Higher shield efficiency means faster venting per point of hard flux absorbed.
- c) For heavily overfluxed ships, high capacity (instead of Hardened Shields) can allow it to fire its weapons for longer before needing to stop and vent.

It can be good to check if, after removing 6/12/18/30 capacitors, a ship still has a high enough flux capacity to prefer Hardened Shields.

*(Probably optimal but kind of boring) For most non-carrier/phase destroyers: **Converted Hangars (CH)**.*

An unfortunate consequence of carriers being so strong currently is that basically every destroyer that can use CH would be better off having it, even if it's just paying 13 OP for a

weaker Talon (or more realistically, 18 OP for Wasps). That said, you're still paying a lot for what you get (and strike craft spam is a bit cheesy), so you'll have to gauge if you'd rather have the vents/caps/luxury hullmods instead.

(Information on the rest of the hullmods, which have more specialized use-cases, can be found in [Part II.](#))

Weapons

One of the great things about Starsector is that nearly all of the weapons have some sort of niche that they can fit into. Thus, weapon selection is not about finding the de facto best weapons, but the weapons that best fit whatever role you're looking for. This means that it's difficult to explain what specific weapons should be used where without simply giving an overview of all the weapons (which, if you're interested, SCC has handily done here: <https://docs.google.com/document/d/1KBy5DI4XZ9lg440ax5Rpq0GsSiuqROwO-GRE68GGg4/>).

Damage Types

Kinetic damage deals twice as much damage to shields, but half as much to armor. Since both shields and weapons use flux, dealing as much damage as possible to shields allows one to "flux lock" opposing ships and make them unable to fire. This makes kinetics an important component of most ships' armaments. However, the AI is generally smart enough to notice when they're only being targeted by kinetics and may switch to armor tanking in response, necessitating the use of other damage types.

High Explosive (HE) damage works opposite to kinetics, dealing double damage to armor but half damage to shields. It's good to have some source of HE or armor piercing in every ship to incline ships to tank using their shields until they're flux locked, but they have lower priority than kinetics.

Energy damage deals equal damage to shields and armor, making it fulfill a more general purpose than kinetic or HE options. It's the damage type most commonly found on energy weapons. Ships that extensively use this damage type often have different design considerations than those capable of fielding complements of kinetic and high explosive damage.

Fragmentation damage deals 25% damage to shields and armor but, as with all other damage types, full damage to hull. To compensate for the low multipliers, most fragmentation dealing weapons often have very high DPS and efficiency. This makes them fairly poor weapons to deal with fresh ships, but they can deal huge amounts to ones that are fluxed up/shieldless with their armor stripped.

Not being one of the main damage types (and hence not mutually exclusive with the ones listed above), **EMP** damage is a unique source of damage applied in addition to a weapon's regular damage. It has no effect on shields, hull or armor, instead dealing damage exclusively to weapon mounts and engines (regular weapons also do this, but usually EMP damage values are extremely high in comparison and furthermore are not reduced by armor). They can be used to lock down opposing ships, allowing free reign in winning the flux war.

Weapon Mount Types

Ballistic weapons fire projectiles at opponents. They almost always have either a kinetic, high explosive or fragmentation damage type (in vanilla, only the Mjolnir Cannon has an energy damage type). Furthermore, they have a very diverse space regarding weapon stats--everything from range to accuracy to flux efficiency--which allows for significant specialization of weapon roles.

Energy weapons can either use projectiles like their ballistic counterparts, or use beams, which have perfect accuracy but varying extension speed (the speed at which the beam travels to its maximum range) and most importantly can only deal soft flux--flux that can be vented even while shields are active. Most of these weapons perform a generalist role, but energy weapons also find a valuable niche in support weapons - particularly through EMP weapons, which exclusively deal damage to weapon mounts and engines.

Projectile-based energy weapons exclusively deal energy damage (at least in vanilla) and have much smaller range bands, as well as shorter range in general, than their ballistic counterparts. They're furthermore somewhat lacking when it comes to efficiency, but in general have better accuracy.

Beam-based weapons can be further distinguished by being categorized as either continuous beams or burst beams. Continuous beams have no cooldown/charge count and can be fired as long as flux is available, while burst beams are active for only a few moments before being restricted by either a cooldown or running out of charges. The former usually fill some sort of pressure or reliable point defense role, while the latter can deal large amounts of damage (either to enemy ships/fighters or to missiles as point defense) in a short period of time. Beam weapons have a bit more diversity when it comes to damage types, with the Graviton Beam and the High Intensity Laser (HIL) dealing kinetic and high explosive damage, respectively. The non-PD continuous beams exclusively have a range of 1000. Most burst beams have lower ranges consistent with projectile weapons, though the Tachyon Lance is an exception with its standard 1000 range. Since they only deal soft flux, beams can either be used as supporting pressure weapons that force enemy ships to raise their shields, or have to be used en masse/in a burst to overwhelm an opponent's flux grid by exceeding their natural dissipation.

Missile weapons have the benefit of providing flux-free, and oftentimes immense, damage and pressure. As a result, they are often the easiest way for AI-piloted ships to set up an advantage

against their opponents. Even when unfired, they can affect the enemy AI by making them unwilling to vent while within strike range. Their benefits are almost always significant enough to offset their limited ammo and the fact that the AI isn't always able to effectively use dumbfire (non-tracking) missiles.

Missiles are not affected by range-boosting hullmods, but they can be upgraded somewhat using the ECCM Package hullmod for better maneuverability, top speed, and acceleration (and hence range).

Some weapon mounts can use multiple types of weapons, but come at the cost of no longer being able to downsize. In short, they are:

- **Hybrid** mounts can use ballistic or energy mounts. Generally ballistic mounts will be preferable due to their ability to fit kinetics, but energy weapons are viable for support roles.
- **Composite** mounts can use either ballistic or missile mounts. Usually missile mounts are preferable, but they may be eschewed in favor of PD, or if they're needed as main guns (for an example: see the Mule).
- **Synergy** mounts can use either energy or missile mounts. Outside of rare cases, they're highly recommended for missile use instead of energy.
- **Universal** mounts are capable of using all three weapon types. The same considerations apply as in the other multi-type mounts, with particular emphasis in providing a kinetic option if the ship in question doesn't already have a source of kinetic damage.

Weapon Roles

Here's a non-exhaustive list of the sorts of specialized roles weapons may fill. Note that these roles are not mutually exclusive and weapons can fill multiple roles. Modded content can further diversify these roles. To emphasize: these roles are ad-hoc ones I've essentially made up, **not the ones shown in the Primary Roles part of a weapon's stat card**. Whether or not a weapon fits into one of these roles depends on a number of different stats, and not all of them are player facing. For more details, see [An In-Depth Look at Weapon Stats](#) in the Appendix.

- **Assault**. These weapons have very low range, but extremely high damage/DPS/flux efficiency to make up for that shortcoming. They're especially useful on fast ships that have the ability to close in and disengage at will.
 - Examples: Light (Dual) Machine Gun, Heavy Machine Gun, Assault Chaingun, Storm Needler
- **Close Support / Artillery**. These weapons have long range and are used to pummel opponents at a distance. They're generally not very efficient or high DPS weapons, but have decent accuracy and projectile speed. Good on ships that don't want to be on the front lines.
 - Examples: Hypervelocity Driver, Heavy Mauler, Gauss
- **Pressure**. Mostly relegated to beam weapons, these weapons provide constant damage to enemy ships, and result in most AI ships raising their shields for what can otherwise be inconsequential hull damage. Since these weapons basically always only deal soft flux damage,

ships should either use them sparingly to raise shields, or use them in overwhelming numbers to overwhelm enemy flux dissipation.

- Examples: LRPD Laser (in a pinch), Tactical Laser, Graviton Beam, Ion Beam, High Intensity Laser.
- **Burst / Strike.** These weapons can deal a large amount of damage very quickly to spike an opposing ship's flux stats. This is generally counterbalanced by long cooldowns or ammo recharge rates.
- Examples: Light/Heavy Needler, Antimatter Blaster, Phase Lance, Tachyon Lance, Autopulse Laser
- **Point Defense.** Weapons with the Point Defense role will automatically fire at missiles and are almost always more efficient than simply tanking the damage on shields. Every ship should strongly consider their inclusion. A couple of things separate good point defense weapons (e.g. Flak) from poor ones (e.g. Heavy Machine Guns). Good point defense should have either high accuracy (lasers), high volume (Vulcans) or an area of effect (Flak). They should also have consistently low refire rates to prevent missiles from hitting during their downtime.
- Examples: Vulcan, (Burst/LR) PD Laser, (Dual) Flak Cannon
- **EMP Support.** Weapons that deal disproportionately high EMP damage in lieu of regular damage. They have limited effectiveness by themselves, but often have on-hit effects that allow them to pierce shields at high flux or arc to other parts of the ship on direct hits.
- Examples: Ion Cannon, Ion Pulser, Ion Beam
- **General.** Simply typical weapons that don't fulfill specialized roles like the ones below. This doesn't mean that they're inferior; on the contrary they'll most likely be the main guns for most ships.
- Examples: (Dual) Light Autocannon, Railgun, Heavy Autocannon, Heavy Mortar, most large Ballistics, (IR) Pulse Laser, Heavy Blaster, Plasma Cannon
- **Budget.** A role not so much because of the weapon's properties, but because they're very cheap to use.
- Examples: Light Mortar, (Dual) Light Autocannon, Arbalest Autocannon

Missiles can fill many of the same roles:

- **Burst / Strike:** Sabot, Atropos, Hammer, Reaper, Hurricane
- **Pressure:** Annihilator, Pilum, Locust, Squall
- **EMP Support:** Salamander
- **Anti-missile/fighter:** Proximity Charge Launcher
- **Finisher.** These missiles are particularly effective in finishing off overloaded or flux exhausted ships. Usually slower and more fragile than other tracking missiles, but with the benefit of better range and ammunition. Note that missiles with the Finisher role in their stat card will specifically only fire against overloaded/fluxed out targets (unless the firing ship is panicking).
- Example: Harpoon, Hurricane

Mount Positions and Arcs

Figuring out what weapons to use is fine and dandy, but it's also important to consider *where* weapons should be placed. First, note the two different types of weapon mounts:

1. **Hardpoints** generally have a fixed arc of 5 or 10 degrees (hence they face in one direction only), a slower turn rate and double the weapon mount hp of turrets. They also have reduced recoil, which can be quite noticeable on, for example, a Hammerhead using Heavy Autocannons/Heavy Mortars.
2. **Turrets** can rotate about larger arcs, have a faster turn rate, but lower hp on their mounts.

Most ships in Starsector have the bulk of their armament facing frontwards (as opposed to broadside ships like the Conquest). As a result, you'll generally want your main guns to be in the forward-facing positions and can strongly consider down-sizing or even eschewing weapons on mounts that do not help this endeavor (see: Onslaught side large mounts for the former, Scarab side mounts for the latter).

Rear and side-facing turret mounts should generally be used for PD, assuming they have useful arcs. Oftentimes enemy missiles will also approach from the front, so it can be worthwhile to use frontal turret mounts for PD as well after the main guns have been added. Hardpoints should never be used for PD (assault weapons that can also be used as PD, like the MG-series weapons, are a different story).

Missile mounts can sometimes have angled or side-facing hardpoints, which means that only missiles with tracking should be placed in those positions.

General Dos and Don'ts

- Use missiles. Without a good understanding of the edge cases, always fill in missile slots. As a wise woman once said: "you ALWAYS want strike missile unless you have a VERY important reason not to.
- Main weapons should have similar range (ideally kinetics slightly outranging the other damage types).
- Prioritize having good kinetic weapons. If hard flux guns are not available, use kinetic missiles. If those also aren't available, try for high efficiency weapons.
- Have weapons with good armor cracking--HE or high per-shot damage (one is generally sufficient, but it is very important).
- Ballistic Examples: Heavy Mortar, Heavy Mauler, Hellbore, Mjolnir, Gauss
- Energy Examples: Burst PD Laser and Mining Blaster (in a pinch), Antimatter Blaster, Phase Lance, Heavy Blaster, High Intensity Laser, Tachyon Lance, Plasma Cannon

- Ship AI gets skittish when they don't have the PD to deal with enemy missiles, so be sure to have some source of PD unless you want to see it run away from every Pilum missile it sees.
- Don't feel compelled to use every weapon mount. Empty weapon mounts don't cost OP and don't use flux. Weapons can absolutely be net negatives.
- Don't feel compelled to use a weapon the same size as the mount. Down-sizing weapons is another way to save OP and flux since higher sizes usually cost more.
- Don't feel compelled to use the highest OP weapon you can install. Higher OP does not mean gooder.
- Do not allow weapon flux to significantly exceed the ship's flux dissipation. **2x dissipation is the feasible limit for all non-PD weapons** and in most cases the closer to equal you are, the better.
- Don't use single-fire versions of missiles. Fewer missiles in a burst means it's easier for PD to shoot them down, and the saved OP is basically never worth it.

Weapon Groups

Most importantly: **keep same-class missiles linked**. There are rare occasions when you may want a missile weapon group to be set to alternating, but they're very specific to the ship and missiles in question.

The AI doesn't care about your autofire settings and will decide which groups to autofire dynamically based on its current flux levels, and the flux usage of the different groups. It's also not smart about attacking according to damage type and will happily fire HE weapons against shields, or kinetic weapons against hull.

For the time being, using the auto function will result in usable weapon groups (though it can be problematic if you're using ships that could reasonably use more than 5 of them - like capital ships). If you are considering personally piloting a given ship be sure to double check that its weapon groups are comfortable for player-piloting.

If you're really set on adjusting weapon groups yourself, here are some things to keep in mind:

- Keep weapons of different ranges separate.
- [Here's an example](#) of what can happen if you don't.
- Keep kinetic and HE weapons separate. This rule isn't as important as keeping weapon group flux levels consistent (for example), but is usually good practice.
- Keep PD weapons separate from non-PD weapons, especially if using ammo-based PD. If it can't be helped, ensure the PD weapon group is set to Alternating.

(Expanded further in [Part II](#).)

Carriers

Rather than investing the majority of their OP in weapons, carriers have an additional OP sink in strike craft. Since most strike craft in the game have engagement ranges of around 4000 and many have more OP in weapons than they cost as a wing, carriers are the premier means of projecting power on the battlespace.

Strike Craft

There are several roles covered by strike craft:

1. Interceptors are primarily used to destroy missiles and other fighters.
 - a. Examples: Talon, Wasp, Spark
2. EMP Fighters can shut down enemy ships or fighters.
 - a. Examples: Claw, Thunder
3. Support Fighters can be used to escort friendly ships, but will return to the carrier if engaging an enemy ship.
 - a. Examples: Mining Pod (has 0 support range, so can't actually escort other ships), Xyphos
4. Assault Fighters use regular non-missile weaponry to damage their targets. They often have Decoy Flares and so can be used to assist missiles and bombers in getting past enemy PD.
 - a. Examples: Broadsword, Gladius, Warthog, Lux
5. Bombers use missiles to damage their targets.
 - a. Kinetic bombers: Longbow
 - b. AOE bombers: Piranha, Flash
 - c. Standard bombers: Khopesh, Cobra, Perdition, Dagger, Trident

In general, strike craft will move at the speed of the lowest wing on the carrier, so it's a good idea to match speeds as best as you can when outfitting carriers.

When in doubt of what to fit for a carrier, air superiority is key. Taking out enemy strike craft helps make your ships more aggressive and strong air presence also makes opposing ships less willing to engage. If you're looking to deal with strong shields or heavier armor, an assortment of bombers--especially when escorted with assault fighters to provide decoy flares--can pack a mean punch.

It's generally better for carriers to specialize; rather than being able to simultaneously intercept with interceptors and attack with fighters and bomb with bombers, which will inevitably be done poorly, focusing on only one or two of the roles will make for far more effective carriers.

Note that carriers do not sync their strike craft across the fleet. Nor are they able to provide separate orders to different wings (e.g. if the carrier orders a regroup because the bombers have expended their ordnance, then accompanying fighters and interceptors will also retreat).

For this reason carriers should generally be able to operate independently, but also avoid having too many diverse roles (e.g. don't put your support fighters with your bombers).

See also: [a minor note on bombers and ship personalities](#).

Phase Ships

Phase ships can temporarily become invulnerable and act at 3x (4x with skill) speed at the cost of not being able to field shields nor strike craft (at least in Vanilla). The ones currently available in vanilla also have unique and powerful ship systems.

At the moment phase ship AI is a bit lackluster. Relative to standard warships, decent AI loadouts are the same, with minor exceptions:

- a) Capacitors are slightly more important than vents, since the AI will naturally vent soft flux, even as their hard flux increases from phasing.
- b) Armor is more valuable for damage mitigation, since phase ships have disproportionately high armor relative to their hull points.
- c) Ideally these ships will have some sort of PD available. Ships in general freak out when they're dealing with missiles they have no ability to shoot down, but phase ships may end up spending their entire flux pool in phase mode.
- d) Certain hullmods, such as Hardened Subsystems and Resistant Flux Conduits are uniquely helpful. The former because of the increased PPT usage and accelerated CR degradation, and the latter because phase ships have naturally good dissipation and are more often in positions where they can safely active vent (in addition, the EMP resistance is also helpful due to their lack of shields).
- e) Since phase ships have 3x time acceleration while phased, cooldown or charge-based burst weapons become more effective: they will unphase, quickly fire then go back into phase to recharge the weapons faster.

They're not the most beginner friendly of ships to outfit and beyond the above considerations, I don't have much to say about them.

Ship Systems

Ship systems provide powerful abilities that help to further differentiate the capabilities of AI-controlled ships. There are more systems than is reasonable to give an overview on, but we can briefly rank them on their AI-friendliness. Note that the list below is non-exhaustive - the descriptions hopefully give a good general idea for any missing systems.

Excellent

Ship systems that help the ship win the flux war and do not require especially good timing to be effective. These systems generally increase DPS, or provide opportunities for flux to dissipate safely.

Examples: Accelerated Ammo Feeder, Damper Field, EMP Emitter, High Energy Focus, Recall Device, Reserve Deployment, Targeting Feed.

Good

Ship systems that are more timing dependent, or provide benefits that do not directly relate to winning the flux war.

Examples: Entropy Amplifier, Fortress Shield, Maneuvering Jets, Phase Skimmer, Plasma Jets.

Okay

Ship systems that can be useful, but are rarely important enough to change the outcome of a battle, or have significant drawbacks if used at the wrong time.

Examples: Active Flare Launcher, Fast Missile Racks, Missile Autoforge.

Unfriendly

Ship systems that require delicate timing and can have disastrous results if used poorly.

Examples: Burn Drive, Plasma Burn.

When it comes to vanilla ships, ship systems can be used as a rough guideline for how AI-friendly a ship is (there's a reason why Hammerheads and Drovers are so popular).

Some ship systems also incentivise changes to loadouts. For example:

- Reserve Deployment, which replaces destroyed strike craft and also provides temporary extras for *non-bombers only*, makes fighters/interceptors preferable over bombers
- Recall Device in conjunction with bombers is devastating since it effectively cuts the time of bombing runs in half and makes them far more likely to survive those bombing runs. In comparison, fighters and interceptors have less time to deal their damage. Furthermore, since the ability has only a flux cost instead of charges or a cooldown, vents are more important in order to use the ability as much as possible.

(It's also worth noting that some ship systems are affected by officer skills, like the Omen's EMP Emitter or the Doom's Mine Strike.)

Obviously, these considerations must be done on a case-by-case basis, so optimizing for them won't be covered further.

Ship Tech Types

Ship tech types **do not** tell you how "good" a ship is; they're more along the lines of design philosophy. The tech type can give you an idea of what weapons a ship will use, their hull, armor and flux stats, and their general playstyle. There are of course exceptions to the rule.

Low Tech ships emphasize the use of ballistics and missiles, giving them many ways to approach the enemy due to weapon variety and most damage types being represented. Along

with high hull/armor and frontal firepower, they can take more than a few punches in the face while hitting back even harder. They are counterbalanced by relatively slow speeds (though this can often be mitigated through ship system use), average to poor shields, low flux dissipation and, generally, some AI-unfriendly ship systems. Generous OP allotments allow for a lot of flexibility in ship builds - from aggressive short range builds with speed-increasing hullmods to long-ranged artillery and many options in between. Their strike craft are middling, but diverse and relatively cheap to field.

Good low tech ships will leverage their high OP and good weapon mount coverage to have a strong balance of elite weapons and PD. Due to their strong armor/hull stats and PD, the cruisers and capitals are fairly competent fleet anchors.

Midline ships strike a nice balance, with most ships having a mix of ballistic and energy weapons, decent speed and shields (barring the Sunder and the Conquest), and some very strong, AI-friendly ship systems. That's not to suggest that they're generalist "jack of all trades, master of none" ships. Most midline ships have fairly clear roles and perform them very well, while being at best average when diverging (e.g. Assault vs Close Support Sunders). They have some of the strongest carriers in the Drover (for Fighters/Interceptors) and the Heron. Regarding strike craft, they have arguably the second best fighter in the game (the Thunder) as well as two pretty terrible fighters (the Gladius and the Warthog). This reddit post nicely highlights the individual ships and is a good primer:

https://www.reddit.com/r/starsector/comments/evvc74/midline_ships_are_not_generalists_they_are/

Well-built midline ships adhere to each ship's specializations. They have tanky frigates and high damage (though somewhat fragile) destroyers. Their cruisers and capitals focus less on overwhelming firepower and more on maneuverability and fighting from a distance.

High Tech ships take advantage of high speed, and excellent shields and flux stats that allow them to outmaneuver their counterparts on the battlespace. To compensate, they're generally fragile behind their shields and are required to use energy weapons, which tend to be lower range, less efficient and less specialized than ballistic weapons (though some high tech ships can offset this with multi-type slots or missiles). Their ship systems range from possibly broken (e.g. the Astral's Recall Device) to actively harmful for the AI (e.g. the Shrike/Odyssey's Plasma Burn). They have the widest complement of strike craft, but ironically no dedicated carriers below the capital ship level. They also have the majority of the game's phase ships, which can behave erratically in AI hands, but have interesting abilities and design considerations.

Ideal high tech ships will circumvent the issues their low efficiency weapons cause by utilizing their speed to constantly harass, pressure and distract their opponents, followed by overwhelming them in areas where they develop local superiority. Rarely can they win flux wars in prolonged, head-on engagements. Instead, the focus should be on being able to dart in, send a large burst of flux or damage, and then get out.

Note that there is no reason to stick to a single tech type aside from setting personal challenges or roleplaying. Most vanilla factions use a mix of the tech types. Even among tech types there is a lot of room for variation - midline frigates are slower than low tech, and the Paragon doesn't have any of high tech's speed and maneuverability, nor a heavy reliance on kinetics.

(For the sake of simplicity, this section does not include modded content, but most of the concepts extend to them naturally.)

IKEA Instructions

Warships

1. Max out vents and caps. Remove caps as necessary in following steps.
 2. Add essential hullmods.
 - a. (Cruiser/Capital) Add Integrated Targeting Unit/Dedicated Targeting Core.
 - b. (Destroyer) Strongly consider Converted Hangars with Talons/Wasps/Sparks.
 3. Add **range-matching** (within +/- 200, before bonuses/malus) main weapons:
 - a. Ballistic-heavy:
 - i. Add a source of hardflux kinetic.
 - b. Energy-heavy:
 - i. Add a source of hardflux kinetic, if possible. Without ballistics, this will generally mean Sabot (or other kinetics from mods) missiles.
 - ii. However, some ships (particularly the cruisers and capitals) have the flux stats to brute-force their way through purely using energy weapons, if necessary.
 - c. Add a source of armor cracking.
 - i. Ballistic-heavy: most HE weapons work fine, and even some high hit-strength kinetics such as the Gauss Cannon are acceptable.
 - ii. Energy-heavy: high hit-strength weapons.
 4. Add missiles.
 5. Add PD (interceptors from Converted Hangars also count).
 6. Add luxury hullmods/weapons to fill OP.
 - a. For ships with energy mounts, "luxury" typically means EMP weapons like Ion Cannons or pressure weapons like Tactical Lasers. Ballistic-heavy ships are generally happy with additional PD or higher tier weapons.
 7. Auto weapon groups, then link any missiles, then adjust as desired.
- (Phase Ships work more or less identically, but the first two steps are slightly different.)
1. Max out vents and caps. Remove *vents* as necessary in following steps.
 2. Add essential hullmods.
 - a. Add Hardened Subsystems
 - b. Resistant Flux Conduits is strongly recommended.

Carriers (2/3/4+ bays, non-combat)

1. Add Expanded Deck Crew.

2. Add desired LPCs.
3. Add luxury hullmods/PD weapons.
4. Add capacitors to fill OP.

(Combat carriers will still do the above, but they'll need to place heavier emphasis on vents and weapons beyond just PD.)

Examples

Here are some basic fits that go through the step-by-step instructions.

Album Link: <https://imgur.com/a/bBTvt5u>

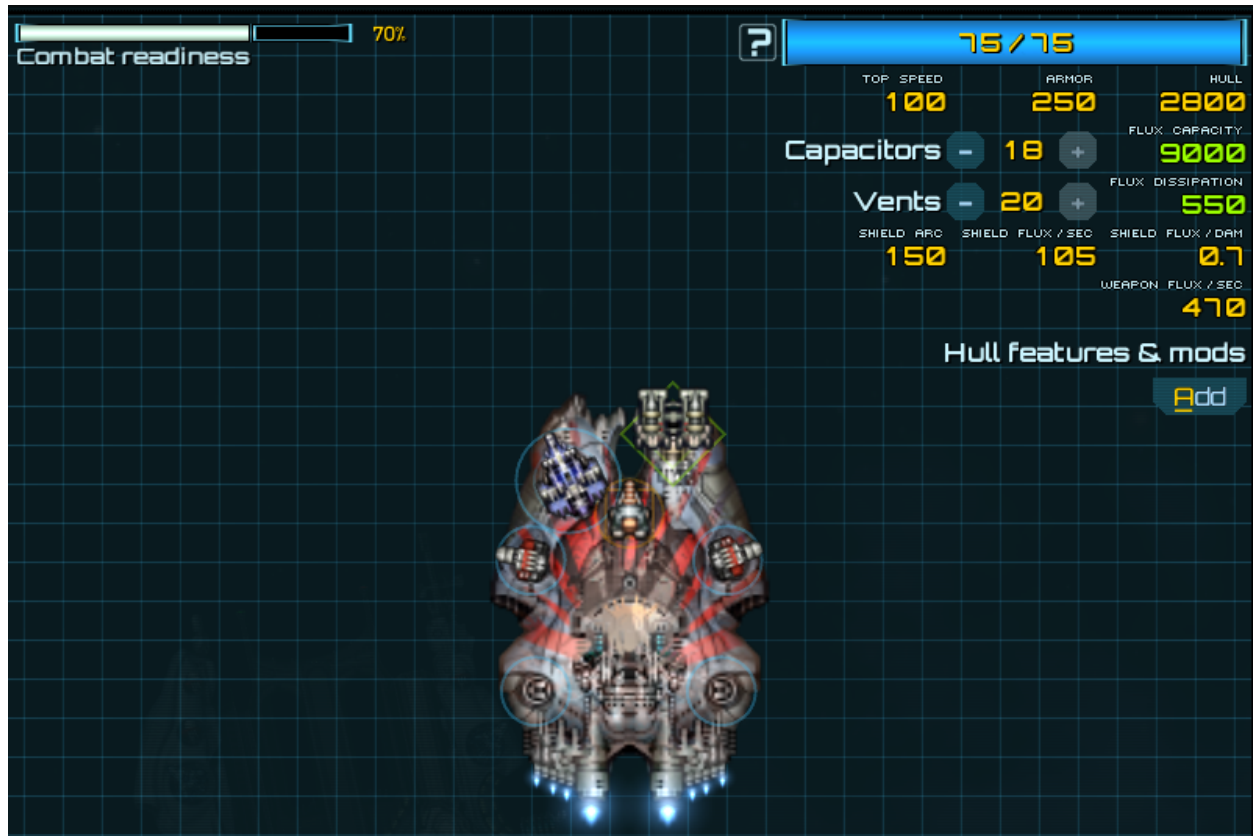
Lasher



- Start with 10 caps and 10 vents. 20/55 OP used.
- Add 2 Railguns for kinetic. 34/55 OP used.
- Back turrets have great coverage.
- Add 2 Light Mortars for budget HE. 38/55 OP used.
- Hardpoints since Light Mortars are inaccurate enough without needing to swing about.
- Add 2 Atropos missiles. 46/55 OP used.
- Add 1 Vulcan for PD. 50/55 OP used.
- Add Flux Distributor. 54/55 OP used.

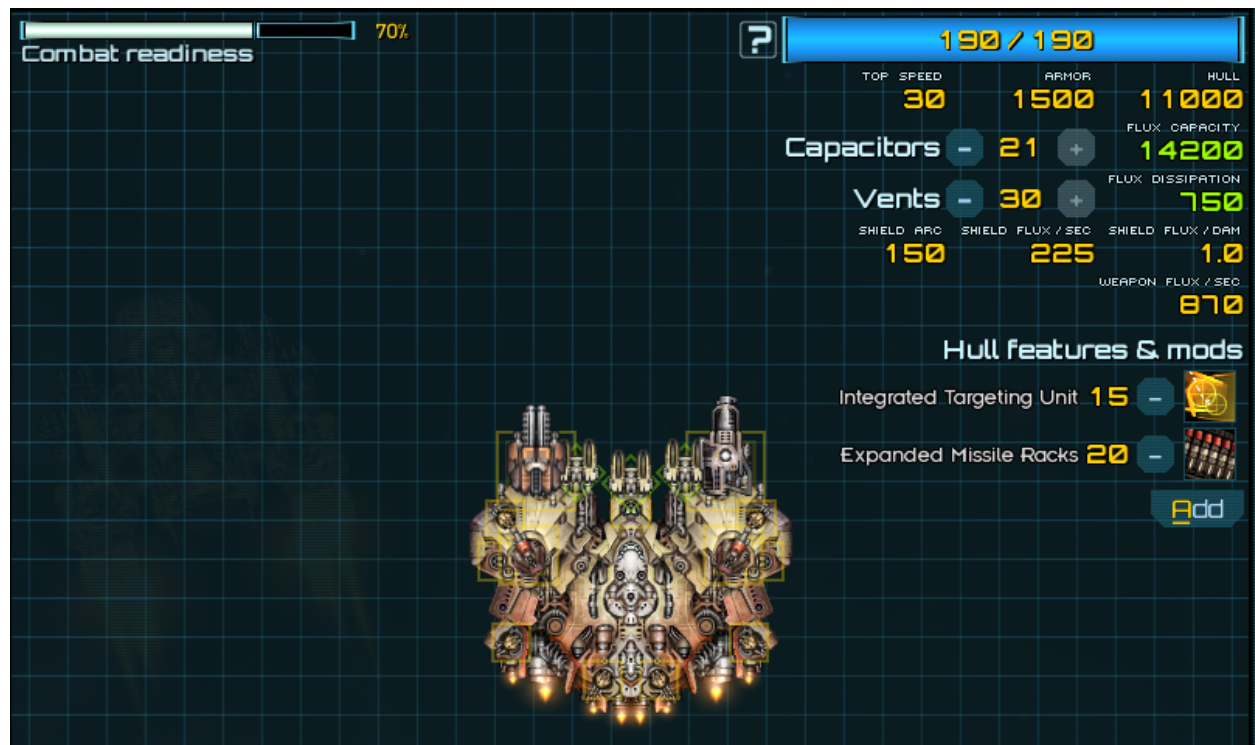
- Remove 3 caps, add ITU. 55/55 OP used.
- Auto weapon groups, then set Atropos missiles to Linked.

Shrike (P)



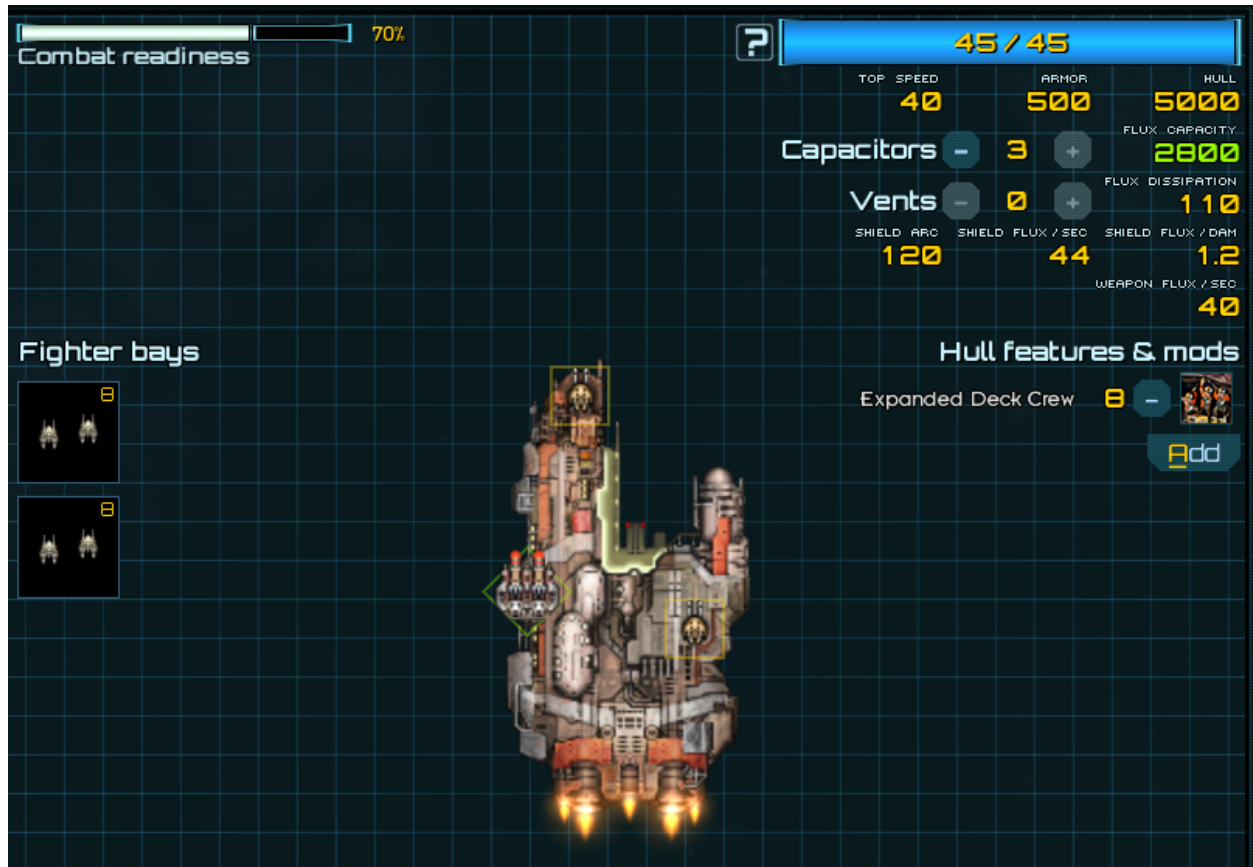
- Start with 20 caps and 20 vents. 40/75 OP used.
- Add 1 Railgun for kinetic. 47/75 OP used.
- Add 1 Phase Lance for armor piercing. 57/75 OP used.
- Add 1 Sabot Pod. 67/75 OP used.
- Remove 2 caps, add 2 LRPD Lasers for PD. 75/75 OP used.
- If you have an aggressive fleet personality, regular PD Lasers are good. For Steady AI, LRPD is a bit more reliable.

Dominator



- Start with 30 caps and 30 vents. 60/190 OP used.
- Add ITU. 75/190 OP used.
- Add 1 Mk.9 Autocannon for kinetic. 93/190 OP used.
- Add 1 Hellbore Cannon for HE. 109/190 OP used.
- Add 3 Annihilator Rocket Pods. 139/190 OP used.
- Add 2 Flak, 6 Vulcans for PD. 169/190 OP used.
- Side smalls have a kinda poor angle and are generally unnecessary due to Flak.
- Frontal small is not needed for PD since Annihilators soak up most frontal missiles.
- Remove 9 caps, add Expanded Missile Racks. 190/190 OP used.
- Used over Hardened Shields because more Annihilators is very helpful for longer-lasting pressure.
- Auto weapon groups, then set Annihilator Rocket Pods to Linked.

Condor



- Add Expanded Deck Crew. 8/45 OP used.
 - Add 2 Thunders. 24/45 OP used.
 - Add Twin Salamander Pod. 34/45 OP used.
 - We want a long-range missile that can take advantage of the Condor's ship system
- Fast Missile Racks (rapidly reloads missiles)
- Add 2 Vulcans for PD. 42/45 OP used.
 - Add 3 caps. 45/45 OP used.

Advanced Concepts & Extensions

Ship/Fleet Roles

When fitting your ship, it's nice to have a decent idea of what you're trying to accomplish with the ship, particularly in a fleet context. Good ships are specialized - they don't need to do everything decently as much as they need to do whatever they're optimising for very well. Once you have an idea of what you want your ship to do, deciding on whether to go for aggressive in-your-face weapons or sustained 1000 range ones becomes much easier.

Example roles:

1. **Fleet anchor.** A fleet anchor should be able to heavily punish any ships that get within weapon range - or be otherwise capable of forcing them back. They'd also ideally be able to hold the line when pushed, but it's a secondary characteristic.
 - 1.1. Example ships: Dominator, Onslaught, Paragon
2. **Line ship.** Line ships form the main part of a battle line. They should be fairly sturdy, or fairly maneuverable to be able to disengage easily. Heavy firepower isn't as important as steady pressure and the ability to not fold or die easily.
 - 2.1. Example ships: Mule, Hammerhead, Venture, Falcon, Apogee, Eagle, Dominator, Mora
3. **2nd line support.** These are ships that can fill in as line ships in a pinch, but are ideally able to sit a bit further back while still being fully effective.
 - 3.1. Example ships: Buffalo2, HIL Sunder, Gryphon, Doom, Atlas2
4. **Backline.** Ships that are fully effective when away from the battle line, but will have serious issues fighting things head on. Basically, non-combat carriers.
 - 4.1. Example ships: Shepherd, Gemini, Condor, Drover, Colossus3, Heron, Astral
5. **Distraction.** Ships that excel at pulling other ships away from the main battle line, or harassing flanks. These ships should be fast, sturdy, expendable, or a combination of the three.
 - 5.1. Example ships: Brawler, Centurion, Wolf, Monitor, Omen, Tempest, Afflictor, Shade, Medusa, Falcon

Note that these designations are basically arbitrary--the goal isn't to divide ships into neat categories, but to give an inkling of what a player might want from their ships. They often also depend on the size of the battles you'll be facing. A Mule might be a decent line ship in the early game, but when capital ships come into play they'll evaporate very quickly. Furthermore, many ships can fit in multiple categories, depending on how they are fitted, and not all roles are even necessary in a fleet.

Fleet / Officer Personalities

See: https://starsector.fandom.com/wiki/Al_Behaviour#Personalities

While choice of officer personality is largely dependent on your playstyle, Timid personalities are generally terrible for the AI on all but the most extreme kiting builds and some very specific missile ships. Avoid them.

Carrier Personalities

Non-combat carriers generally want to be steady (or sometimes even cautious) so that they avoid direct contact with the enemy and try to disengage at earlier flux levels. However, cautious carriers will prefer to escort rather than engage opposing ships. This can cause issues with non-interceptor fighters (e.g. Broadswords, Thunders) since they're generally quite poor escorts. To circumvent this, the addition of a single bomber to the carrier's loadout will prevent them from escorting with *all* of their wings. However, this should be done with caution for carriers with 2 bays - the AI will want to set the fighters to regroup upon completion of the bomber's attack run, thereby reducing your other strike craft's performance.

Combat carriers

Range-finding

Since ships adjust their engagement range based on the lowest (reckless/aggressive/steady) /highest (cautious/timid) range weapons (excluding missiles), you can adjust their standard engagement distance simply through your weapon choice. Cautious (non-carrier) ships will desire at least one long-ranged non-PD/missile weapon (if they are composed entirely of PD/missile weapons, then they'll have an engagement range of 0 and charge recklessly despite their personality).

Station Combat

Even typically well behaved AI can sometimes act erratically when battling against stations, oftentimes charging regardless of flux level and inevitably resulting in casualties. Personality changes don't really affect this behaviour, so there isn't much alternative to biting the bullet and just trying to take down the station as quickly as possible.

Capacitors/Vents II

When properly specializing your loadouts, rarely will you be able to have enough OP to max out both your capacitors and vents. The ship/role you're aiming for will change what the most effective allocation is. Some possible allocations:

- Prioritize vents. Dissipation is how you fire your weapons and relieve pressure on your shields, so the more dissipation you have, the more you can sustain your shooting. Maxing vents is the most common recommendation, and it's hard to go wrong with it. Also Safety

Overrides doubles the effectiveness of vents, so it's doubly worth considering when using that hullmod.

- Prioritize capacitors. Despite the above, there are still a number of ships that don't need maximum dissipation - any ship that has weapon+shield upkeep flux lower than their dissipation is effectively wasting the excess, especially since the AI is quite bad about opportunistically active venting. Furthermore, there are ships that need to prioritize being durable over firing their weapons constantly, good examples being distraction frigates like the Centurion and the Omen. More suicidal ships like the Shrike might also consider it, though weapon flux can be an issue depending on the loadout.
 - Mixed. When not prioritizing vents or caps, I think most people play it by ear. Some reasonable allocations would be:
 - Add vents up to weapon flux (or weapon+shield flux) with the rest invested in caps. You may also consider excluding PD weapon flux in this calculation.
 - Maximize the marginal value of each OP. Caps and vents increase at a 20:1 ratio (10:1 for SO), so you can maintain that ratio to get the most out of each OP.
- If you're fitting a ship meant to do as much damage as it can with ballistic/energy weapons, prioritize vents. If it needs to survive as well as possible, prioritize caps*. Alternatively, if it's an offensive ship that doesn't need much dissipation (e.g. Gryphon, some Odyssey builds), then capacitors may be more useful.

* One exception is the Monitor, since its Flux Shunt hullmod allows it to remove hard flux even with shields up.

Another concept that comes up fairly often is that of an *overfluxed* ship. Some ships, such as the Onslaught, have more weapon mounts and necessary armaments than they can reliably maintain with their dissipation, even when maxing vents and adding a Flux Distributor. In cases where overfluxed ships also have high capacity, one may be tempted to simply use high damage/DPS weapons instead of lower flux alternatives. This is a mistake. The more overfluxed a ship is, the more imperative it is to be conservative with your flux usage.

Flux Distributor vs Capacitors

A typical vent becomes more efficient for firing weapons/generating soft flux than a capacitor in any engagement that lasts for longer than 20 seconds. Flux Distributor, being slightly less efficient, is more efficient than its equivalent OP in caps after 26.67 seconds. It's not uncommon for most cruisers and capitals to be able to fire continuously for that long, even under pressure from enemy fire, which makes the hullmod a compelling choice. This is particularly relevant for ships that have a tendency to be over-fluxed, like Onslaughts and Paragons.

Hullmods II

Safety Overrides

Safety Overrides (SO) provides massive bonuses to dissipation, speed and maneuverability at the cost of range over 450 SU, peak performance time, an inability to actively vent, and a hefty OP cost. The viability of many weapons changes heavily on a ship with SO, such as the Assault Chaingun whose exorbitant 400 flux/second cost and 450 range becomes significantly more manageable with SO's benefits, or conversely long range weapons like the Hypervelocity Driver become terrible.

SO ships generally require aggressive, or even preferably reckless officers/fleet doctrine in order to properly engage with their longer ranged enemies. They also perform significantly better in large numbers, which can cycle in and out of the battle as required, than as individual ships, which have a tendency to fly ahead and die while isolated.

Luxury Hullmods

The hullmods listed in the previous section indicated highly recommended hullmods for most ships. However, some ships have unique characteristics that may make some of the luxury hullmods more valuable. Here are some possible reasons you might want to consider these hullmods:

- **Accelerated Shields.** (Omni-shielded) Ships that really need their shields up ASAP, or ships with particularly slow raising time.
- Examples: Hyperion, Paragon.
- **Advanced Turret Gyros.** Slow moving weapons like the Gauss or Hellbore Cannons, or for PD ships, especially those running Advanced Optics or Armored Weapon Mounts (both of which slow weapon turn rate).
- Example: PD Scarab.
- **Advanced Optics.** Ships that basically only use beams. Mostly good for Frigates since the bonus is larger than ITU for them at comparable cost.
- Example: PD Scarab.
- **Armored Weapon Mounts.** Technically more effective per OP than Heavy Armor at the following thresholds: 375/800/1350/1500 armor. (However, note that armor does not scale linearly - every point of armor makes additional armor more valuable. Also nice for ships that have many hardpoints and don't need to turn quickly.
- Examples: Afflictor, Centurion, Dominator, Onslaught.
- **Automated Repair Unit.** Ships that have Ill-Advised Modifications, or shieldless ships.
- Examples: unrestored LP Ships, Hound
- **Auxiliary Thrusters.** Ships that need to aim with hardpoints, but lack natural agility. Ships that lack defenses from certain angles.

- Examples: Dominator, Legion, Onslaught
- **ECCM Package.** Missile ships, or any ship that is using a Hurricane MIRV (it becomes far more precise). Also worth considering for ships that only run Salamanders/ammoless missiles.
- Example: 4 M Missile Falcon P.
- **Expanded Magazines.** Ships using Autopulse and Burst PD Lasers. **It does not affect ammoless weapons.**
- Example: Autopulse on Paragon.
- **Expanded Missile Racks.** Ships with a healthy complement of missiles, or any ship using Annihilator Rocket Pods. Slightly more efficient on destroyers.
- Examples: Enforcer, Drover.
- **Flux Coil Adjunct.** Like Flux Distributor, but for Phase Ships.
- Examples: Afflictor, Shade.
- **Hardened Subsystems.** Phase Ships, smaller ships with extra OP, ships using Safety Overrides.
- Examples: Afflictor, Shade, Drover.
- **Insulated Engine Assembly.** Outperforms Resistant Flux Conduits when preventing flameouts from Anti-engine missiles like Salamanders. (Also for lowering your fleet's sensor profile in campaign.)
- Example: Lashers wanting to not get wrecked by Salamanders.
- **Integrated Point Defense AI.** One of the better "luxury" hullmods, should be strongly considered whenever you have a lot of PD. Any ship with over 12/24/36/60 OP in PD would probably be better off down-sizing/removing 4/8/12/20 OP and grabbing IPDAI instead.
- Example: The previous Dominator example, Onslaughts (most combat capital ships, tbqh)
- **Makeshift Shield Generator.** For very fragile ships that also don't have shields.
- Example: Buffalo Mk.II.
- **Reinforced Bulkheads.** Ships you want to recover whenever they blow up (if they blow up often). Particularly fast and fragile ships, which sometimes get a little too aggressive and end up paying for it. There's also probably some comparison to AWM/Heavy Armor for armor/hull ratios, but I don't know any specifics besides playing it by ear.
- Examples: Hound, Omen, Tempest.
- **Resistant Flux Conduits.** Phase ships, ships that need to reduce EMP damage (e.g. ship system that disables shields) and want to vent faster (usually not relevant for AI control beyond fast frigates, but it's better than vents for active venting at 120/240/360/600 dissipation).
- Examples: Afflictor, Omen, Shade.
- **Shield Conversion - Front.** Note the reduction to shield upkeep stacks multiplicatively with Stabilized Shields (to ¼ of original shield upkeep). Usable on 180+ degree omni-shielded ships to get 360 degree coverage. Good on ships that might want both Stabilized Shields and Extended/Accelerated Shields. Not especially good on ovular ships like the Aurora, since the shields will extend far out into the flanks and can end up taking unnecessary hits, or broadside ships like the Conquest and Odyssey since it can mess with the AI.
- Example: Centurion.

- **Solar Shielding.** Reduced energy damage taken affects only armor/hull (i.e. does not affect shields), so ships that specifically need that. It furthermore reduces the PPT and CR degradation penalties that occur when fighting in hazardous terrain like star coronas. Note that it does not affect EMP damage from energy weapons.
- Examples: Phase ships.
- **Unstable Injector.** Note that the reduced weapon range does not affect missiles. Ships that want to move faster and also probably don't really need weapon range. Frigates and destroyers early-game/pre-ITU.
- Examples: Omen, Shade, Gryphon.

(For a deeper explanation of the mechanics of some hullmods (e.g. Auxiliary Thrusters), consult the wiki:

<https://starsector.fandom.com/wiki/Hullmods>)

Weapon Groups II

Flux Management

The main reason to adjust weapon groups is to spread out the flux used by your weapons. The AI becomes more willing to shut off weapon groups when they use too much flux and, contrapositively, they can consistently keep low flux groups permanently on autofire.

I don't have any rigorous testing backing this, but as a rule of thumb, it should be something like (assuming linked, though this possibly applies to alternating fire as well) **no weapon group's (sustained) flux should exceed $\frac{2}{3}$ of your total dissipation**. Some exceptions can be made for Strike-tagged weapons, which are only ever fired as the active weapon group anyways.

Active Weapon Groups & Mixing Different Weapons

This technique primarily applies to missiles, which the AI may not be using as often as you desire. You can link missiles that only fire at opportune moments such as Harpoons with missiles that can essentially be auto-fired, such as Salamanders, or Point Defense in order to have the missiles be fired as often as possible/whenever enemy missiles or fighters are in range. Sometimes you have to strike a balance in the ratio of opportunistic and autofire weapons, making this something that has to be tested in sim before proper use.

If you have multiple missiles that are not opportunistic, but also do not auto-fire, such as Locusts, Sabots and Squalls, the AI will generally be unable to use them cohesively. You can get around this by placing these weapons in the same weapon group, or in conjunction with other similarly ranged weapons. This also has the secondary benefit that some missiles be "screened" by the weapons they're grouped with. However, be aware that the AI may waste some missiles in nonoptimal situations.

Auto-firing missiles like Salamanders can safely be placed in the PD weapon group if there isn't enough room to give them their own group.

Firing Modes

There are three different ways you can adjust how a set of weapons fire:

1. Same weapon group, Linked. As the active weapon group, the AI will fire the weapons together as long as its flux permits it.
2. Same weapon group, Alternating. As the active weapon group, the AI will fire the weapons together while at low flux, but may only fire some of its weapons when it reaches higher flux. On autofire, it's effectively the same as Linked. Its main use-cases are:
 - a. Reliably use weapon groups that have huge flux costs (e.g. multiple Plasma Cannons or AM Blasters)
 - b. Mixing hardpoints and turrets in the same weapon group so the hardpoints don't fire at nothing
 - c. Prevent funky stuff happening when mixing the different types of PD beams (sometimes the AI will use it as the active weapon group, wasting flux and/or charges on targets that can't be hit).
3. Different weapon groups. This option is rarely available for capitals or ships that use a large variety of weapons, but it's more reliable at flux management than Alternating and may be preferable if you're more worried about overloading or being flux locked than about dealing as much damage as possible.

Ultimately, however, aside from setting missiles to Linked, the specific firing mode used is unlikely to have a significant impact on the ship's performance.

Miscellaneous Concepts, Tips & Techniques

Ablative Point Defense

Disregarding the weapons with pass-through mechanics, non-point defense weapons can still be used to stop missiles simply through stopping it with a large volume of fire. Examples where this can be seen:

- The Hammerhead with dual Heavy Autocannons can usually get away without any forward PD since its Accelerated Ammo Feeder-boosted fire rate can block a large number of missiles.
- Dominators and Onslaughts that use Annihilator Rocket Pods often have enough forward facing ordnance that torpedoes cannot hit the front of the ship while they're firing, hence less PD is required in that section.
- Locusts can be an excellent means of dealing with missiles, or screening for more dangerous missiles like Harpoons and Sabots.

Broadside Ships

In vanilla, there are two notable broadside ships: the Conquest and the Odyssey (though the modiverse has many more examples). The Odyssey still follows a fairly standard loadout process since its main guns are limited to one side, but the Conquest's symmetric design results in a lot of ways to cause problems for the AI.

In short, the simplest way to get an AI-friendly loadout is to have main guns on only one broadside, with the other side being empty or PD. This saves a lot of flux and OP, and comes with the additional benefit of lost DPS and time from the ship haphazardly switching sides. The fewer fancy maneuvers a ship ends up doing, the better it will perform on average.

EMP Mitigation

There are a number of methods for reducing the effects of EMP weapons from anti-engine missiles (e.g Salamanders) and weapons with on-hit effects such as Ion Cannons, Pulsers and Beams.

First, some universally helpful hullmods:

- Resistant Flux Conduits (RFC) reduces the EMP damage taken by ships by 50%.
- Armored Weapon Mounts (AWM) doubles the HP of your weapon mounts while maintaining the same time to repair.
- Insulated Engine Assembly (IEA) doubles the HP of your engines while maintaining the same time to repair.
- Automated Repair Unit (ARU) allows disabled weapons and engines to repair at twice the rate (note: due to a bug in 0.9.1a, weapons are actually repaired at 4x the rate).

Additionally some hullmods help against specific types of EMP weapons:

- Hardened Shields reduces the likelihood of shield-piercing arcs from weapons like Ion Beams and Tachyon Lances by 25%.
- Integrated Point Defense AI is helpful for having better tracking to take out missiles like Salamanders.

Due to the bug, ARU is probably the most helpful of the four when it comes to dealing with weapons being disabled. Reduced EMP damage from RFC and doubled health from AWM and IEA are essentially equivalent, so which to choose depends on which of the other benefits the hull mod provides (25% faster active vent / 10% armor, slower mount turn speed / 10% hull, campaign benefits, logistic hullmod slot) is most preferable.

Weapon positioning and usage can be manipulated to mitigate the effects of EMP arcs. Since EMP arcs randomly hit any weapon or engine on a ship (including disabled ones), but not empty weapon mounts, the more weapons you add to a ship the less likely its main weapons will be hit by EMP damage. Thus, it is a viable strategy to add low OP-cost weapons (especially when

modded content adds usable low-flux 1 OP-cost weapons) for additional EMP protection. Furthermore, because EMP damage hits in a small radius around the point of contact, keeping important weapons separated can stop all of a ship's main weapons from being disabled at once.

Fighting Fighters and Other Strike Craft

Some factions (particularly Tri-tachyon in vanilla) can generate fleets with massive numbers of strike craft which can cause serious issues for unprepared fleets. Some issues with large numbers of strike craft if a sufficient number aren't killed at every engagement are:

- Carriers will have time to replace their fighters and engagements can end up "cycling" between the strike craft of different carriers, allowing no downtime.
- The AI struggles to be aggressive enough to push through strike craft swarms and hit the carriers behind them.
- Most weapons that are good against larger ships also tend to be weak against strike craft, and vice versa.

Hence, knowing ways to specialize against strike craft can prove to be helpful. Here are things to look out for (**bolded** examples are especially effective):

- Weapons that deal damage in an area of effect (AoE), especially if it is High Explosive damage.
- Examples: (Dual) Flak, **Devastator Cannon**, **Proximity Charge Launcher**.
- Weapons that fire a large number of (accurate) projectiles at once.
- Examples: Light Assault Gun (in a pinch), Assault Chaingun, **Locust SRM**.
- Beams with high extension speed (this notably precludes Tactical Lasers).
- Examples: (Burst/LR) PD Lasers.
- Some damage dealing ship systems.
- Examples: Doom **Mine Strike**, Omen/Shade **EMP Emitter**.
- Your own **interceptors**.
- Examples: Sparks, Wasps, Talons.

The only particularly important hullmod is Integrated Point Defense AI. It nullifies the flares of Assault Fighters, provides a nice bonus to autofire accuracy for PD weapons, and the increased damage to missiles can be extremely helpful against bomber barrages. The EMP-mitigating hullmods should also be considered if facing EMP Fighters.

Finally, setting your fleet's aggression to Aggressive or Reckless (or using the more aggressive in-combat orders, like Full Assault or Eliminate) can help somewhat to deal with AI skittishness. Ultimately, carriers and strike craft are very dependent on reaching a critical mass; if enough strike craft are taken out between each engagement, they will eventually be worn down.

Missile/strike craft pass-through

When most weapons hit missiles, the projectile will disappear upon destroying the missile, even if their damage exceeds the missile's health. Some of the larger weapons have a unique ability to destroy missiles and then continue flying. In vanilla, these would be the Hellbore and Gauss Cannons. Furthermore, in addition to missile pass-through the Plasma Cannon has strike craft pass-through, allowing it to damage multiple strike craft per projectile (note that it only does a single damage instance, so while it may overload shields, it will not then damage the hull underneath).

Weapon Range distribution

This technique works best on ships running on Steady personality, but the idea is to use high efficiency/impact but low range weapons in conjunction with standard main gun armaments so that the high efficiency weapons can be used in an anti-fighter/frigate role. Despite appearing to be significantly overfluxed, these extra weapons will not always be active, preventing extreme flux buildup. Examples:

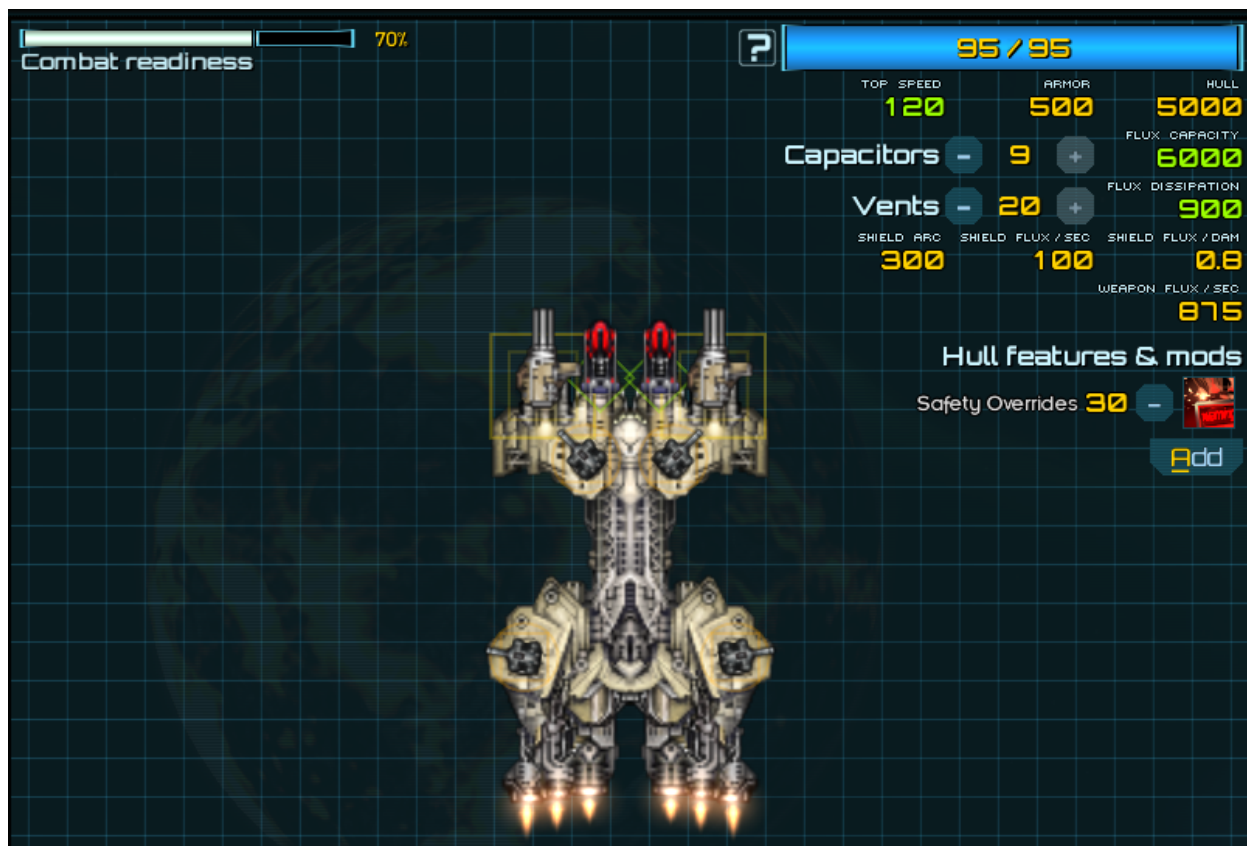
- Assault Chainguns/HMGs on Dominator and Onslaught medium/side slots.
- AM Blasters on Paragon

Examples

Here are some fits that try to show stuff like: SO builds, phase ships, down-sizing weapon mounts, leaving mounts empty, luxury hullmod considerations, ship system considerations.

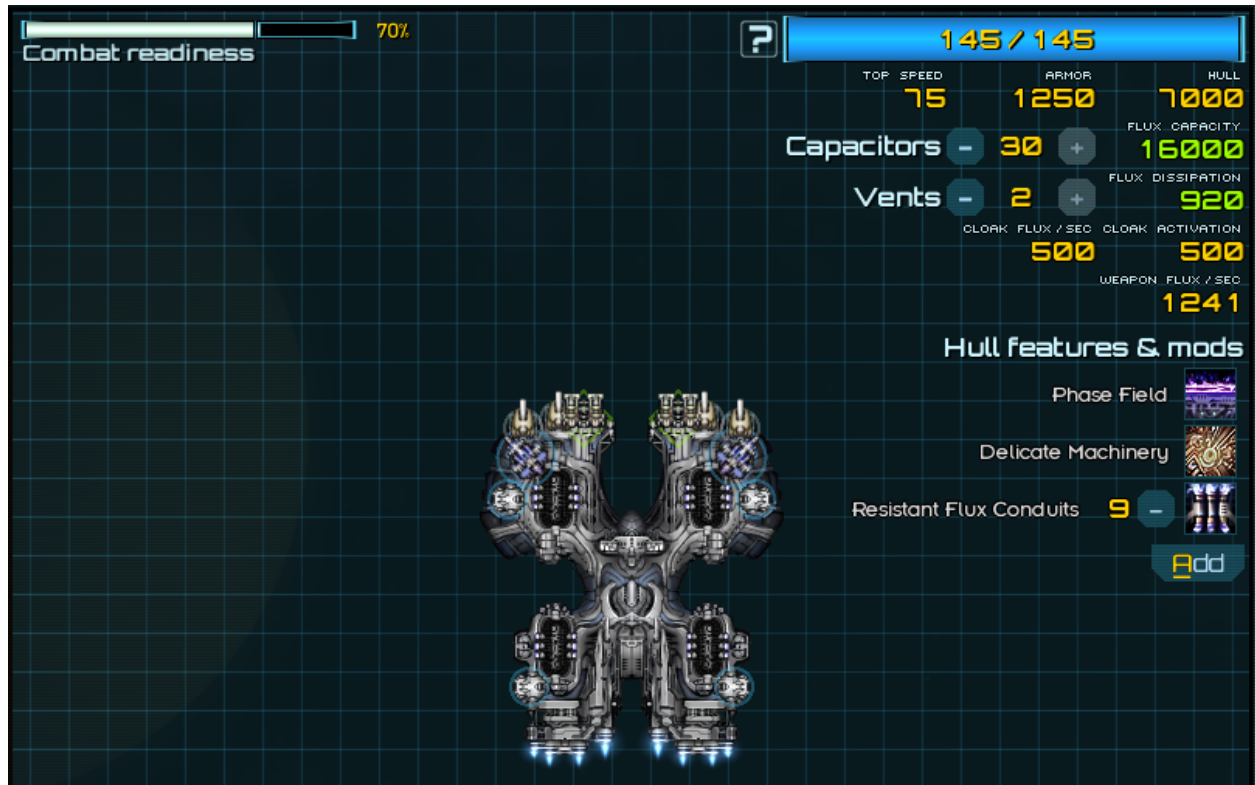
Link to album: <https://imgur.com/a/BzqSCkA>

SO Hammerhead



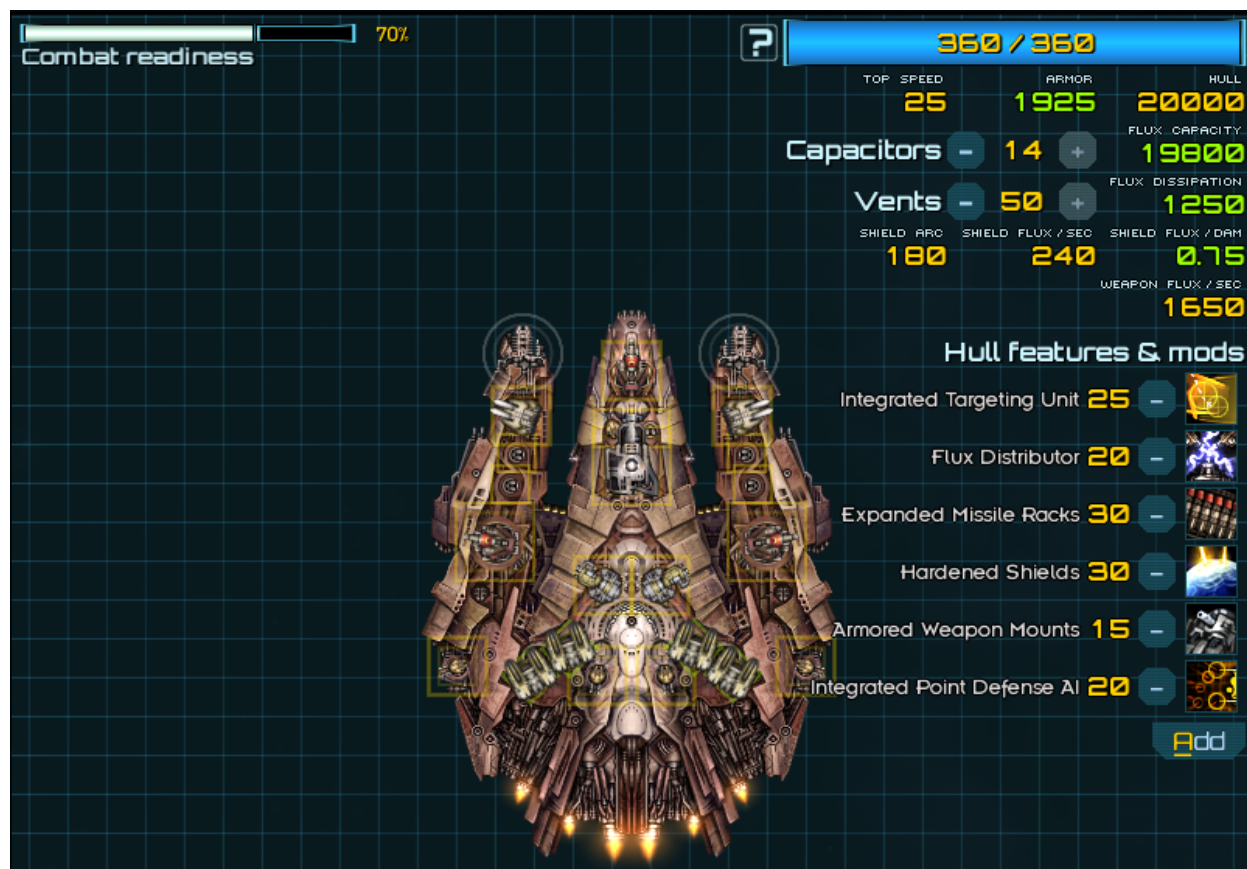
- Double Assault Chainguns (ACGs) for maximum HE damage (they're kinda broken).
- LMGs (not dual to save on OP) for kinetic damage.
- Max vents due to its efficiency on SO ships, plus lack of venting options.
- Linked Reapers, and ACGs on separate weapon groups.

Doom



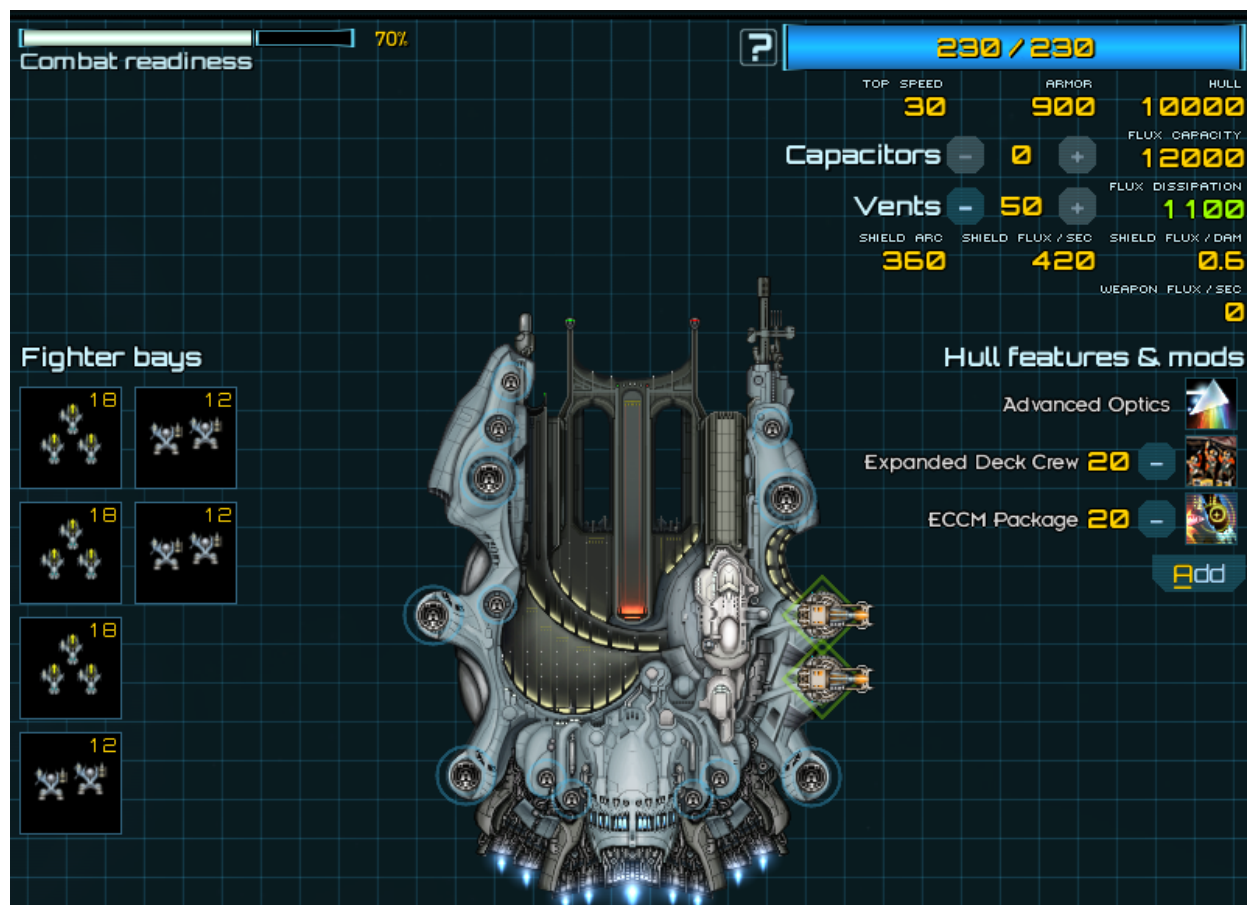
- Max capacitors for higher alpha striking.
- Sabots and Needlers for spiky kinetic damage with faster cooldown during phase.
- Phase Lances for additional spike damage with faster cooldown during phase.
- Burst PD Lasers can regenerate ammo faster when phased.
- RFC for faster venting when safe.

Onslaught



- Side large weapon mounts downsized to Flak Cannons since they do not converge forwards.
- Flux Distributor out performs extra capacitors.
- Annihilator Rocket Pods really want EMR for longevity.
- Hardened Shields are more AI friendly than Heavy Armor and more efficient than additional capacitors.
- Armored Weapon Mounts provide good value due to high armor and many weapon mounts.
- IPDAI Flak and Vulcans can deal with anything less than 8 concurrent Salamanders
- Frontal Flak and Vulcan slightly outperforms Dual Flak (better vs Sabots, EMP arcs, lower flux usage)
- HVDs and Hellbore are placed in the same weapon group to have consistent kinetic pressure (as opposed to grouping with Needlers).

Astral



- Expanded Deck Crew in case any bombers die during the run.
- Linked ECCM'd Hurricane MIRVs for long-range burst damage.
- 3/3 mix of Longbow (kinetic) and Dagger (HE) bombers. Usually the Longbows will hit before the Daggers.
- Max vents to maximize the use of the Astral's Recall Device ship system.
- No weapons besides the Hurricanes so we can have more vents. If something gets close to your Astral you've already got problems.

Conclusion

Honestly, just get your flux stats down right and everything else will probably follow naturally.

Appendix

Loadout Adjustments for Player Piloting

While the advice present in this guide is written in the context of designing ships for AI control, much of it is also applicable for player piloted ships. Some notable differences are:

- Weapon groups are much more personalized. If you want to set your missiles to Alternating for finer control, do so. Alternating fire has a more pronounced effect since you can properly control it.
- Vents and hullmods such as Hardened Shields, Flux Distributor and especially Resistant Flux Conduits gain significantly more value since the player can be much more aggressive about actively venting, so reducing vent time is extremely useful.
- Armor/Hull increasing hullmods become significantly more valuable since the player can use it contextually instead of basically always being the last resort defense.

Basically, instead of working to increase raw stats as much as possible to maintain ships' longevity, a player can use less efficient but more aggressive loadouts to support a more active playstyle.

And of course, you can always do much fancier things with your loadouts that the AI could never handle, like broadside Onslaughts.

Testing: Simulator, Missions, Mods

Even when a ship looks solid in theory, it's very possible that some AI quirks exist that affect its actual performance in combat. Hence, testing your ships is the most important part of the shipbuilding process. There are several methods available with which you can test the loadouts you've created.

The simulator is the most accessible one, being right on the refit screen. However it has a number of limitations:

- The variant selections available are limited, and the ones that are there are not well-optimized themselves.
- If used for 1v1s, results will have poor applicability in fleet situations. **Don't evaluate ships based on 1v1 performance!**
- Some 1v1 scenarios can be deterministic when they shouldn't be (e.g. I can always win an Onslaught 1v1 even with identical loadout)

That being said, it's still helpful to spot issues with weapon groups, flux usage (in particular, you can see if/how quickly your loadout can get choked on flux) and weird weapon behavior (like double Phase Lance Medusas sometimes approaching at an off-angle).

If you find yourself lacking in available gear, or just want to be able to make the best possible build in a vacuum, finding and refitting the ship you're looking for in one of the game's missions provides you with every available weapon, wing and hullmod (and some that shouldn't be available) for you to test with. Some limitations:

- You're limited to using whatever ships you can find
- If you have a large mod list, sorting through all the weapons/wings can be annoying
- You can't take into account Loadout Design 3.

but for the most part it's the best means to design ships if that's your goal.

You can find the variants you've created in missions in the file path

.../Fractal Softworks/Starsector/saves/missions/<mission_name>

They can be viewed using any text editor.

(Also for anyone interested, I have a mod to provide missions with blank ship hulls of basically all the ships for vanilla and most mods, which can be found [here](#).)

Some mods have useful tools for testing:

- LazyWizard's **Console Commands**, for obvious reasons.
- Blothorn's **Automatic Orders** allows you to test different officer personalities and AI orders.
- Tartiflette's **Target Practice** provides some stationary hulls (some with shields!) in the simulator that you can use to check time-to-kills or whatever, as well as one dummy that fires harpoons to test your PD.
- MesoTroniK's **Tiandong Heavy Industries** provides the amazing `shootinggallery` console command, which expands on the Target Practice mod to allow you to create dummy versions of *any* ship/variant you've loaded into the game. (It can also be used with the built-in `toggleAI` command to make them proper simulator opponents.)
- Tartiflette's **Fleet Tester / AI Battles** (available in the [Starsector Discord](#)). The same mod used for tournaments, these mods allow you to create your own battles with custom made variants. There's some overhead involved in the process of setting up the battles, but it's an excellent resource for testing proper fleet battles (or even doing 1v1s without aforementioned simulator bias). I'd recommend AI Battles over the Fleet Tester mod, since the latter still allows enemy ships to retreat.
- (My **Second Wave Options** updates the variants in the simulator with ones that are a bit more challenging and adds some more variants besides, but it comes with some other campaign stuff that you have to disable in a settings file.)

The above mods can all be found in the forum's [Mod Index](#), with the exception of AI Battles.

An In-Depth Look At Weapons Stats

Which weapon stats are the important ones, you may find yourself asking. It turns out the answer is most of them. Here are some important criteria for evaluating weapons in general (and, in my opinion, in rough order of importance):

1. **Damage Type.** See [damage types](#).
2. **Flux efficiency.** The more damage that can be done per point of flux used, the better.
3. **Flux per second.** Some weapons like the Storm Needler may have excellent flux efficiency, but the flux cost is still exorbitant and hence becomes unusable. A decent rule of thumb is that the total weapon flux of all non-PD weapons should not exceed twice your total dissipation.
4. **Range.** Having higher range means being able to raise the flux of opposing ships before they can return fire, and reduces the risk of ships being caught in the crossfire of multiple opposing ships. That said, lower range weapons generally tend to be more efficient (at least for ballistics--energy weapons typically operate within similar range bands if you disregard beams) and depending on loadout these weapons can be preferable. More importantly, it is usually ideal for the main guns of a ship to have similar range as the AI can handle this better.
5. **Accuracy/Projectile(/Extension) Speed.** These stats effectively determine what proportion of shots fired actually manage to hit the opponent. Shots that miss are essentially wasted damage, so a weapon's effective DPS may be lower than the value listed on their stat card.
6. **Damage per shot.** Because of the way armor calculations work in this game, one high damage shot is better for piercing armor than many low damage shots. It's therefore important for ships to have *some* source of high damage, especially when trying to break the heavy armor present in cruisers and capital ships (and more especially ones that have officers with armor improving skills). High DPS HE weapons can somewhat get away with this due to their double damage multiplier, but energy weapons like the Pulse Laser can have serious issues without some means of dealing with armor. Also, higher damage per shot weapons can make opposing ships more reluctant to vent.
7. **OP Cost.** Every ship has a budget and they're designed so that you can't outfit a ship entirely with elite weapons without serious issues with flux stats or hullmods. Even weapons that seem lacklustre can be preferable if the difference in OP is large enough.

Less important, but still noteworthy:

8. **Damage per second.** This stat can be a bit of a trap, since sometimes high DPS weapons can perform poorly (e.g. Pulse Laser against high armor) and low DPS weapons can be very powerful (e.g. AM Blaster). It's good to do higher DPS on paper, but this stat is almost entirely superseded by the ones above.
9. **Flux per shot.** This stat is essentially negligible for nearly all the weapons except for the Gauss Cannon (and only for the Mudskipper Mk.2), the Antimatter Blaster and the Mining Blaster. Basically while these weapons can deal massive bursts of damage, on smaller ships it may have a detrimental effect by severely fluxing out the ship that's firing the weapon. It adds an

extra period of vulnerability that you may not notice looking purely at the flux per second stat (particularly in the case of the AM Blaster).

Mechanics

For armor mechanics, see: <https://starsector.fandom.com/wiki/Armor>

Yet Another Armor/Damage Calculator

Efficiency vs Armor Comparisons

~~Also the given values correspond to regular armor, as opposed to stripped armor. In the case of stripped armor, fragmentation weapons will deal 4x the damage, kinetic will deal 2x, and HE will deal 0.5x compared to the values below.~~

General formula: solve for x = Armor given F = FluxPerShot, D = DamagePerShot

$$F1 / (D1^2 / (D1 + x)) = F2 / (D2^2 / (D2 + x))$$

(Remember multipliers for HE, Kinetic and Fragmentation damage)

~~Heavy Blasters = Pulse Lasers when the enemy ship has 41.872 (5% of 837.44) armor.~~

~~Mining Blasters = Pulse Lasers when the enemy ship has 71.838 (5% of 1436.76) armor.~~

~~Plasma Cannons = Autopulse Lasers when the enemy ship has 79.47 (5% of 1589.4) armor.~~

~~Heavy Maulers = Heavy Mortars when the enemy ship has 338.46 armor.~~

~~Mining Blasters = Heavy Blasters when the enemy ship has 636.36 armor.~~

(This doesn't say anything about effectiveness vs shields, or DPS in the end, but it may be worth considering. Hopefully it's also a decent illustration of how armor can be a serious issue for Pulse Lasers.)

DPS vs Armor Comparisons

General formula: solve for x = Armor given D = DamagePerShot, R = RefireDelay

$$(D1^2 / (D1 + x)) / R1 = (D2^2 / (D2 + x)) / R2$$

~~Hellbore Cannons = Hephaestus Assault Guns when the enemy ship has 318.707 armor.~~

~~Heavy Maulers = Heavy Mortars when the enemy ship has 1545.95 armor.~~

EMP Damage

EMP damage is not affected by armor.

Ion Beam / Tachyon Lance

The base chance for either beam to pierce shields is $(\text{HardFlux}/\text{Capacity} - 0.1)$, per tick of damage. EMP arcs will randomly hit any weapon or engine of the ship, including disabled ones.

Ion Cannon

Despite listing 400 EMP damage on the stat card, the Ion Cannon only deals around ~200 damage on direct hits, with a small AOE that deals ~100 EMP damage. EMP arcs will randomly hit any weapon or engine of the ship, including disabled ones.

Salamander

Similarly, despite listing 1500 EMP damage on the stat card, the Salamander can really only hit engines for around ~750 damage at best, along with a small AOE that does half the damage. Hence:

- Frigates will need both Insulated Engine Assembly and Resistant Flux Conduits to survive direct hits against Salamanders.
- Destroyers need both for their smaller engines, but can survive on only one for their larger engines.
- Cruisers need one of the two to survive direct hits.
- Capitals can usually take one hit without problems.

Mounts, Weapons and Engines

Weapon HP for small/medium/large weapons in turrets: 250/500/800

Weapons in hardpoints have double the health.

Weapons and engines that are disabled cannot be further damaged until they are repaired.

When repairing after being disabled:

Turrets recover at a rate of ~22.5/33.3/40 HP/sec for small/medium/large weapons.

Time to recover is ~11.1/15/20 seconds.

Hardpoints recover at a rate of ~33.3/50/66.7 HP/sec for small/medium/large weapons.

Time to recover is ~15/20/24 seconds.

Armored Weapon Mounts doubles the recovery rate, but also the turret HP, so same time to recover.

Automated Repair Unit also doubles the recovery rate

Engine HP = $\text{size} \times (150 + \text{length} + \text{width})$ where size is 1-4 for frigates to capitals.

Further clamped to be between $175 \times \text{size}$ and $250 \times \text{size}$ (e.g. some capital engines will have 1000 HP even though their trails are larger). Thus, before modifications due to hullmods:

- Frigate engine HP ranges from 175 to 250.
- Destroyer engine HP ranges from 350 to 500.
- Cruiser engine HP ranges from 525 to 750.
- Capital Ship engine HP ranges from 700 to 1000.

Ship Systems

See the wiki for additional details: https://starsector.fandom.com/wiki/Category:Ship_Systems

Cost, uptime and cooldown stats can be found in the ship_system.csv file. Listed are some minor notes that require looking at individual .java files or testing.

Burn Drive: provides +200 speed.

Drone Systems (there aren't any in vanilla at the moment, but some mods have them): unaffected by fighter boosting skills.

EMP Emitter: releases 20 100/500 energy/EMP damage shots over 5 seconds. Has 500 range.

High Energy Focus (getEnergyWeaponDamageMult()): does affect EMP weapons.

Mine Strike: mines do 2000 HE damage and have 500 HP. Has 1500 range.

Phase Skimmer: 300 range.

Plasma Burn: provides +600 speed. Flameouts are based on the mass of the ship (Shrike can flameout from hitting large asteroids!)

Quantum Disruptor: Lasts 1 second. Has 600 range.

Targeting Feed: The AI for this is fickle as hell. Bombers have high weight, fighters have small weight and interceptors have 0 weight, so the AI will not manually fire this if you use 3 Sparks, for example. Less willing to use the ability when targeting capital ships for some reason?

Other Resources

SCC's Guides:

[How 2 Weapons](#)

[How 2 Ships](#)

[How 2 Fighters](#)

Important Wiki Pages:

[AI Behaviour](#)

[Armor](#)

(Do let me know if you find other helpful resources.)

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And of course, thanks for reading. Feel free to send questions, comments and suggestions to me at [rubi#0864](#), or wherever this guide is posted.