

# Multi-Stage Aether Drive



The Multi-Stage Aether Drive is a heavily upgraded and more mature version of the [Dual Stage Aether Drive](#), developed for use in [Star Army of Yamatai](#) vessels in [YE 39](#) by [Kage Yaichiro](#). Its purpose is not only to diversify the modes of operation of earlier engine technology, but to allow it to support components commonly installed nearby. It also has applications in planetary and aquatic craft, due to its various modes of operation.

## History and Background

Developed as an expansion to the [Dual Stage Aether Drive](#) technology used in the [Kirie Thought Armor](#) and [Keiko Thought Armor](#), the Multi-Stage Aether Drive was designed to be a versatile engine system suitable for a high performance general purpose exploration and combat vessel. The thrust vectoring attributes were inspired by the [Hayai-Class Gunboat](#).

The system was intended to allow a vessel to operate optimally in various environments, as well as to avoid polluting worlds with Turbo Aether Plasma emissions and sensor clutter in the move away from gravimetric and CFS-based slower-than-light travel. Feedback on the [Plumeria-class \(2D\) Medium Gunship](#) also indicated that the antimatter storage tanks in the pylons for storing the ammunition of the [Ke-S3-W2901 Positron Accelerator Cannons](#) was a notable weakness, so it was decided to also use the engine as a real-time source of positrons for the weapons to remove the weakness and perhaps move these cannons to the pylons. This introduced the concept of having the engine act not just as an engine, but a supplemental positron and electron/energy source for surrounding systems such as a [Integrated CFS Array](#) as well as a matter/plasma source for a [Standard Star Army Fabrication Area](#).

## About the Multi-Stage Aether Drive

The Multi-Stage Aether Drive is a streamlined unit that uses the innate Aether tap nature of the engine to also function as a power, matter, and antimatter source on demand while also expanding the areas in which an equipped vessel can operate with assorted STL types. The fact that STL components are often placed adjacent to weapons, a [Continuum Distortion Drive](#), a [Combined Field System](#), or [Integrated CFS Array](#) components resulted in the creation of this system's support equipment. This unit can also convey plasma drawn from the Aether Drive as well as mass from the intake of the engine to a [Standard Star Army Fabrication Area](#).

As a result of the fact that such a system would often be found in nacelles at the end of pylons and would likely be unmanned during battle in a Plumeria-class, streamlining and simplicity were orders of the day in the development of this system. As such, though it can act as a secondary powerplant, it was designed not to require the same fine level of direct physical intervention as a ship's actual engineering area nor is it meant to replace one. It still, however, requires occasional servicing as well as to be checked over after battle. This nature also lends the design well to shuttles and other more compact secondary craft which may not require a dedicated engineering area in the first place and also need a diverse set of propulsion options for various mediums. For example, the Jet Mode allows for an option which is attractive to atmospheric fighters and the Magnetic Drive is useful for aquatic craft or use in a non-combusting atmosphere.

## Modes, Practices, and Ranges of Engine Operation

The multi-role nature of the Multi-Stage Aether Drive is specific in that it is intended to minimize the damage in the atmosphere of a planet by transitioning into different modes of operation to better suit the environment in which it is used. Propeller and Jet are for use in atmosphere, Magnetic is for use in water or non-combustible atmosphere, and Turbo Aether Plasma is used for space. These are developed not merely as a matter of technological superiority, but to maximize diversity and for the safety of a planet's ecosystem against Aether emissions. It also helps avoid the diplomatic disagreements which may occur if Turbo Aether Plasma is employed in atmosphere, and clears up sensor clutter for traffic control on populated worlds.

Mode of Propulsion	Standard Altitude Range <sup>1</sup>	Functional Altitude Range	Operational Speed Range	Special Details
Propeller	0 ~ 12.5 km	0 ~ 24 km	0 ~ 864 kmh / 537 mph(Mach 0.7)	Used in subsonic flight or non-magnetic liquid, useful in volatile or noncombustible atmospheres
Jet	0 ~ 33 km	0 ~ 40 km <sup>2</sup>	0 ~ 6174 kmh <sup>3</sup> / 3836 mph(Mach 5)	Primary method of lower atmospheric propulsion
Magnetic	N/A	N/A	Variable by pressure	Used for underwater propulsion or in thick, magnetic alien atmospheres
Low Turbo Aether Plasma	33 ~ 100,000 km	10 ~ 65,000 km	0 ~ 14,990 kms / 0.05c	Low thrust mode with diffuse exhaust within atmosphere/magnetosphere

Mode of Propulsion	Standard Altitude Range <sup>1</sup>	Functional Altitude Range	Operational Speed Range	Special Details
Turbo Aether Plasma	100,000 km onward	65,000 km onward	Vessel's full STL Range <sup>4</sup>	Standard Operation

<sup>1</sup> This presumes a Yamatai or Nepleslia-like planet <sup>2</sup> Upper limit in practical use on vessels, 75 km is theoretical top altitude for specialized systems <sup>3</sup> Upper limit on most aerodynamic craft or vessels using the [Integrated CFS Array's Streamlined Mode](#), Mach 15 is limit for specialized craft <sup>4</sup> Dependent on specific vessel's standard top speed

It is standard practice above a Yamatai or Nepleslia-like planet to transition between Jet and Turbo Aether Plasma Modes, the two modes most often employed, at roughly 33 kilometers of altitude for this purpose. Turbo Aether Plasma Mode is used at a reduced capacity below 0.05c ( just under 14,990 kilometers per second), with its thrust vectoring systems diffusing the exhaust into a cloud rather than a cohesive beam, until reaching a distance of 100,000 kilometers. This minimizes the cumulative impact of Turbo Aether Plasma on the atmosphere and also prevents oversaturation of the inner magnetosphere with anti-particles and radiation. It also significantly speeds up the clearing of the engine signature on sensors. Combat operations or other situational needs may alter or waive this practice. The computer is capable of managing the entire process from liftoff to space and from space to landing in under a minute, simplifying the procedure for crew.

## Thrust Vectoring

All modes of operation can take advantage of force field and magnetic thrust vectoring at the exhaust for improved pitch, yaw, and roll. It is also possible in some variants to reverse the intake and exhaust for the ability to reverse or brake the vessel. For VTOL capability, both ends of the engine are switched to exhaust and a sub-intake is opened in the middle of the engine for more balanced control of the vessel on take off. It should be noted that this mode of operation is notably inferior to the [Integrated CFS Array's](#) emergency thrust vectoring capability through its [Discharge Redirection](#) function, but does not cost barrier strength to employ. The two are also not mutually exclusive.

While this capability is typically limited to the other modes when not in space, Turbo Aether Plasma Mode may use a pulse of it explicitly for the purpose of damaging hostile ground targets surrounding the vessel as it lifts off from a planetary site before switching to another mode. This is entirely at the discretion of the CO or XO.

## Propeller Mode

Perhaps the most simplistic mode of operation, Propeller Mode is the ability of the intake of the engine to use forcefields to direct air through the engine for thrust. While less efficient than the Jet Mode and having a sub-sonic top speed, it is capable of moving through gas or liquid without heating the medium and uses reduced power. In some volatile atmospheres or non-combustible ones, this is a suitable mode to fall back on. It is not intended for combat operations.

## Jet Mode

When in Jet Mode, the Aether Generator's ability to generate heat and microwaves is used to heat the medium being traveled through and make it expand without the need for fuel. This is a mode borne of the earlier [Aether-heated Jet Engine](#). Rather than using a conventional intake fan and exhaust, rotating and specially shaped forcefields near the intake powered by the Aether Generator component of the engine are utilized. This not only allows the intake to be micromanaged by the computer for optimum efficiency and acceleration; but also allows the engine to operate as various types of jet geometries and gradually transition from turbofan, through ramjet, and on to scramjet if needed in a specific application.

It should be noted that the structural integrity of the vessel the engine is installed in, the materials used for ship construction, and heat tolerances must all be taken into consideration when rating top speed. Because of this, vessel speed specifications will vary. Almost none can achieve the theoretical limit of Mach 15 for this system without being specially designed for this speed and lacking maneuverability. Most craft that are not as aerodynamic are limited to Mach 1.7, while more aerodynamic vessels can achieve approximately Mach 5. The CFS' barrier capability can help mitigate structural concerns and achieve high speeds, however, especially if an [Integrated CFS Array's](#) Streamlined Mode is being employed to minimize drag. As such, units that have this capability may have both of these different top speeds in Jet Mode; with and without the CFS' support. If the CFS collapses at these speeds, however, it could be problematic for the vessel at best. Extreme high speed should only be used if the CFS' strength is strong, and exceeding Mach 5 is possible but carries risks.

## Magnetic Mode

The Magnetic Mode operates on the practice of using magnetic force to draw matter into the intakes of the engine and accelerate it out the rear. It can be used as a traditional Magnetohydrodynamic Drive, but it is also capable of being used in other mediums such as atmospheres which are non-combustible and have some magnetic properties. As such, it replaces the Jet Mode in such scenarios.

It also has the benefit of not generating large amounts of heat and running off of a ship's fusion reactors if necessary, making a ship which uses this mode better able to conceal itself in the oceans of a planet if its CFS stealth is unavailable or impractical. It can even allow a ship to be explicitly designed for ocean operation. It should be noted that it is possible to shunt water to other parts of the vessel from the engines in this mode; be it for cooling or for electrolysis to obtain oxygen(for breathing) and hydrogen(for nuclear fuel).

As with use in Jet Mode, structural considerations should be employed with determining top speed, especially in regards to intended depth and pressure. The CFS can again assist with such matters, with the same considerations as in Jet Mode.

## Turbo Aether Plasma Mode

Turbo Aether Plasma Mode is where the Multi-Stage Aether Drive operates as a [Turbo Aether Plasma](#)

**Drive** Drive. It boasts the same performance and capabilities, making it a plausible option for Star Army craft. This is typically a fast engine, but the speed varies based on the specific model.

This mode, like the existing Turbo Aether Plasma, should not be used in atmospheres of planets (especially populated areas) heavily and the exhaust trail has the same destructive output. As they are based on Star Army of Yamatai designs, they have a teal glow. While the signs of Turbo Aether Plasma remain detectable for weeks, the actual potential for causing damage is only present for a matter of minutes. Due to this, it can safely be used at higher altitudes and for achieving escape velocity if certain practices are employed. Combat maneuvers may necessitate less throttling back of the engine or the complete rejection of these practices, at the CO's or XO's discretion.

When used in the upper atmosphere at reduced output, the magnetic component of the thrust vectoring systems can be used to diffuse the exhaust and the lower frequency radiation to cut the potential time for harm to a matter of seconds. This also reduces the time registering on sensors to something more akin to a few hours at most. The higher frequency radiation isn't diffused as much by this process, but cannot penetrate a Yamatai-like atmosphere past an air density consistent with 10 kilometers of altitude. Even with these safeties, it is recommended only to use this mode of operation when above an altitude of 33 kilometers, and not to go full-bore with the plasma engines until being clear of (or at least well-within) the magnetosphere of the planet. A downside of this mode of operation is that it requires large holes to be made in the CFS barrier to the rear to release the diffuse exhaust, and is impractical to employ in combat.

## Components

Rather than being a conventional engine, the design has multiple systems that work together to make the unit capable of performing various functions. They are geared to interact with other systems, and several parts have more than one purpose.

### Intake/Exhaust

The intake and exhaust on either end of the Multi-stage Aether Drive are largely the same in function and can switch roles as needed for reversing the vessel, slowing or braking the vessel, or rotating the vessel in place even without the use of supplemental thrusters. The appearance of the components more often used as intakes can vary widely, however, as they are not expected to produce the same amount of sustained thrust. Some are even armored with shutters when not in use or have a high variance in geometry depending on application. They are used normally to draw in matter when used as an intake, and can use forcefields and magnetic fields to shape and direct the intake. This can actively suck in matter both for actual engine use as well as for matter collection for other systems.

As an exhaust, the same forcefields and magnetic fields are used to thrust vector the output of the engine to adjust the orientation of the vessel more freely than previous offerings. This is inspired directly by the thrust-vectoring features of the [Hayai-Class Gunboat](#), though force fields are used instead of the physical shutters which were a point of wear in the Hayai's design. Electrons and/or Positrons can also be drawn from the plasma exhaust for extra power without compromising speed if desired.

Intake Appearance (Varies)	Exhaust Appearance
	

## Sub Intake

The sub-intake is simply an intake which is used to inject matter into the Engine for use exclusively for its VTOL capability. It allows all Intake/Exhaust to go into Exhaust mode, meaning that most vessels will have four vents from two engines for attitude and stability control. It is also not as elaborate nor as large as the normal Intake/Exhaust, as it is not expected to provide the same amount of thrust for acceleration. This intake is small, normally sealed, and covered in armor.

## Engine/Generator

Based on the [Dual Stage Aether Drive](#), the actual engine has a number of propulsion modes . It has the ability to heat a gas or liquid medium like an actual jet, it can move through water or other such materials with magnetic fields, and it can also act as a normal Turbo Aether Plasma Drive. The Generator is actually a separate component that feeds into the Engine tube directly for Turbo Aether Plasma Mode, but provides electrical power in all four modes of operation and supplemental heat and microwaves in Jet mode. The actual electron output of the generator exceeds the needs of the engine in all modes of operation, allowing the vessel to power adjacent equipment and assist in powering nearby equipment like a CFS or Integrated CFS.

Electrons for power aren't the only supplemental component drawn from these engines though. As Aether is comprised of plasma and anti-plasma, it can thus just as easily draw positrons from the Aether and readily use them as needed for positron weaponry. This allows the equipped vessel to bypass the dangerous need to store antimatter on board. Matter can also be collected both from the intake and from plasma for other systems.

## OOO Notes

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