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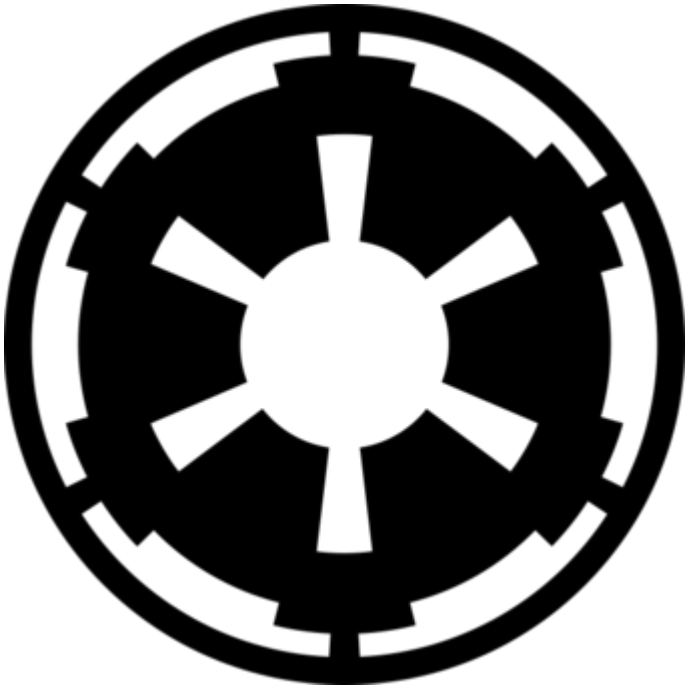

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RHO SQUADRON

First Recon Div, Battlegroup II, ISDII Warrior

3-01B - BASIC FIGHTER MANEUVERS

DISTRIBUTION STATEMENT A: Classified, For limited release within the Starfighter Corps.

DEPARTMENT OF THE NAVY
HEADQUARTERS STARFIGHTER COMMAND
IMPERIAL PALACE, CORUSCANT

47 After the Formation of the Empire (AFE)

FOREWORD

Starfighter Command Reference Publication 3-01B, Basic Fighter Maneuvers, presents how Basic Fighter Maneuvers are employed by the individual pilot, contains the skills and techniques required for individual pilot proficiency, and provides the skills that are required for basic through advanced fighter maneuvers.

This publication is intended to be used as a reference guide concerning fighter maneuver skills for unit commanders, trainers, and individual Pilots. It presents fighter maneuver techniques organized by topic, and within each of those topics, techniques are broken down further as they apply to employment in a combat environment

This publication supersedes Starfighter Command Reference Publication 3-01A, Basic Fighter Maneuvers, dated 15 AFOE. Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE STARFIGHTER COMMAND

Rapier

Grand Admiral, Imperial Starfighter Corps

Publication Control Number: 200208261141

Basic Fighter Maneuvers

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CH. 1 Introduction to Basic Fighter Maneuvers [15]

Basic fighter maneuvers (BFM) are actions that a fighter craft makes during combat maneuvering, historically known as dogfighting.

Basic fighter maneuvers consist of many varying tactical turns, rolls, and other actions to get behind or above an enemy, before the opponent can do the same. BFM are typically universal maneuvers which can be performed in almost any fighter spacecraf and are usually considered to be training maneuvers. Training usually begins with pilots flying the same type of spacecraft, pitting only their skills against each other. In advanced training, pilots learn to fly against opponents in different types of aircraft, so pilots must learn to cope with different technological advantages as well, which more resembles real combat. In actual combat maneuvering, variations of these basic maneuvers may become necessary, depending on the different types of spacecraft involved, the weapon systems each side is using, and the number of spacecraft involved.

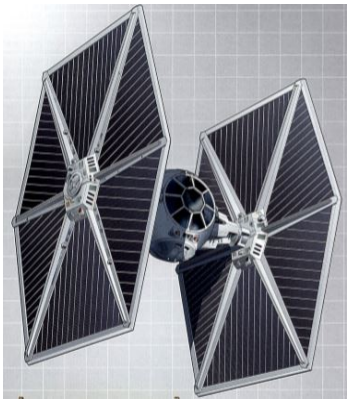
BFM are used in the three-dimensional arena of combat, where maneuvers are not limited by simple two-dimensional turns, such as during a car chase. BFM not only relies on a fightercraft's turn performance, but also on the pilot's ability to make trade-offs between speed (kinetic energy) and altitude (potential energy) to maintain an energy level that will allow the fighter to continue maneuvering efficiently. BFM also relies on the pilot's understanding of the geometry of pursuit within the three-dimensional arena, where different angles of approach can cause different rates of closure. The fighter pilot uses these angles not only to get within a range where weapons can be used, but also to avoid overshooting, which consists either of flying out in front of the opponent, called a "wingline overshoot", or crossing the enemy's flight path, called a "flight path overshoot."

The fighter pilot with the most advantageous position is usually above or behind the opponent and is commonly called the attacker. Conversely, the pilot in the disadvantageous position is usually either below or ahead of the opponent and is referred to as the defender. Most maneuvers are offensive, such as the "barrel-roll attack", "high Yo-Yo", "low Yo-Yo", and "lag roll". Defensive maneuvers more often consist of turning very aggressively to avoid the attacker's guns, with maneuvers like the "break" and the "high Yo-Yo defense"; sometimes tightening the turn, sometimes relaxing it, and other times reversing the turn. The defender will usually maneuver to force an overshoot, or to extend the range enough to dive away and escape. However, other "last-ditch" maneuvers are used by the defender when the attacker achieves a , or a firing solution energy becomes depleted so that maximum turn performance cannot be maintained, such as "guns defense" or the "defensive spiral."

CH. 2 Fighter Craft of the Empire

TIE/LN Starfighter [48]

The **TIE/LN starfighter**, or **TIE/line starfighter**, simply known as the **TIE Fighter** or **T/F** is standard Imperial starfighter seen in massive numbers throughout most of the Galactic Empire.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Characteristics:
The TIE Fighter is the original design for later upgraded TIE models such as TIE/SA bomber, TIE/IN interceptor, TIE/D Defender, and many more. The TIE Fighter is a descendant of the T.I.E. starfighter and the V-wing starfighter, both developed for the Galactic Republic, and was manufactured by Sienar Fleet Systems. In addition to the T.I.E. and V-wing, it was also descended from the TIE starfighter, the first TIE model developed for the Galactic Empire. The namesake for the fighter and line is the Sienar Fleet Systems P-s4 twin ion engines.

The TIE/LN's engine is one of the most precisely manufactured propulsion systems in the galaxy and, with no moving parts, is low-maintenance. Unlike the TIE before it, the TIE/Ln sports independent generators for the engine and weapons. The lack of combat shields, hyperdrive, and life-support systems, in concert with the advanced engine design, reduced the mass of the fighter and conferred exceptional maneuverability. This also made them both inexpensive and quick to replace.

Primary armament is a pair of L-s1 laser cannons, coupled with a powerful sensor suite. The cannons are relatively powerful, and a well-placed hit on a starfighter or medium transport could damage or destroy it. It does not carry missile tubes, but such weapons can be added if necessary.

Due to the lack of life-support systems, each TIE pilot has a fully sealed flight suit superior to their counterparts. The absence of a hyperdrive also rendered the fighter totally dependent on carrier ships when deployed in enemy systems. TIE/LNs also lack landing gear, another mass-reducing measure. While the ships were structurally capable of "sitting" on their wings, they were not designed to land or disembark their pilots without special support. On Imperial ships, TIEs are launched from racks in the hangar bays.

TIEs are designed to attack in large numbers, overwhelming enemy craft. Standard attack squadrons consist of 12 fighters while full attack wings are made up of six squadrons.

A disadvantage of the fighter is its lack of deflector shields. In combat, pilots have to rely on the TIE/LN's maneuverability to avoid damage. The cockpit does incorporate crash webbing, a repulsorlift antigravity field, and a high-g shock seat to help protect the pilot, however these do next to nothing to help protect against enemy blaster fire.

History:
The basic TIE starfighter was designed at some point before 3 BFE (Before the Founding of the Empire) and inspired a number of other Imperial starfighters manufactured by Sienar Fleet Systems, which became collectively known as the TIE series. The TIE Line fighter was one of and replaced the original model as the standard fleet fighter in the Empire. While the original TIE had performance parity with heavier-built X-wings, the newer TIE/LN boasted improved engines and more powerful weapons, surpassing contemporary Rebel fighters.

TIEs would be used in massive numbers throughout the Galaxy and would be regarded by many as a symbol of the Empire.

It had been intended that the TIE/ln would be replaced by the TIE Interceptor, as a direct result of the T-65 X-wing starfighter owned by the Lightspeed Panthers outperforming them in the Fei Hu campaign, resulting in 286 destroyed TIEs. Indeed, Interceptors began to see greater use around the time of the Battle of Endor.

TIE/IN Interceptor [49]

The **TIE/IN interceptor**, also known as the **TIE Interceptor**, is a type of TIE fighter used by the Galactic Empire. The interceptor is identifiable by the addition of four arrow-shaped panels tipped with laser cannons.


[2]

Characteristics:
The TIE/IN interceptor is a far deadlier opponent than the standard TIE/LN space superiority starfighter and featured four very recognizable pointed solar panels. These panels, based on the "bent-wing" configuration used on the prototype TIE Advanced flown by Darth Vader, were given a dagger like design, which gave a TIE fighter pilot a wider field of vision. Lacking both shields and a hyperdrive, it made up for its lack of defensive capabilities with a top speed of 1,250 kph owing to upgraded engines providing considerably improved maneuverability and speed. In addition, four laser cannons on its wingtips allowed for far more firepower to overload the shields on an enemy craft. With the Empire placing its elite pilots into Interceptor cockpits to maximize the craft's effectiveness, Interceptors are ideally suited for their main function: chasing down and eliminating rebel starfighters.

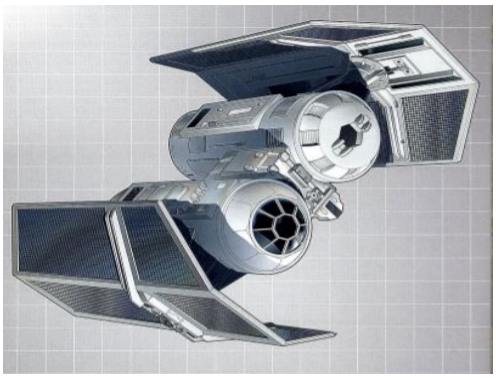
Veteran rebel pilots understand that they should not underestimate the TIE interceptor's maneuverability and speed. In fact, to maximize the craft's speed, designers enlarged the standard twin ion engines. The TIE interceptor's large solar panels are included to give the needed power. Some interceptors belonging to

elite pilots featured additional red (181st) and dark gray (Rho) markings. In 17 AFE, Vult Skerris flew one of these starfighters when he was based at Skystrike Academy.

HISTORY:
The TIE Interceptor was created by Sienar Fleet Systems upon realization that the TIE Advanced x1 would be too costly to mass-produce and was also the Empire's direct response to the Rebel Alliance's introduction of faster starships. Despite this, it was not as fast as the RZ-1 A-wing interceptor, being 50 kph slower. By the time of the Battle of Endor, the TIE Interceptor made up one-fifth of the Empire's starfighter fleet

TIE/SA Bomber [50]

The TIE/SA bomber, formally known as the TIE Surface Assault Bomber and also known as the TIE/SA tactical bomber and TIE bomber, was a bombing variant of the TIE line used by the Galactic Empire and was their main source of anti-emplacement air-support.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Characteristics:
The TIE/SA bomber was specifically designed by Sienar Fleet Systems for use in the military of the Galactic Empire. A model of light bomber, it was part of the TIE line of starfighters, distinguished by their twin ion engines and solar collector panels. The bomber measured 7.9 meters long, 10.6 meters wide.

Like the TIE Advanced x1 prototype, the TIE/SA bomber had inclined wings, which maximized its speed and maneuverability while carrying mass of heavy ordnance. Unlike the other models in the TIE line, the bomber had not one but two central pods: a starboard cockpit for the pilot and a portside ordnance bay for the munitions. The cockpit featured two forward-mounted laser cannons, the standard transparisteel viewport, and an ejector seat in case a pilot on a distant bombing run needed to abandon ship.

The ordnance bay was divided into two sections. The forward ordnance bay carried either eight concussion missiles or four proton torpedoes. The main ordnance bay carried either four proton torpedoes and eight concussion missiles, or eight proton bombs and sixty-four thermal detonators, or six orbital mines, or even stormtroopers. Located underneath the ordnance pod was a bomb chute connected to the ship's targeting systems, a T-s7b targeting computer and a 398X bomb sight. The pod also featured a missile port that allowed for front-launching and torpedoes. The ordnance bay could also be swapped for a passenger cabin with room for six.

TIE bombers are a main source of anti-emplacement, anti-trap air support for the Empire. They often serve in the first line of attack, and Star Destroyer captains like to send them out to carpet bomb and weaken large targets like capital ships in space or buildings on the ground.

History:
A decade after the rise of the Empire, one was deployed by the Imperial-class Star Destroyer Ultimatum in order to attack the mobile refinery Forager used by the corrupt Count Denetrius Vidian.

Three years before the Battle of Yavin, TIE/sa bombers were being launched from a Quasar Fire-class cruiser-carrier above Ryloth to attack Cham Syndulla's rebel cell. When the Lothal rebel cell attacked, trying to capture the carrier, most of the TIE bombers were shot down by the rebels, who were manning gun stations on the carrier.

At least one was present aboard the Death Star during the Battle of Yavin. After the Battle of Hoth, they were sent to flush the Millennium Falcon out from the asteroid field it was hidden in.

The bombers also played a role during Operation: Cinder after the Battle of Endor, serving at the Battle of Cawa City.

TIE/D TIE DEFENDER [51]

The TIE/D Defender, commonly known as the TIE Defender and referred to as the TIE Defender project when it was in development, was an advanced experimental TIE line starfighter manufactured by Sienar Fleet Systems for the Imperial Navy of the Galactic Empire. Unlike previous TIE models, the starfighter featured a hyperdrive as well as deflector shields, and was easily recognized by its three wings mounted around an aft section of the cockpit. These specifications made the fighter much more difficult to destroy than standard TIE fighters.

The TIE Defender was considered a fighter-bomber; it was armed with heavy cannons and missiles. The ship was introduced as a result of Grand Admiral Thrawn's new fighter initiative at the Imperial Factory on Lothal in the year 21 FOE, launched to deal with the growing rebel threat, and was supported by both Grand Moff Wilhuff Tarkin and Emperor Palpatine. As the project was to be less expensive than Project Stardust, and due to the constant delays of Director Orson Callan Krennic, many Imperials started to consider using the funding of Project Stardust for Thrawn's TIE/D Defender instead. However, after Governor Arihnda Pryce destroyed Lothal's fuel depot to kill Jedi Knight Kanan Jarrus, the project was halted indefinitely.

[4]

Characteristics:
Like the rest of the TIE line starfighters, the TIE/D Defender featured a ball-shaped cockpit module and solar array wings. However, while the standard TIE/ln space superiority starfighter and many other TIE variants, including the TIE/IN interceptor and the TIE Advanced x1, had two parallel wings to either side of the pilot module, the TIE/D Defender had three wings mounted around an aft section of the cockpit. It also included deflector shields and a hyperdrive, new features for TIE fighters. The fighter was too fast for Y-wing starfighters and armed with six heavy laser cannons and concussion missiles—causing high damage

over a moderate area. Some TIE/Ds featured six additional missiles and red markings on their wings, similar to some elite TIE interceptors.

As development of the TIE Defender progressed, a new, faster and stronger variant was produced, which was classified as the TIE Defender Elite, with the prototype being tested by Commander Vult Skerris. The speed and maneuverability of this craft was drastically increased compared to the earlier Defender prototypes, along with stronger shields, better hyperdrive, and the addition of six missiles mounted onto the wings.

History:
In the year 21 FOE, the Galactic Empire, at the instigation of Grand Admiral Thrawn, began preparations to mass produce TIE Defenders at the Imperial Factory on the planet Lothal. With the help of Ryder Azadi's Lothal resistance, the Spectres stole the starfighter's schematics. Upon seeing the Defender's specifications, Captain Hera Syndulla of Phoenix Cell feared that if the Empire were to mass produce them, their pilots wouldn't have a chance against them.

Thrawn's project was supported by high-ranking Imperial officials, such as Grand Moff Wilhuff Tarkin and Grand Admiral Balanhai Savit. Although most of the Empire's R&D funding was tied up in Project Stardust, supervised by Director Orson Krennic, Tarkin and other Imperial leaders had become dissatisfied with its progress, which had turned into a costly operation while yielding little results. This allowed Thrawn and Tarkin to acquire the funding necessary to begin production of the TIE Defender on Lothal.

Thrawn's fighter initiative was able to produce a prototype for the TIE Defender in a short amount of time, and it was first used during a mission to capture the rebel senator Mon Mothma. The Ghost crew transported the senator through the Archeon Nebula to avoid Imperial capital ships. Thrawn then tasked the TIE fighter pilot Vult Skerris to pilot the prototype and flush the rebels out into the open, with the assistance of two TIE Interceptors. The experimental fighter proved to be very effective against the rebel pilots, as Skerris easily destroyed three Y-wing starfighters of Gold Squadron. The rebels then attempted to defeat Skerris by getting close to a forming star in the nebula, but the ship was able to withstand the extreme temperature which burned up the TIE Interceptors. Eventually, the rebel pilots Ezra Bridger and Jon "Dutch" Vander managed to disable the prototype and escape by hitting the ship with an ion cannon

After completing their mission to Batuu, Darth Vader spoke to Thrawn about the Defender. He informed Thrawn that he believed the Defender was an excellent ship and that he would speak to the Emperor on behalf of the project. Vader informed Thrawn that the ship, however, needed to be faster and more heavily armed than it currently was at the moment. The ship's controls also needed to be simpler to handle. Thrawn thanked the Sith Lord for his input and assured him that he would relay the Sith Lord's recommendations to the facility on Lothal once they had returned to Coruscant.

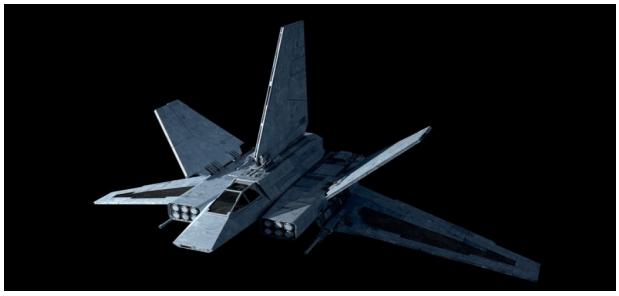
Later, a new prototype, the TIE/D Defender Elite, was produced on Lothal, adding Vader's recommendations. This model had superior speed, maneuverability, shields, and weapons. One TIE Defender Elite was stolen by members of the Spectres, who had recently returned to Lothal. Thrawn activated the TIE's kill switch, causing the ship to crash, however the Spectres were able to salvage the ship's hyperdrive and flight data recorder. Eventually, the flight data recorder made its way to the Rebel Alliance and they decided to launch an attack on Lothal. In the ensuing battle, another TIE Defender Elite was used by Skerris, but was shot down by the rebels and crashed into a Arquitens-class command cruiser, which in turn crashed into the bridge tower of an Imperial I-class Star Destroyer.

After the failed attack on Lothal and the capture of General Hera Syndulla, Tarkin contacted Thrawn, telling him that Krennic had been arguing strongly in favor of his project and that the TIE Defender program's funding was at risk of being pulled away to fund the continued construction of the Death Star. In order to persuade the Emperor to continue supporting the TIE Defender, Tarkin arranged a meeting with the Emperor for Thrawn, who immediately departed the planet.

Soon after Thrawn's departure, a rescue of Syndulla was attempted by the remaining rebels on the planet. Although Governor of Lothal, Arihnda Pryce was successful in cornering the rebels as they made their escape through the factory's fuel depot, her determination to stop them led her to order the destruction of the depot. The resulting explosion resulted in the death of rebel leader and Jedi Knight Kanan Jarrus, dealing a crippling blow to the rebels but an even bigger one to the Empire. With the fuel depot destroyed, the factory was instantly shut down and production of the TIE/D Defenders was brought to an indefinite halt. With the production halted, the funding for the Defender was instead given to Project Stardust.

Alpha Class Xg-1 Starwing [52]

The Cygnus Spaceworks Alpha-class Xg-1 Star Wing, also known as the Xg-1 Starwing or Assault Gunboat, was one of the Galactic Empire's first general-deployment starfighters to be equipped with deflector shields and a hyperdrive.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Characteristics:
The 10-meter-long Xg-1 was based on a tri-wing design similar to the Lambda-class shuttle, another craft that Cygnus Spaceworks designed. Like the Lambda shuttle, the Star Wing had a fixed dorsal wing flanked by a pair of lateral folding wings. When landing, the lower wings folded upwards. However, the Xg-1 had a sleeker cockpit and warhead/engine pods along the side of the hull. It had two additional folding wings that protruded diagonally from the side pods, at an angle reflexive to the lateral wings. These secondary wings afforded the Xg-1 significantly increased maneuverability over its shuttle counter-part. When in flight position, the wing configuration resembled a flattened five-point star, thus the name "Star Wing."

Its armament consisted of two chin mounted laser cannons, two ion cannons above the cockpit, and a pair of general purpose warhead launchers. The Star Wing could also carry the tractor beam weapon developed for the TIE Avenger and newer Imperial starfighters; the only known use of this was during Maarek Stele's campaign in the Eva-T system to snare enemy craft.

The standard payload was sixteen concussion missiles, eight per launcher, though depending upon the mission the Star Wing could alternatively carry twelve proton torpedoes, eight heavy rockets, or four heavy space bombs. Some Xg-1s also carried Ion torpedoes.

The Xg-1 was a relatively large craft, which enabled it to accommodate a hyperdrive and deflector shields. However, it was not particularly fast and had an average level maneuverability, making it mediocre in space superiority. The starfighter also borrowed the standard reactor design from the TIE series, which, like those fighters, was mounted directly on the tail of the craft.

The Star Wing was equipped with a hyperdrive, which meant that it did not need the support of a Star Destroyer or other starfighter carrier. It proved very useful in conducting hyperspace raids against convoys and space stations, and also served in a reconnaissance capacity.

The fact that it was armed with ion cannons made the Star Wing an ideal choice for capture operations or planetary customs duties. Its high magazine capacity made it a deadly bomber, as a squadron of Star Wings could penetrate most medium-sized capital ships' shields with a single warhead salvo from each fighter.

The Xg-1 was famed for its resilience. Its powerful shields allowed it to engage foes at point blank range, enabling it more opportunity to inflict damage, whereas an unshielded craft would be forced to break off the attack. The Star Wing's reinforced hull could survive a direct hit from an advanced concussion missile, and several times these craft were able to return home safely despite being badly damaged. Pilots such as Maarek Stele, having previously flown TIEs whose best defense was speed and maneuverability, often took advantage of the Star Wing's defenses to press bold assaults. If the Star Wing was deployed into a combat zone directly by a Star Destroyer or carrier, its deflector shields enabled it to spearhead the attack and draw fire away from unshielded TIEs.

One such rare deployment when Maarek Stele led other Imperial Navy starfighters at the final battle of the Conflict at Mylok IV.

The Star Wing was designed and deployed to perform specific missions that standard TIE fighters were unable to complete. It was not planned for widespread production like TIEs, so it did not alter the Imperial doctrine of quantity over quality. (The TIE Avenger and TIE Defender, however, were designed as high-quality alternatives to using swarms of cheap craft.)

History:
The Star Wing did not prove overwhelmingly successful in its first independent deployments. As the Star Wing was the only hyperdrive-capable starfighter in the Imperial arsenal, there was initially no other space superiority craft available to escort it. The Xg-1 was able to compare favorably against similarly heavy Alliance craft such as the Y-wing and the B-wing. However, against the more common X-wing and especially the nimble A-wing which it was often forced to engage, the Xg-1 had a hard time. The Xg-1 did have the advantage of stronger shields and armor to prolong its survival, but its comparative lack of speed prevented it from coming out on top. Consequently, Star Wings were often forced into lengthy dogfights with more maneuverable Alliance fighters, which detracted from their main mission goals. When the tractor beam weapon was developed, while it would have helped the Xg-1's chances against other starfighters, most flight officers opted to install what limited beam weapons they had on the TIE Avenger and other newer faster craft, where it would be even more effective. At some point, several Star Wings underwent servicing at the Naval Station Validusia.

As a stopgap, Imperial flight officers decided that hyperspace raids should be conducted in two groups, with a squadron of missile-equipped Star Wings being pressed into the space superiority/escort role, and another group tasked with delivery of the warheads to their target, usually proton torpedoes, heavy rockets, or heavy space bombs. An example of this was the assault on the Rebel Mon Calamari Light Cruiser Lulsla, in which the Imperials succeeded.

Once available, Star Wings were escorted by TIE Avengers—another class of Imperial fighter equipped with shields and hyperdrive. Because of the hyperspace capability of both classes, they could arrive in a system at the same time, catching Rebel patrols by surprise. As the Avengers proved excellent at space superiority, this enabled Star Wings to concentrate on their intended roles, whether that be capturing craft or assaulting capital ships. Successful Star Wing-Avenger partnerships included the capture of Admiral Harkov and the seizure of Galactic Electronics' mag pulse weapons.

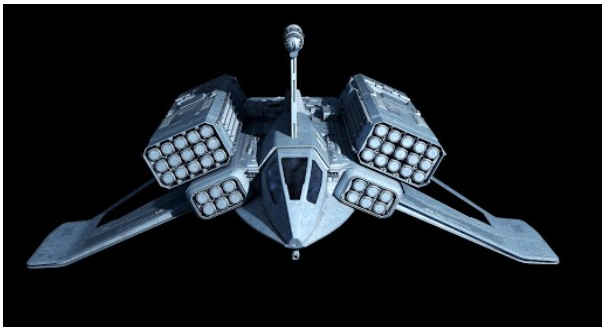
The Xg-1 was eventually overshadowed by the fast and versatile TIE Defender, which was virtually equal or superior in every aspect save for armor and cost. However, due to the traitor Admiral Demetrius Zaarin who threatened loyalist Avenger and Defender facilities, the loyalists were forced to resort to older craft. The Star Wing made a comeback in the Eva-T system to combat the rogue TIE Defender threat. The first was during the "trade" with the Rneekii pirates for the TIE Defender scientist; the mutual exchange was actually an Imperial trap, but sending a newer starfighter would be provocative, and also because the Rneekii would underestimate the Gunboat. The Xg-1, however, was piloted by ace Maarek Stele, and it carried a full load

of advanced concussion missiles and the new tractor beam weapon. In the following mission, Stele would take the Xg-1 into battle against the Zaarin's TIE Defender and TIE Advanced fighters, where Stele used the tractor beam in conjunction with advanced proton torpedoes to great effect against much faster and more agile craft. Stele's ability and the inclusion of the latest technology in the Star Wing proved that it could prevail against overwhelming odds.

Cygnus Missle Boat [53]

The Missile Boat was an advanced Imperial starfighter designed by Admiral Thrawn and built by Cygnus Spaceworks. Designed as a countermeasure against the rogue Grand Admiral Demetrius Zaarin and his supply of TIE Defenders, the Missile Boat was a descendant of the Alpha-class Xg-1 Star Wing, also manufactured by Cygnus Spaceworks. The Missile Boat relied primarily on warheads for dogfighting and assaults, a notable difference from other Imperial starfighters, which relied more heavily on laser cannons. The Missile Boat also included an innovative propulsion feature known as the SubLight Acceleration Motor (SLAM).

Though they proved instrumental in the defeat of Zaarin's rogue faction and in executing Emperor Palpatine's plan to lead the Rebel Alliance to Endor, they were removed from Imperial Navy operations by the Emperor's own orders and were not seen in use after 4 ABY.



[6]

Characteristics:
The Missile Boat loosely resembled the general body style of its predecessor, the Alpha-class Xg-1 Star Wing. The Missile Boat was ten meters in length with a bulky profile in comparison to the Star Wing, yet both models shared a pronounced fuselage with dorsal stabilizer, flanked by the craft's primary warhead launchers. The Missile Boat's second set of warhead launchers extended from pylons attached to the dorsal surface of the primary launchers. This secondary set rested at an angle reflexive to the lateral wings.

Extremely uncommon among Imperial starfighters, portions of the pilot's flight data displays were located on the cockpit exterior. The deflector shield configuration and beam weapon displays were attached to the port and starboard nose surfaces, outside the cockpit, just forward of the viewports. The fighter had room for a single pilot and could carry up to 100 kilograms of cargo and consumables for up to three days.

The Missile Boat was armed with two high-capacity twin warhead launchers and a single nose-mounted laser cannon. The secondary pair of warhead launchers was exclusively assigned to carry a payload of concussion missiles, while the primary could be outfitted with an array of space-borne projectiles. Each individual launcher had a concussion missile capacity of twenty missiles, affording the Missile Boat a maximum load of eighty concussion missiles; the primary launchers could alternatively hold fifteen proton torpedoes, ten heavy rockets, or five heavy space bombs. This immense warhead capacity greatly overshadowed the TIE Bomber and Assault Gunboat magazines by more than sixty missiles. By the time of its deployment, the Missile Boat was afforded the use of advanced concussion missiles and advanced proton torpedoes. These projectiles fielded larger payloads and increased agility than their predecessors. Advanced concussion missiles offered Missile Boat pilots the ability to suppress more advanced starfighters such as Rebel A-Wings and rogue TIE Defenders.

The abundance of missiles led to the development of unorthodox tactics. Missile Boat pilots, armed exclusively for anti-starfighter work, often used advanced missiles as dumb-fire rockets against capital ships and space stations, supplementing their accompanying Assault Gunboats or TIE Bombers. Unlike their TIE pilot brethren, Missile Boat pilots could easily afford the use of missiles to overwhelm space station anti-warhead defensive systems or defend targets from pursuing warheads.

The most noteworthy weakness of the Missile Boat was its single laser cannon. Should the craft's warhead stores run empty, pilots were forced to dogfight with a single cannon. Dogfighting in general could be problematic due to the fact the that Missile Boat pilots had only a single cannon reserve from which energy could be transferred to deflector shields. However, this single laser cannon did fire faster and could charge to full capacity in just ninety seconds, a major improvement over other laser cannons found in Imperial fighters.

Missile Boats were frequently equipped with a beam weapon system. The tractor beam was another tool the Missile Boat employed against TIE Defenders, robbing the Defender of its superior maneuverability and holding them on course while Missile Boat pilots attained missile locks. Alternatively, Missile Boats could be fitted with a jamming beam, a weapon that disrupted the fire-control systems of spacecraft, which allowed Missile Boats safer transit on bombing runs against capital ships.

The Missile Boat was equipped with dual ion engines and a hyperdrive. Hyperdrive capability permitted the Missile Boat to compete with other advanced fighters of the era and assume multiple mission roles by operating independently of bases and carriers. The class 6 motivator, however, was slower than that of hyperdrive-equipped members of the competing TIE series, like the TIE Advanced x1 and TIE Defender. The Missile Boat was faster and more maneuverable than the Assault Gunboat, and its engines were also equipped with the new SubLight Acceleration Motor(s). The SLAM was an overdrive system that drained laser cannon energy reserve to boost the craft's engines to 200 percent output. Comparable to the Alliance's A-wing, the Missile Boat boasted a respectable maximum cruising speed of 122 MGLT. A pilot competent in energy management could push the craft's speed beyond 250 MGLT using the SLAM system, up to a maximum of 426 MGLT with all power redirected to the engines. The Missile Boat could achieve acceleration of 21 MGLT/s and had a maximum atmospheric velocity of 1,150 km/h[3] and a maneuverability rating of 91 DPF

While the defensive armor plating, rated at 19 RU, was less than that of many non-Imperial starfighters—comparable to that of all types of TIE fighters—the Missile Boat's deflector shields were heavily reinforced, rated at 120 SBD, even superior to those of the Alliance's B-wing starfighter.

The Missile Boat was specifically designed to counter the menacing TIE Defender. As byproducts of the space superiority role, shield and hyperdrive systems permitted the Missile Boat to assume various other starfighter roles. Missile Boats were used on several occasions as reconnaissance scouts to inspect enemy craft in distant systems. Considering the immense payload and deflector shield systems, the Missile Boat was also well suited as a heavy bomber, frequently inserted into enemy territory to destroy enemy capital ships. While these heavy bomber roles typically came with the assistance of fighter escorts, Missile Boats could operate autonomously in light of their dedicated concussion missile launchers, most appropriate for destroying enemy fighters. The Missile Boat was also frequently deployed on heavy assault missions. A major drawback to this role was the Missile Boat's lack of ion cannons. Missile Boats would be reliant on Assault Gunboats or TIE Defenders to disable mission critical craft for capture, thus making the Missile Boats responsible for the livelihood of the disabling craft

History:
Cygnus Spaceworks developed the Missile Boat during the Galactic Civil War as a dominantly projectile-weapon-based platform to counter the most advanced starfighters of the day. The advent of the Missile Boat was the result of a chain of events put into motion by the technologically-driven Grand Admiral Demetrius Zaarin, a highly respected officer in the Imperial Navy. Like many other noteworthy Imperial officers, Zaarin sought to increase his power; unlike most of those officers, he chose to stage a coup against Emperor Palpatine, pitting himself against Admiral Thrawn and the rest of the Imperial Navy. While

planning the Rebel Alliance's ultimate defeat at the Battle of Endor, the Emperor ordered Thrawn to pursue and destroy Zaarin and his advanced TIE starfighters. Zaarin's defection posed a great danger to the Empire, as he possessed superior Imperial starfighters like the TIE Avenger and TIE Defender. Knowing this, Thrawn collaborated with Cygnus Spaceworks to design a new starfighter to counter the threat of Zaarin's treachery; the Missile Boat was the offspring of this collaboration

In 22.5 FOE, the Missile Boat made its debut during Thrawn's campaign to police various factions who mysteriously came into possession of TIE Defenders. The Missile Boat's first combat mission, flown by Imperial ace Maarek Stele, was to lead an assault on the Nami Strike-class cruiser Nuance, which was carrying an arms merchant who planned to sell TIE Defenders to the Rebel Alliance. Following this sortie, a lone Missile Boat was responsible for the destruction of three Carrack-class cruisers on a mission to wrest captured TIE Defenders from Thrawn's grasp. The Missile Boat accomplished this mission with only a squadron of TIE Fighters as cover. With the Rebel strike force destroyed, another solo Missile Boat was utilized to destroy a TIE Defender factory controlled by the Nami pirate Ali Tarrak.

Upon completion of a campaign to rid secondary forces of their TIE Defender possessions, Thrawn utilized the Missile Boat on a direct campaign against the rogue Zaarin. The Missile Boat was used extensively to raid Zaarin's supply convoys and defend loyal Imperial forces against attacks by Zaarin's rogue forces. During this campaign, Missile Boats were frequently employed as bait for the technologically greedy Zaarin. Missile Boats were responsible for protecting convoys from Zaarin's raiders—on one occasion, protecting a convoy carrying actual Missile Boats and on another, a decoy convoy meant to entrap Zaarin. Moreover, Missile Boat pilots were specifically instructed not to permit the capture of the new Missile Boat; the Missile Boat would not even be deployed, they were told, if not for the dire circumstances facing the Empire. In addition, during this campaign, Missile Boats were instrumental in the protection of the cloaking shield project aboard the CR90 corvette Vorknkx. Research personnel were quite shocked by the arrival of only a single fighter, but stated that there were rumors about its prowess.

The Missile Boat designated Mu 1, along with two scout craft, faced off against Nebulon-B2 frigate Z-Borus and its compliment of TIE Bombers and Interceptors. As the battle progressed, Zaarin brought more of his TIE Avengers to bear down on the research facility. Failing at their initial attempt to capture the facility, Zaarin's forces followed up the previous sortie with a larger onslaught of three Carrack-class cruisers and assault transports, all the while aided by traitorous TIE Defenders. A lone Missile Boat, backed by escort transports, repelled this intense attack, while the Muurian transport Shadow docked with the Vorknkx to enable its hyperdrive. Despite all efforts by Missile Boat pilots, the Empire was forced to evacuate the research platforms V1 and V2, but the Vorknkx was safeguarded and escaped to hyperspace.

During Thrawn's campaign against Zaarin, Darth Vader also employed Missile Boats in his campaign leading up to the Battle of Endor, involving the Bothan spies. Missile Boats were responsible for destroying a Bothan Dreadnaught-class cruiser attempting to transfer information to the Rebellion, performing raids and reconnaissance on the Rebel buildup, and wearing down the Alliance starship reserves prior to the battle. While Mon Mothma was not referring to the Missile Boat when she spoke of the Bothan sacrifice, Bothan blood was spilled at the hands of Missile Boat pilots.

The Missile Boat played a key role defending the Emperor himself, perhaps the most prominent of its accomplishments. Immediately following Darth Vader's preliminary arrangements for the impending battle at Endor, Emperor Palpatine boarded his private passenger liner Excalibur, en route to Endor. During its voyage, it came under attack by more of Zaarin's traitor forces. Maarek Stele and his Missile Boat, escorted by TIE Avengers, repelled an attack composed of the Victory-class Star Destroyer Zeplin, the Nebulon-B frigate Kimik, and a number of Assassin-class corvettes. With the Missile Boat having thwarted the bulk of the attack force, the Excalibur escaped into hyperspace.

After Darth Vader's strategic campaign against the Bothans, Admiral Zaarin became privy to the Emperor's plot to destroy the Rebels. While Zaarin too detested the Rebellion, his henchman, Namuura Din, sought to defect to it. Missile Boats played a role in the capture of Namuura Din and his flagship, the Victory-class Star Destroyer Zeplin; moreover, Missile Boats were responsible for the inspection of a Rebel craft carrying a stolen Missile Boat, dubbed Sealion, and information concerning the operational status of the second

Death Star. Upon this discovery, the Empire was faced with the perilous task of retrieving this classified information. Missile Boats led an assault on the Rebel cruiser Link, which was carrying the stolen Missile Boat; although Imperial forces captured the Rebel cruiser, the captured craft escaped, but was quickly located on the Rebel XQ4 Platform Enin'sd. In what would prove to be their last sortie, Missile Boats facilitated the capture of the Rebel platform and the stolen Missile Boat. An inspection of the Sealion confirmed that the Rebels had insufficient time to reverse engineer the Missile Boat and expose its secrets. Despite this fact, the Emperor deemed the loss of the Missile Boat too great a threat to his elaborate plans to crush the Rebel Alliance due to Zaarin's usage of the vehicles as well as many of the Missile Boat manufacturing plants having been destroyed by bombings issued by Zaarin himself, killing thousands of innocents in the process; thus it was ordered that all Missile Boats would be put into protected storage until the Rebel "problem" was solved. The Emperor's recall order was never rescinded after his death at Endor. Following the death of the attempted usurper, Imperial Missile Boats were never again seen in combat.

CH 3. Basic Fighter Maneuvers

NOTE: This manual includes terminology and tactics that are also used in atmosphere.

Principles

The Five Stages of Starfighter Combat [8]

Detection

The first stage is detection (and its opposite, avoidance of detection). Starfighters can be detected by two methods – visual and electronic. These are the keys to Identification-the main objective in detection.

Closing

The second phase of starfighter combat is called closing. The objective during this stage is to reach an advantageous position from which to attack the enemy.

Attack

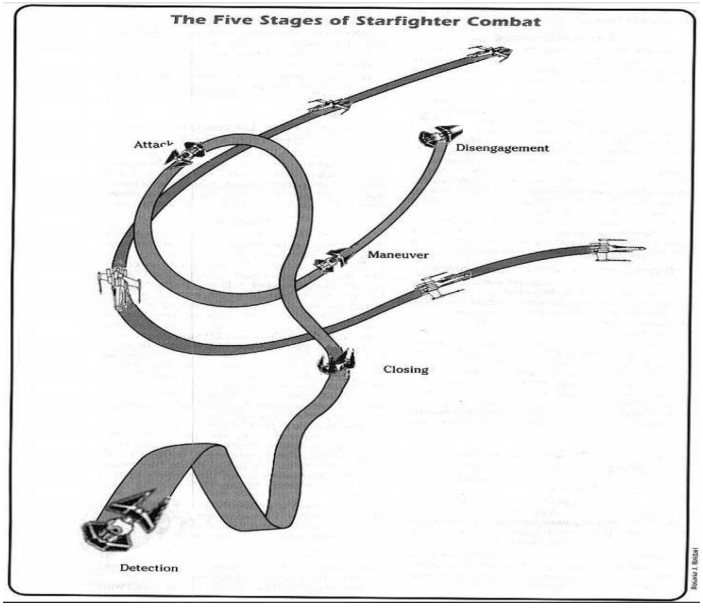
The third, and most decisive stage is attack

Maneuver

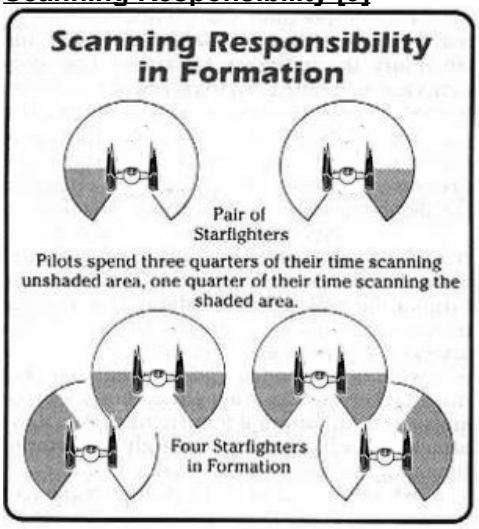
Maneuver is the fourth and most glamorous stage of starfighter combat. Its importance is often overrated, however. A successful attack stage renders maneuver academic.

Disengagement

Finally, there is the fifth and most underrated stage, disengagement. New pilots often take this stage for granted-usually to their dismay.



Scanning Responsibility [9]



Specific Energy [16]

Energy is a primary factor in controlling and maneuvering a spacecraft. If an attacker has too much energy, it may be easy to get in range but difficult to prevent an overshoot. Too little energy and the attacker may not be able to get in range at all. If the defender has more energy than the attacker, an escape may be possible, but too little energy and the defender will lose maneuverability.

In combat, the term "energy" does not refer to the fuel nor the thrust it produces. Instead, thrust is referred to as "power." Energy is the state of the fighter's mass at any given time and is the result of the power. Energy comes in two forms, which are kinetic and potential. Kinetic energy is a function of the fighter's mass and speed, while potential energy is a function of its mass, gravity and altitude. The combined potential and kinetic energy is called the total energy. Because the energy package is the combination of mass, speed, and altitude, a fighter flying at low altitude but high speed may have the same total energy as a fighter of equal mass flying at a low speed and high altitude.

One of the inputs to the formula for total energy is the mass of the object, in this case the spacecraft. This means that two spacecraft flying under identical conditions of speed and altitude will have different energy; the heavier spacecraft will have higher energy. However, this does not imply that the heavier spacecraft will be more maneuverable, as that mass will require more energy to accelerate. For this reason, a more useful measure is the specific energy, the energy per unit weight. Lighter spacecraft generally have higher specific energy for any given operational conditions.

Energy state can be changed through the application of power. Heavier spacecraft will require more power to change their energy state, so two spacecraft with equal energy will not have the same maneuverability. This leads to the concept of "specific power" in the same fashion as specific energy. For any given operational condition, a selected speed and altitude for instance, any given spacecraft will require a certain amount of power simply to maintain those conditions, due largely to the effects of etheric drag. This gives rise to the concept of "specific excess power", the amount of additional power available to a spacecraft over and above the power needed to maintain those flight conditions.

Specific excess power is normally expressed for a spacecraft flying straight and level. Turning requires an expenditure of energy, both to change the energy state of the spacecraft, as well as due to the additional induced etheric drag that is naturally created as a side effect of generating the force required to change direction. This implies that a spacecraft with higher specific excess power has higher sustained maneuverability performance. This overall concept is known as "energy maneuverability."

Maneuverability is not solely a factor of energy or specific power, many other factors like the efficiency of the thrusters at generating change in direction, or the load limits of the spacecraft, can limit the maneuverability in ways that are not directly related to weight and power. This gives different spacecraft very different types of performance under various maneuvers. For instance, a spacecraft with high thrust for weight may have high specific excess power but nevertheless suffer from very high induced drag during turns - in which case it will attempt to avoid turns and instead use climbs and dives to its advantage. Such spacecraft are referred to as "energy fighters." Others, typically those with lower thruster loading, may have less excess power but nevertheless be able to perform turns without losing as much energy, and are referred to as "angles fighters" or "dog-fighters."

When two spacecraft meet in combat, they may have different energy states and energy retention. Typically, the fighter with higher energy and better retention will make an "energy move", like a high yo-yo to maintain the energy advantage, while the fighter at an energy disadvantage (angles fighter) will make an "angles move" such as a break turn, trying to use the opponent's energy to their own advantage.

Energy Management [17]

In combat, a pilot is faced with a variety of limiting factors. Some limitations are constant, such as gravity, structural integrity, and thrust-to-weight ratio. Other limitations vary with speed and altitude, such as turn radius, turn rate, and the specific energy of the spacecraft. The fighter pilot uses BFM to turn these limitations into tactical advantages. A faster, heavier spacecraft may not be able to evade a more maneuverable spacecraft in a turning battle but can often choose to break off the fight and escape by diving or using its thrust to provide a speed advantage. A lighter, more maneuverable spacecraft cannot usually choose to escape, but must use its smaller turning radius at higher speeds to evade the attacker's guns, and to try to circle around behind the attacker.

BFM are a constant series of trade-offs between these limitations to conserve the specific energy state of the spacecraft. Even if there is no great difference between the energy states of combating spacecraft, there will be as soon as the attacker accelerates to catch up with the defender. However, potential energy can easily be traded for kinetic energy, so a spacecraft with an altitude advantage can easily turn the potential energy into speed. Instead of applying thrust, a pilot may use gravity to provide a sudden increase in speed, by diving, at a cost in the potential energy that was stored in the form of altitude. Similarly, by climbing the pilot can use gravity to provide a decrease in speed, conserving the spacecraft's kinetic energy by changing it into altitude. This can help an attacker to prevent an overshoot, while keeping the energy available in case one does occur.

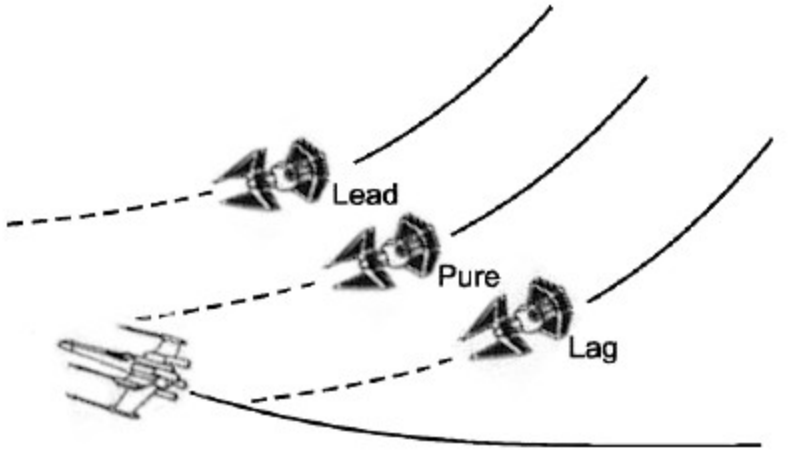
Turn Performance [18]

Both turn rate (degrees per second), and turn radius (diameter of the turn), increase with speed, until the "corner speed" is reached. Corner speed is defined as the minimum speed at which the maximum sustainable g-force load can be generated (the load at which power equals drag), and varies with the fighter's structural design, thruster loading characteristics, weight (including added weight from missiles, drop-tanks, etc...), and thrust capabilities. The maximum sustainable-load the spacecraft can generate also varies. At the corner speed, the fighter can attain its maximum turn-rate. Turning at the maximum sustainable-load at speeds above the corner speed will result in an increase in turn radius which, respectively, will cause a decrease in turn rate.

"Instantaneous turn-rate" describes turns which are above the maximum sustainable-load. Before the advent of inertial compensators these turns could be as high as 9 g's before the pilot begins to lose consciousness (G-LOC). These turns can have a very small turn radius, but cause a loss in energy, either in the form of speed or altitude. Therefore, these turns are unsustainable, causing the fighter to lose massive amounts of speed, sometimes reaching stall speed in as little as a quarter turn. To some degree the energy loss may be compensated for by increasing thrust, known as applying "excess specific power", but this cannot fully make up for the losses. This usually occurs during hard turns or even harder "breaks." Only by turning the spacecraft at its best "sustained turn-rate" can the spacecraft maintain its specific energy.
However, situations in combat may require a change in energy, and energy may also be increased by pulling less than the maximum sustained g-force load

Pursuit [19]
Successful BFM requires geometry as much as it does skill and stamina. Pilots must know their spacecraft's corner speed, as well as optimum angles of bank (AOB) and angles of attack (AOA), without consciously thinking about them. At the same time, pilots must remain conscious of the angle between the opponent's velocity vector and their own, called the track crossing angle (TCA), which is important when aligning or avoiding a firing solution. Most importantly, the pilot must remain aware of the angle off tail (AOT), which is the angle between flight paths. A high AOT causes a high rate of closure, but makes achieving a suitable guns solution nearly impossible. Acquiring a low AOT (getting on an enemy's tail), can decrease or even reverse closure rate, and is usually the primary goal before an overshoot occurs. However, an uncooperative defender may try to take advantage of the high closure rate by turning to increase AOT, forcing an overshoot.

The AOT is often estimated by the position of the attacking spacecraft's nose in relation to the defender. AOT are generally grouped into three categories, called "pursuit curves." "Lead pursuit" occurs when the nose of the attacker points ahead of the defender, while "pure pursuit" happens when the attacker's nose points directly at the defender. If the attacker's nose points behind the defender, the condition is known as "lag pursuit."



Lead [20]
The primary purpose for lead pursuit is to provide closure, even when chasing a faster opponent. The high AOT presented during lead pursuit allows the attacker to quickly decrease the forward, lateral, and vertical separation between spacecraft, simply by traveling a shorter path. However, lead pursuit causes the AOT to increase at a rapid rate. This causes the closure rate to increase as well, and, in an attempt to prevent an overshoot, the attacker will have to pull an increasingly tighter turn upon nearing the defender.

An attacker in lead pursuit is well within the defender's rear view. Unless the defender has enough of a speed advantage to escape by relaxing the turn and dropping into a shallow dive, the defender will likely turn sharply in an effort to increase the AOT, forcing the attacker to turn even harder, to overshoot, or to perform a maneuver out of the horizontal plane to compensate.

Lead pursuit is used during laser attacks, because the fast motion of combat requires that the spacecraft's cannons be aimed at a point in space ahead of the defender, where the enemy will be when the shots arrive. This is called "leading the target." Lead pursuit presents the attacker with difficulty in maintaining sight of the opponent, as the nose of the attacking spacecraft becomes an obstruction to the pilot's view (not applicable in TIE series).

Pure [21]
Like lead pursuit, pure pursuit is used to provide closure. However, closure is not as rapid, nor is the rate of increase in AOT. This is not as effective against a faster moving opponent, so the attacker may need to accelerate to maintain pure pursuit. Pure pursuit is used when acquiring a missile lock. It both places the attacker further aft of the defender and presents the defender with the smallest amount of surface area to see. This complicates evasive action, since only the front of the attacking spacecraft is in view.

Lag [22]
Lag pursuit is used to stop or reverse closure rate and to decrease AOT, while allowing the attacker to maintain or increase forward separation (also called nose/tail separation, or nose-to-tail). Following outside the defender's turn radius, the attacker can maintain or increase energy while forcing the defender to turn at an energy depleting rate.

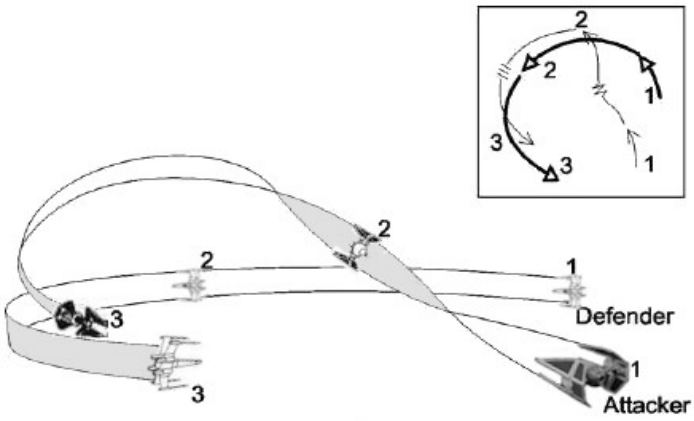
"Hot side" lag occurs when there is a large amount of forward separation between spacecraft, showing the top side of the defending fighter. This puts the attacker in the defender's rear view, and the common defense is to tighten the turn. "Cold side" lag occurs when there is little nose-to-tail separation, leaving the belly of the defending fighter in view. This puts the attacker in the defender's blind spot, and the common defense is to reverse the turn. Unless the defender is markedly more maneuverable, and lateral separation is just right, lag pursuit cannot be maintained for long, causing the AOT to decrease until a suitable firing solution is presented.

Out of Plane Maneuvers [23]
Maneuvers are rarely performed in the strictly vertical or horizontal planes. Most turns contain some degree of "pitch" or "slice." During a turn in an oblique plane, a pitch turn occurs when the spacecraft's nose points above the horizon, causing an increase in altitude. A slice turn happens when the nose points below the horizon, causing a decrease in altitude. The purpose is not only to make the spacecraft harder for an enemy to track, but also to increase or decrease speed while maintaining energy.

An out-of-plane maneuver enhances this effect, by diverting the fighter into a new plane of travel. Increasing the pitch or slice can quickly provide a change in speed, which can just as quickly be reversed by returning to the original plane of travel. Out-of-plane maneuvers are not only used to provide a reduction in turn radius, but also causes the fighter to fly a longer path in relation to the direction of travel. A maneuver such as a high Yo-Yo is used to slow closure and to bring the fighter into lag pursuit, while a low Yo-Yo is used to increase closure and to bring the fighter into lead pursuit.

During an out-of-plane maneuver, the attacker's nose no longer points at the defender. Instead, the spacecraft is rolled until its lift vector (an imaginary line running vertically from the center of the spacecraft, perpendicular to its wings), is aligned either ahead of, directly at, or behind the defender, using roll rate instead of turn rate to set the proper pursuit curve. The spacecraft's velocity vector (an imaginary line in the direction of motion) will be pulled in the direction of the lift vector.

Displacement rolls [24]
A useful type of out-of-plane maneuver employed to decrease AOT are various barrel rolls called displacement rolls, in order to shift the spacecraft laterally from its projected flight path onto a new flight path. By controlling the roll rate, the pilot can control the degree of displacement. An attacker following a more maneuverable opponent may become stuck in lag pursuit (outside the defender's turn radius), unable to achieve a firing solution. By displacing the turn, the two spacecraft's flight paths will eventually cross. The AOT will then decrease until the nose of the attacker's spacecraft points momentarily at the defender, and then ahead of the defender. A displacement roll is a good tactic whenever a reduction in turn radius is needed, but a decrease in turn rate is allowed.



Positioning [25]

There are three basic situations in combat maneuvering requiring BFM to convert to a favorable result, which are neutral, offensive, and defensive. Most relative maneuvers can be grouped into one of these three categories.

Neutral [26]

Neutral positions generally occur when both opponents spot each other at the same time. Neither the pilot nor the opponent has the advantage of surprise. Neither has the ability to point the nose of their spacecraft at the opponent with sufficient range to employ forward firing ordnance (missiles/lasers) prior to the opponent presenting a threat of a similar manner. Each is focused on converting to an offensive situation while forcing their opponent into a defensive.

Offensive [27]

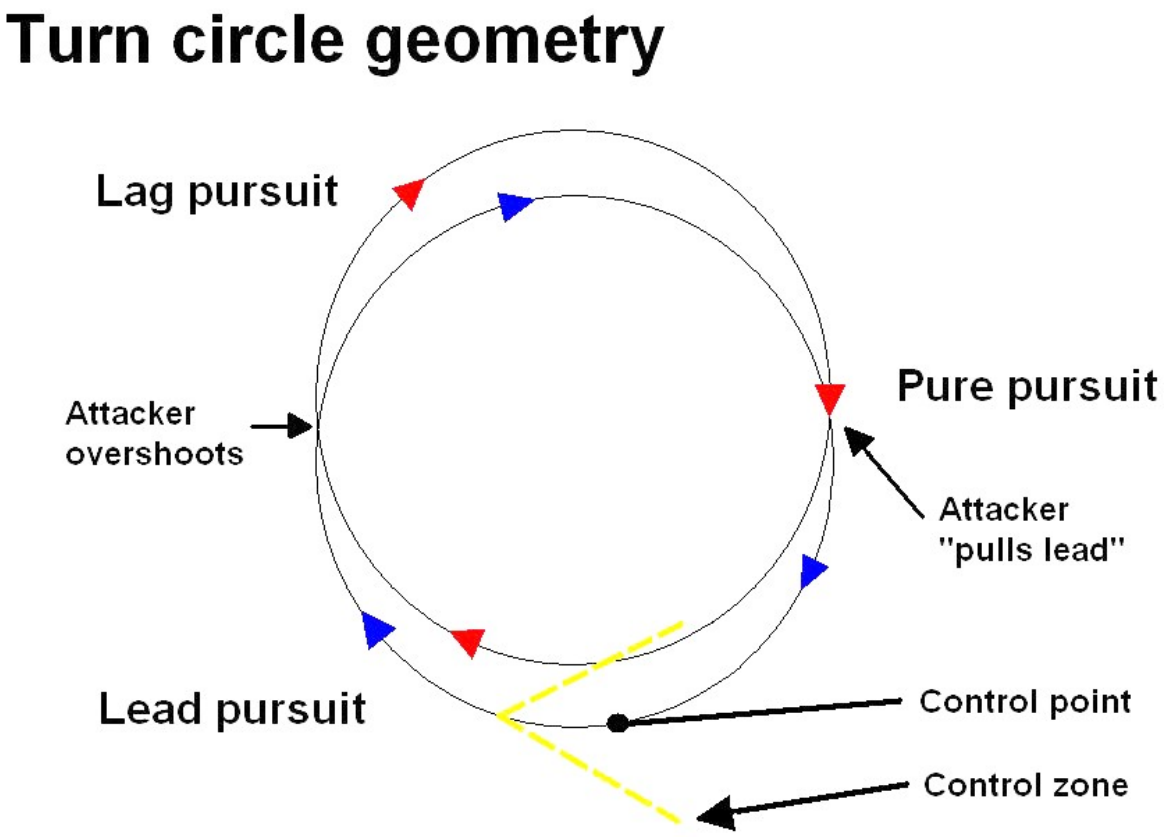
An offensive position generally occurs when the pilot gets sight of the opponent first. With the advantage of surprise, the pilot can maneuver into a better position to attack the opponent, making it more difficult for the enemy to evade the attack. Common tactics include increasing altitude and/or attempting to place the fighter directly between the sun and the opponent. This helps put the pilot in a dominant position, primarily concerned with prosecuting their advantage for a kill. An offensive position is generally defined as the ability to get above or behind the enemy. The pilot is able to create an energy advantage, providing the ability to swoop down on the opponent and spray the area with lasers while using the speed to move back to a safe attitude. The attacker also has an orientation-related advantage, being able to press the attack while avoiding the enemy's weapons.

Defensive [28]

A defensive position usually occurs when the pilot spots the attacker late. Usually below or ahead of the opponent, the pilot is in a weak position, primarily concerned with denying a shot to the opponent and converting to a neutral position. The secondary goal is either to escape or to achieve a dominant position. If the attacker is at an energy disadvantage, the defender will likely use the speed to disengage, but, if the attacker is moving much faster, the defender will usually maneuver in order to force a dangerous overshoot. A dangerous overshoot happens when an attacker flies out in front of the defender, causing their roles to be reversed.

Concepts [29]
Once an attacker gets behind a defender, there are three problems to solve in order to prosecute the kill. The attacker must be able to get into the same geometric plane as the defender, get in range without overshooting, and be able to lead the target. The defender will usually turn aggressively to spoil the attacker's solution

Turn Circle [30]
Spacecraft turn in circular motions, following a circumference around a central point. The circumference is often referred to as the "bubble", while the central point is often called the "post." Any change in the g-force load on the spacecraft causes a change in the bubble's size as well as a change in turn radius, moving the post in relation to the fighter. Because a spacecraft turning at its maximum load cannot turn any tighter, any spacecraft located between such a fighter and its post is momentarily safe from attack. It is in this area where an attacking fighter will usually try to position itself.



Once inside the defender's bubble, the attacker will be in lead pursuit and may have an opportunity for a lucky "snapshot" hit. If the attacker can maneuver onto the defender's flight path before an overshoot occurs, the attacker will be able to stop or reverse closure rate. The most desirable position is, following the defender's flight path, a distance equal to one turn radius behind the opponent. This position, from which the attacker will be able to safely maintain command of the fight, is termed the "control point."

The control point lies in the heart of an imaginary, cone-shaped area, called the "control zone", and it is within this zone that the attacker will have both sufficient time and range to react to the defender's countermeasures.

Overshoots [31]
During a dogfight, the term "overshoot" refers to situations in which the attacker either crosses the enemy's flight path or passes the defender, ending up in front.

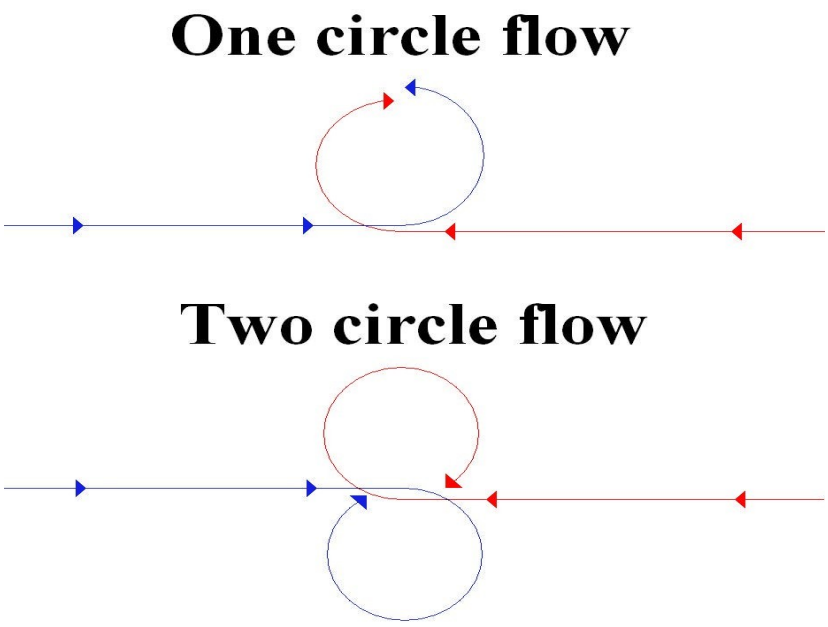
Passing the defender is referred to as a "wingline overshoot." Also called a "3-9 line overshoot" or a "dangerous overshoot", this occurs when an attacking spacecraft approaches too fast and accidentally crosses the defender's wingline (an imaginary line passing through the center of the spacecraft at the 3 o-clock and 9 o-clock positions). A wingline overshoot is usually referred to as "flying out in front" and causes "role reversal", putting the attacker in range of the defender's weapons, and the attacker suddenly becomes the defender.[40]

When the attacker crosses the defender's flight path, the situation is called a "flight path overshoot." This happens when an attacker fails to control closure and crosses the defender's flight path from behind. Although not necessarily dangerous, it is possible for a flight path overshoot to cause the attacker to fly out in front of the defender. More often, however, it greatly reduces the attacker's angular advantage over the defender. Flight path overshoots are divided into two categories, called "control-zone overshoots" and "in-close overshoots."[40]

A "control-zone overshoot" occurs when the attacker crosses the defender's flight path from behind the front edge of the control zone. After a control-zone overshoot, the defender will continue turning in the same direction to retain the acquired angular advantage, trying to prevent the attacker from getting a good aim.[40]

An '"in-close overshoot" happens when the attacker overshoots the defender's flight path ahead of the control zone. This gives the defender the opportunity to reverse the turn and possibly to cause a wingline overshoot, allowing the defender to move in behind the attacker and reverse their roles.

Circle Flow [32]
Spacecraft can turn either towards or away from each other. How the opponent turns in relation to the other determines the flow of the fight. If two fighters meet head-on, they will usually make a very close, neutral pass, called a "merge." After the pass, both fighters may turn to engage. If the two



fighters turn in the same direction (i.e.: both turn to the north), they will be traveling toward each other along the same turn circle. This type of engagement is known as "one-circle flow." If the spacecraft turn in opposite directions (i.e.: one turns north but the other turns south), they will move away from each other, flying around to engage each other on separate turn circles. This is called "two-circle flow."

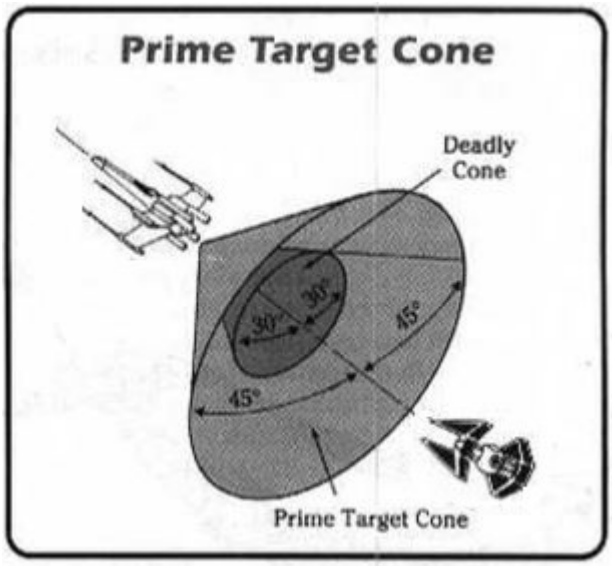
One-circle flow will result in another merge, unless an angular advantage can be obtained. During one-circle flow, the fighter with the smaller turn radius will have the advantage. Pilots will often pitch-up out-of-plane while increasing thrust, to help minimize turn radius. Because it does not really matter where the two fighters meet in the circle, turn rate is of little importance during one circle flow. Therefore, it is often called a radius fight. An out-of-plane maneuver, such as a displacement roll, is a viable option for reducing turn radius.

Two-circle flow will also result in another merge. In two-circle flow, turn radius is of little importance, because what matters is which fighter can get back to the merging place first. Two-circle flow is a turn rate fight, and the angular advantage usually goes to the spacecraft with the higher turn rate at its corner speed. Pilots will often slice turn in order to maximize their turn rate.

A third option is called vertical flow, in which one or both fighters turn toward the vertical plane. If both fighters go up or down, the fight becomes one-circle flow. If one fighter goes up or down, while the other turns horizontally, it is really a modified version of one-circle flow. However, if one fighter goes up while the other goes down, it becomes two-circle flow.

In both types of flow, the closest possible merge is desirable to keep the enemy at an angular disadvantage. Although circle flow is often described using neutral merges, the concept applies anytime two spacecraft maneuver in relation to each other and the horizon. For instance, the "flat scissors" is an example of one-circle flow, while the "rolling scissors" is an example of two-circle flow.

Prime Target Cone [10]
The prime target cone is an imaginary cone shaped area behind a defending fighter. This cone is considered the best spot to engage a defending fighter. Any angle from 45 degrees to 30 degrees off the center line of the defending fighter is in the prime target cone. Any angle from 0 to 30 degrees is considered the Deadly Cone and is the spot most pilots try to maneuver into to gain a kill shot



Maneuvers [33]

Combat Spread [34]

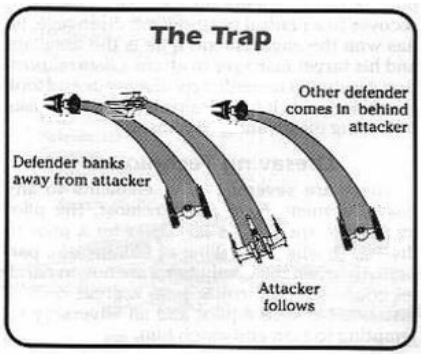
The combat spread is the most basic of maneuvers used prior to engagement. A pair of attacking spacecraft will separate, often by a distance of one kilometer horizontal by 1.5 kilometer vertical. The fighter with the lower altitude becomes the defender, while the wingman flies above in "the perch" position. The defender will then attempt to lure their opponents into a good position to be attacked by the wingman

Defensive Split [35]

A pair of fighters encountering one or two attackers will often use a defensive split. The maneuver consists of both defenders making turns in opposite directions, forcing the attackers to follow only one spacecraft. This allows the other defender to circle around, and maneuver behind the attackers.

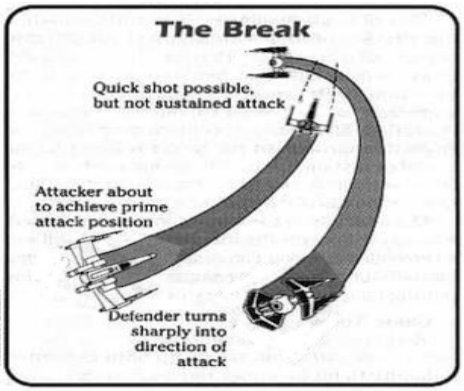
Sandwich (The Trap) [11]

A sandwich maneuver begins with two defenders flying line-abreast (side by side at the same altitude), with typically about a kilometer of lateral separation. When an attacker maneuvers onto the tail of one spacecraft, the defender will make a sharp turn away from the wingman. At the same time, the wingman turns in the same direction as the defender. When both fighters turn 90 degrees, they will come into single-file alignment with each other, "sandwiching" the attacker in the middle. Because the attacker is distracted chasing the defender, this allows the wingman to maneuver onto the attacker's tail for an easy shot

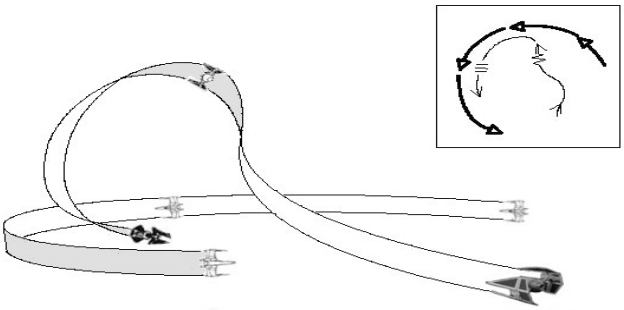


The most effective defense against this maneuver is for the attacker to feint, pretending to follow the first man. As the second man slots in behind the attacker, he performs a full throttle-hop or Tallon Roll, forcing the second man to overshoot him. This leaves both defending fighters in front of the attacker.

Break [36]
Spotting an attacker approaching from behind, the defender will usually break. The maneuver consists of turning sharply across the attacker's flight path, to increase AOT (angle off tail). The defender is exposed to the attacker's guns for only a brief instant (snapshot). The maneuver works well because the slower moving defender has a smaller turn radius and bigger angular velocity, and a target with a high crossing speed (where the bearing to the target is changing rapidly) is very difficult to shoot. This can also help to force the attacker to overshoot, which may not be true had the turn been made away from the attacker's flight path.

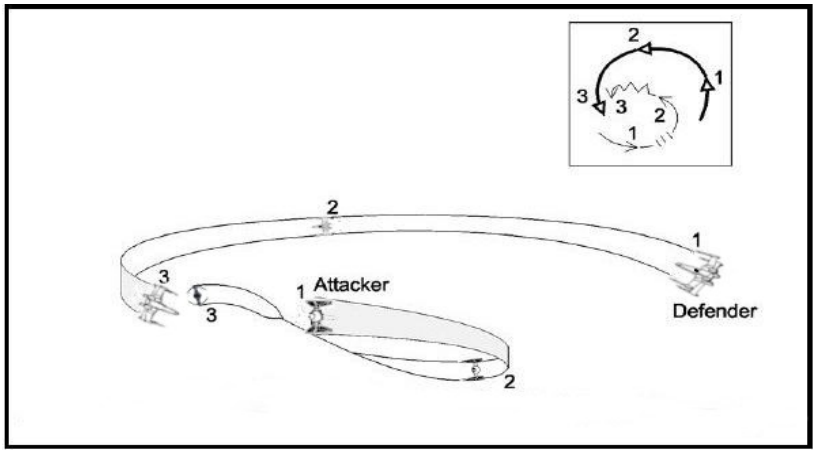


Barrel Roll Attack [37]
The counter to a break is often a displacement roll called a barrel roll attack. A barrel roll consists of performing a roll and a loop, completing both at the same time. The result is a helical roll around a straight flight path. The barrel roll attack uses a much tighter loop than the roll, completing a full loop while only executing 3/4 of a roll. The result is a virtual 90 degree turn, using all three dimensions, in the direction opposite of the roll. Rolling away from the defender's break, the attacker completes the roll with the spacecraft's nose pointed in the direction of the defender's travel.

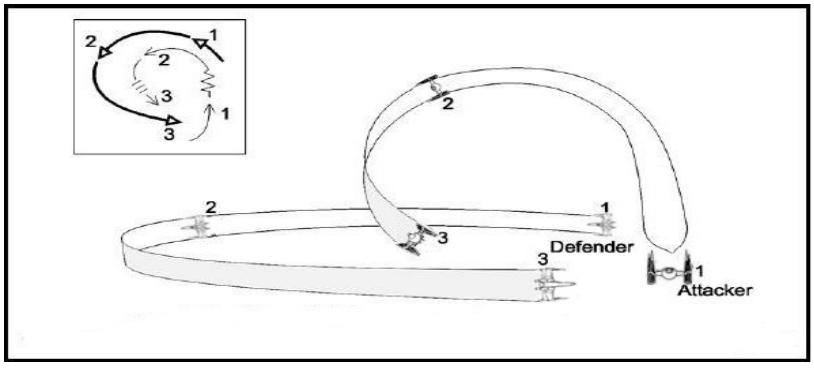


High-Side Laser Pass [38]
If the attacker has a significant altitude/attitude advantage, a high-side laser pass is usually prudent. Sometimes called a "swoop," "boom and zoom," "hit and split," plus a variety of other names, it consists of a powered dive toward the rear quarter of a lower flying opponent. Shooting with the cannons in a single, high-speed pass, the attacker uses excess kinetic energy to disengage from the fight in a zoom climb back to a safe altitude/attitude, restoring the potential energy. This allows the attacker to set up another attack and dive again. Surprise is often a key element in this type of attack, and the attackers will often hide in the sun or clouds, stalking their opponents until a good opportunity is presented. A high-side laser pass is a very effective tactic against a more maneuverable opponent, where the turning battle of a dogfight is best avoided.

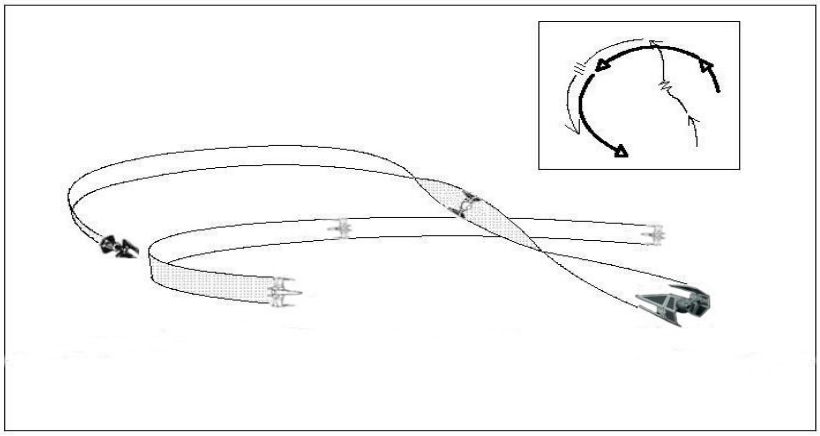
Low Yo-Yo [39]
The low Yo-Yo is one of the most useful maneuvers, which sacrifices altitude for an instantaneous increase in speed. This maneuver is accomplished by rolling with the nose low into the turn, and dropping into a steeper slice turn. By utilizing some energy that was stored in the vertical plane, the attacker can quickly decrease range and improve the angle of the attack, literally cutting the corner on the opponent's turn. The pilot then pulls back on the stick, climbing back to the defender's height. This helps slow the spacecraft and prevents an overshoot, while placing the energy back into altitude.
A defender spotting this maneuver may try to take advantage of the increase in AOT by tightening the turn in order to force an overshoot. The low Yo-Yo is often followed by a high Yo-Yo, to help prevent an overshoot, or several small low Yo-Yos can be used instead of one large maneuver



High Yo-Yo [40]
The high Yo-Yo is a very effective maneuver, and very difficult to counter. The maneuver is used to slow the approach of a fast moving attacker while conserving the speed energy. The maneuver is performed by reducing the angle at which the spacecraft is banking during a turn, and pulling back on the stick, bringing the fighter up into a new plane of travel. The attacker then rolls into a steeper pitch turn, climbing above the defender. The trade-off between airspeed and altitude provides the fighter with a burst of increased maneuverability. This allows the attacker to make a smaller turn, correcting an overshoot, and to pull in behind the defender. Then, by returning to the defenders plane, the attacker restores the lost speed while maintaining energy.



Lag Displacement Roll [41]
A lag displacement roll, also called a "lag roll", is a maneuver used to reduce the angle off tail by bringing the attacker from lead pursuit to pure, or even lag pursuit. The maneuver is performed by rolling up and away from the turn, then, when the spacecraft's lift vector is aligned with the defender, pulling back on the stick, bringing the fighter back into the turn. This maneuver helps prevent an overshoot caused by the high AOT of lead pursuit and can also be used to increase the distance between spacecraft.



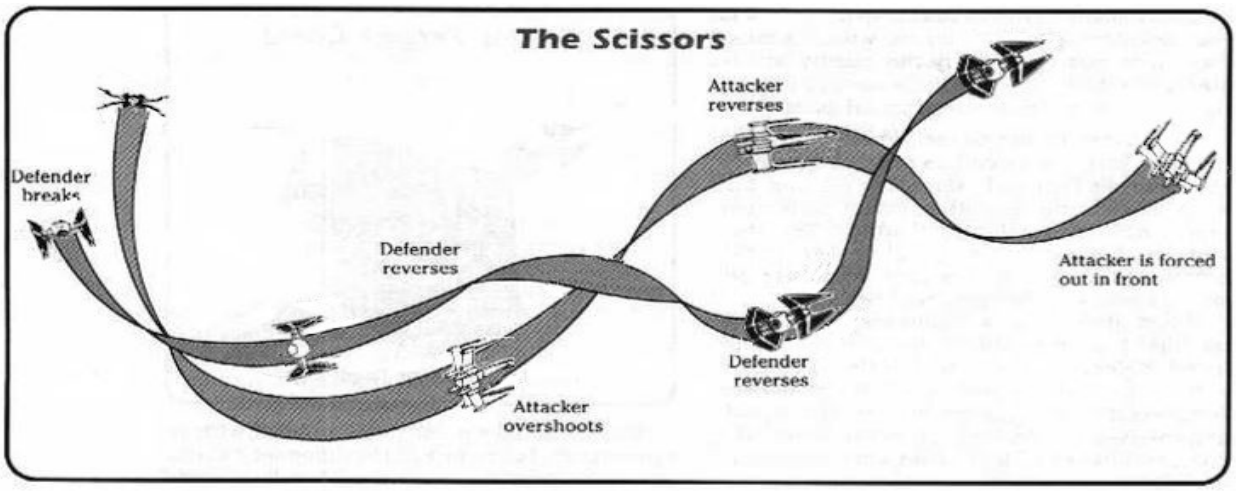
High Yo-Yo Defense [42]
To prevent an overshoot, an attacker in lead pursuit may need to correct with an out-of-plane maneuver. If the lateral separation is excessively high, the attacker will probably use a displacement roll. However, if the lateral separation is low enough, the attacker will likely use a high Yo-Yo. The high Yo-Yo defense can be a good tactic in these situations. The maneuver is performed when the attacker rolls away from the turn to begin the correction. The defender will begin to relax the turn by easing off the stick, called "unloading", which causes both turn radius and speed to increase, restoring the fighter's lost energy. If the defender maintains the same angle of bank, the subtle maneuver will be very difficult for the attacker to spot. When the attacker completes the out-of-plane maneuver, the defending fighter has regained some of its energy. This allows the defender to, once again, turn harder into the attack, regaining an angular advantage over the higher energy attacker. If the attacker is surprised by the maneuver, a high Yo-Yo defense might even cause an overshoot

Unloaded Extension [43]
An unloaded extension is a disengagement (bug out) maneuver often used by the pilot whenever there is enough energy and separation. The maneuver consists of slipping into a steep, straight dive and applying full thrust. Removing all g-force load from the spacecraft causes it to accelerate at a very high rate, allowing the pilot to vastly increase range, or "extend", and possibly to escape.

If a defender breaks suddenly, causing the attacker to overshoot, the defender may reverse the turn and move in behind the attacker. An unloaded extension is usually the attacker's best option, using the energy advantage to escape the slower moving defender. An unloaded extension is usually not recommended against a higher energy opponent. However, in many circumstances, such as when an attacker performs a high Yo-Yo too steeply, an unloaded extension is a viable option for the defender

Scissors [44]
The scissors are a series of turn reversals and flight path overshoots intended to slow the relative forward motion (downrange travel) of the spacecraft in an attempt to either force a dangerous overshoot, on the part of the defender, or prevent a dangerous overshoot on the attacker's part. The defender's goal is to stay out of phase with the attacker, trying to prevent a laser solution, while the attacker tries to get in phase with the defender. The advantage usually goes to the more maneuverable spacecraft. There are two types of scissor maneuvers, called flat scissors and rolling scissors

Flat Scissors [45]
Flat scissors, also called horizontal scissors, usually occur after a low-speed overshoot in a horizontal direction. The defender reverses the turn, attempting to force the attacker to fly out in front and to spoil aim. The attacker then reverses, trying to remain behind the defender, and the two spacecraft begin a weaving flight pattern



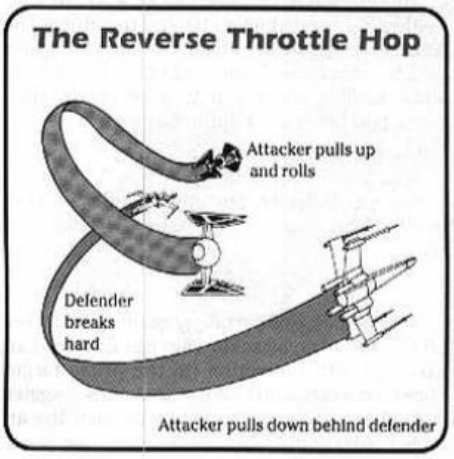
Rolling Scissors [46]
Rolling scissors, also called vertical scissors, tend to happen after a high-speed overshoot from above. The defender reverses into a vertical climb and into a barrel roll over the top, forcing the attacker to attempt to follow. The advantage lies in the spacecraft that can pull its nose through the top or bottom of the turn faster. In battles with spacecraft that have a thrust-to-weight ratio of less than one, the spacecraft will quickly lose altitude, and crashing into the ground becomes a possibility.

Lasers Defense(Jinking) [47]
Laser defense maneuvering, or "Laser-D", is the last resort for a defender that fails to outmaneuver the attacker. Laser-D is a series of random changes in the defender’s flight path intended to spoil the attacker's aim by presenting a constantly shifting target, and, hopefully, to maneuver out of the bullet stream (hose). It consists of arbitrary speed changes, yaws, skids, slips, pitch-ups, and rolls, and is often referred to as "jinking." Because the attacker must aim ahead of the opponent, the primary goal in guns-D is to disorient the attacker's aim by keeping the nose pointed in a different direction than the velocity vector (the direction of travel), and is very effective at preventing the attacker from achieving a suitable laser solution. However, Laser-D maneuvering still leaves the defender susceptible to stray shots and "lucky shot" hits and does little to improve the relative positional situation. Thus, it is only employed as a last-ditch defensive effort when nothing else works.

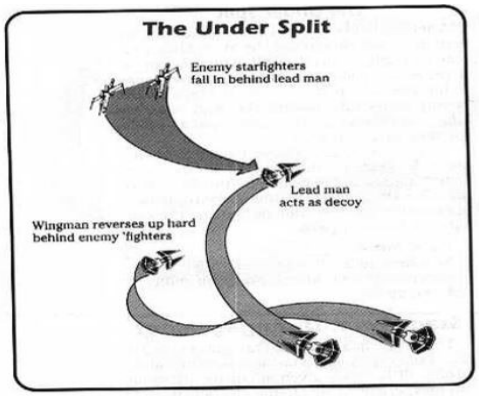
The Tallon Roll [12]
This difficult maneuver is performed when the attacker becomes aware that he is going to overshoot a breaking defender. He comes level, pulls his nose hard up, then rolls away from the direction of the turn. This three-dimensional maneuver is completed by sliding in astern of the target. Effectively, this maneuver alters the angle of approach to the target without losing speed or distance. It is difficult for a defender to counter the roll, as it takes place entirely behind him and in his blind spot.

The difficulty of the maneuver is the roll itself. It is easy to become disoriented while in a roll and an unskilled attacker can easily overshoot, taking himself out of the fight completely and possibly putting himself out of the fight completely and possibly putting himself at the mercy of the defender.

Reverse Throttle Hop [13]
This Maneuver is a way of retaining the advantage when the target breaks. As the defender goes into his break, the attacker pulls up above his opponent and decelerates. As the defender finishes his break, the attacker drops back down behind the defender, having performed a sort of exaggerated hop. This is a very difficult maneuver to perform well. It requires split-second timing, precise execution, and a bit of intuition. If it is started too early, the defender will simply loop back and follow the attacker up, giving himself the advantage. If it is started too late, the attacker is in danger of overshooting and once again ending up in front of his opponent.



Undersplit [14]



This maneuver involves some danger for the lead man, an should only be attempted if the lead starfighter can take a bit of punishment. In it, the lead man shoots out ahead of his wingman in full view of a pair of enemy fighters. As the enemy ships turn toward the lead man, his wingman crosses under unobserved and pulls up hard for a belly shot.

Trainee pilots are always taught to keep a sharp lookout for this type of decoy move. Unfortunately, in the heat of battle, the chance of a quick kill against an outnumbered opponent often drives out this training, leaving the starfighters at deadly peril.

See Also

Attribution:

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[39][40][41][42][43][44][45][46][47]**

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https://starwars.fandom.com/wiki/Alpha-class_Xg-1_Star_Wing/Legends
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https://starwars.fandom.com/wiki/Missile_Boat
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Disclaimer: Many pictures in this manual were altered to conform to the imperial centric nature of the document.