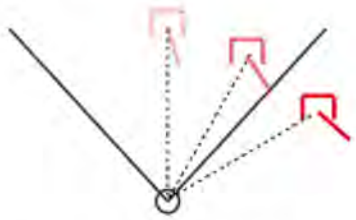
COLLISION COURSE AND DRIFT

DRIFT

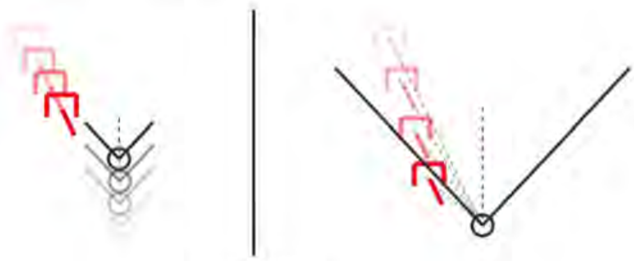
The effect of the contact moving on the display is called "Drift". It has two main causes:

1. the fighter manoeuvring: Turn Drift;



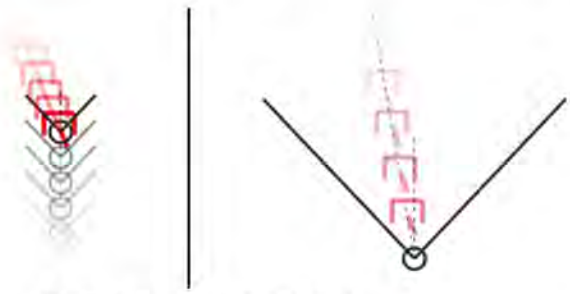
Aircraft Stabilized mode.

2. the absence of collision course: Intercept Drift.
   The following image shows the evolution of a contact not on collision. As you can see it is "shifting" towards the left side of the Display. This is even more evident on a B-Scope, rather than the TID, as the contact leaves a curved trail as it approaches the bottom part of the display.



no collision.

This sketch represents a target on collision. Its position is consistent and on the B-Scope it appears as a contact moving vertically but not horizontally.



Example: collision course.

Turn Drift and Intercept Drift combined are called **Displayed Drift**. Understanding the Drift and compensating for it is a basic requirement for any RIO interested in a more simulative experience.

A FAMILIAR TOOL: TACTICAL INFORMATION DISPLAY IN AIRCRAFT STABILIZED MODE


Cut greater than collision.

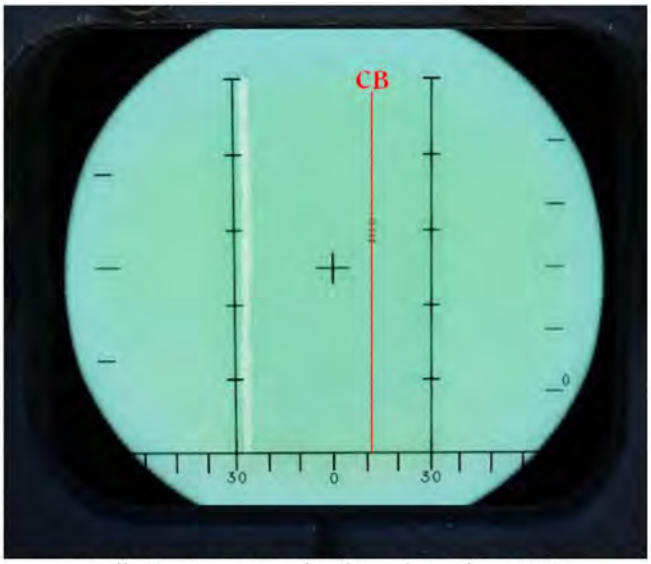

Cut equal to collision.


TID: Cut less than collision.


TID: Cut equal to BR.

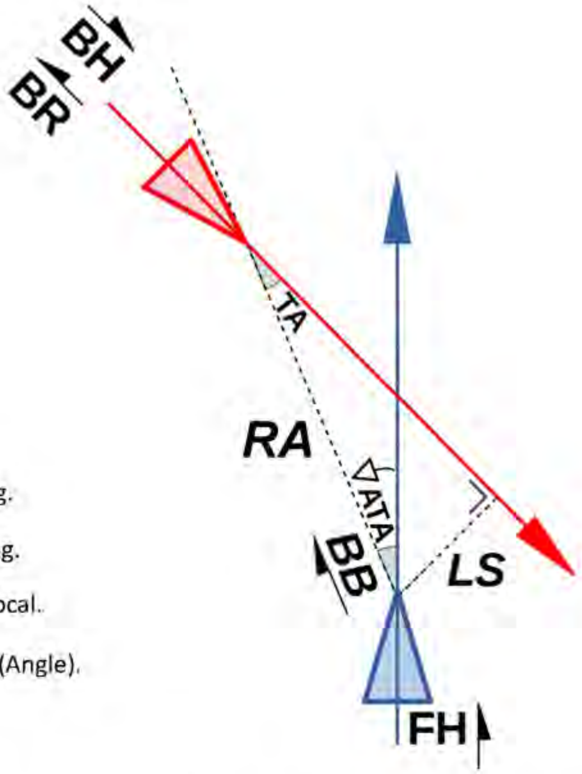
DRIFT ASSESSMENT

Due to how the DDD in Pulse mode works, it is a very helpful tool during an intercept. The DDD in Pulse Doppler mode in fact, does not show Azimuth vs Range, but Azimuth vs Relative Closure. Therefore, assessing the Drift is not always immediate.



Collision Bearing displayed on the DDD in Pulse radar mode.

In Pulse mode instead, assessing the Drift is immediate the contact's return on the DDD moves "straight down" towards the bottom of the DDD as the range decreases, without any changes in Azimuth. In fact, the lack of drift means that the F-14 Tomcat and the contact are on a collision course.



FH	Fighter Heading.
ATA	Antenna Train Angle
RA	Range
LS	Lateral Separation

BB	Bandit Bearing.
BH	Bandit Heading.
BR	Bandit Reciprocal.
TA	Target Aspect (Angle).

Intercept Geometry: fundamental angles.

DETERMINING THE BANDIT RECIPROCAL: THE +2/-2 RULE

This is a simple but useful trick to calculate the BR. The Bandit Reciprocal can be in fact mathematically obtained by using the modulo but when calculating the result in your head, using the modulo may not be the fastest way.

Since ±180° are added depending on the BH, the +2/-2 rule can be effectively used:

If 0° < HDG < 180°: add 2 to the hundreds, subtract 2 from the tens;

If HDG > 180°: subtract 2 from the hundreds, add 2 to the tens.

As you can see, it's simply a more structured way to add or subtract 200 and compensate for the remaining 20 degrees.

Examples:

- HDG 347 → "3" – 2 and "4" + 2. "7" is carried over. Reciprocal: **1 6 7**
- HDG 125 → "1" + 2 and "2" – 2. "5" is carried over. Reciprocal: **3 0 5**
- HDG 220 → "2" – 2 and "2" + 2. "0" is carried over. Reciprocal: **0 4 0**
- HDG 021 → "0" + 2 and "2" – 2. "1" is carried over. Reciprocal: **2 0 1**

DETERMINING THE TA PRACTICAL EXAMPLES (BB = 0)

TA = angle between BR and BB

+2
-2

BR = 080 ⟶ 260

BB = 000 (BR 000 on TID, so 295 on BDHI)

TA = 295 - 260

TA = 35

Target Aspect: Example I.
ATA = 0

DETERMINING THE TA PRACTICAL EXAMPLES (BB ≠ 0)

TA = angle between BR and BB

+2
-2

BR = 080 ⟶ 260

BB = 10L (BR 350 on TID, 10 degrees left, so 285 on BDHI)

TA = 285 - 260

TA = 25

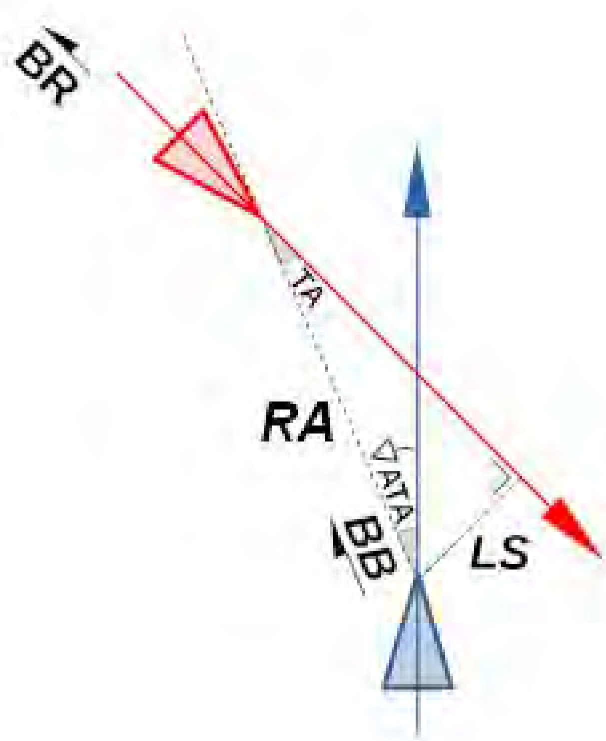
Target Aspect: ExampleII.
ATA ≠ 0

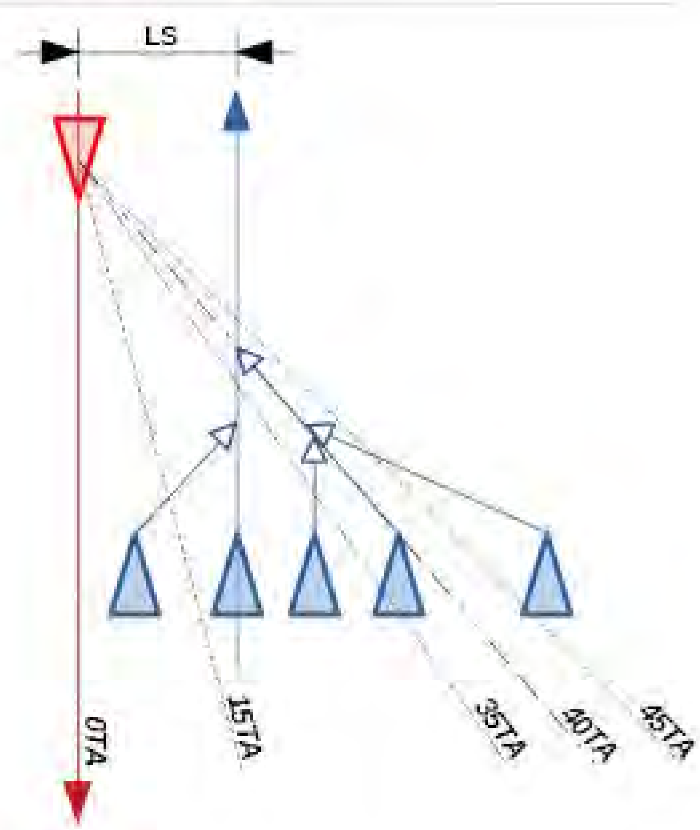
INTERCEPT

$$LS_{[nm]} = RA \times TA / 60$$

RA/TA	10°	15°	20°	30°	40°	50°	60°
60nm	10	15	20	30	40	50	60
54nm	9	13.5	18	27	36	45	54
48nm	8	12	16	24	32	40	48
42nm	7	10.5	14	21	28	35	42
36nm	6	9	12	18	24	30	36
30nm	5	7.5	10	15	20	25	30
24nm	4	6	8	12	16	20	24
18nm	3	4.5	6	9	12	15	18
12nm	2	3	4	6	8	10	12

TA Assessment at 30nm	Initial LS	First Turn	Second Turn	Third Turn
0°– 10°	0 – 5 nm	50 ATA Cold	Bandit Recip	Collision at 40 ATA Hot
20°	10 nm	Bandit Recip	Collision at 40 ATA Hot	Nose-on at 10nm
30°	15 nm	Bandit Recip	Collision at 40 ATA Hot	Nose-on at 10nm
40°	20 nm	Collision at 40 ATA Hot	Nose-on at 10nm	
>= 45°	+22.5 nm	50-60 ATA Hot with 0.1IMN speed advantage	Collision at 40 ATA Hot and remove speed advantage	Nose-on at 10nm





DETERMINING THE LS
PRACTICAL EXAMPLES
(BB = 0)

TA = 35

Use table page 5

LS = 35 nm

Target Aspect: Example I.
ATA = 0

DETERMINING THE LS
PRACTICAL EXAMPLES
(BB ≠ 0)

TA = 25

Use table page 5

LS = 12.5 nm

Target Aspect: ExampleII.
ATA ≠ 0

PRACTICAL

TA = ?

LS = ?

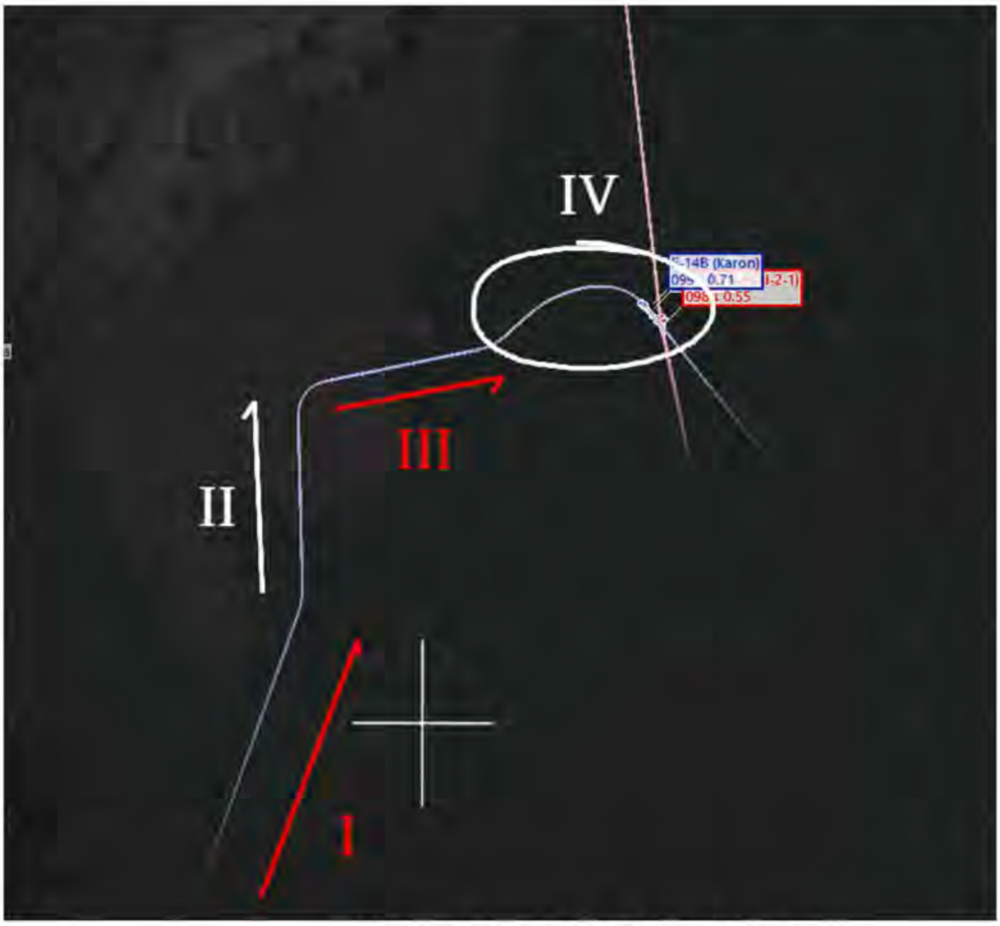
TA = ?

LS = ?

TA = ?

LS = ?

DEMO I: STERN CONVERSION TURN FROM OFFSET



Modern intercept – TacView video I.

1. Phase I: "Point and Assess"
   I started with the hostile directly dead ahead to simulate the Point and Assess phase. This helps to determine the geometry and the gameplan.
2. Phase II: Turn to BR
   Since the TA was determined to be ~25, the suggested gameplan is to turn at 30 nm to BR (Bandit Reciprocal) and let the TA increase.
3. Phase III: Turn to Collision
   When the ATA (BR on TID) is close to 40°, it can be captured by turning to Collision.
4. Phase IV: Counterturn
   At 10nm, I started the counterturn to place the F-14 in the RQ (Rear Quarter) of the target.

DEMO II: STERN CONVERSION TURN FROM 0TA

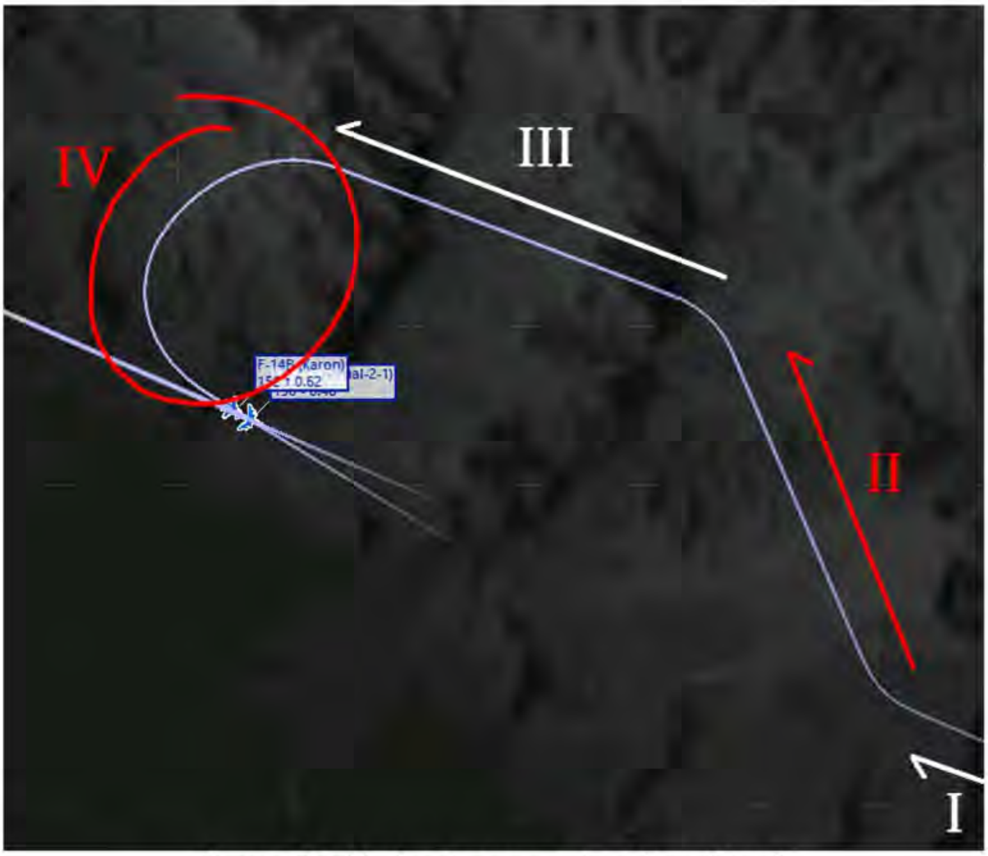
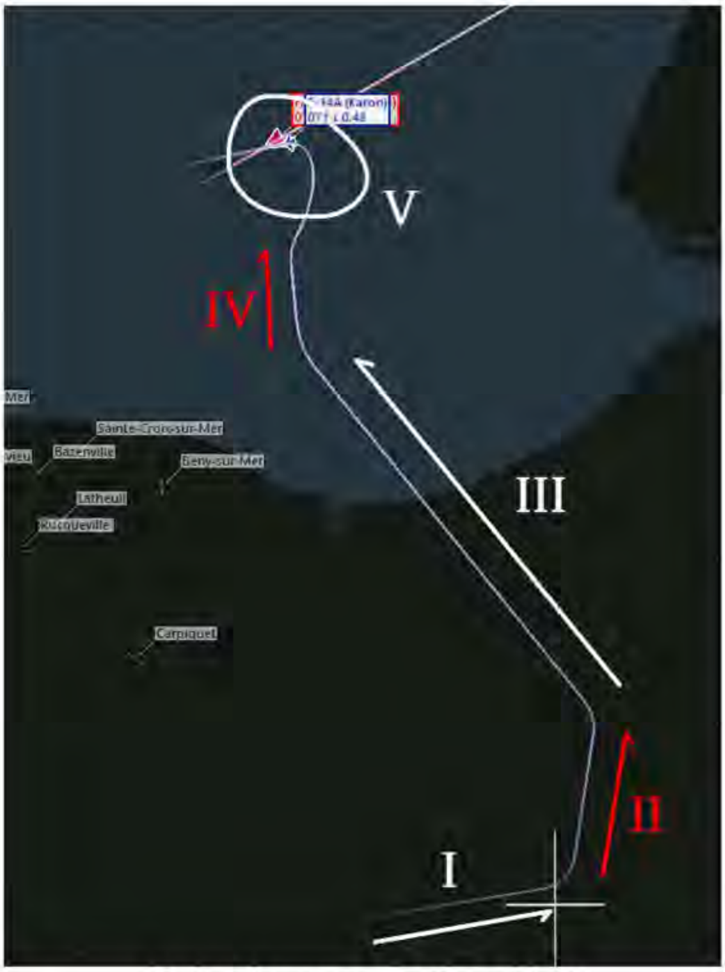


Figure 365: Modern intercept – TacView video II.

1. Phase I: "Point and Assess"
   The target is dead ahead. The True Head-On situation is confirmed by FH = BR and ATA = 0.
2. Phase II: Make room!
   The doctrine suggests a turn to 50ATA at 30nm, I preferred a 40 ATA at 40nm, since it is more manageable whilst flying both seats. The goal is always the same, to increase the TA and the LS enough to enable the stern conversion turn.
3. Phase III: Turn to BR
   The LS is very close to the desired 10 nm, so I turned to the Bandit Reciprocal heading to capture it.
4. Phase IV: Counterturn
   I set the fictional objective to place the F-14 at the Tanker's 7 o'clock. A standard CT would result in the fighter too close to the Tanker. There are a number of ways to achieve the objective, such as by power management, using the vertical or, like in this case, delaying the turn to Pure Pursuit and start by using Lag Pursuit.

DEMO III: COMPLEX SCENARIO

The last and most complex scenario, I decided to include an AI AWACS to receive Picture and BRAA information during the flight.



Modern intercept – TacView video III.

1. Phase I: CAP
   The F-14 is following is flying its CAP track and Commits to a Group in the Picture. Correlation and additional comms are skipped since they are not supported (the AI AWACS is probably one of the worst features of the game).
2. Phase II: "Point and Assess"
   The bogey is placed on the nose, geometry is evaluated. TA results ~45°. This phase should have been shorter and the delay ended up increasing the TA. This is an unforeseen yet valuable lesson.
3. Phase III: Decreasing TA and LS
   Gameplan is computed and the bogey is placed at 50 ATA with speed advantage.
4. Phase IV: Turning to Collision
   As the bogey was approaching the radar's gimbal limits, the F-14 hit the goal of 40 TA. In order to capture it, I turned to CB.
5. Phase V: Counterturn
   Delays in the operations (mostly due to playing as both crewman) caused the CT to start quite late. Nevertheless, the goal was visually identifying the bogey and the objective was met.