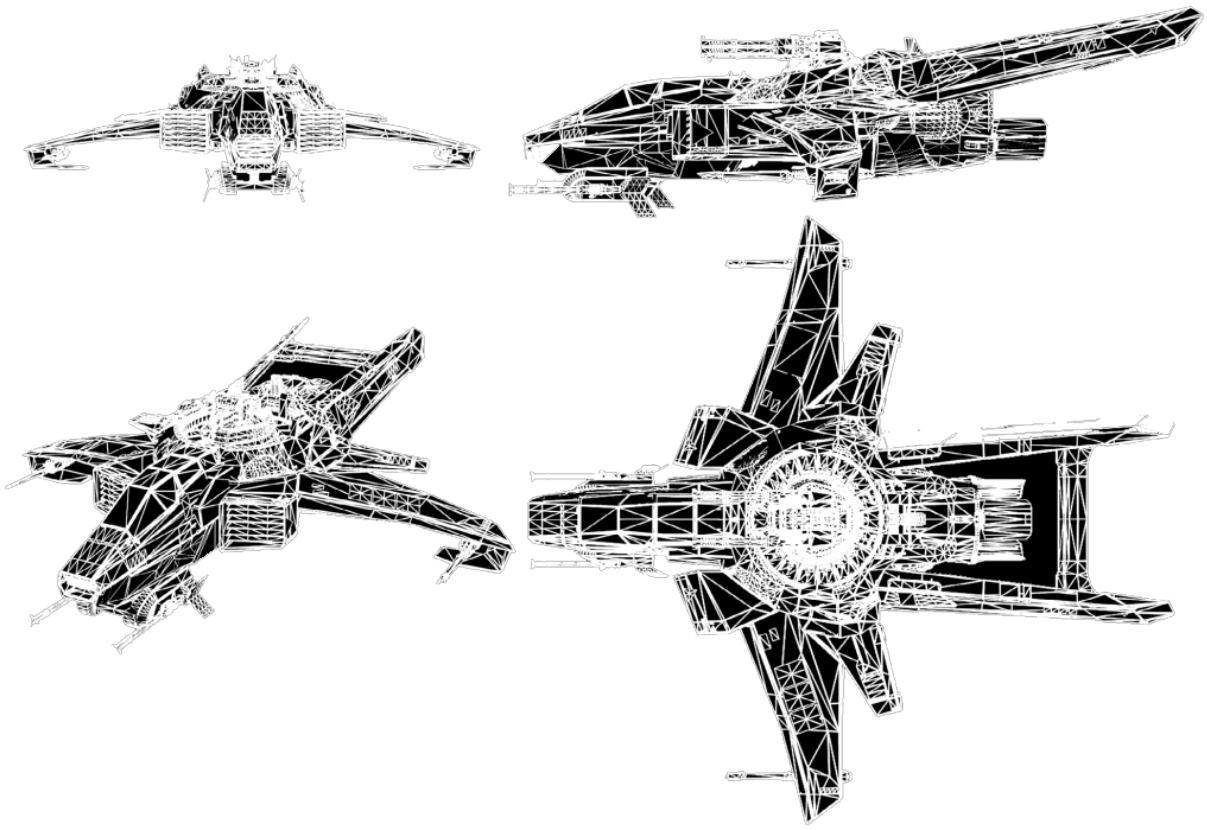
Legacy Instructional Series

Chapter 7
Space Combat



Combat

7.1. SITUATIONAL AWARENESS

The cornerstone to success in combat is situational awareness (SA). SA is your perception and understanding of what is actually occurring around you and is gained through the use of the spacecraft's on-board systems, visual scanning, other crew members and wingmen.

7.2. WINGMANSHIP

Wingmen have critical responsibilities when working as a team. They help the mission leader in the planning and organisation of any mission. Wingmen are a central part of enabling SA by reporting contacts via TDAS or visually to the formation leader and can perform backup navigation tasks if required. They are essential to mission success especially during strike missions where target destruction is essential. Wingmen must engage as briefed or when directed by the flight leader and to support when their leader engages a target. It is essential that wingmen carry out their responsibilities with discipline and dedication.

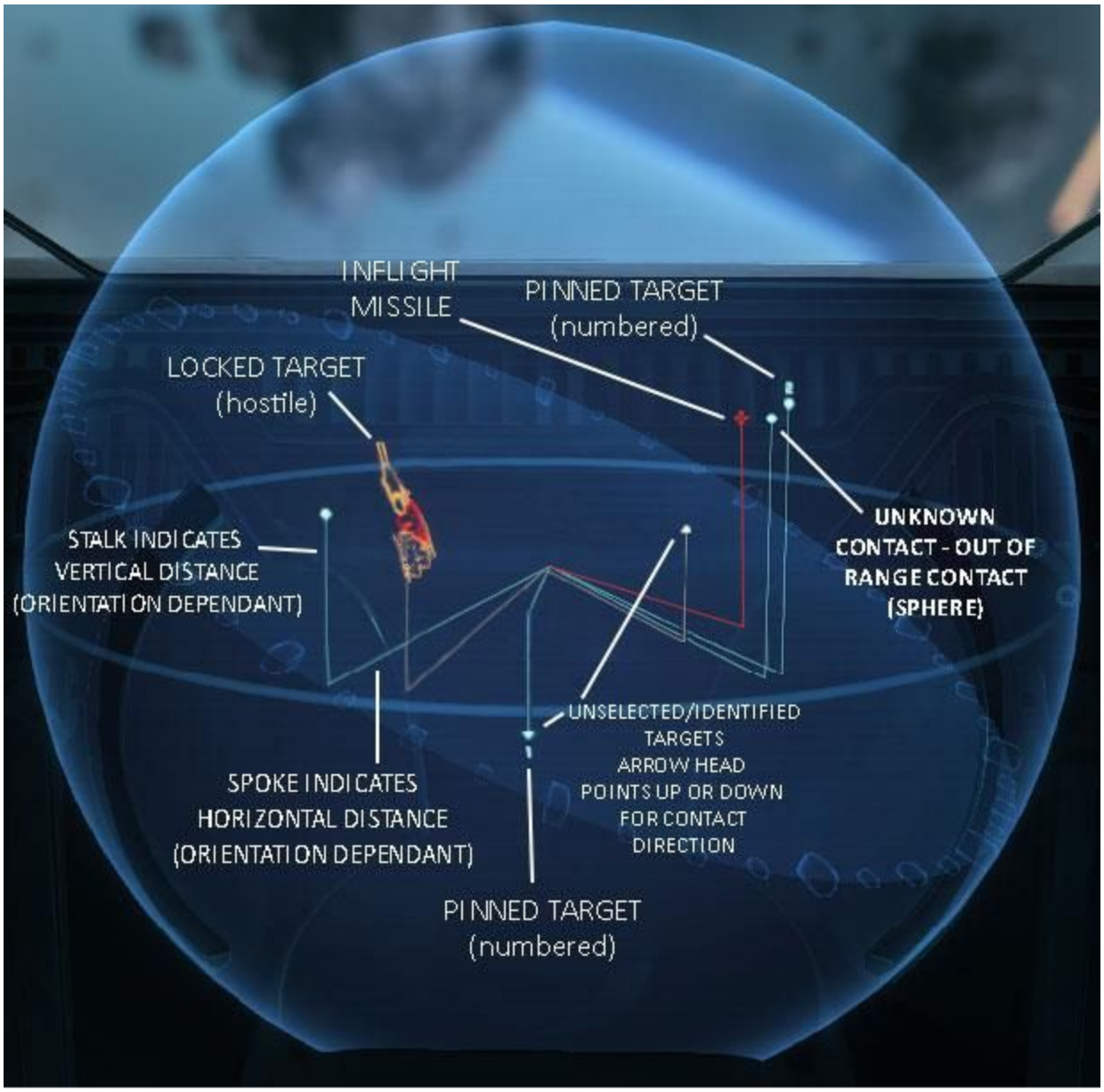
Discipline is the most important quality a pilot can possess and leads to success in the spacial arena. Discipline is executing self-control, maturity, and judgment in a high-stress, emotionally charged environment. Teamwork is the foundation of any fighting force and is cornerstone to mission success. If all team members know and perform their respective duties dutifully the chance of mission success and survival increases dramatically.

7.3. RADIO DISCIPLINE

Discipline and effectiveness within a formation starts with communication. All communications must be clearly understood by every member of the team. Radio message discipline requires clarity and brevity. Where possible the message should identify the message initiator by way of call sign followed by the message. The other members of the formation should where possible respond by way of their number in the formation e.g. “Sica 1, TDAS contact, 12 o’clock, 15 clicks” to which the remaining members of the formation would replay “Two, tally”, “Three, tally” etc. When there is a delay in responding the message should again include the transmitters call sign. For brevity keywords see Annex A.

7.4. TDAS EMPLOYMENT

7.4.1. Effective use of the TDAS system is critical to situational awareness (SA) in all situations. In combat SA is critical in mission success. TDAS is capable of tracking multiple targets at all angles at three ranges, Short, Medium and Long. Short range detects and tracks targets up to 1000m range, Medium range detects and tracks targets up to 6000m range and Long range detects and tracks targets up to 15 klms(*1) in range. Targets continuing to be tracked whist within the TDAS max range, but outside the currently set scanning range limit are displayed on the TDAS holo-sphere as a small blue sphere. Targets being tracked in the currently set scanning range identified as friendly are displayed in green. Targets being tracked in the currently set scanning range identified as threats are displayed in orange.



The currently selected target is displayed as a 3D render of the ship type within the holo-sphere. Targets can be selected directly using touch(*2) in the TDAS holo-sphere or via the stick grip mounted targeting controls. Selected targets (friendly or Enemy) are able to be pinned using the Pin Target button on the Stick Grip assembly. TDAS can also identify in flight missiles by way of bracketing them on the CVI with a red triangle.

*1 Subject to amendment

*2 “Touch” means via the mouse

7.5. CVI ENHANCED OPTICS

7.5.1. The CVI enhanced optical zoom is useful for target identification and battle damage assessment. The enhanced optical zoom used during torpedo employment can analyse the effectiveness of the strike and if the weapon has functioned correctly.

7.6. WEAPON SELECTION

Selecting the best weapon for the mission at hand can make all the difference in combat effectiveness. Flight commanders should consider the number and types of weapons carried during mission planning.

7.6.1. Ordnance.

7.6.1.1. Missiles. The F7 is capable of carrying a wide variety of missile types that can be selected dependent on mission type and pilot preference. Missile selection should take into account range, number and type of enemy anticipated to be encountered, mission objectives, number of ships in the formation. The types of missiles available to the F7 include:

a) **Infrared (IR)**  – Infrared missiles track the targets heat generated by the target spacecraft.

b) **Electromagnetic (EM)**  – Electromagnetic missiles track the EM signature of the target spacecraft.

c) **Cross-section (CS)**  – Cross section missiles utilise active radar tracking to track the cross section of the target spacecraft.

d) **Dumb fire**  – Dumb fire missiles are essentially a rocket. The rocket when fired will travel in a straight line and do not track targets in any way. Dumb fire missiles (rockets) can not lock onto a target prior to firing.

7.6.2. Guns. The F7 can mount a wide variety of guns ranging from projectile (kinetic) weapons, to energy beam weapons on it's hardpoints. Each weapon has advantages and disadvantages and these need to be taken into account during mission planning to ensure flight effectiveness. Mounting like weapons (e.g. Badger repeaters with Bulldog repeaters) will reduce the number of PIPs displayed by the ITTS and will make targeting easier, especially at range. The addition of a gimballed mount to a weapons hardpoint will reduce the weapon size that is possible to be attached to that hardpoint by one (e.g. S3 fixed -> S2 when gimballed). Refer to Whitley's Guide for more detailed weapons information.

7.6.3. Countermeasures. Ordnance employed against your spacecraft can be spoofed through the use of correct countermeasures. Countermeasures do not guarantee missile defeat. Always employ defencive SCM as well as the appropriate countermeasures for the incoming weapon detected. During combat, the avionic systems will display the detected

type of missile tracking your spacecraft on the CVI as a warning containing one of the icons shown below.

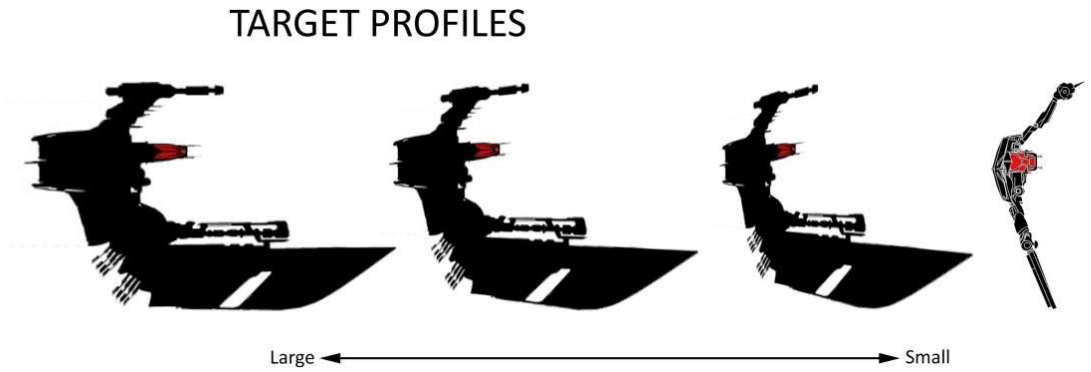
a) **Infrared (IR)** – Spoofed by flares.

b) **Electromagnetic (EM)** – Spoofed by Flare.

c) **Cross-section (CS)** – Spoofed by Chaff.

d) **Dumb fire** – As dumb-fire missiles do not use a guidance system, no missile caution will be displayed on the CVI. Due to this, there are no effective countermeasures available. The best defence is manoeuvring.

7.6.4. Effective targeting. During SCM the best manoeuvres will result in the target presenting a large profile. Larger target profile means that more of the target's surface area is exposed resulting in easier targeting and more projectiles on target.



7.7. SPACE COMBAT MANOEUVRING (SCM)

The primary objective of SCM is to manoeuvre into a position that you can bring weapons to bear, or employ ordnance on enemy spacecraft. To accomplish this you may need to first out manoeuvre you intended target through translation and direction changes to prevent them bringing their weapons to bear on you. The maneuvers presented here are only intended to be a guide or “play book” of manoeuvres that can be combined as necessary during combat to achieve a kill.

7.7.1. Barrel Roll. The barrel roll is an effective way to avoid fire whilst advancing on, or retreating from an enemy. The barrel roll is carried out by pitching and applying full left or right roll command. Hold this commanded roll and pitch input. The spacecraft should “cork screw” through space until the roll and pitch commands are removed.

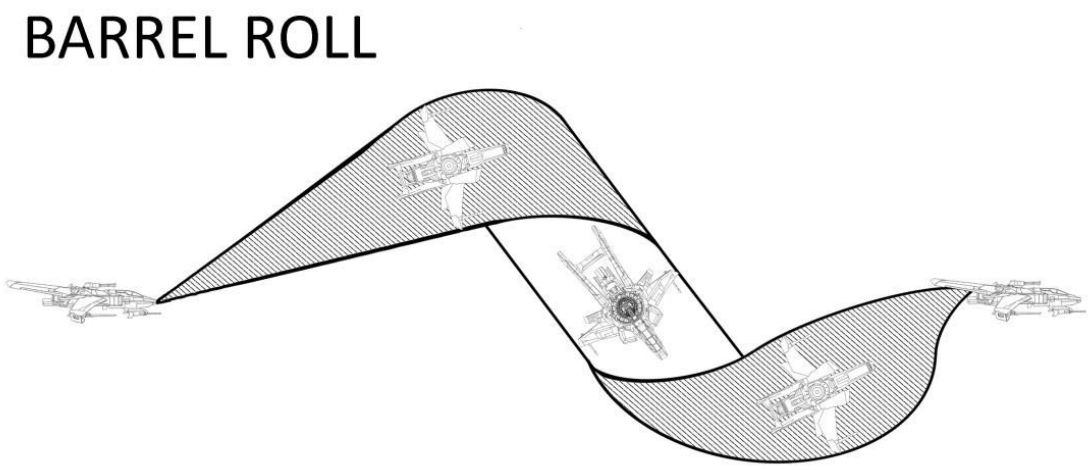


Figure 7-3 Barrel roll

7.7.2. Barrel Yaw. The barrel yaw uses the same principal as the barrel roll manoeuvre with the exception of utilising yaw instead of pitch as the second input. The barrel yaw is carried out by applying yaw and roll at the same rate to produce a flat spiral maneuver (the spacecraft nose always points forward).

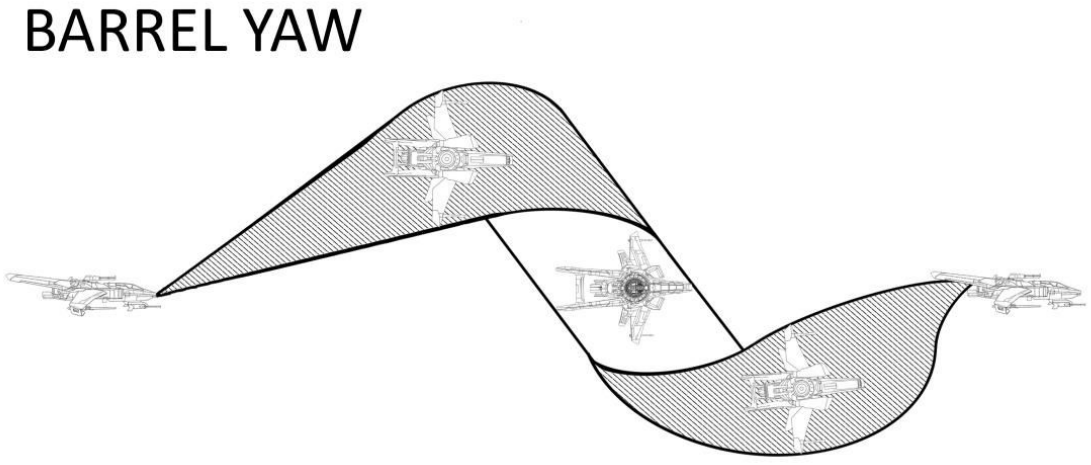


Figure 7-4 Barrel yaw

7.7.3. Pursuit curves. Pursuit in space combat involves aiming the nose of the spacecraft ahead, at, or behind the target ship to manoeuvre your spacecraft into firing position. The direction the target ship's nose is facing is indicated by the cone on the targeted ship bracket. This does not however necessarily indicate the direction of flight of the target. A better method of determining the direction of flight of your target is to use the extending

line from the ITTS PIP. The direction of the extending line from the PIP to the boresight cross can be used as a more accurate direction of flight indicator of the target.

a) **Lead pursuit** is pursuing a target with the nose of the spacecraft is pointing ahead of the target and will decrease the distance between the spacecraft and the target (boresight cross and PIP ahead of the target).

b) **Pure pursuit** is pursuing a target with the nose of the spacecraft pointing directly at the target and will maintain the distance between the spacecraft and the target (boresight cross directly at the target).

c) **Lag pursuit** is pursuing a target with the nose of the spacecraft pointing behind the target and will increase the distance between the spacecraft and the target (boresight cross and PIP behind the target).

Pursuit curves are an important consideration during any attack for closure.

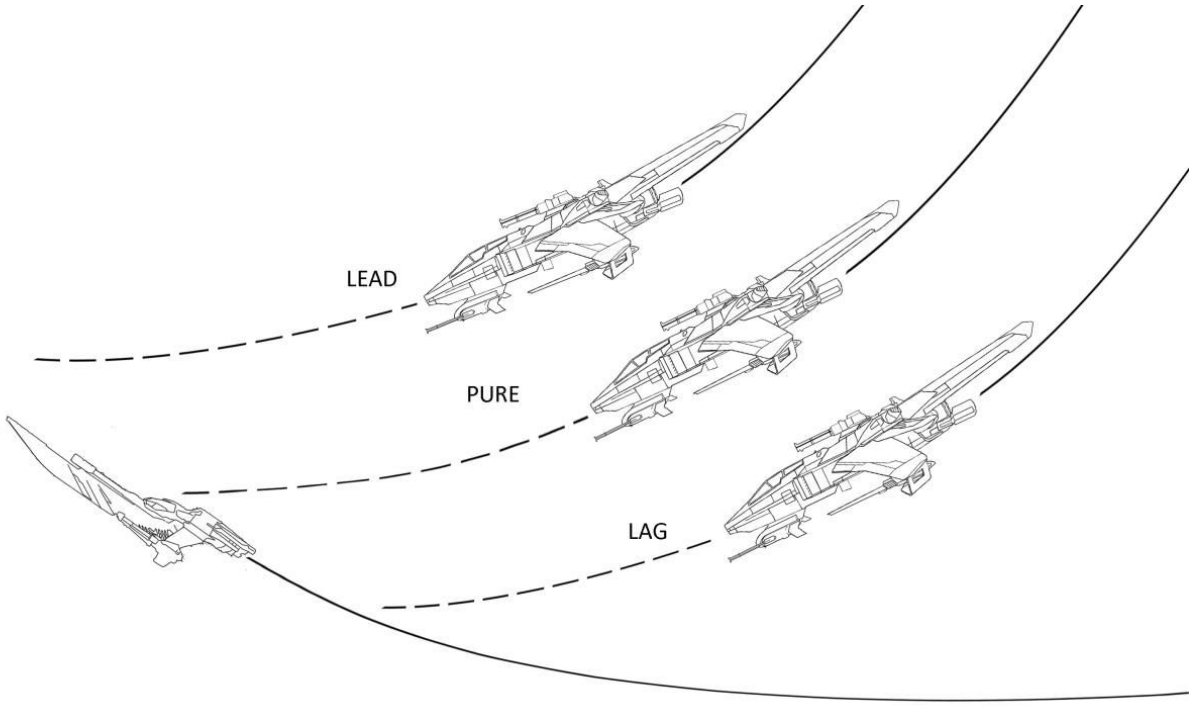


Figure 7-5 Pursuit curves

7.7.4. Instantaneous Turns. The instantaneous turn allows for rapid changes in direction while reducing the effects of G during the manoeuvre. Execution of this manoeuvre is to decouple prior to initiating the turn, carry out the turn by rotating on either the lateral or longitudinal axis (pitch or yaw), recouple, when exiting the turn carry out a 90o roll. After executing the roll, boost to regain speed lost and stabilise flight path.

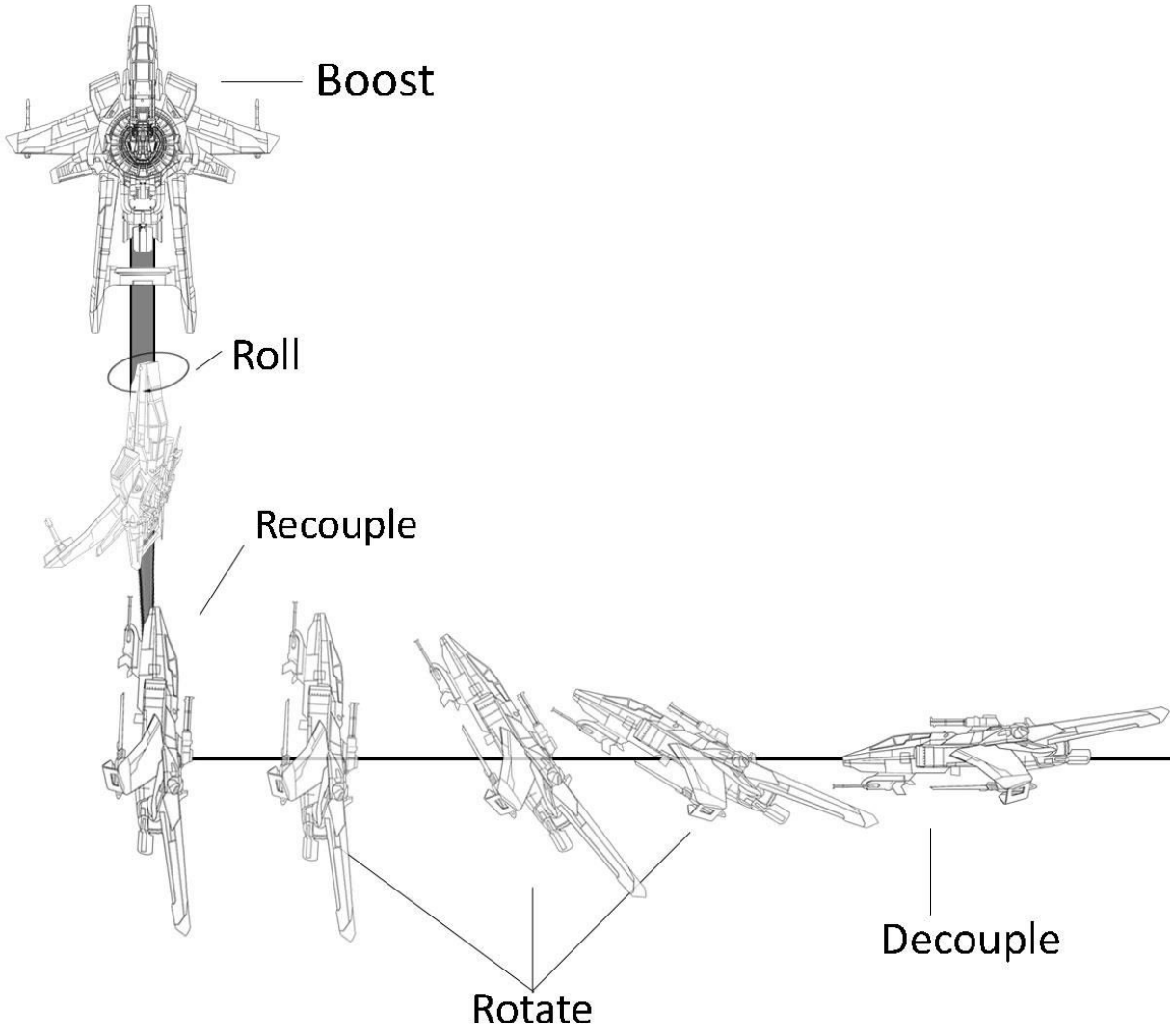


Figure 7-6 Instantaneous turn

7.7.5. Boost Braking. Application of main engine/manoeuvring thruster boost whilst applying spacebrake will increase the effectiveness of the manoeuvring thrusters in arresting spacecraft movement. This will nullify main engine thrust regardless of throttle position.

7.7.6. Translation Commands during Boost Braking. When applying translation commands during the Boost brake will cancel out all spacecraft motion except the commanded translation vector. This effectively nullifies all vectors apart from the newly commanded translation vector.

7.7.7. Circling Attack/Defence. The circling attack/defence (sometimes referred to as an orbit attack) is a common tactic utilised in dogfighting. The circle attack/defence is used to defeat the enemy targeting by continually changing the plane of the spacecraft's manoeuvring. Utilising translation left or right, yaw to rotate about the target. Utilise roll to change the spacecraft's plane of rotation. Always maintain speed with throttle and translation controls. In defence, increase range from the target during this manoeuvre to extend and escape.

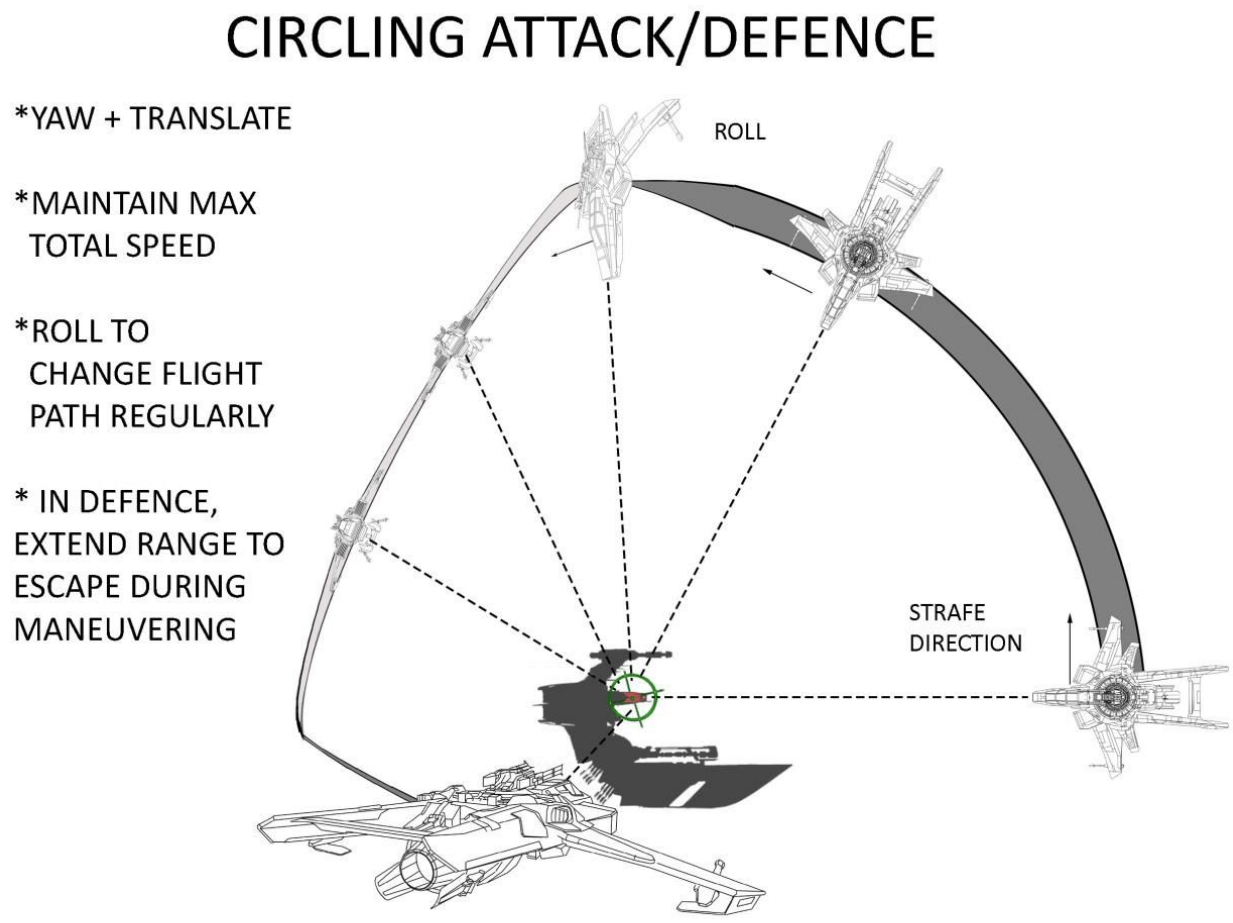


Figure 7-7 Circling attack/defence

Note: enabling COMSTAB will reduce the effectiveness of this manoeuvre due to IFCS reducing speed during the turn.

7.7.8. RIX Roll. The RIX roll is a variation on the circling attack/defence whereby the pilot utilises small roll movements during translation to vary the plane of rotation of the orbit slightly whilst still allowing relatively steady aiming for return of fire. The RIX roll, roll inputs only need to be slight. To execute, roll slightly and boost momentarily to avoid incoming fire whilst executing a circling attack/defence.

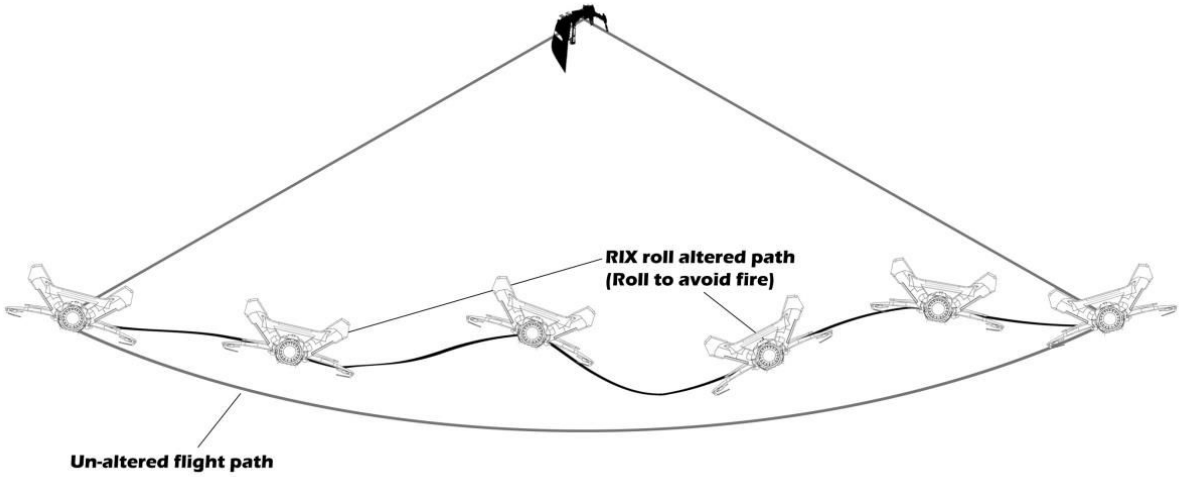


Figure 7-8 RIX roll

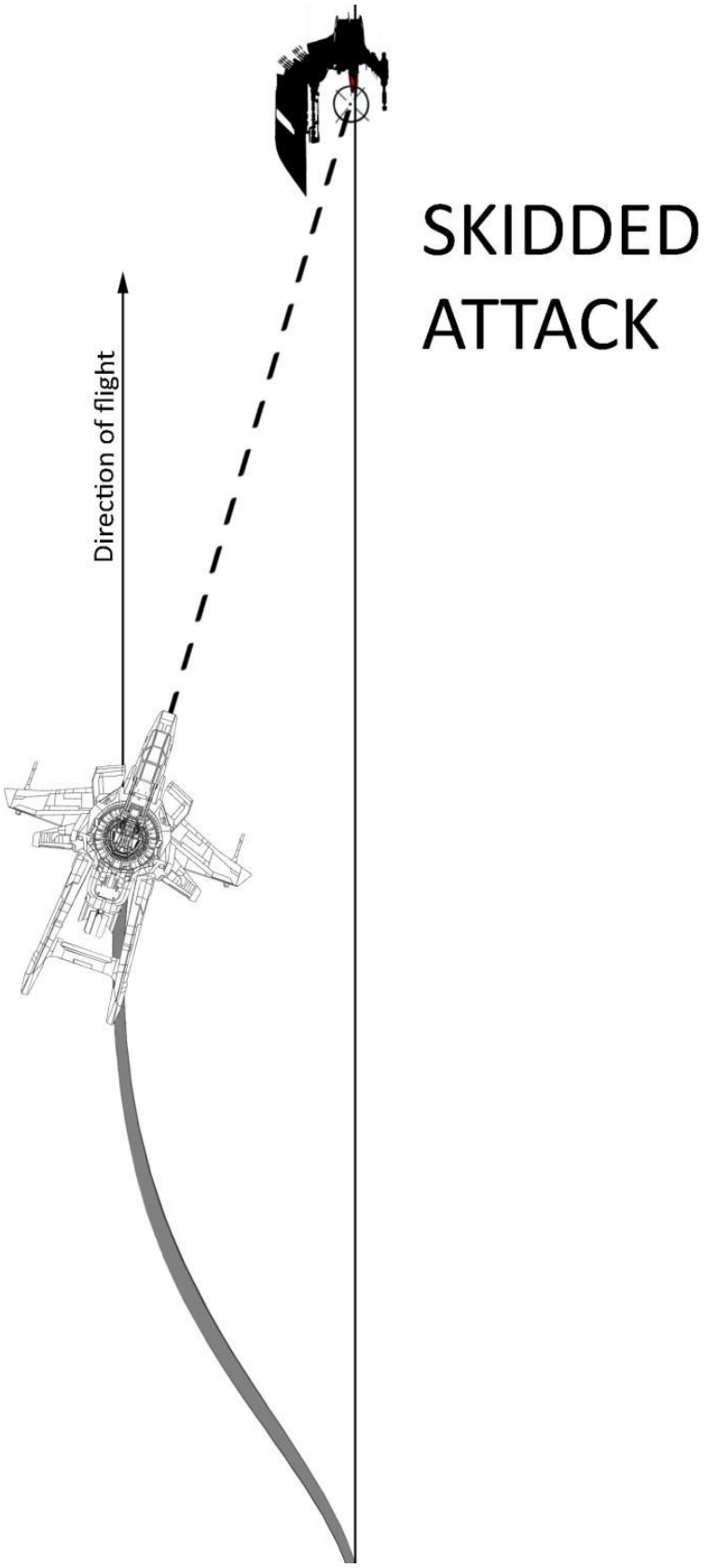
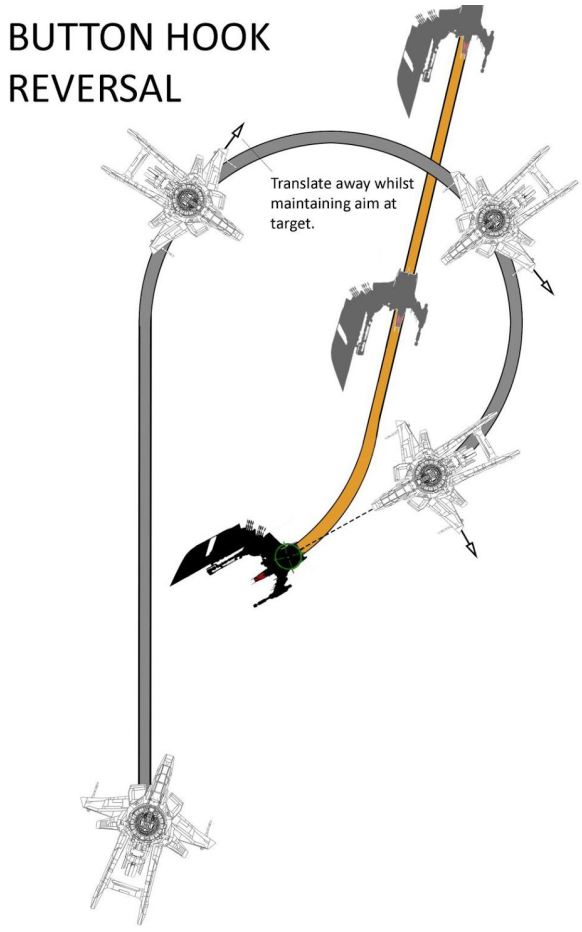


Figure 7-9 Skidded attack

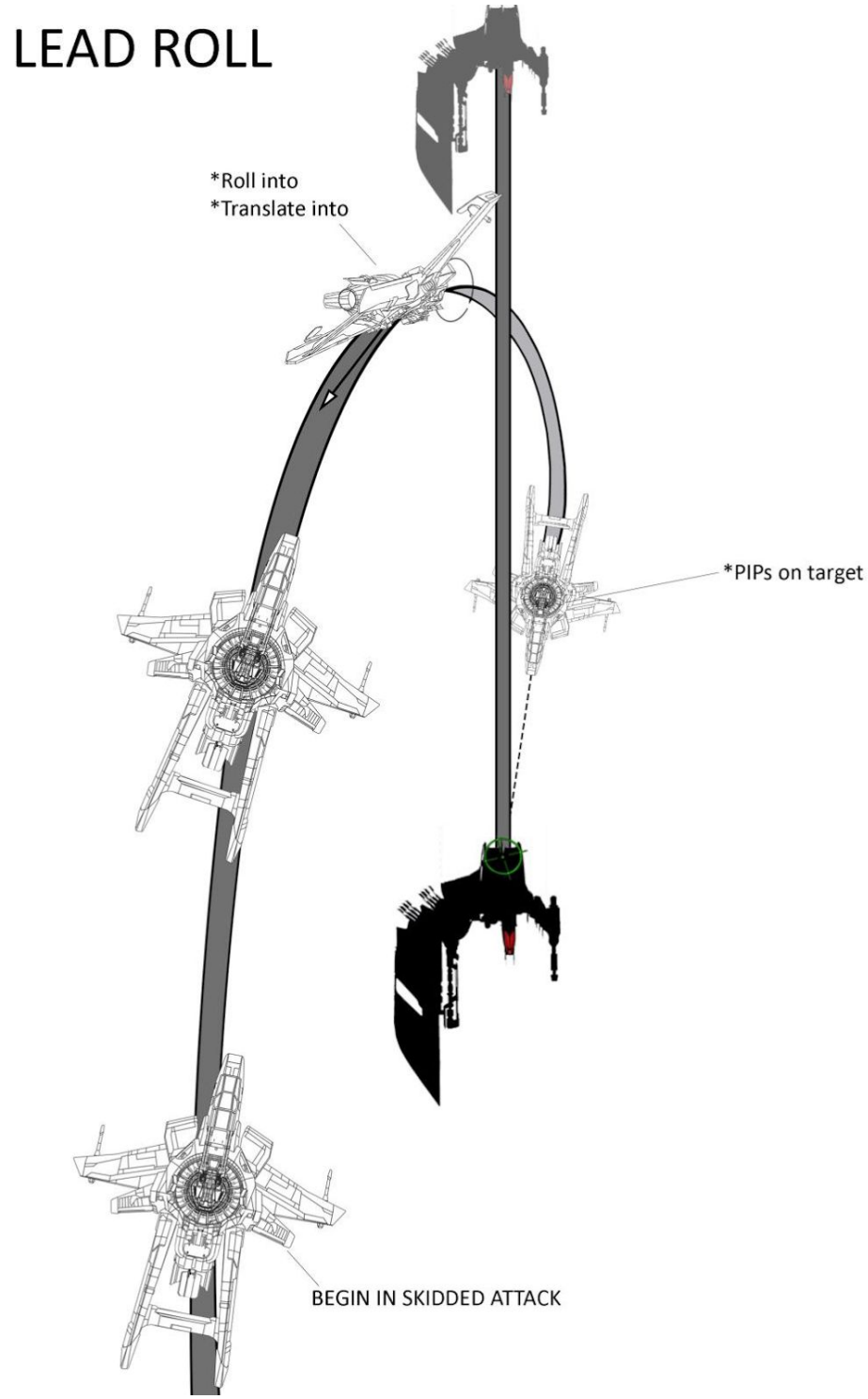
7.7.9. Skidded Attack.

The skidded attack can be used during head-to-head, high rate of closure attack/defence. This allows for weapons to be aimed independently of spacecraft direction of flight without being decoupled. This manoeuvre is carried out by maintaining max forward speed, applying lateral translation left or right and maintaining the boresight cross on the target. The amount of translation angle can be varied depending of the offset of the target's trajectory. This manoeuvre can be utilised during anti-capital ship weapons to present minimum cross section for target turrets/guns whilst maintaining visual contact for guided weapons implementation.

7.7.10. Button hook. The button hook manoeuvre is used to reverse the spacecraft's direction by repositioning for re-attack after a boom and zoom. The manoeuvre is executed by aligning the targets flightpath laterally with your own. Maintain maximum lateral separation at CPA by translating as in a skidded attack. After passing the target, turn into their flightpath arcing behind them whilst maintaining the nose of the spacecraft pointed at your target.



7.7.11. Lead roll. The lead roll is carried out by rolling into the direction of the target's flightpath at CPA, strafing into the target's flightpath, utilising boost. Re-acquire the target and gain a firing solution. The lead roll will result in losing a large amount of speed to gain a more advantageous position immediately following a high speed pass ("joust"). Best used when yours and your targets velocity vector differ in direction by more than 90o.



7.7.12. Lag Roll. The lag roll is an attack manoeuvre that uses geometry to control closure rate and maintain movement in all three axes of motion for defensive manoeuvring whilst maximising firing capability and preventing overshoots. This manoeuvre is carried out by rolling into (towards) the target whilst translating in the opposite direction of the inputted roll. Ensure that the target remains insight during the

manoeuvre. As the target's closure is checked or reduced, gain a firing solution by bringing the PIP's onto the target profile. If completed optimally, the target profile presented will be large.

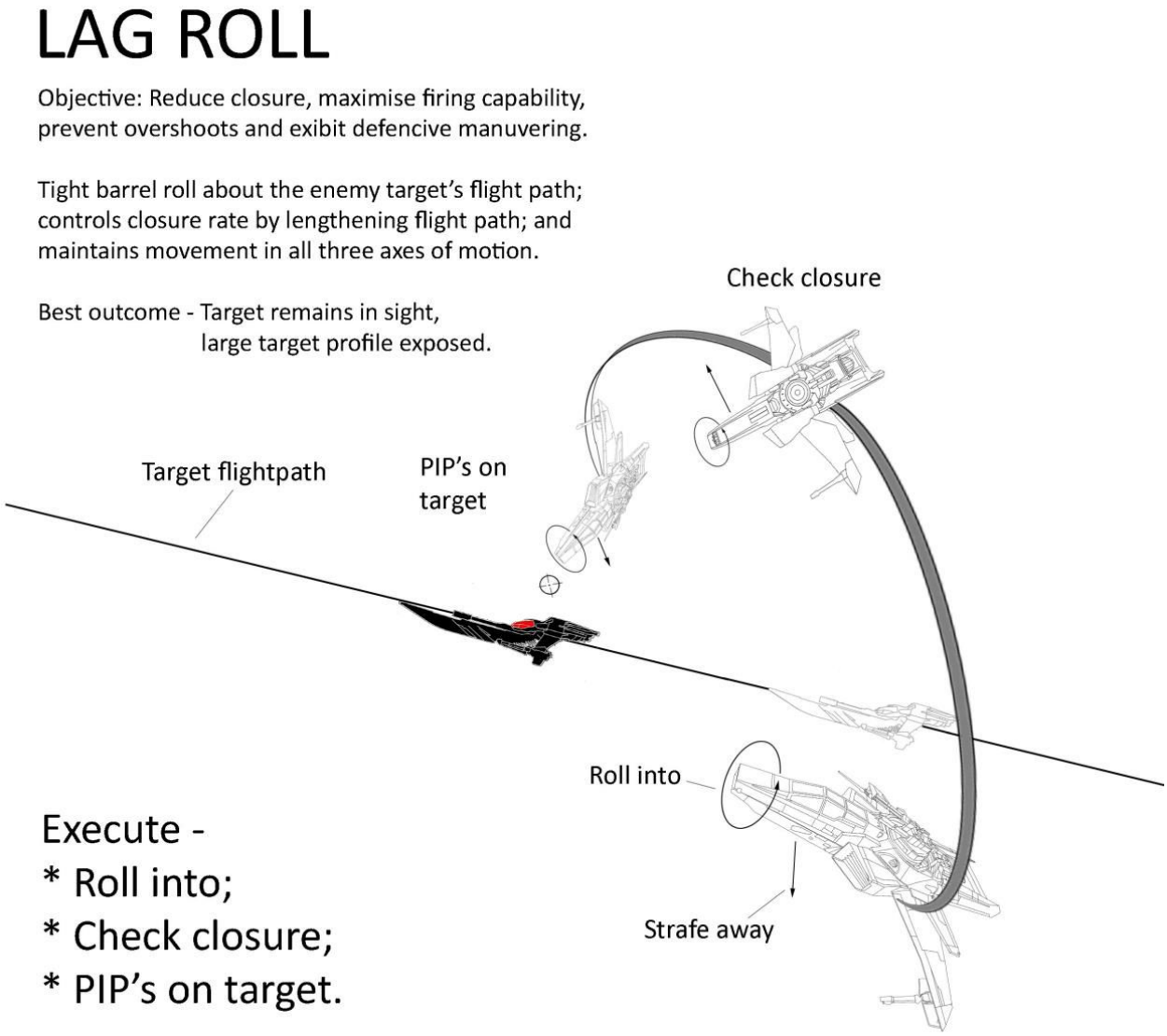
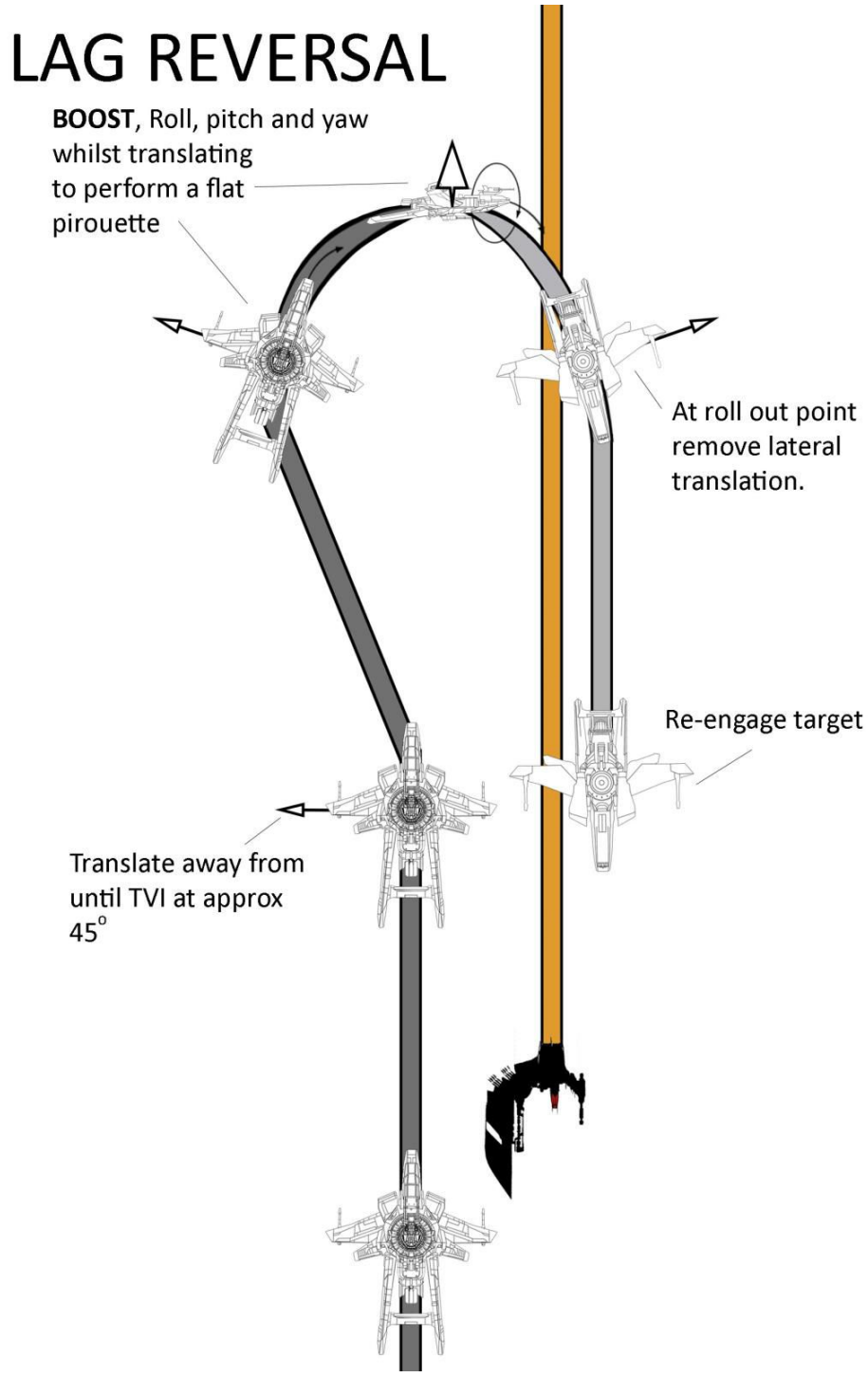


Figure 7-12 Lag roll



7.7.13. Lag reversal.

The lag reversal is similar to a flat pirouette where the spacecraft maintains its relative plane of motion and is an effective reversal when used to counter a high speed pass. The lag roll is executed by translating away from the oncoming target until the TVI is at approximately 45o from the nose of the spacecraft. At this point boost, roll, pitch and

yaw into the target's direction of flight. When nearing the roll out point remove the lateral translation and re-acquire the target. The lag reversal has the advantage of speed maintenance, but has a high level of difficulty.

7.7.14. Vertically Skidded (VS) Roll. The VS roll is an offensive manoeuvre that allows you to close on your target, keep your bore-sight cross on the target, whist manoeuvring defensively. Execute by rolling and translating vertically upwards, whilst maintaining the bore-sight cross on target. The VS roll is an offensive version of the barrel yaw.

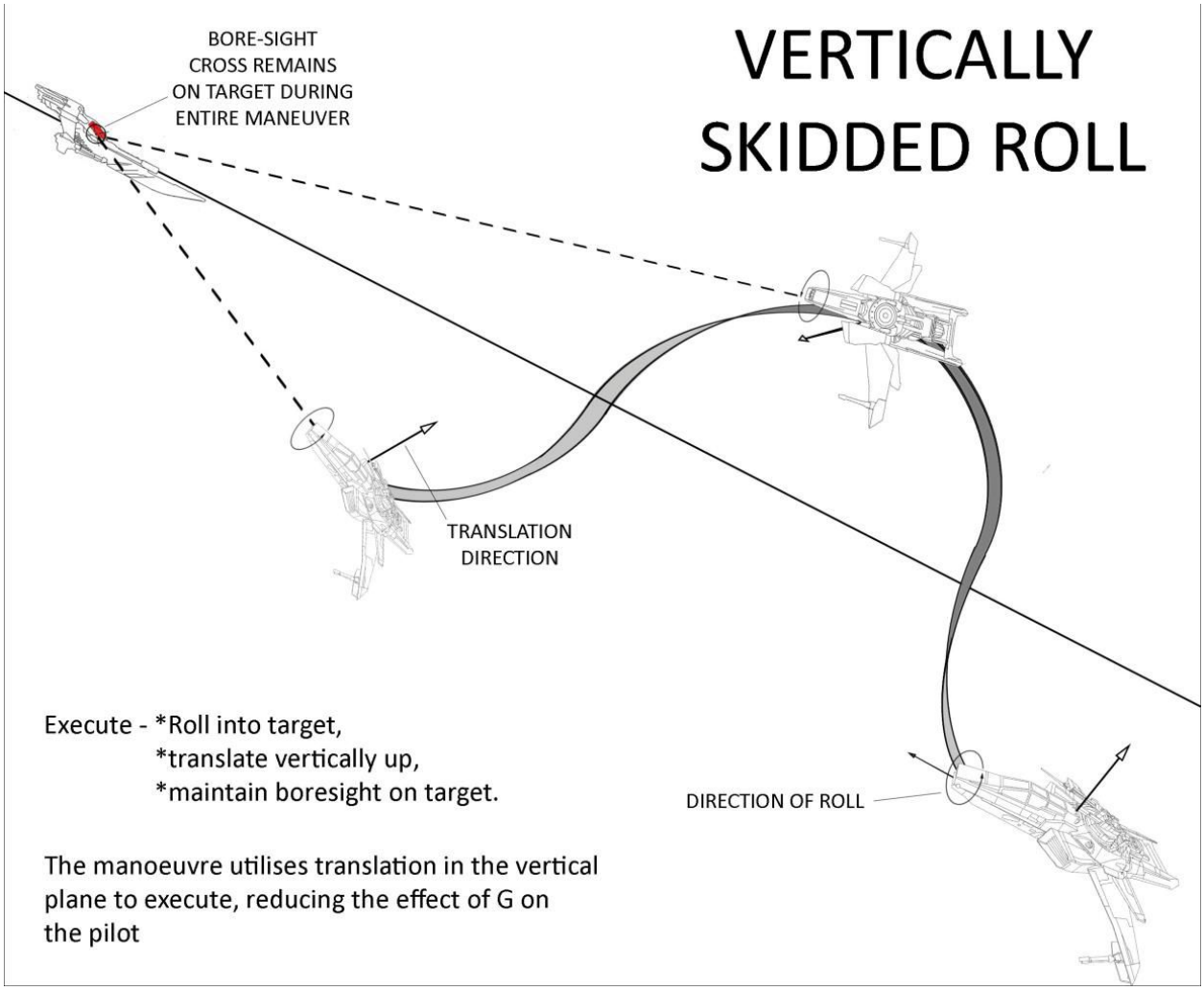


Figure 7-14 VS roll

7.7.15. Boom and Zoom. The boom and zoom refers to a high speed attack whereby the attacker strafes by the intended target, firing at the closest point, and then escapes at high speed. Best practice in this manoeuvre is to maintain visual contact with the target at all times by facing the spacecraft toward the enemy. During the zoom phase, carry out defencive manoeuvres to defeat enemy engagement (see Zooms para 6.7.7). Best used against targets who are unaware of, or ignoring you.

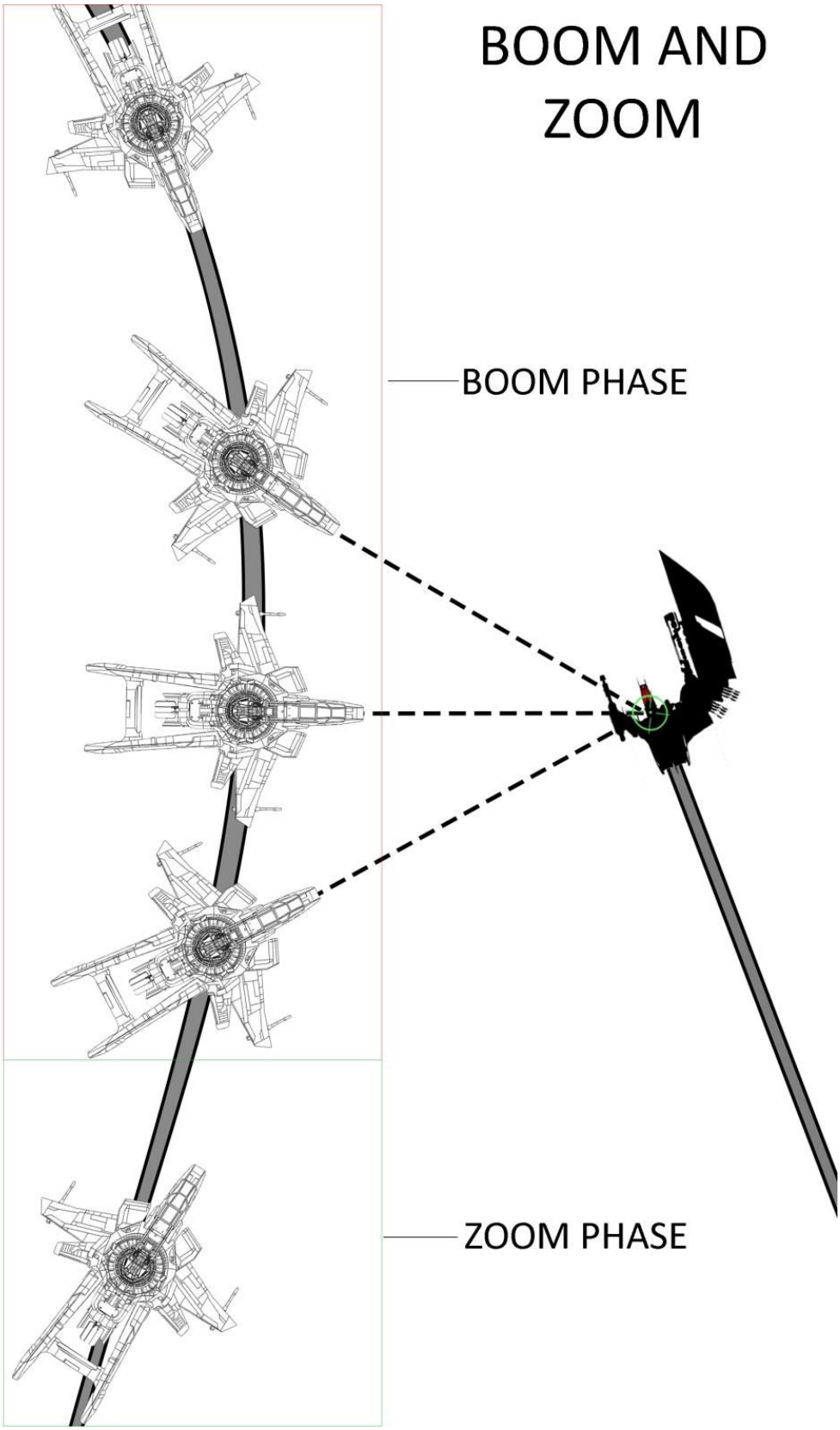


Figure 7-15 Boom and zoom

7.7.16. Zooms. Zooms refer to a repositioning manoeuvre completed after an attack, or when separating from an area of engagement. Executing a zoom correctly will assist in confounding the enemy's targeting systems, making aiming more difficult for the enemy. In their simplest form zooms can take the form of a barrel roll or barrel yaw whilst translating away from your target. Always ensure to check aft (using the aft facing camera) during zooms when flying to prevent collisions with obstacles.

7.7.16.1. Barrel yaw escape (BYE) zoom. The BYE zoom is a tight barrel yaw whilst translating aft (translate aft, roll and yaw to barrel yaw). Increase the diameter of your flight path via roll as range increases to increase evasion effectiveness.

7.7.16.2. Arcing Zoom. The arcing zoom maintains a closer range to the target than the BYE zoom. The Arcing zoom is carried out by changing your direction and plane of movement by translating aft, translating left (or right). After a second of travel, jink yaw left (or right) to change direction.

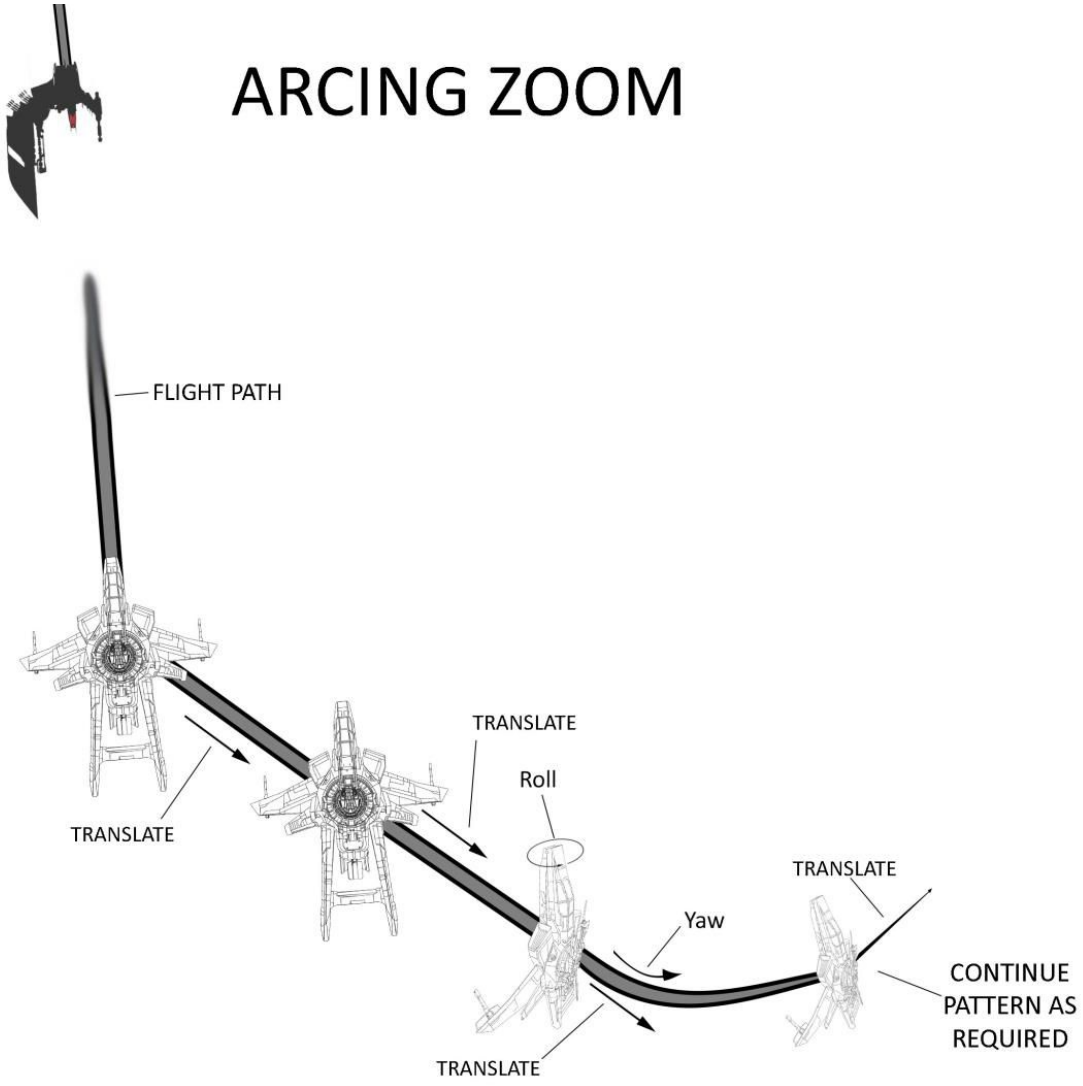


Figure 7-16 Arcing zoom

7.7.16.3. Vertically Skidded (VS) Zoom. The VS zoom is essentially executing the VS roll whilst translating aft. The VS zoom allows you to escape whilst maintaining your boresight cross on target to enable return of fire. By translating in the vertical plane instead of the lateral plane (as in BYE zoom) the effects of G are reduced.

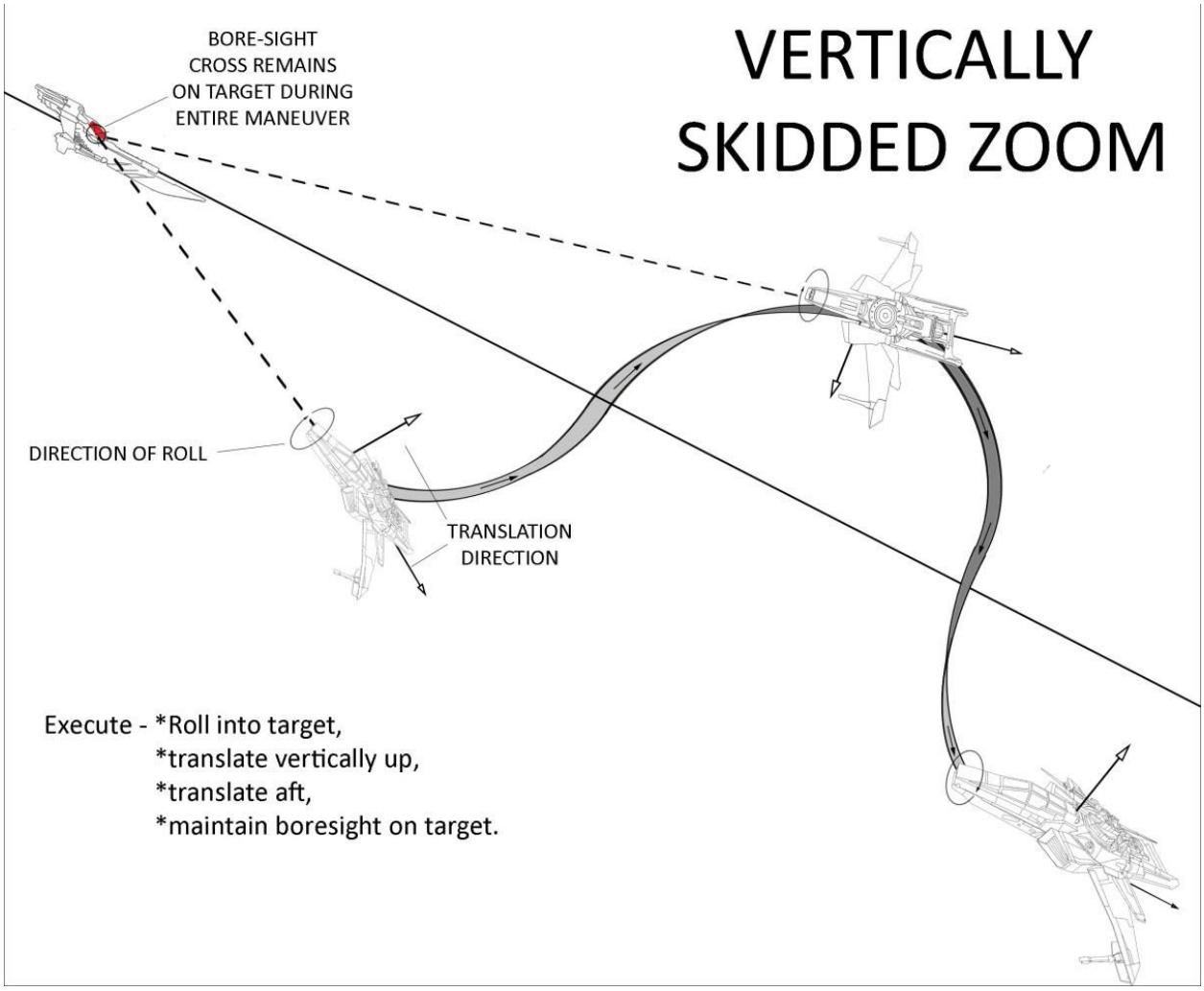


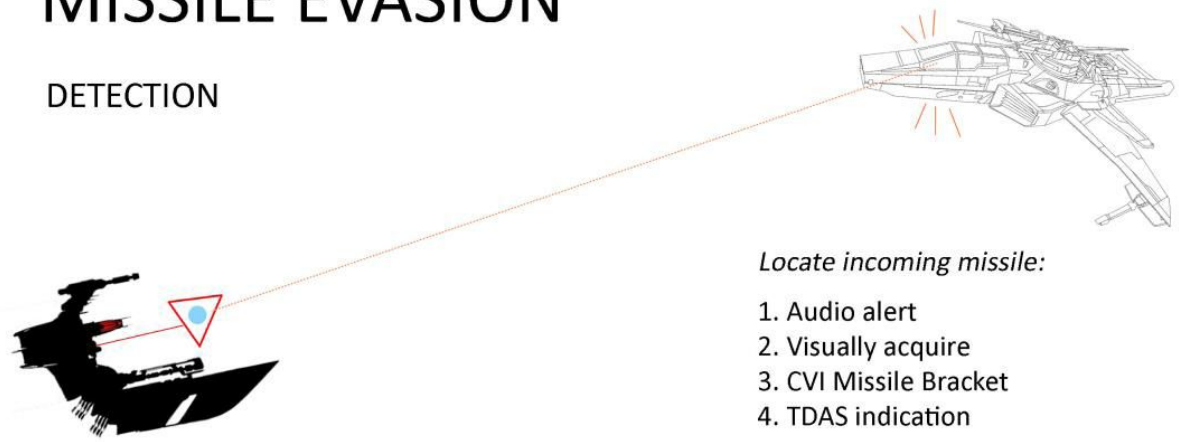
Figure 7-17 VS zoom

7.7.16.4. Missile evasion. Effective manoeuvring for defence from missile attack is essential to ensure survival. Employing countermeasures during maneuvering will increase their effectiveness. Upon detection of hostile missile launch (Visually, via the missile alert warning on the CVI, and/or audibly via alert tone), determine the location of the attacking missile via the CVI and TDAS. When you have located the missile, translate in the opposite direction of the missile's flight path. Pitch, roll and yaw to position the missile on your beam (90o from the spacecraft's nose), either left or right. Utilise the TDAS to maintain missile location awareness. Maintain minimum vertical separation from the missile to present the minimum cross section possible. Maintain maximum forward speed via boost whilst rolling and yawing to maintain the missile abeam (with minimum vertical separation), and the missile flightpath perpendicular to the spacecraft flight path.

This method forces the missile to bleed off velocity to make effective turns during pursuit.

MISSILE EVASION

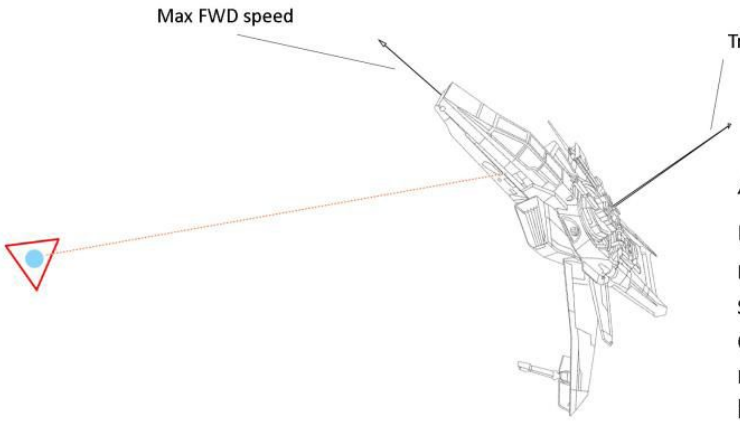
DETECTION



Locate incoming missile:

1. Audio alert
2. Visually acquire
3. CVI Missile Bracket
4. TDAS indication

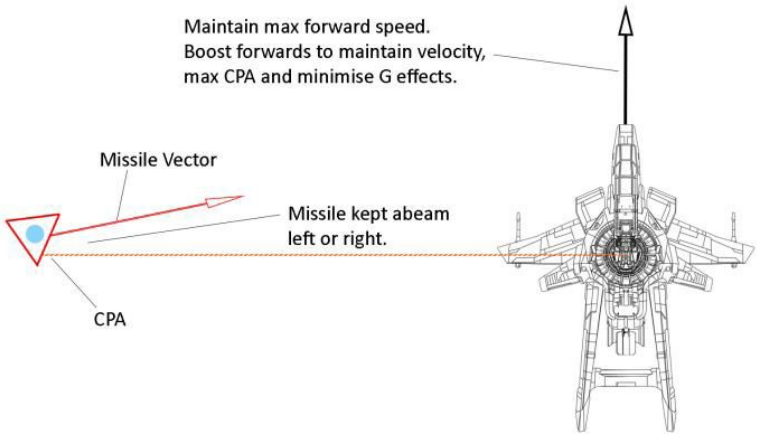
POSITION FOR BEST DEFENCE



At Closest point of approach (CPA):

Upon initial aquirement of the missile, maintain max forward speed and translate opposite direction, away from inbound missile to maximise lateral distance between you and the missile.

MAINTAIN MISSILE ABEAM

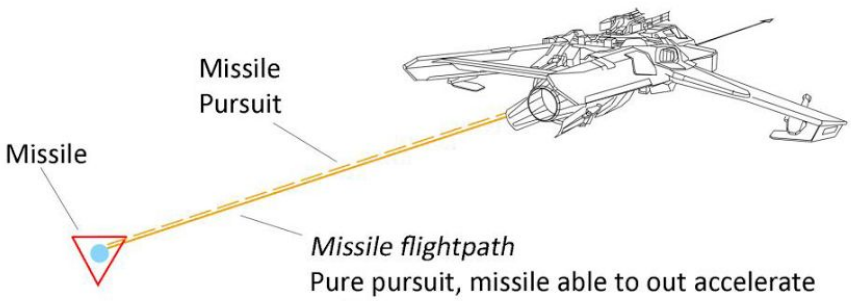


Manoeuvre to maintian missle horizontally abeam (left or right) the spacecraft with minimum vertical separation.

Utilize boost in the forward direction only, to maintain max speed, max CPA, and minimise G effects.

MISSILE AVOIDANCE PRINCIPALS

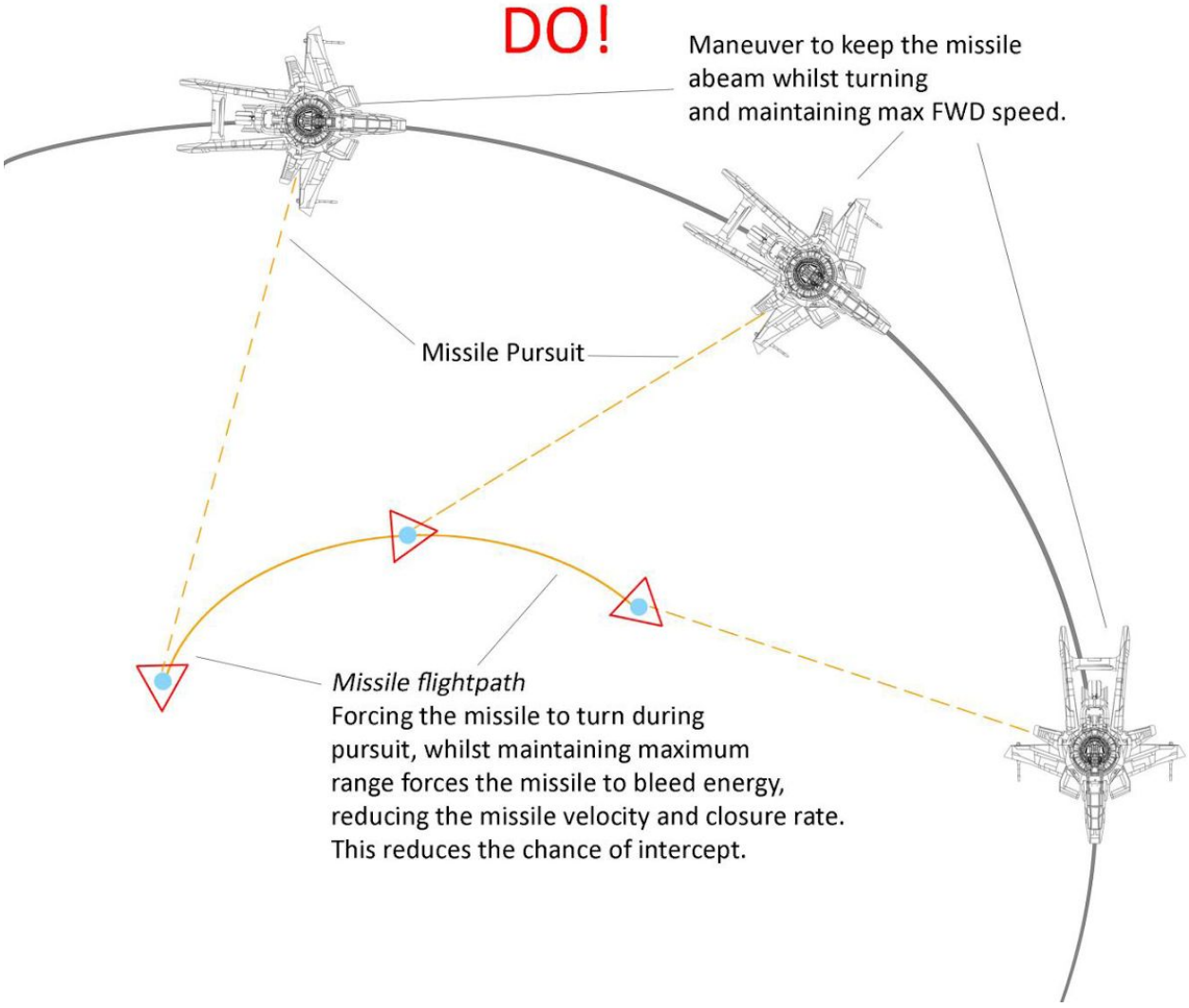
DON'T!



Forward Vector only. No defencive maneuvering. The missile will intercept due to superior speed and acceleration.

Missile flightpath
Pure pursuit, missile able to out accelerate and use greater speed to intercept target.

DO!



Missile flightpath
Forcing the missile to turn during pursuit, whilst maintaining maximum range forces the missile to bleed energy, reducing the missile velocity and closure rate. This reduces the chance of intercept.

7.7.17. Re-attacks. Re-attacks are aggressive manoeuvres that can be used to keep the target engaged in lieu of executing a zoom or blow through.

7.7.17.1. Decoupled reversal. To execute a decoupled reversal, carry out an instantaneous 180o turn after passing the target. Boost to recover any speed lost during the manoeuvre in the direction of the target. The decoupled reversal is a one dimensional manoeuvre and due to the 180o turn involved in the manoeuvre a large amount of speed will be lost, therefore this manoeuvre should only be considered when defence is not a primary concern.

7.7.17.2. Turning reversal. The turning reversal is a slightly more defensive reversal and simply requires that the spacecraft be turned back towards the passing target to re-engage. The turning reversal will result in a larger turning arc than the decoupled reversal, but will not result in the same amount of speed lost.

7.7.17.3. Buttonhook. Refer para 7.7.10.

7.7.17.4. Lag roll. The lag roll (covered in para 7.7.10) can be used to re-engage the target when reaching the CPA. Best used when yours and your targets velocity vector differ in direction by less than 90o (especially useful when passing your target in a high speed pass or “joust”).

7.7.17.5. Lead roll. Refer para 7.7.11.

7.7.17.6. Lag reversal. Refer para 7.7.13.

7.7.18. Fence Check.

Certain items on your vessel should be checked to ensure that detection time is as long as possible when entering into a combat area. These checks should be carried out as a minimum, but is not necessarily comprehensive depending on mission requirements. Prior to entering into combat complete:

a) Fire control - **HOT**

b) Emitters – **CHECK SIGNATURE LEVELS**

c) Navigation - **SET**

d) Camera – **AS REQUIRED**

e) Expendables – **CHECK QTY** (fuel, ammo, countermeasures, etc.)