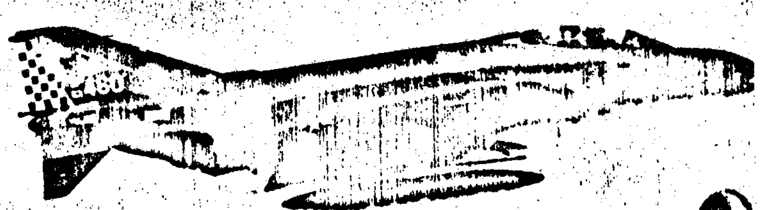
3TFS

3rd TACTICAL FIGHTER SQ

INTERCEPTS

"DIFFERENT WAYS TO SKIN THE CAT"

Sync-Z-Turn



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No matter where in the world you are flying the F-4, with certainty you will be called upon to perform in the air-to-air role—air defense or tactical air superiority. Would you like to learn about an intercept technique that is easy to use; immediately applicable to <u>all</u> tactical air superiority situations, day or night; gives you greater air-to-air flexibility; and does not require long hours of training? If so, read on. It is the SYNC-Z-TURN—a method for performing stern conversions—that's yours for the reading.

SYNC-Z-TURN is applicable to tactical intercepts where only limited GCI information is available, as was often the case in Vietnam. It is designed to convert a high aspect angle (150-180 degrees) to a stern attack. The reason for the stern attack may be due to limited missile capability. You may only have AIM-9s, or your AIM-7 capability is degraded. The technique can also be used very effectively for tanker rejoins during air refueling missions, or for identification passes on unknown targets. Further, with this technique you can utilize the AOJ function of the radar to effectively intercept a target.

The technique is worthy because it is very easy to use and understand. In its simplicity, it provides the aircrew a powerful tool that is truly night and all-weather capable, with or without a radar lock-on. SYNC-Z-TURN can be mastered in just two hours of concentrated practice in a flight simulator. That exposure is all that is necessary in order to apply and execute stern conversions in the air, with precision, against unknown targets.

I believe that we should train as we intend to fight. To this end we have the Aggressor DACT program and simulators. I prepare to fight the enemy by assuming that I will have little or no GCI intercept information and will be under autonomous control; that is, not being controlled by GCI and controlling my own intercept. Second, I assume it will occur at night and the enemy will attempt to evade and will use ECM and weather to his advantage. SYNC-Z-TURN prepares me for these assumptions, although it can be used day or night.

When under autonomous control there are basically three methods for stern conversion. They are: (1) visual, (2) the checkpoint method, and (3) SYNC-Z-TURN. Let's discuss all these. Once you acquire the target visually, you maneuver to trap him at your twelve o'clock—KILL! This method works fine in day VFR but unfortunately a "blackened out" target at night negates it. The second method, currently taught in RTU, is the lock-on checkpoint technique illustrated by Figure 1. It simply defines a pursuit curve to the target or the best flight path to fly in terms of closing velocity (V_C) and range. It is designed to get you at zero azimuth and 2nm in trail.

The third method, the SYNC-Z-TURN, assumes an unknown target, which is picked up on radar, with unknown heading and airspeed. Any additional information is nice to have but not essential. We further assume a speed advantage (5:4), and fly V_{mc} (AFM 3-16, Confidential) until commencing the attack, or new information dictates a higher speed. Additionally, I will define target acquisition outside of 30nm as long range; acquisition inside 30nm but greater than 15nm as short range; and inside 15nm as extremely short range. Figure 2 depicts a target at 180° aspect angle, 180° heading difference, and co-speed (350KIAS). As I describe the technique, try to relate the scope picture with aircraft positions in Figure 2. The procedure is as follows:

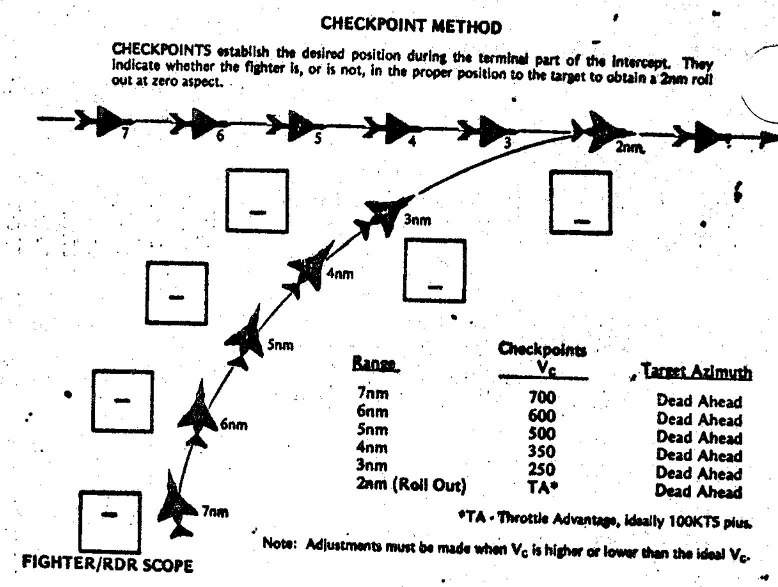
1. Determine the cold side of the scope by turning to place the target at zero degrees azimuth and check for drift; target will drift from the hot side of scope to the cold side.

2. Turn to place the target at some azimuth cold. For an unknown target, never move it inside 45 degrees.

3. When the bank angle increases rapidly or exceeds 30 degrees and increasing rapidly, bring the target to the zero azimuth position. You will be at "deep six."

Here's why the technique works.

Step 1: Determine the cold side of the scope. It is extremely important to gain as much information about the target as soon as possible. For example, knowing the range and using your radar elevation you can quickly approximate the target's altitude. (Elevation X Range = Altitude separation in feet between you and him.) Also, the target's range will determine how quickly you must make your initial



Range	Checkpoints V_c	Target Azimuth
7nm	700	Dead Ahead
6nm	600	Dead Ahead
5nm	500	Dead Ahead
4nm	350	Dead Ahead
3nm	250	Dead Ahead
2nm (Roll Out)	TA*	Dead Ahead

*TA - Throttle Advantage, ideally 100KTS plus.

Note: Adjustments must be made when V_c is higher or lower than the ideal V_c.

FIGURE 1

turn. A target acquired at long range does not require an aggressive turn; a target at short range does. At extremely close range, depending upon aspect angle and target speed, you may not have enough displacement to maneuver successfully. So, unless you have prior target information from GCI or other sources, the

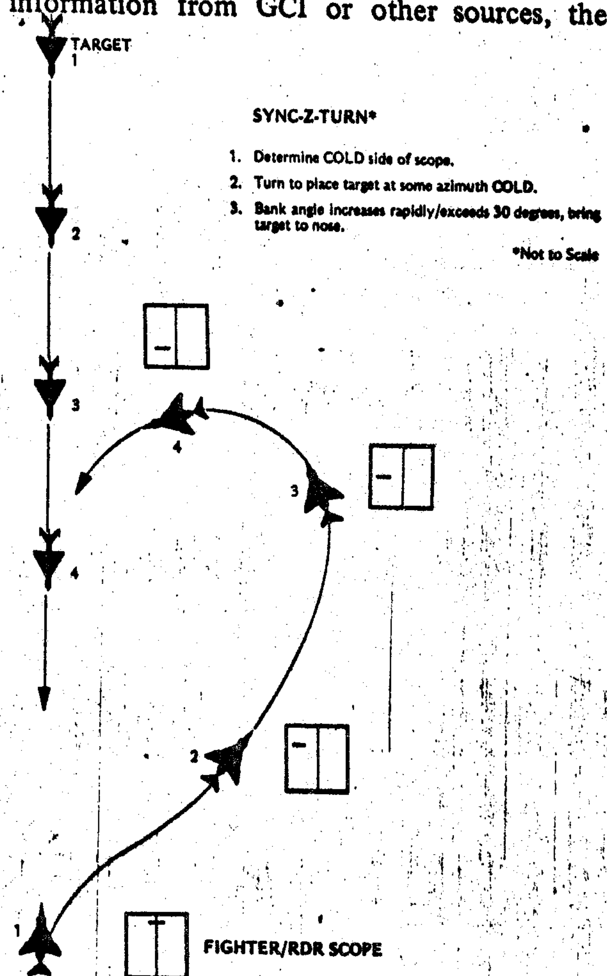


FIGURE 2

extremely short range pick up will be considered a conversion and not a SYNC-Z-TURN. The important point is that the range from the target will dictate the rate of the initial move or turn.

We also know that the rate of target drift is directly related to the displacement of the target from the Collision Antenna Train Angle (CATA). The further the target is off of the CATA, the greater the drift rate. Therefore, when you turn to place the target at zero degrees azimuth, you are checking the drift to determine the cold side of the scope. That is the side of the radar scope that the target must be on or placed on to insure diverging flight. The target will always drift away from the CATA and toward the cold side of the scope at a rate dependent upon the displacement from the CATA. It should be noted that when you and the target have 180° of heading difference and are at a 180° aspect angle, either side of the scope can be selected as the cold side.

If the target is detected at a range greater than 30nm (extremely long range—a tanker for example), flying cutoff will reduce the time to intercept. So, maintain the target at zero degrees and determine drift. Due to the long range, drift may be difficult to distinguish. After positive drift direction is established, fly cutoff until approaching 30nm, then proceed with Step 2.

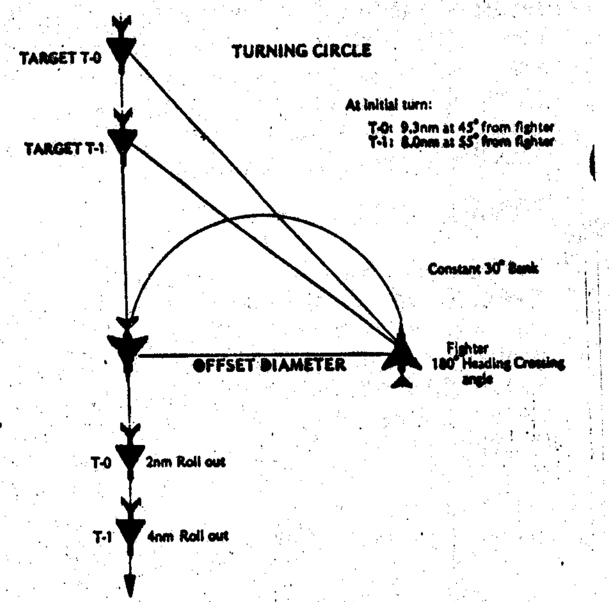
Finally, for the initial turn use a standard rate turn or 30° of bank unless the initial radar pick up range dictates otherwise.

Step 2: Turn to place the unknown target at a selected azimuth COLD. In effect, a target drifting toward the cold side of the scope decreases the aspect angle. By holding the target at a selected sync azimuth, commensurate with your turn radius, you are reducing aspect angle in a controlled way.

With an unknown target, never select a sync azimuth inside of 45°. When you do not know the target's speed, you need to give yourself as much displacement as possible to maneuver, and if possible, stay outside of visual range in day VFR conditions.

Next, simply synchronize the target at the selected azimuth by continually turning to keep the target at sync azimuth. At first, depending upon range and aspect angle, the bank angle will be shallow—5° or less, but will gradually increase. As the target moves closer in range, the bank angle will increase more rapidly and the aspect angle will decrease. It should be noted that the rate at which the target moves down the scope is an indication of target V_C.

Step 3: As the bank angle increases rapidly, or exceeds 30° while increasing rapidly, bring the target to the zero azimuth. As the target tracks down the scope, we have already indicated that the bank angle will increase and the aspect angle will decrease. If the initial aspect angle was great—150° to 180°—then the bank angle and aspect angle will change more rapidly as the range closes. If the initial aspect angle was low—150° and less—then the bank angle and aspect angle will change more slowly. In some cases, the bank angle may never exceed 30°, resulting in a smooth roll-out at deep six. This latter case usually occurs with a slow speed target, such as a T-33 or B-57 (or your buddy F-4 target trying to pull a sneaky), when the initial aspect angle is below 150°.



Target Speed (TAS)	Fighter Speed (TAS)	Bank Angle Azimuth/Range 30°	Bank Angle Azimuth/Range 45°	Turn Rate/Radius (°/sec) / nm 30°	Turn Rate/Radius (°/sec) / nm 45°
300	360	45/9.3		1.75/3.3	
300	360		55/5		3.1/2
350	420	43/13.6		1.45/4.6	
350	420		50/6.8		2.7/2.6
420	500	40/19.4		1.25/6.3	
420	500		45/10.3		2.25/3.7

FIGURE 3

What bank angle should you hold when turning to the target's heading? The answer to this question depends upon the closure rate and your lateral displacement. SYNC-Z-TURN, when flown using the above procedures, and keeping the target at a constant azimuth, automatically provides you with the proper displacement. The initial aspect angle controls V_C and bank angles used throughout the intercept. Generally, as bank angles rapidly pass through 30°, simply increasing to 45° will suffice. The worst that can happen is a slight overshoot, which isn't bad for an unknown target. Remember, in some cases you may not exceed 30° bank. The end result is the same–DEEP SIX.

One more idea needs to be clarified for a complete understanding of the SYNC-Z-TURN technique. As the speed of a target increases, the range at which your turn to target heading is initiated increases. One of the reasons for the concentrated two-hour simulator mentioned before is to give you a feel for turn-in ranges. While teaching this method to aircrews, the most asked question is: When do I bring the target to the nose? From the procedure already given, Step 3 gives you that answer. This question usually arises when the aircrew has prior target information. So, to give you a better understanding of turn-in range, I will briefly discuss the Turning Circle concept.

TURNING CIRCLE

Turning Circle is, with target speed, your true airspeed and bank angle known, a method for stern conversion. Assume a target flying a straight line path as in Figure 3. Every pilot knows that turn rate and radius of any aircraft are a function of two variables: bank angle and velocity (TAS). Regardless of type, aircraft flown in a steady, coordinated turn at specific bank angles and true airspeeds, have a fixed turn rate and radius. If by magic, depending upon your TAS, you could initiate a constant bank turn and roll out at deep six. Figure 3 illustrates this theory: T-O is the initiation time for a 2nm roll out; T-1 is for a 4nm roll out. Note that fighter bank angle is constant and that target azimuth and range are different at the initiation of the turn to target heading.

If you wish to fly a constant bank angle, say 30°, then target speed dictates an azimuth and range for turn-in. Therefore, you have an infinite number of solutions which are all dependent upon your speed, bank angle, and target speed. It would take the proverbial "mental giant" or a clip board full of confusing numbers to use the system in autonomous control. Combat calls for something simple. You should recognize that, as in the checkpoint method, an evasive target negates the system. Figure 3 also summarizes several selected target and fighter airspeeds for a desired 2nm roll out distance using the Turning Circle method. Note initiation ranges for the various conditions.

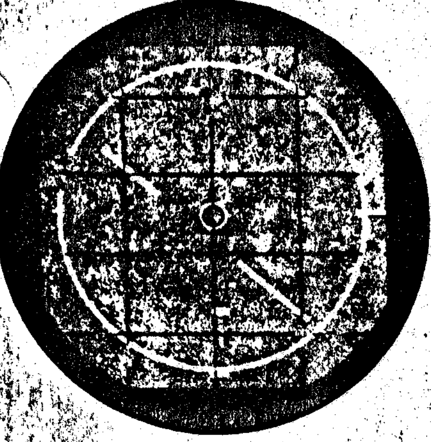
SYNC-Z-TURN combines the best of all worlds, since bank angle is continually changing, and the target at turn-in will determine roll out distance. Experience and knowledge of Turning Circle indicates that for slow speed targets, you should start no later than 7nm, which requires an approximate 45° sync azimuth. For high speed targets, start no later than 10nm with an approximate 45° sync azimuth. There you have it: SYNC-Z-TURN. The verbiage takes longer than the actual procedure. It is simple and it works.

To illustrate the technique, Figure 4 describes the flight path and scope presentation of an actual F-4C intercept of an F-4C target aircraft at approximately 350 KIAS. Aspect was 180°, and for illustration purposes, a lock-on was achieved to display closure rates. The sequence begins after target drift was determined; the right side of the scope (50nm scope) was the cold side. A standard turn was made to place the target at approximately 45° starboard and is shown by ID 1. ID 2, (25nm scope) shows the very shallow bank required to hold the target at sync as it moved down the scope. ID 3 shows the bank increasing as the range decreased. ID 4 (10nm scope) displays increased bank and turn necessary to bring the target to zero azimuth. Note that V_C is low, indicating that the fighter is approaching a beam position. And finally, ID 5 demonstrates the desired roll out with approximately 100 knots of overtake.

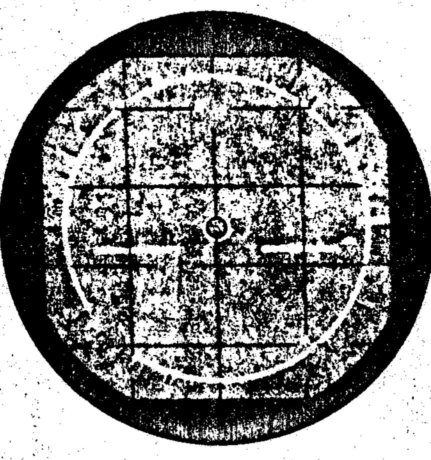
SYNC-Z-TURN is a powerful aid that you can immediately use. Its advantages are:

1. SYNC-Z is easy to use and understand and is applicable to both day or night tactical intercepts.

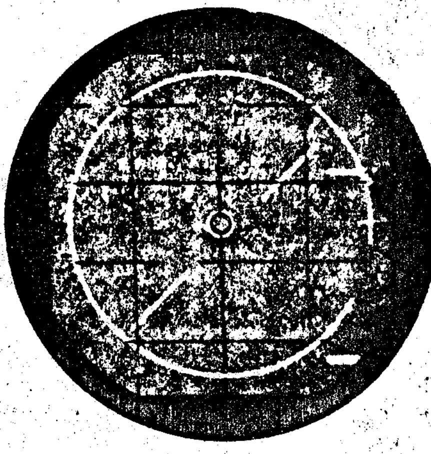
2. The technique eliminates inter-cockpit communication during the intercept. For instance, once the Weapons System Operator acquires the target, spurts out the AERO report, and determines the cold side of the scope, he directs the turn. For example: "Sync 45 Port." The aircraft commander then syncs the target at that azimuth. No other communications are necessary for a successful intercept unless a change in the target is noted. This allows external transmissions to be heard without interference. In combat and in a comm-jamming



ID 1 - 50NM SCOPE



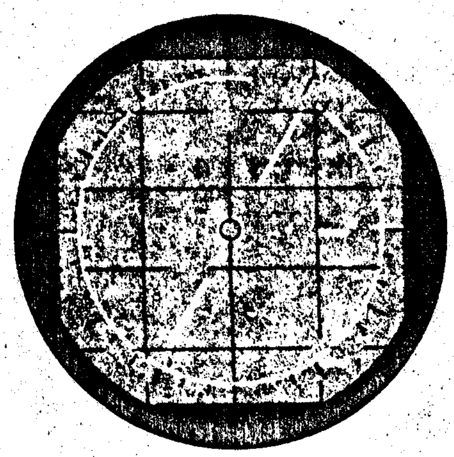
ID 2 - 25NM SCOPE



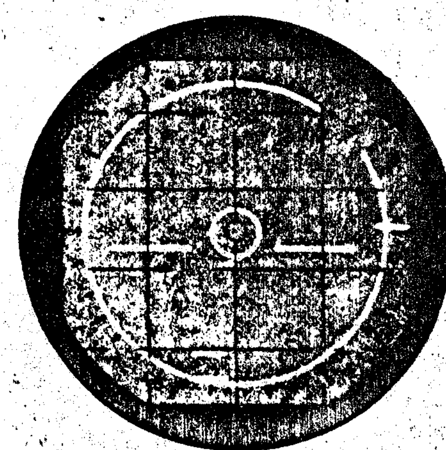
ID 3 - 10NM SCOPE

FIGURE 4

A full radar lockon is used here to illustrate SYNC-Z-TURN geometry. The major strength of this technique, however, is that it works well with no lock-on and in a radar jamming environment.



ID 4 - 10NM SCOPE



ID 5 - 10NM SCOPE

environment, where understanding is vital, this technique will help.

3. The technique works equally well with or without a lock-on. I prefer to deny the enemy as much information as possible by not locking on. A sharp WSO, using narrow scan and the hand control, can intermittently paint the target just long enough to continue tracking. Remember, a lock-on will probably give the enemy the information he needs to successfully levade.

4. The WSO can be monitoring and computing target speed, heading and aspect angle by various methods (timing the target, BDHI, etc.).

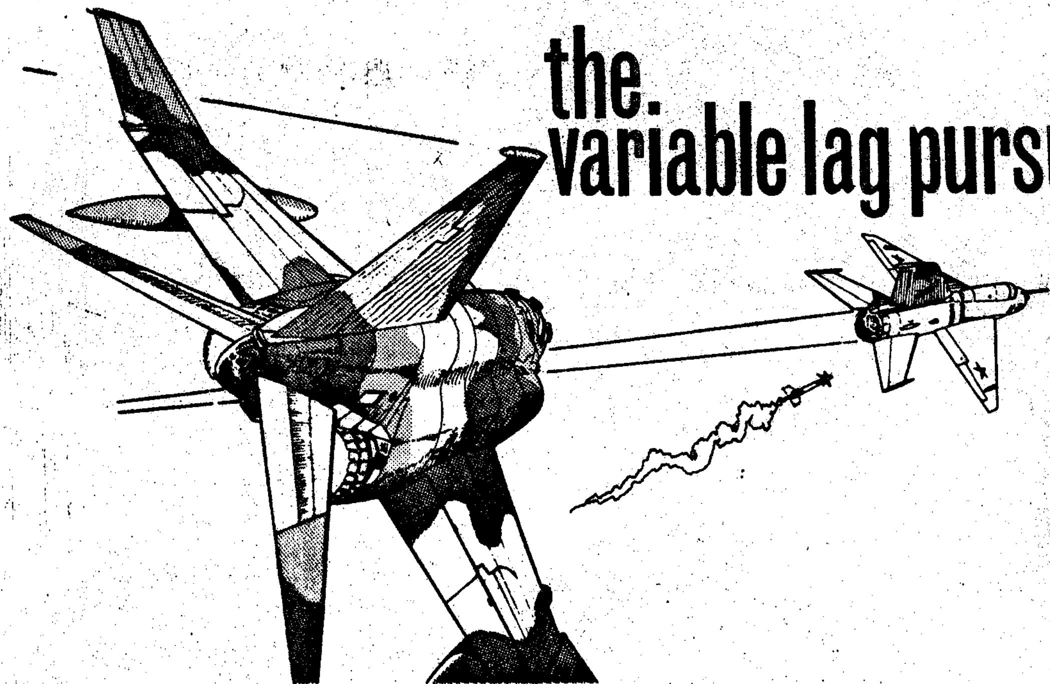
5. An evasive target can be immediately identified. If the target becomes evasive, the change in your bank angle will immediately tell you that he has turned. For example, if you were holding 25° of bank at short range and suddenly you note that it now takes 10° to hold the target at sync, then obviously he has turned into you. Conversely, an increase in bank angle indicates a turn away. Given enough range, the sync procedure can be started again.

6. Finally, a jamming enemy will provide you with azimuth information (AOJ) that will allow you to use SYNC-Z to convert to six o'clock and fire your armament. How? Simply use the jamming strobe as you would a target.

I have talked about using the technique in two dimensions, but tactically the same technique can be applied to the vertical as well as in the horizontal plane. In day VFR, you can use this technique to stay outside of visual range (vertically and horizontally).

SYNC-Z-TURN is a very simple intercept technique that you can add to your bag of tricks. Its application to tanker rejoins, identification of aircraft, tactical intercepts, and ECM/evasive targets is readily apparent. The next time you're in a simulator, give it a try. To get the idea, start with co-speed, co-altitude, high aspect angles with known targets. Then vary aspect angle, speed, etc., and finally attack unknown targets. You will be amazed at how simple the technique is to use.

the. variable lag pursuit stern...



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EDITOR'S NOTE: The value of a successfully run stern intercept cannot be overstressed, especially if your goal is an undetected approach (no lockon) to a hostile, or a tanker rendezvous with bingo-minus fuel. Maj Evans offers these procedures as another method toward achieving those goals. Whatever your objective - ID, or destroy — understanding stern geometry is basic to rounding out your intercept skills.

INTRODUCTION

The satisfaction of sliding into an opponent's deep six is as real as the advantage of being there. One tactical intercept technique is to take the target to 30° cold, hold it there, and finish the pass visually. This is fine in a clear air mass at 20,000 feet. However, put yourself at 35,000 feet or in IMC and you'll soon be looking for a good *radar* stern intercept technique. Other uses for the stern intercept — such as ID passes, tanker join-ups, and ECCM passes — serve to highlight the importance of a radar stern intercept capability. Because of this, the variable lag pursuit method was developed.[1] If you are new at the intercept game, this method will enable you to learn the stern intercept sooner. If you are an old head, this method will make your stern intercepts more consistent and reliable — especially with no lockon. In either case, read on if you want to learn a useful and valid stern intercept technique.

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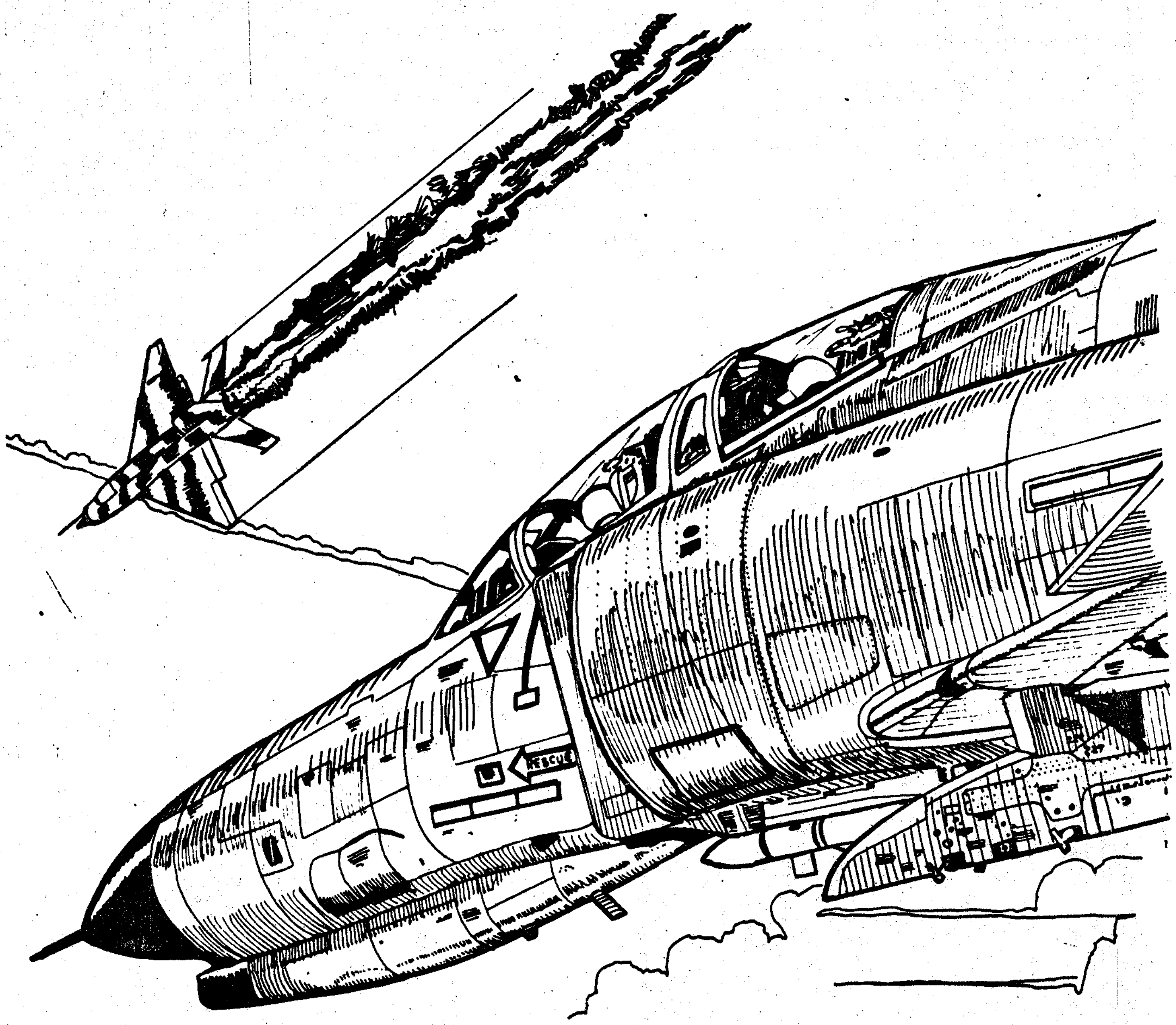
[1]This explanation of the variable lag pursuit method assumes a working knowledge of the F-4 weapons system and standard aircrew intercept duties.

THE BASIS

The constant bank turn technique has long been used as a basis for the stern intercept — especially by GCI controllers. Since they are dealing with a god's eye view, the technique is relatively simple for them. That is not the case for the aircrew. The aircrew must know the heading crossing angle, interpret the target drift, and control the target to a checkpoint for the final turn. Since the checkpoint changes for each turn, the method is further complicated in that the checkpoints are only valid for one airspeed combination. Unless the aircrew has checkpoints for several airspeed combinations, this method becomes extremely difficult to use. A commonly used airspeed combination is 500 KTAS for the fighter and 400 KTAS for the target. *Figure 1* shows the target path on the radar scope for a 45° angle of bank (AOB) 180° turn to a 2 NM in-trail final position.



10 NM SCOPE RANGE

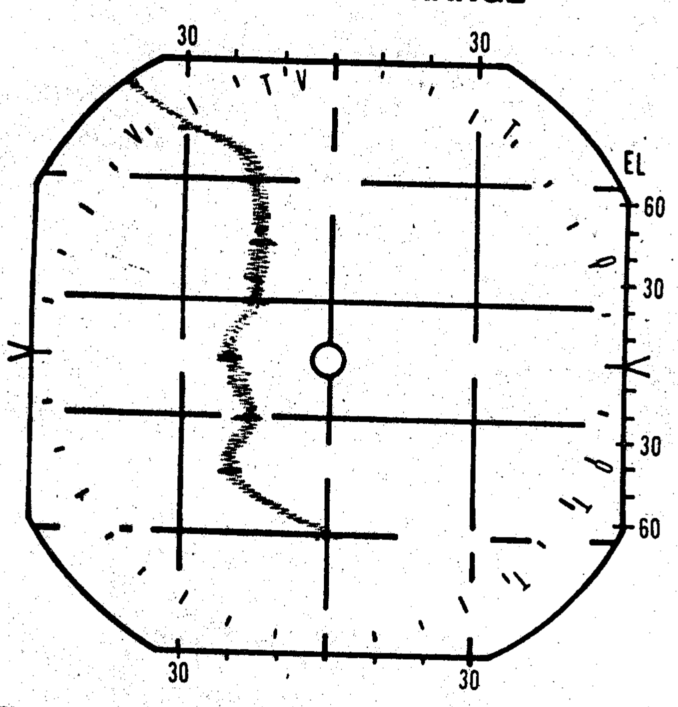


Figure 1. Radar Display for the Constant Turn Stern Intercept

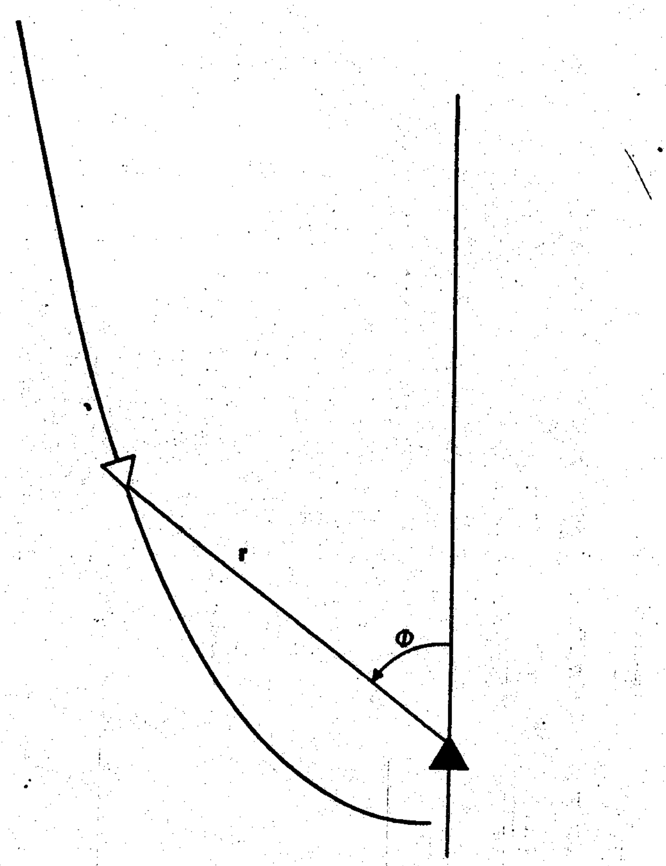
By the way, the so-called checkpoint method presently used by most TAC aircrews was derived from this method. The following data was computed for the above conditions with an intitial position of 46° at 10 NM. From that position, a constant 45° AOB turn is computed for the fighter.

TARGET AZIMUTH	RANGE (NM)	CLOSURE VELOCITY (KTS)
46°	10	630
29°	9	690
17°	8	700
14°	7	670
17°	6	580
19°	5	490
17°	4	390
18°	3	320
0°	2	100

It is interesting to note that while the closure velocity versus the target range schedule matches that of the checkpoint method, the azimuth is not 0° — which is what it is supposed to be. Instead it varies between 14° and 19°.

A critical disadvantage of both methods discussed so far is their dependence on the 500-400 airspeed relationship. If you are a devotee of either method, try it on a low altitude target. Disenchantment is sure to follow.

The best approach for any intercept technique — aside from validity — would be to emphasize that data readily available to the aircrew — target azimuth, elevation, and range. The method presented herein does that. A simple analytical procedure allows the aircrew to complete a stern intercept for any initial target position and heading.



$$r = \frac{.590529}{(.3235 + \sin \phi)\left[\frac{.3235 \tan\frac{\phi}{2} + .0538}{.3235 \tan\frac{\phi}{2} + 1.9462}\right]^{1.276}}$$

FOR A SPEED RATIO OF 1.25:1 AND A FINAL POSITION OF r = 2 NM at φ = 170°

Figure 2. 15° Lag Pursuit Curve

If the heading is not known, techniques for deriving it (with or without a lockon) are presented.

The basis for the variable lag pursuit method is the mathematical solution of the lag pursuit intercept. With the correct choice of a coordinate system, some manipulation, and a little help from differential equation techniques, the mathematical solution is obtained (see formula, *Figure 2).*

Investigation of the different lag pursuit curves shows that a 15° lag angle for a 1.25:1 speed ratio results in an intercept which is a good compromise between the fighter's maximum required bank angle and the time required to complete the intercept. *Figure 2* shows the flight path curve for this intercept. Although the flight path is a curve, it is sufficiently straight to permit the derivation of three constants: 600; 100; 50.

Before we go any further, let's define some terms to simplify the explanation:

θ_c	Collision azimuth. Also known as collision antenna train angle.
R15LAG	This is the target range at which a collision course is broken. The target is moved from the collision azimuth to 15° on the cold side of the scope. A 45° AOB turn is used.
135°-to-go	This and 180°-to-go, 90°-to-go, and 45°-to-go refer to a fighter-target heading relationship. At 135°-to-go the fighter has 135° to turn to get to the target's heading.

Now, let's see how the constants are used. Six hundred is used to determine your position relative to the 15° lag pursuit curve. Divide 600 by the collision azimuth. The result is R15LAG. You use R15LAG to determine your position relative to the 15° lag pursuit curve. If the target range is greater than R15LAG, you are outside the curve and should maintain the target on a collision course until R15LAG occurs. At that point, take the target to 15° cold and maintain for a 2 NM rollout. On the other hand, if the target is closer than R15LAG, you are inside the curve. Your action for this case is to take the target to 45° cold, keep it there, and go to the next number — 100.

One hundred is used to determine the target lag angle for 135°-to-go. Divide 100 by the anticipated target range at 135°-to-go and the result is the target lag angle. You must jockey the turn so as to have the target at the proper lag angle when your heading is 135°-to-go.

The act of juggling the turn rate to arrive at 135°-to-go at the correct lag angle for a specific target range requires a feel for intercept conduct that comes only with experience. This is not an insurmountable problem for an old head. However, a new troop will find it frustrating. The solution is to anticipate the lead required at 180°-to-go.

This lead is automatically obtained by noting the target range at 180°-to-go and:

- If the target range *exceeds 10 NM*, move the target to *15° Cold.*
- If the target range is *less than 10 NM*, leave the target at *45° cold.*

In either case, anticipate the target range at 135°-to-go and compute the correct lag angle as soon as possible.

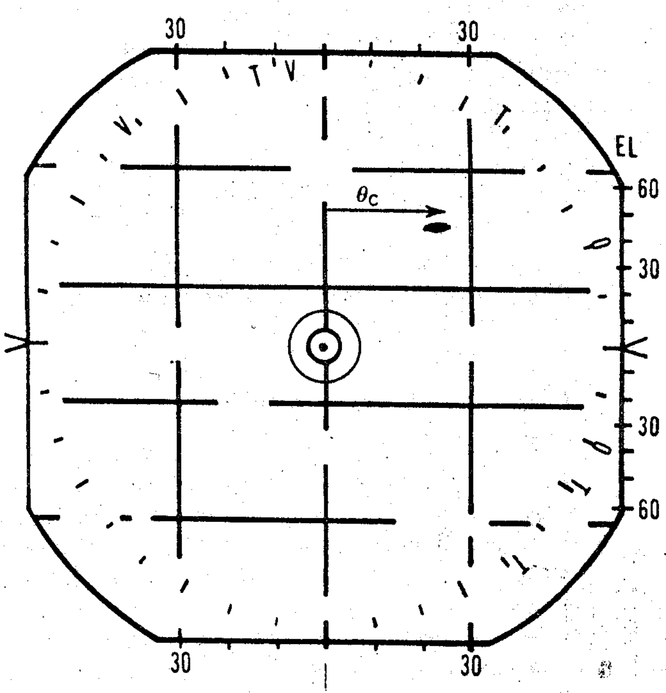


Figure 3a. Target at Collision Azimuth

Fifty is used to check intercept progress at 90°-to-go. Divide fifty by the anticipated target range at 90°-to-go. The result is a new target lag angle, and it is a correction if it is different from the previous lag angle.

TO PUT TARGET AT COLLISION AZIMUTH

1. **READ ANGLE oc**
2. **DOUBLE oc**
3. **TURN THE RESULTANT DEGREES IN THE DIRECTION OF DRIFT (IN THIS CASE, LEFT)**

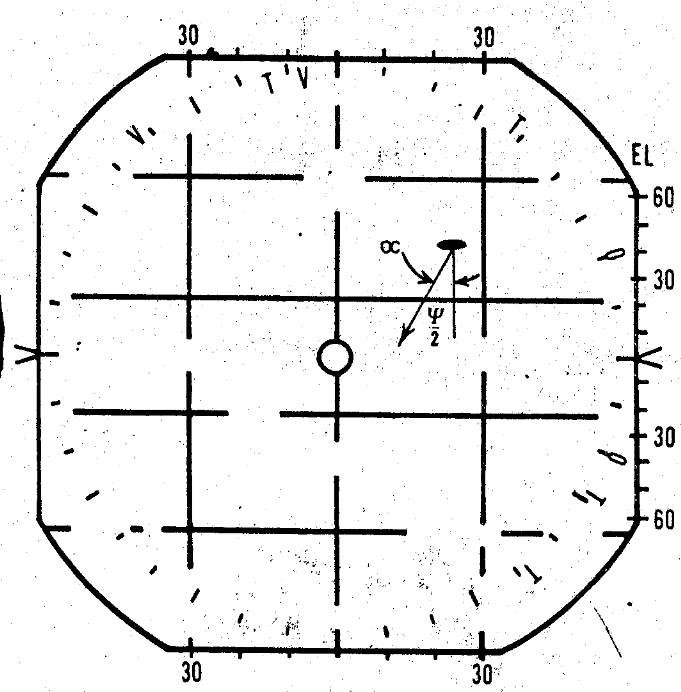


Figure 3b. Target Drift on Scope

Both 100 and 50 can also be used to provide a check on intercept progress when the stern intercept was initiated outside the 15° lag pursuit curve.

You should now understand the basis of the variable lag pursuit method. Now we will integrate the method into a procedure which will allow the successful conclusion of a stern intercept from any practical heading crossing angle with or without a lockon.

AIRCREW TECHNIQUES

The success of this method depends on your ability to accomplish certain analyses and actions in the Action sequence. Explanations of these requirements follow:

Target to the Collision Azimuth

This is easy if you have a lockon — simply center the AIM dot with radar missiles selected. It is slightly more complicated with no lockon. Change the fighter's heading to make the target move straight down the scope as shown in *Figure 3a.* This is done by moving the target to an estimated collision azimuth. If the target moves straight down the scope, your problem is solved. If not, estimate the angle between the target path and a vertical line on the scope, double that angle, and turn the resultant number of degrees in the direction of drift *(see Figure 3b).*

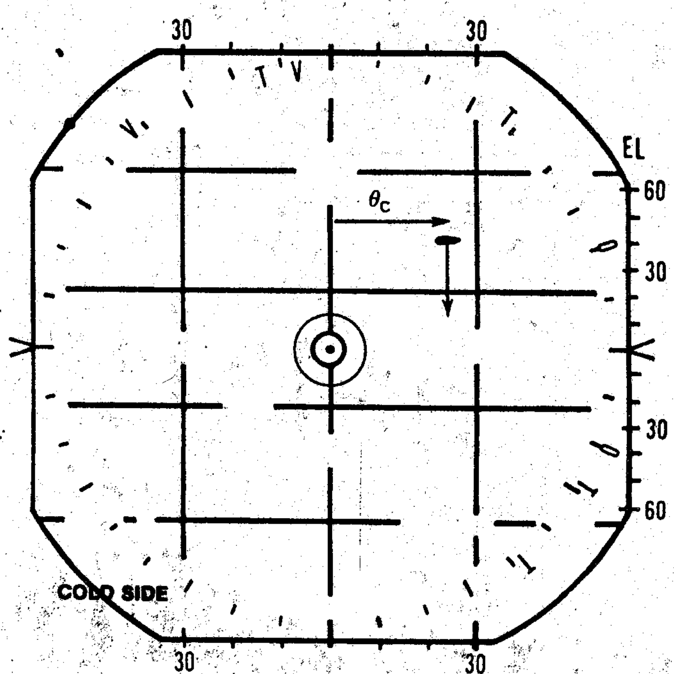


Figure 4a. Target at Collision Azimuth

Cold Side of the Scope

This determination is easy when the target is on a collision course. The cold side is simply the opposite side from the target *(see Figure 4a)*. Two indications can be used when the target is dead ahead. One indication is that the AIM dot is on the cold side. The other indication is the direction of target drift and is useful with no lockon. As shown in *Figure 4b*, the target drifts towards the cold side.

Target Heading (Target on Collision Azimuth)

The target heading can be read on the compass face when the collision azimuth, θ_C is known. The following procedure is used: (An example is presented in parentheses from *Figures 4a and 5.)*

- Read θ_C on scope.
- Add 10% of θ_C to θ_C (For example, $\theta_C = 20°$; result is 22°.)
- Double the result to obtain the angle Ψ (2×22° = 44°).
- Go up from the bottom of the compass the angle Ψ as shown in *Figure 5*.
- Read target heading on compass face.

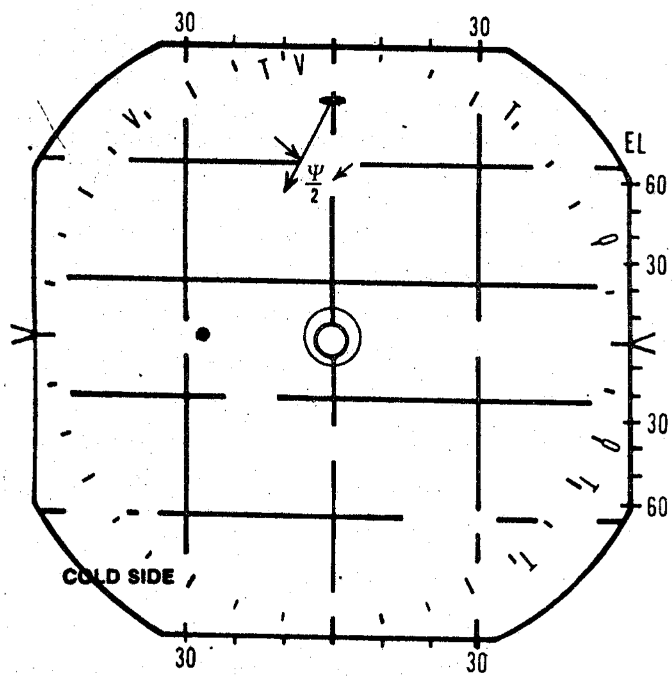
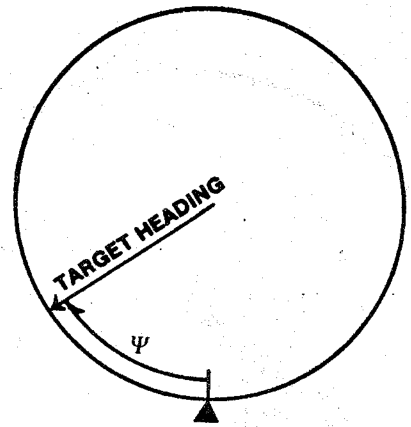


Figure 4b. Target at 0° Azimuth



TARGET AT 0° AZIMUTH	TARGET AT θ_C
1. READ $\frac{\Psi}{2}$ ON SCOPE.	1. READ θ_C ON SCOPE.
2. DOUBLE TO GET Ψ.	2. ADD 10% AND DOUBLE TO GET Ψ.
3. GO UP Ψ FROM BOTTOM INDEX ON COLD SIDE.	3. GO UP Ψ FROM BOTTOM INDEX ON COLD SIDE.
4. READ TARGET HEADING ON COMPASS.	4. READ TARGET HEADING ON COMPASS.

Figure 5. Heading Determination on Compass

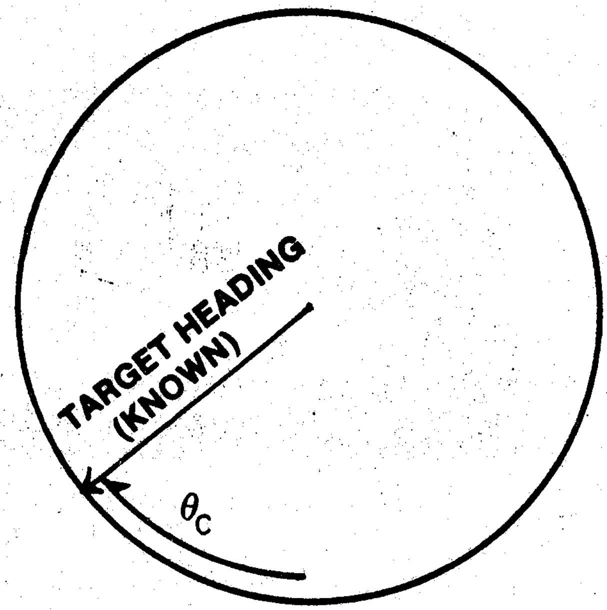
Correcting θ_C by 10% is done to compensate for the speed advantage. The target heading error with this correction increases with θ_C to 12° for a θ_C of 50°. If the 10% correction is not used, target heading error will double — increasing with θ_C to 22° for a θ_C of 50°. If you are willing to accept the increased heading error, skip the 10% correction and merely double θ_C to find ψ.

Target Heading (Target at 0° Azimuth)

In this case the angle Ψ is determined in a different way. Estimate the angle between the target path and the 0° azimuth line on the scope as shown in *Figure 4b*. Double that angle and you have Ψ. Use this Ψ as above. Go up from the bottom of the compass face on the cold side the value Ψ as shown in *Figure 5*. Read the target heading.

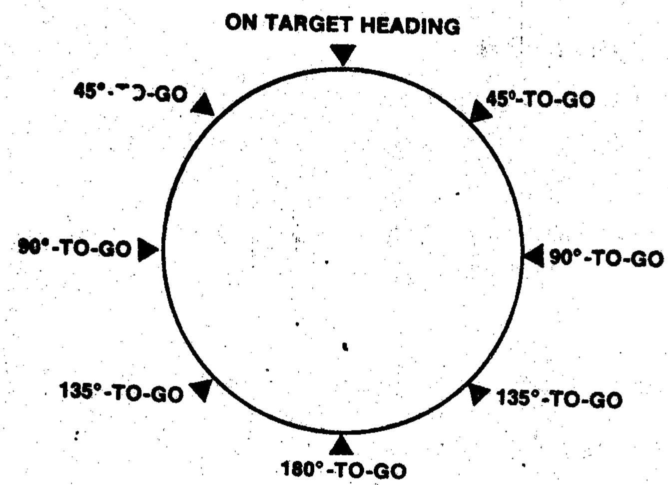
Collision Azimuth (Target at 0° Azimuth)

To find R15LAG when the target is dead ahead, you must find the collision azimuth, θ_C. It couldn't be easier. The angle Ψ, that was used to find the target heading, is also θ_C. The direction of θ_C on the scope is opposite the cold side. If the target heading is already known, θ_C can be read on the compass face. It is the angle between the bottom compass index and the target heading *(see Figure 6)*.



1. **TARGET AT 0° AZIMUTH.**
2. **θ_C IS ANGLE BETWEEN BOTTOM INDEX AND TARGET HEADING.**
3. **θ_C IS ON OPPOSITE SIDE OF SCOPE FROM TARGET HEADING.**

Figure 6. Collision Azimuth with Target at 0° Azimuth



READ SIDE OF COMPASS CORRESPONDING TO COLD OF SCOPE (I.E., IF LEFT SIDE OF SCOPE IS COLD, READ DEGREES-TO-GO ON LEFT SIDE OF COMPASS.)

Figure 7. Degrees-To-Go

Degrees-To-Go

This method depends on your ability to note the target ranges at various degrees-to-go. This is made easier by selecting the degrees-to-go to match the indices on the Bearing-Distance-Heading Indicator (BDHI) bezel — which we have done for this intercept technique. With a little practice, you'll find that you can watch both the radar display and the BDHI. The index for each degrees-to-go is indicated in *Figure 7* and is read on the cold side for the intercept.

Factors Influencing Rollout Range

One of the advantages of this method is your control of the rollout range. The constants presented were derived for a 2 NM rollout. For a 1 NM rollout, divide the constants by 2. For a 4 NM rollout, double the constants. Another approach is to alter the lag angle. To add 1 NM to the rollout, add 10° to the lag angle at 135°-to-go. To subtract 1 NM, reduce the lag angle at 135°-to-go by 10°.

THE ACTION SEQUENCE

This technique was developed for any initial target position and heading. However, your initial action must be to put the target at either the collision azimuth or θ_C azimuth. The analysis procedures were developed for these two target positions. What you do with an unknown target will depend on your judgment of the intercept. If you know that you have, or suspect, a beam intercept (especially with a target range of more than 25 NM), your best action is to establish a collision course. For a head-on intercept or a short range contact (less than 25 NM), take the target to dead ahead.

Now for the action sequence:

STEP 1. Move the target to the collision or 0° azimuth.

STEP 2. Analyze the intercept and determine:

- The cold side of the radar scope.
- Target heading, if not known.
- Collision azimuth (target at 0° azimuth).
- R15LAG

If R15LAG is more than target range, go to Step 3a.

If R15LAG is less than target range, go to Step 3b.

STEP 3a. Take the target to the collision azimuth and maintain until target range equals R15LAG.

STEP 4a. At R15LAG, move the target to 15° cold and maintain.

STEP 3b. Move target to 45° cold and maintain.

STEP 4b. When fighter heading approaches 135°-to-go, move the target to the lag angle for the anticipated target range at 135°-to-go.

STEP 5. Have the target at the correct lag angle for 135°-to-go.

STEP 6. Have target at the correct lag angle for 90°-to-go.

STEP 7. Begin controlling target overtake by varying fighter speed as necessary. Overtake at 45°-to-go will be about 50% more than the V_C at rollout.

Examples

The data for the following examples were produced by using the variable lag pursuit method on actual intercepts.

Example No. 1. 35 NM GCI Setup *(Figure 8)*

Initial Conditions:

Fighter - Heading 135°, 500 KTAS, 30,000 feet

Target - Heading 360°, 400 KTAS, 30,000 feet

Contact - 20° right for 35 NM

STEP 1. Target to collision azimuth. (GCI has already established a collision course which is verified by checking the AIM dot and the lack of azimuth target drift.)

STEP 2. Analyze the intercept:

- Since the target is at the collision azimuth on the right side, the left side is cold.
- Heading is furnished by GCI (360°).
- Collision azimuth is target azimuth (20°).
- R15LAG $= \frac{600}{20} =$ 30 NM. Since target range is greater than 30 NM, go to STEP 3a.

STEP 3a. Maintain target on the collision azimuth until 30 NM.

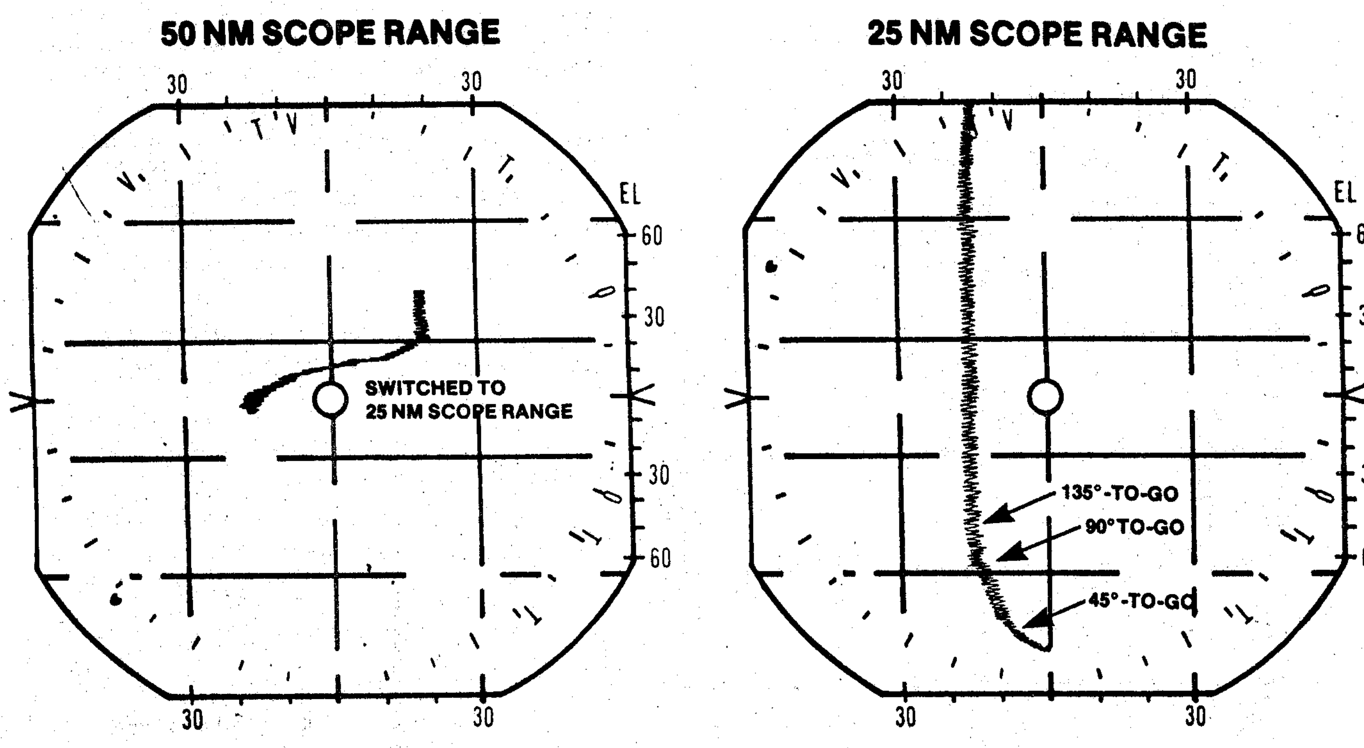


Figure 8. 135° STERN INTERCEPT

STEP 4a. At 30 NM-target to 15° on the left side of scope with a 45° AOB turn. Maintain target at 15° on the left side by varying the turn rate as necessary.

STEP 5. Target range is 7 NM when the fighter heading is 135°-to-go. Lag angle = $\frac{100}{7} = 14^\circ$ No change in lag angle required.

STEP 6. Target range is 4 NM when the fighter heading is 90°-to-go to the target heading. Lag angle = $\frac{50}{4} = 12^\circ$. Decrease lag angle slightly.

STEP 7. Check closure speed, V_c at 45°-to-go. It should be about 50% higher than at rollout. It is 140 KTS; no action is required. Rollout on target heading, is at 2 NM with 100 KTS overtake.

Example No. 2. 22 NM GCI Setup *(Figure 9)*

Initial Conditions:

Fighter - Heading 135°, 500 KTAS, 30,000 feet

Target - Heading 360°, 400 KTAS, 32,000 feet

Contact - 20° right for 22 NM

25 NM SCOPE RANGE

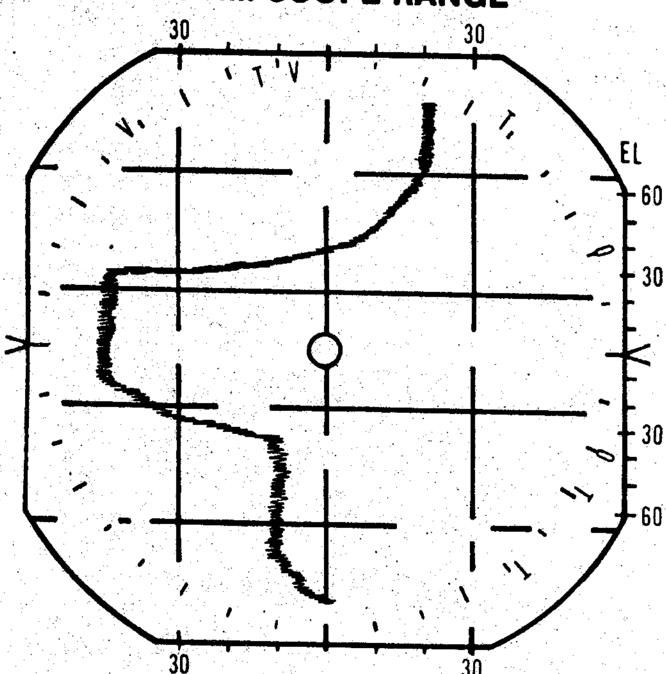


Figure 9. 135° Stern Intercept

STEP 1. Target to collision azimuth. GCI has already established a collision course which is verified by checking the AIM dot and target drift.

STEP 2. Analyze the intercept:

- Since the target is at the collision azimuth on the right side, the left side is cold.
- Heading is furnished by GCI (360°).
- Collision azimuth is target azimuth (20°).
- R15LAG = $\frac{600}{20}$ = 30 NM. Since target is less than 30 NM, go to STEP 3b.

STEP 3b. Move the target to 45° cold (left side) with a hard tu (60° AOB) and maintain.

STEP 4b. When the fighter heading approaches 135°-to-go to target heading, lead turn to take the target to the correct lag angle. This is done by noting the target range when the fighter heading is 180°-to-go (12 NM). Since the range was more than 10 NM, the target is moved to 15° cold (left side) with the degree of turn required (in this case a 45° bank was used). The turn is continued when it is noted that 135°-to-go will be passed at an approximate target range of 8 NM. One hundred thirty-five degrees-to-go is passed with the target at 8 NM and a lag angle of 15°. Lag angle = $\frac{100}{8} = 12^\circ$.

STEP 5. The turn (45° AOB) is continued to take the target to a 10° lag angle.

STEP 6. Target range is 4 NM at 90°-to-go. Lag angle = $\frac{50}{4}$ - 12° Target is maintained by varying turn rate as necessary at a 10° lag angle.

STEP 7. V_c is checked at 45°-to-go. It is 150 KTS and no action is required. Rollout is at 2.1/4 NM on target heading with an overtake of 100 KTS.

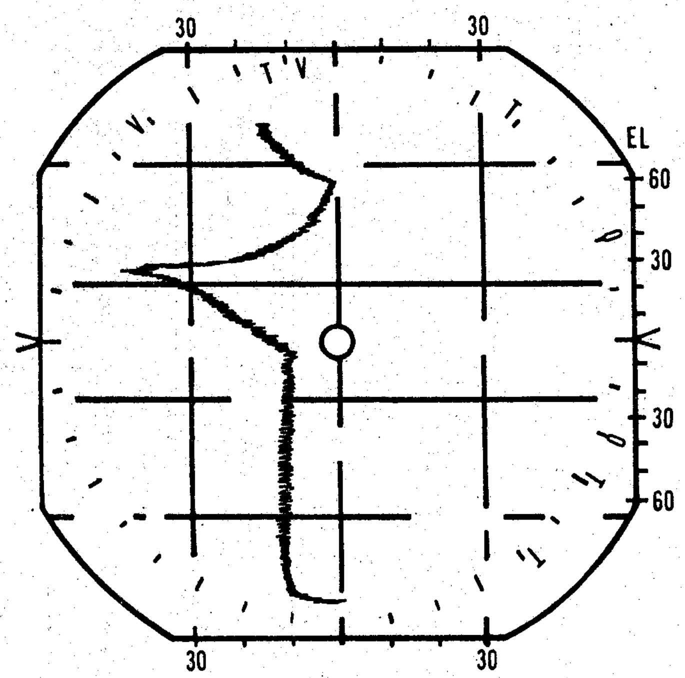
Example No. 3. Unknown Target (Figure 10)

Initial Conditions:

Known - Fighter heading 135°, 500 KTAS, 20,000 feet

Unknown - Target heading 360°, 400 KTAS, 22,000 feet

Contact - 15° left at 24 NM



25 NM SCOPE RANGE

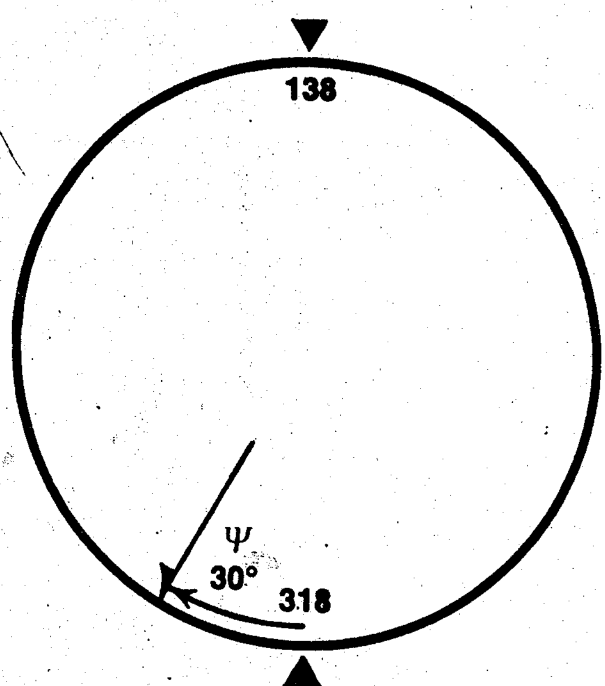


Figure 10. Unknown Target

STEP 1. Head-on pass is suspected due to the high overtake. Target is moved to 0° azimuth with a hard turn (in this case, 60°).

STEP 2. Analysis of the intercept.

- Cold side. The target is drifting left; left side is the cold side.
- Target heading. The angle between the target path and the 0° azimuth line is estimated to be 15°. This is doubled to get 30°. Now we go up, on the cold side (left) from the bottom of the compass (318°) and read 358° (round it off to 360°) for the target heading.
- Collision azimuth is 30°.
- R15LAG= $\frac{600}{30}$=20NM. Target range is less than 20 NM, go to STEP 3b.

STEP 3b. The target is moved to 45° on the left side of the scope with a hard turn (60° AOB).

STEP 4. As soon as the fighter is steady, the number of degrees-to-go is noted. In this case, we find we have 175°-to-go. Since the target is beyond 10 NM (using the 180°-to-go lead criteria) we immediately begin a hard turn to put target at 15° cold.

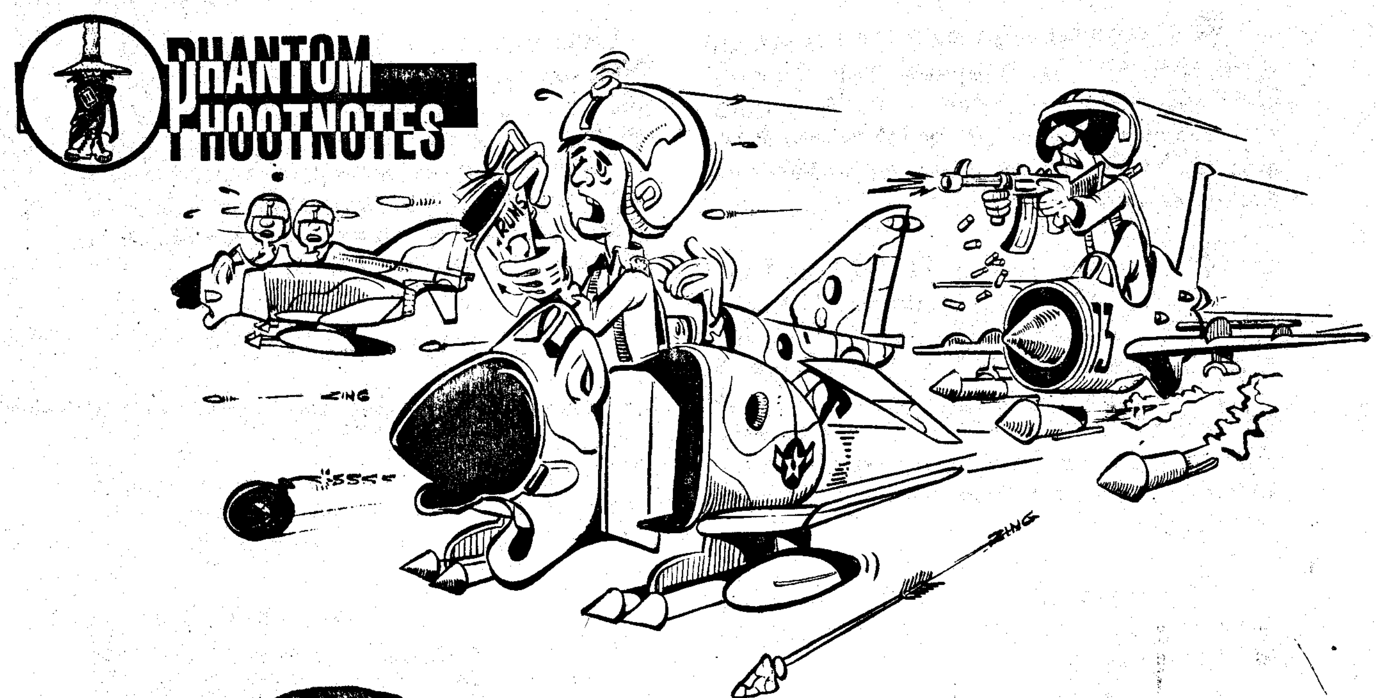
STEP 5. The 135°-to-go point is passed with the target 15° cold (left side) at 13 NM. Lag angle = $\frac{100}{13}$=8° (approximately). The turn is continued to put the target at 5 - 10° cold. The target is then maintained at 5 - 10° cold by varying the turn rate as required.

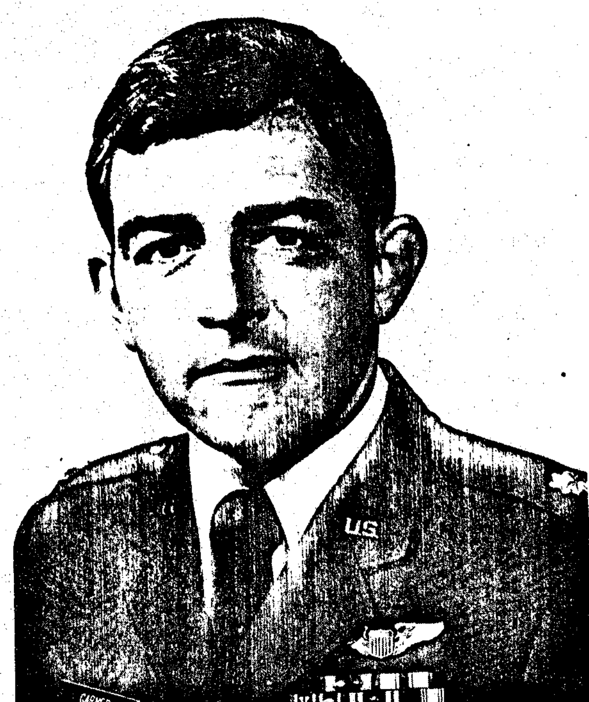
STEP 6. At 90°-to-go the target is 5 NM. Lag angle = $\frac{50}{5}$=10°. The target is put at 10° cold and maintained.

STEP 7. Overtake is under control at 45°-to-go. No adjustment was made. Rollout is at 2 NM on target heading.

CONCLUSION

The last example presented a no lockon stern intercept against an unknown target. The aircrew planned for a 2 NM rollout and made it — precisely. When was the last time that you took an unknown target and made a specific rollout range with no lockon?





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The purpose of this article is to introduce a tactic enabling two aircraft flying in a tactical spread formation to intercept a single target or formation of targets capable of evasion and communications jamming. The constraints being both fighters have operable radars and full GCI support while operating in an air defense posture with a contract to ID/KILL the target(s).

INITIAL RADAR CONTACT

From initial radar contact to a minimum of 15 NM, the tactic to employ should be determined. The fighter with the first radar contact is considered the tactical lead and should accomplish the following on initial contact.

- Note the el strobe position and call the contact on UHF; e.g., *"Tom, contact, 2 up, 2 up."* (A single syllable tactical call sign is preferable, not necessarily using first names.)

● Double the el strobe of the contact and pitch up or down the computed value. This will place the target on a collision course in elevation, enabling the second fighter to search the area of lead's elevation call for a more expeditious contact.

● Place the target on the collision course in azimuth if the heading is known; if unknown, then place the target at 0° azimuth. This technique will eliminate a UHF transmission and the second fighter will automatically search for the target on the collision azimuth or "on-the-nose." This also enables the aircrew to easily analyze target drift and determine the target's heading or evasion.

● Analyze the target drift to determine the heading crossing angle and which option of RUMS to employ.

● Search the area in azimuth and elevation to note possible target formations. Formation positions can be determined by selecting PPI and comparing the targets' positions to the known target heading. This is a result of negative target azimuth distortion on the PPI scope. Inform the wingman if a formation is noted. Attack the trailing target if it is less than 7 NM behind the lead target; attack the lead target if it is over 7 NM in front of the trailing target. For targets in a two-ship tactical spread formation on a 180° HCA with little displacement each fighter attacks the target corresponding to his side of the formation, i.e., left fighter attacks the left target. On any other HCA both fighters attack one target.

● Against formation targets, radar lockon should be delayed as long as possible to detect the targets' tactical maneuvering or evasion, and to enable the fighter to further search in azimuth and elevation for other targets.

SECOND CONTACT CALL

The second fighter must call contact prior to 15 NM to employ RUMS. With only one radar contact, prebriefed TRI-COMM 3-1 or ADCOM 3-1 tactics should be employed.

Upon the second "contact" call prior to 15 NM, the fighters should assure the geometry of the intercept and assess which option of the RUMS tactics that will be employed. If both fighters have radar contact with the target at any range prior to 15 NM, one select radio call from either fighter will automatically assign one of two exact roles utilizing RUMS.

RUMS

The following techniques should be used to initiate RUMS on a target with little displacement from the fighters' track and on a 180° HCA.

● Either fighter transmits the key word "RUMS" on UHF and calls a hard altitude in thousands of feet of the target, e.g., *"RUMS 18."* This key word, "RUMS," automatically assigns each fighter the role of converting to the stern of the target.

● Each fighter automatically selects afterburner on the "RUMS" call and checks the other fighter for elimination of smoke.

● Upon the UHF transmission, "RUMS 18," each fighter places the target approximately 35° on the radar scope, turning away from their original tactical formation positions. This will effectively split the formation to opposite sides of the target in azimuth. Each fighter should then attempt to obtain 2.5 - 2.9 NM displacement from the target's track. (See *Figures 1 through 4* for examples of fighters gaining 2.5 - 2.9 NM displacements at 30 NM, 25 NM, 20 NM, and 15 NM from the target.) Upon gaining the desired displacement, each fighter then turns to the original fighter heading, effectively placing the target back on a 180° HCA.

● Upon the UHF call, "RUMS 18," each fighter not only splits the target in azimuth, as discussed, but also maneuvers to bracket the target in the vertical. From the call "RUMS 18," both fighters know the target is at approximately 18,000 feet, and both will begin to obtain approximately 6000 - 9000 feet altitude separation from the target, in opposite directions. The tactical lead will maneuver vertically in the direction of the original contact in elevation; e.g., from the original call, *"Tom, contact, 2 up."* Tom is the tactical lead and will automatically maneuver high when employing RUMS. If the sun angle, sky conditions, terrain or other factors prove advantageous for the second fighter to go in the direction of the original contact elevation call, either fighter should transmit *"RUMS 18 low."* This call directs the tactical lead to maneuver vertically below the target and commits the second fighter to now maneuver above the target. The roles of vertical separation for both fighters reverse. For a target below 10,000 feet or above 25,000 feet, both fighters should consider vertical separation in the same direction, i.e., on a 5000-foot target, both fighters at 11,000 feet.

If the target does not become evasive, then each fighter should perform a stern intercept, converting from opposite directions horizontally and vertically. *Figures 5 and 5a* depict "god's-eye-view" and radar scope depictions for the fighter 8000 feet low on the target; *Figures 6 and 6a* present the same data for the fighter 6000 feet high on the target. Note the displacements and altitude separations at the original turn point and the 90° HCA during the turn. This azimuth and range should be used to begin the 4 - 4.5 G turn and at the 90° HCA to evaluate progress during the turn. The conversion is designed to roll the fighter into the stern at 1.5 NM, 20° angle-off, with the fighter's nose on the target. This data was extracted from an Air Combat Maneuvering Instrumentation (ACMI) mission, flown in an F-4C with two empty wing tanks. Differing aircraft will obviously have different performance factors and should set their appropriate altitude separation and displacement as necessary.

The first *eyeball* on the target should call: tactical call sign, "kill" or "friend" on UHF; e.g., *"Tom, kill, kill."* Either fighter then maneuvers to employ ordnance, escort, or shadow the target. Visual mutual support should be regained as quickly as possible.

EVASION AFTER "RUMS"

If the target becomes evasive after the original "RUMS" call, one select UHF call will key both fighters to the evasion, simultaneously assigning each fighter a tactical role. When either fighter detects target evasion, a UHF call of the fighter being evaded into as "HOT" should be made *(see Figure 7)*; e.g., target evading into Tom, call *"Tom's hot."*

The fighter called "HOT" is automatically assigned the role of placing the target on a collision course in azimuth and elevation. "Double-the-error" techniques in azimuth and elevation should be used to establish collision geometry. If the low fighter is "HOT," at 5 NM from the target, the pitch angle should be reduced in half enabling the low fighter to identify the target visually. The "HOT" fighter's role is to get an *eyeball* on the target and call: tactical call sign, "kill" or "friend." Upon identification, the "HOT" fighter should maneuver employing basic fighter maneuvers and attempt to regain visual mutual support as quickly as possible.

The second fighter is automatically assigned the role of converting on the target, placing the aircraft in an advantageous position to employ ordnance. The target will be on a lower HCA after the evasion away from the second fighter, resulting in a colder intercept (see Figure 7). The second fighter must react to this evasion by placing the target on the nose and using the turn-in parameters for a 90° HCA or reassessed HCA. (See Figures 5, 5a, 6, and 6a for altitude separation, azimuth, and range for HCA criteria.) The second fighter should complete the conversion, employing ordnance on the "HOT" fighter's "KILL" transmission on UHF.

If the target evades into the fighter converting to the stern, a UHF call by either fighter that the stern converting fighter is "HOT" will reverse roles for each *(see Figure 8).*

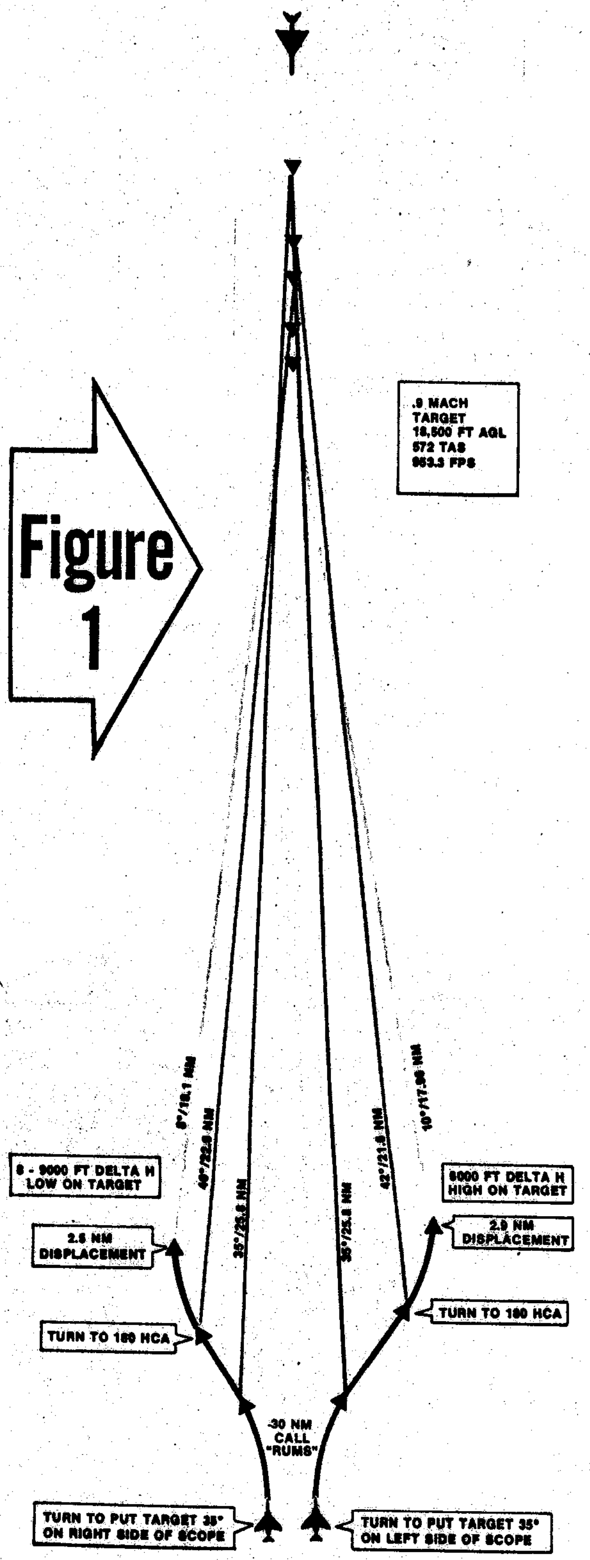


Figure 1
.9 MACH
TARGET
18,500 FT AGL
572 TAS
953.3 FPS
8°/18.1 NM
40°/22.8 NM
35°/25.6 NM
35°/25.8 NM
42°/21.8 NM
10°/17.36 NM
8 - 9000 FT DELTA H
LOW ON TARGET
6000 FT DELTA H
HIGH ON TARGET
2.5 NM
DISPLACEMENT
2.9 NM
DISPLACEMENT
TURN TO 180 HCA
TURN TO 180 HCA
30 NM
CALL
"RUMS"
TURN TO PUT TARGET 35°
ON RIGHT SIDE OF SCOPE
TURN TO PUT TARGET 35°
ON LEFT SIDE OF SCOPE

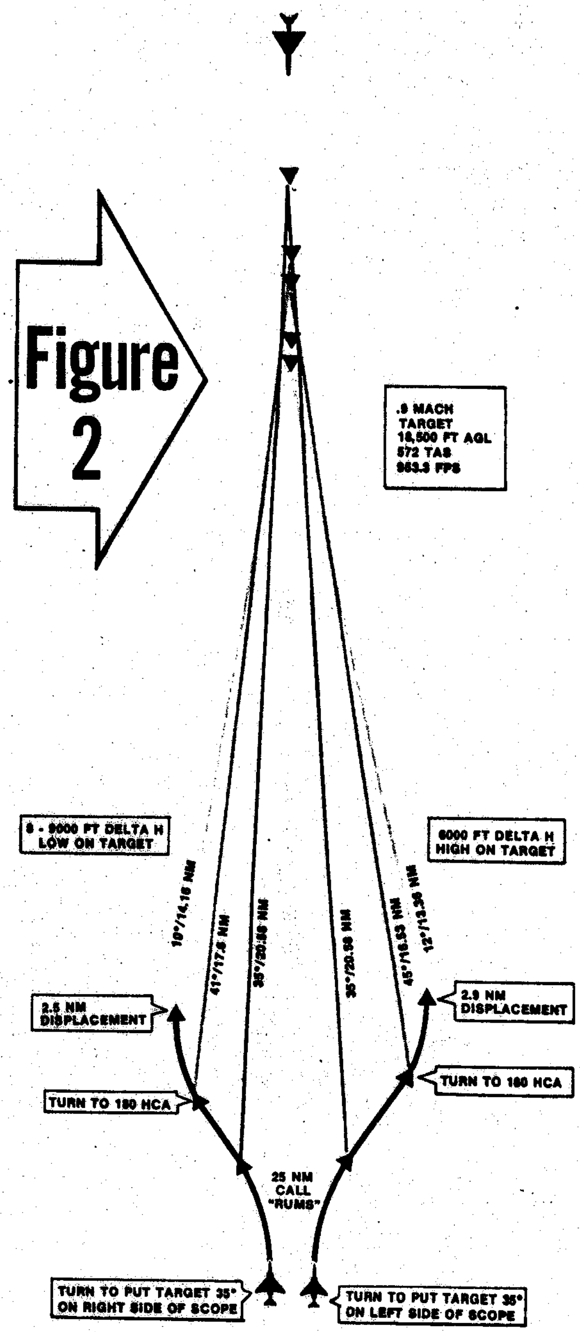


Figure 2
.9 MACH
TARGET
18,500 FT AGL
572 TAS
953.3 FPS
8 - 9000 FT DELTA H
LOW ON TARGET
6000 FT DELTA H
HIGH ON TARGET
10°/14.16 NM
41°/17.6 NM
35°/20.56 NM
35°/20.58 NM
45°/16.53 NM
12°/13.38 NM
2.5 NM
DISPLACEMENT
2.9 NM
DISPLACEMENT
TURN TO 180 HCA
TURN TO 180 HCA
25 NM
CALL
"RUMS"
TURN TO PUT TARGET 35°
ON RIGHT SIDE OF SCOPE
TURN TO PUT TARGET 35°
ON LEFT SIDE OF SCOPE

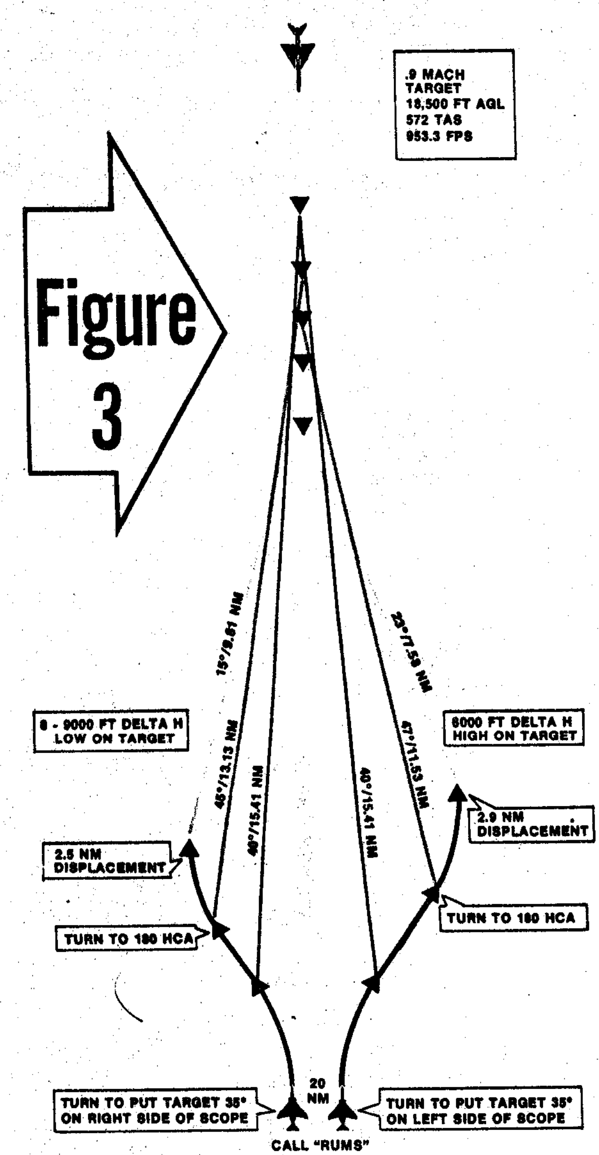


Figure
3
.9 MACH
TARGET
18,500 FT AGL
572 TAS
953.3 FPS
15°/9.61 NM
23°/7.59 NM
8 - 9000 FT DELTA H
LOW ON TARGET
6000 FT DELTA H
HIGH ON TARGET
45°/13.13 NM
40°/15.41 NM
40°/15.41 NM
47°/11.53 NM
2.9 NM
DISPLACEMENT
2.5 NM
DISPLACEMENT
TURN TO 180 HCA
TURN TO 180 HCA
TURN TO PUT TARGET 35°
ON RIGHT SIDE OF SCOPE
20
NM
TURN TO PUT TARGET 35°
ON LEFT SIDE OF SCOPE
CALL "RUMS"

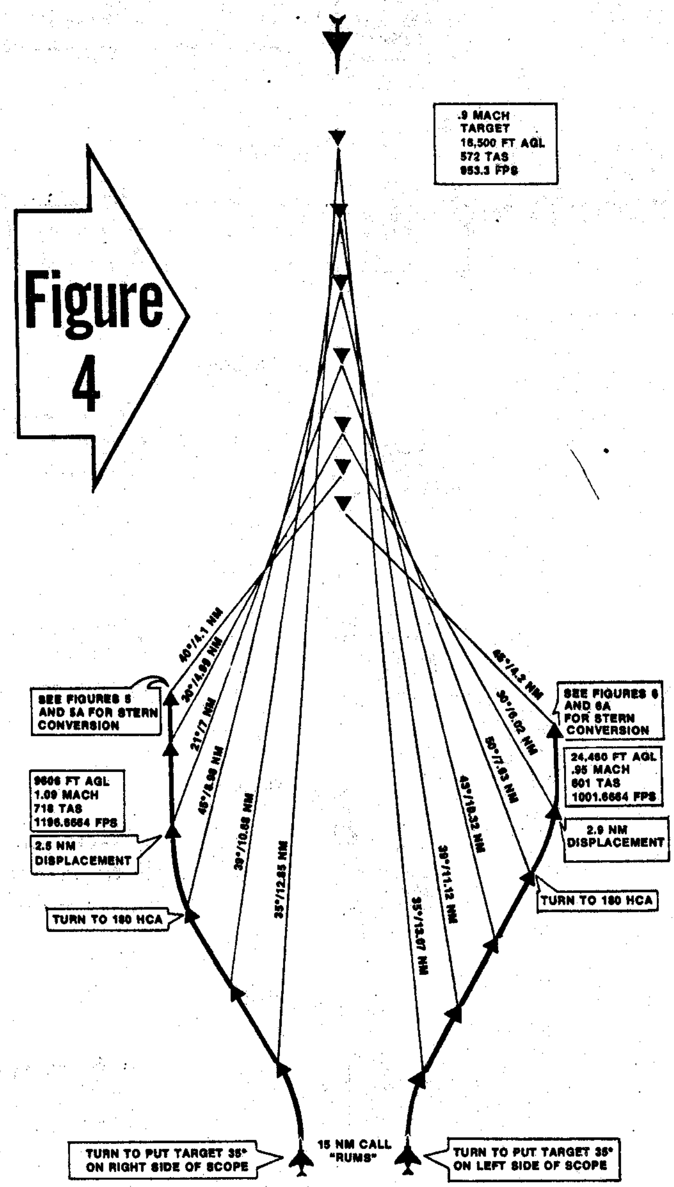
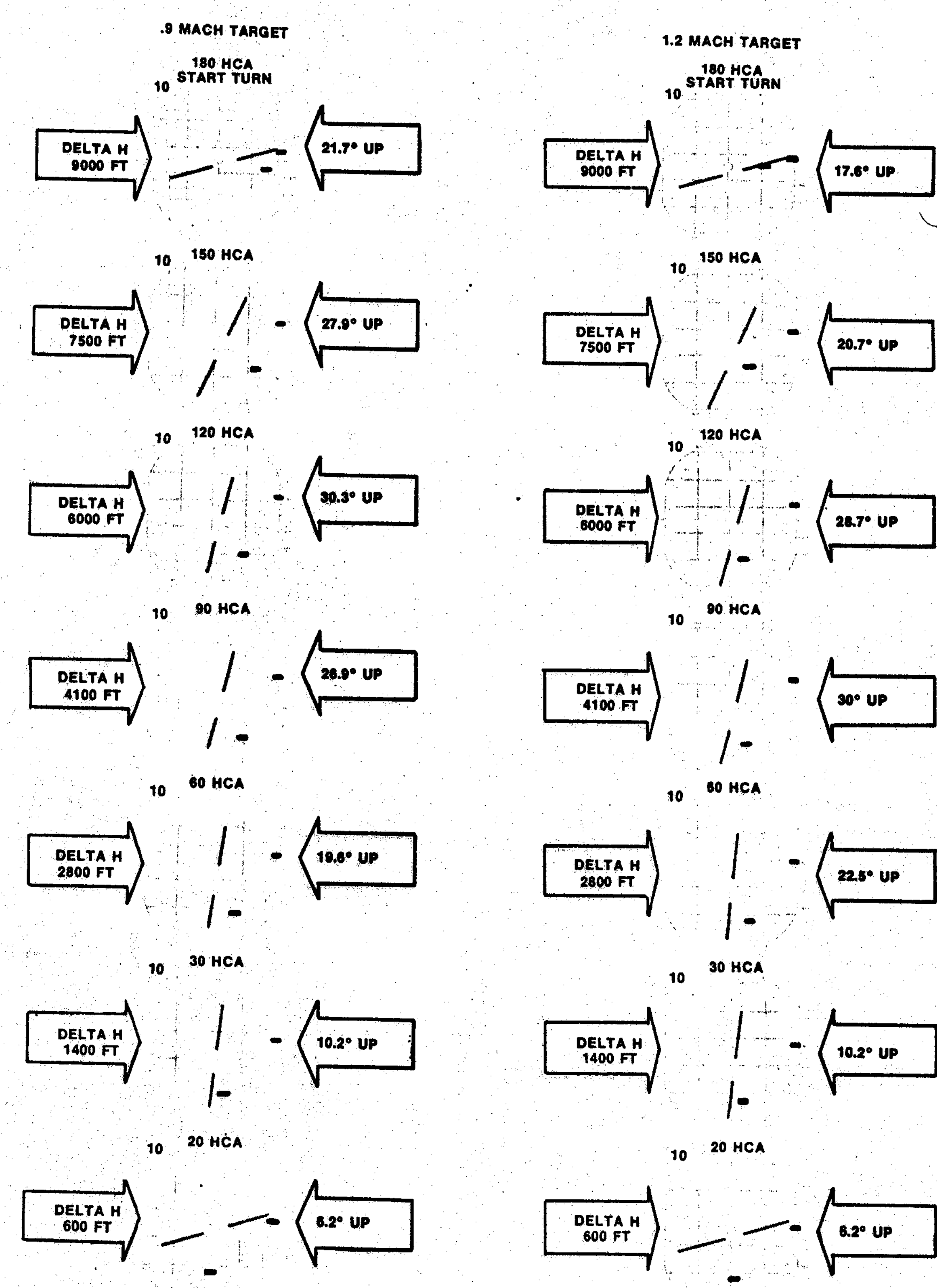


Figure
4
.9 MACH
TARGET
18,500 FT AGL
572 TAS
953.3 FPS
40°/4.1 NM
30°/4.89 NM
21°/7 NM
45°/8.98 NM
39°/10.68 NM
35°/12.85 NM
35°/13.07 NM
39°/11.12 NM
49°/18.32 NM
50°/7.63 NM
90°/6.02 NM
65°/4.2 NM
SEE FIGURES 5
AND 5A FOR STERN
CONVERSION
SEE FIGURES 6
AND 6A
FOR STERN
CONVERSION
9606 FT AGL
1.09 MACH
718 TAS
1196.6664 FPS
24,460 FT AGL
.95 MACH
601 TAS
1001.6664 FPS
2.5 NM
DISPLACEMENT
2.9 NM
DISPLACEMENT
TURN TO 180 HCA
TURN TO 180 HCA
TURN TO PUT TARGET 35°
ON RIGHT SIDE OF SCOPE
15 NM CALL
"RUMS"
TURN TO PUT TARGET 35°
ON LEFT SIDE OF SCOPE



.9 MACH TARGET
1.2 MACH TARGET
180 HCA
START TURN
DELTA H
9000 FT
21.7° UP
180 HCA
START TURN
DELTA H
9000 FT
17.6° UP
150 HCA
DELTA H
7500 FT
27.9° UP
150 HCA
DELTA H
7500 FT
20.7° UP
120 HCA
DELTA H
6000 FT
30.3° UP
120 HCA
DELTA H
6000 FT
28.7° UP
90 HCA
DELTA H
4100 FT
26.9° UP
90 HCA
DELTA H
4100 FT
30° UP
60 HCA
DELTA H
2800 FT
19.6° UP
60 HCA
DELTA H
2800 FT
22.5° UP
30 HCA
DELTA H
1400 FT
10.2° UP
30 HCA
DELTA H
1400 FT
10.2° UP
20 HCA
DELTA H
600 FT
6.2° UP
20 HCA
DELTA H
600 FT
6.2° UP

Figure 5.

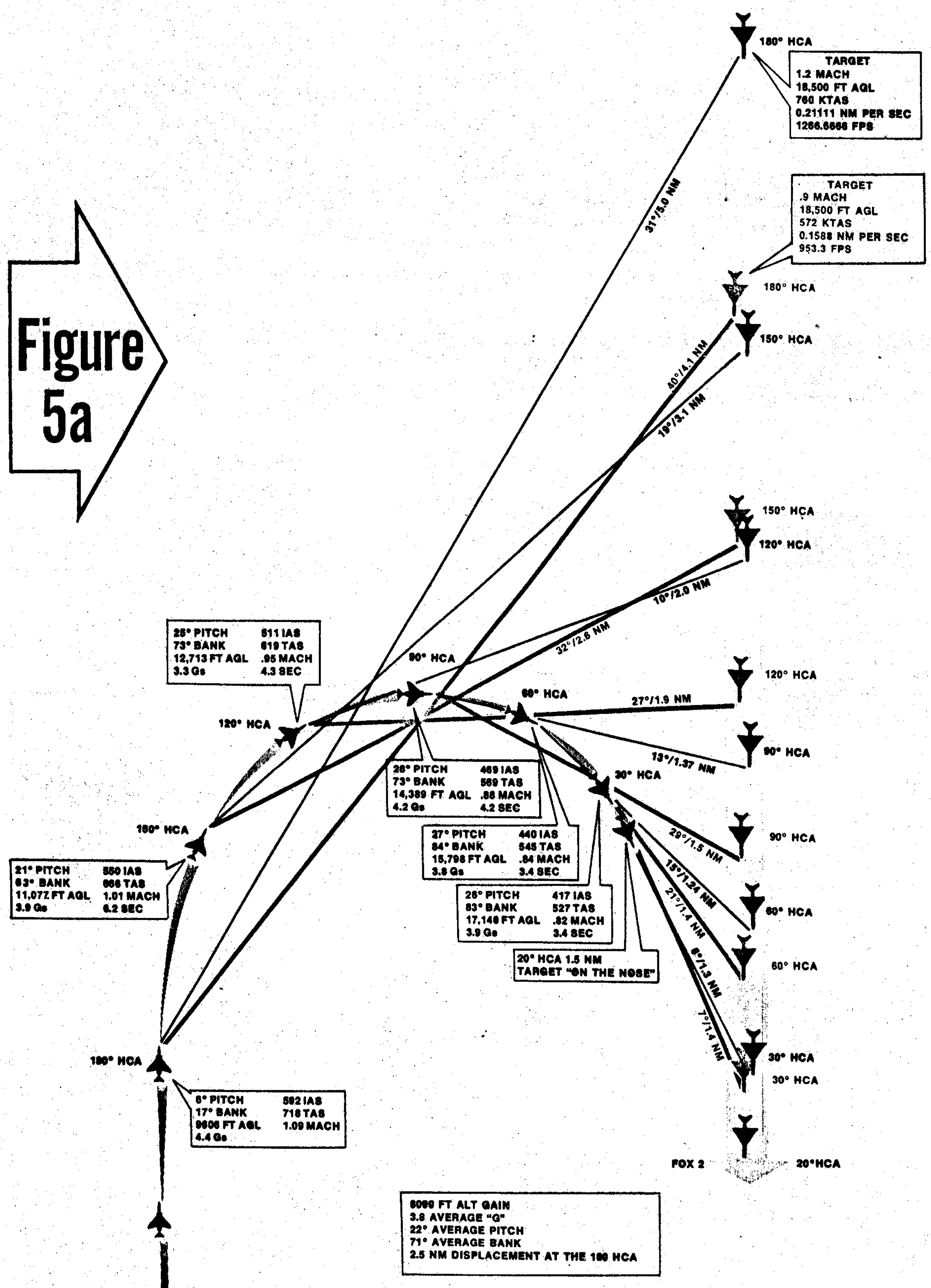


Figure 5a
180° HCA
TARGET
1.2 MACH
18,500 FT AGL
760 KTAS
0.21111 NM PER SEC
1266.6666 FPS
31°/5.0 NM
TARGET
.9 MACH
18,500 FT AGL
572 KTAS
0.1588 NM PER SEC
953.3 FPS
180° HCA
150° HCA
40°/4.1 NM
18°/3.1 NM
150° HCA
120° HCA
10°/2.0 NM
32°/2.6 NM
25° PITCH 511 IAS
73° BANK 619 TAS
12,713 FT AGL .95 MACH
3.3 Gs 4.3 SEC
90° HCA
120° HCA
60° HCA
27°/1.9 NM
120° HCA
90° HCA
13°/1.37 NM
30° HCA
28° PITCH 469 IAS
73° BANK 569 TAS
14,389 FT AGL .88 MACH
4.2 Gs 4.2 SEC
150° HCA
27° PITCH 440 IAS
84° BANK 545 TAS
15,798 FT AGL .84 MACH
3.8 Gs 3.4 SEC
29°/1.5 NM
90° HCA
21° PITCH 550 IAS
63° BANK 666 TAS
11,077 FT AGL 1.01 MACH
3.9 Gs 6.2 SEC
26° PITCH 417 IAS
83° BANK 527 TAS
17,148 FT AGL .82 MACH
3.9 Gs 3.4 SEC
15°/1.24 NM
60° HCA
21°/1.4 NM
20° HCA 1.5 NM
TARGET "ON THE NOSE"
60° HCA
6°/1.3 NM
7°/1.4 NM
180° HCA
30° HCA
30° HCA
6° PITCH 592 IAS
17° BANK 718 TAS
9606 FT AGL 1.09 MACH
4.4 Gs
FOX 2
20°HCA
8099 FT ALT GAIN
3.8 AVERAGE "G"
22° AVERAGE PITCH
71° AVERAGE BANK
2.5 NM DISPLACEMENT AT THE 180 HCA

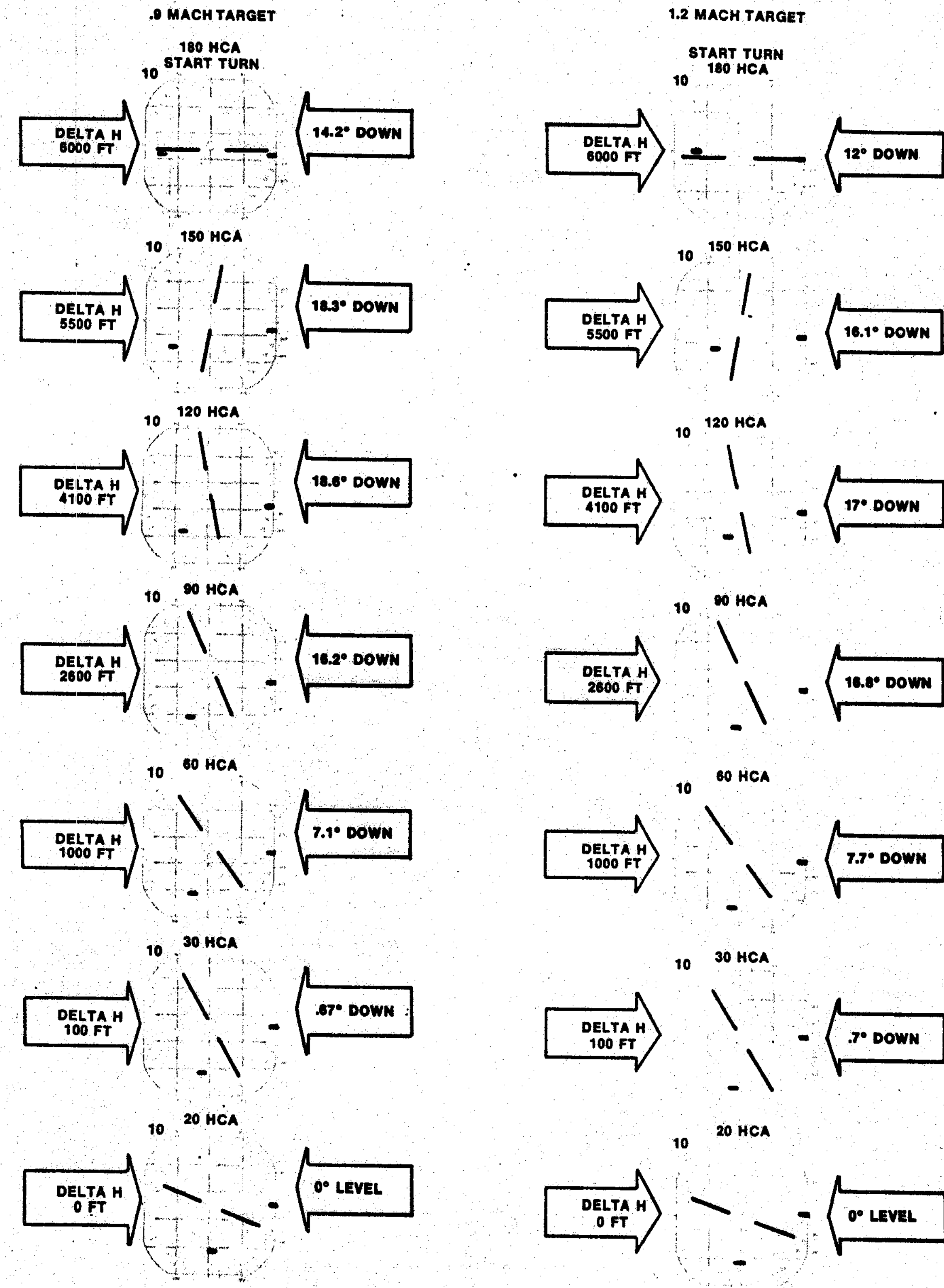

.9 MACH TARGET
180 HCA
START TURN
10
DELTA H
6000 FT
14.2° DOWN
150 HCA
10
DELTA H
5500 FT
18.3° DOWN
120 HCA
10
DELTA H
4100 FT
18.6° DOWN
90 HCA
10
DELTA H
2600 FT
16.2° DOWN
60 HCA
10
DELTA H
1000 FT
7.1° DOWN
30 HCA
10
DELTA H
100 FT
.67° DOWN
20 HCA
10
DELTA H
0 FT
0° LEVEL
1.2 MACH TARGET
START TURN
180 HCA
10
DELTA H
6000 FT
12° DOWN
150 HCA
10
DELTA H
5500 FT
16.1° DOWN
120 HCA
10
DELTA H
4100 FT
17° DOWN
90 HCA
10
DELTA H
2600 FT
16.8° DOWN
60 HCA
10
DELTA H
1000 FT
7.7° DOWN
30 HCA
10
DELTA H
100 FT
.7° DOWN
20 HCA
10
DELTA H
0 FT
0° LEVEL

Figure 6.

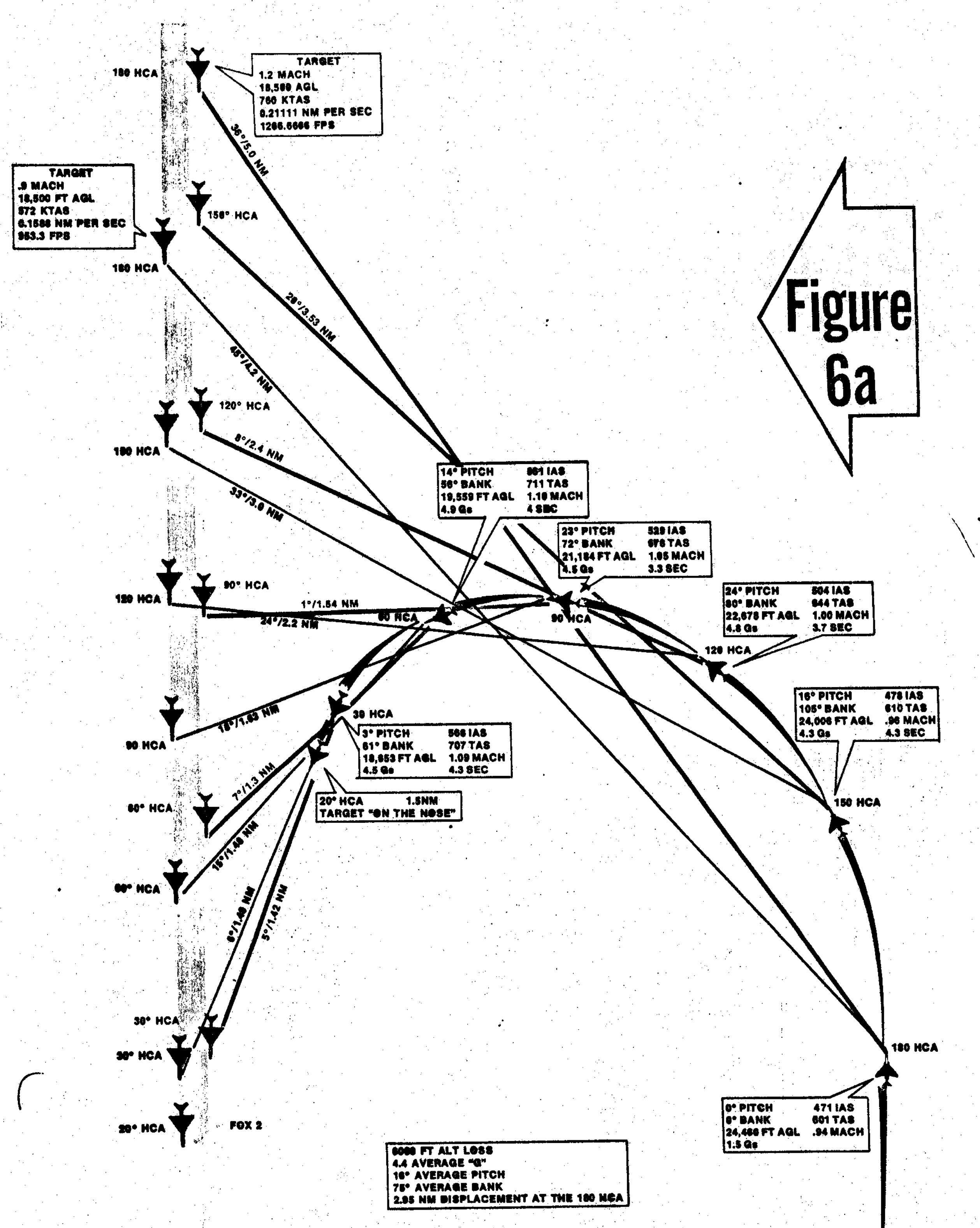


Figure 6a
180 HCA
TARGET
1.2 MACH
18,500 AGL
760 KTAS
0.21111 NM PER SEC
1266.6666 FPS
36°/5.0 NM
TARGET
.9 MACH
18,500 FT AGL
572 KTAS
0.1588 NM PER SEC
953.3 FPS
150° HCA
180 HCA
29°/3.53 NM
45°/4.2 NM
120° HCA
180 HCA
8°/2.4 NM
33°/3.0 NM
14° PITCH
56° BANK
19,559 FT AGL
4.9 Gs
591 IAS
711 TAS
1.10 MACH
4 SEC
23° PITCH
72° BANK
21,184 FT AGL
4.5 Gs
539 IAS
678 TAS
1.05 MACH
3.3 SEC
90° HCA
180 HCA
1°/1.54 NM
24°/2.2 NM
60 HCA
90 HCA
24° PITCH
80° BANK
22,678 FT AGL
4.8 Gs
504 IAS
644 TAS
1.00 MACH
3.7 SEC
120 HCA
16° PITCH
105° BANK
24,006 FT AGL
4.3 Gs
478 IAS
610 TAS
.96 MACH
4.3 SEC
90 HCA
18°/1.65 NM
30 HCA
3° PITCH
81° BANK
18,653 FT AGL
4.5 Gs
566 IAS
707 TAS
1.09 MACH
4.3 SEC
20° HCA
1.5NM
TARGET "ON THE NOSE"
7°/1.3 NM
60° HCA
60° HCA
15°/1.48 NM
150 HCA
6°/1.48 NM
5°/1.42 NM
30° HCA
30° HCA
180 HCA
20° HCA
FOX 2
0° PITCH
0° BANK
24,466 FT AGL
1.5 Gs
471 IAS
601 TAS
.94 MACH
6000 FT ALT LOSS
4.4 AVERAGE "G"
16° AVERAGE PITCH
75° AVERAGE BANK
2.95 NM DISPLACEMENT AT THE 180 HCA

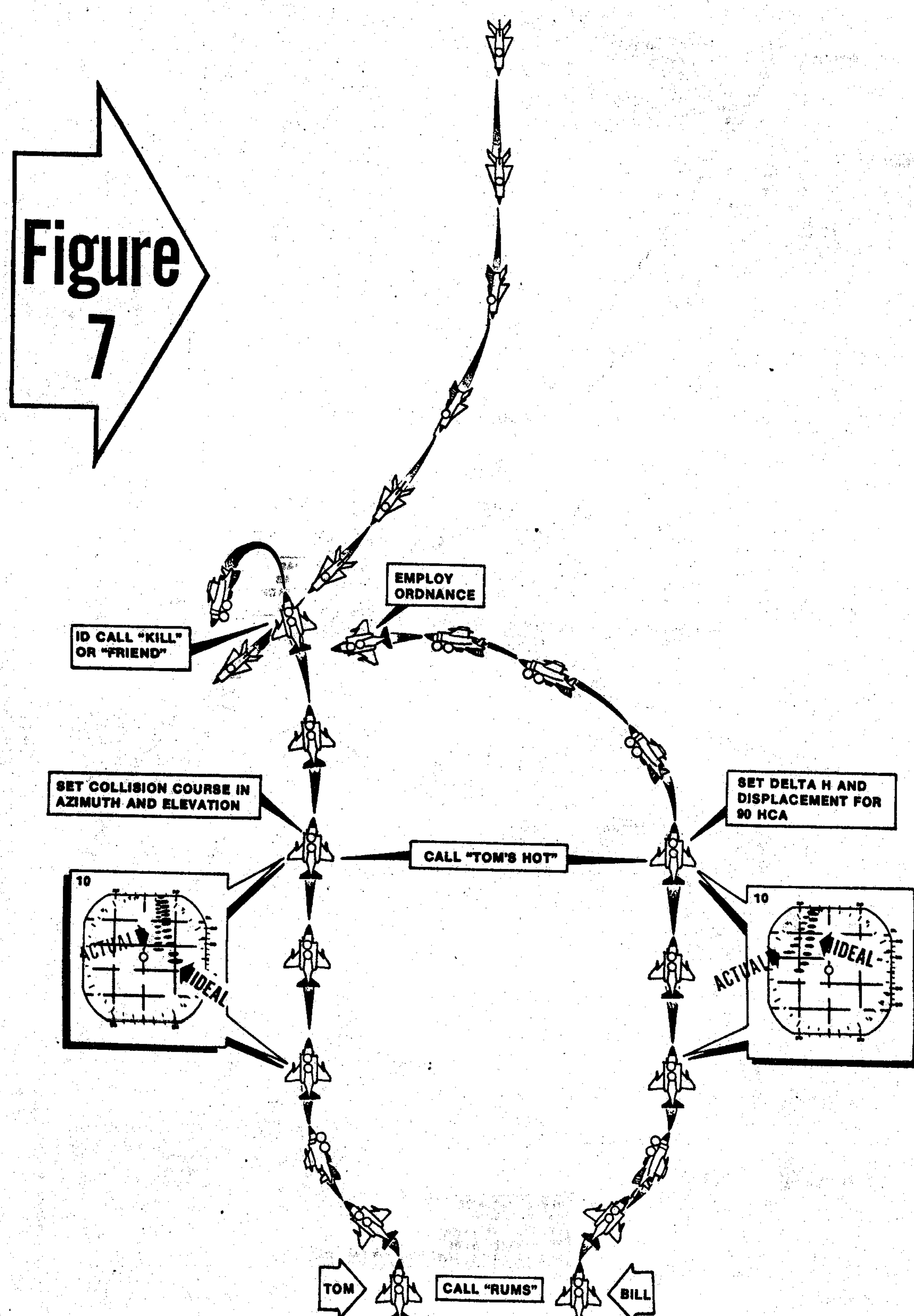


Figure 7
EMPLOY ORDNANCE
ID CALL "KILL" OR "FRIEND"
SET COLLISION COURSE IN AZIMUTH AND ELEVATION
SET DELTA H AND DISPLACEMENT FOR 90 HCA
CALL "TOM'S HOT"
10
ACTUAL
IDEAL
10
ACTUAL
IDEAL
TOM
CALL "RUMS"
BILL

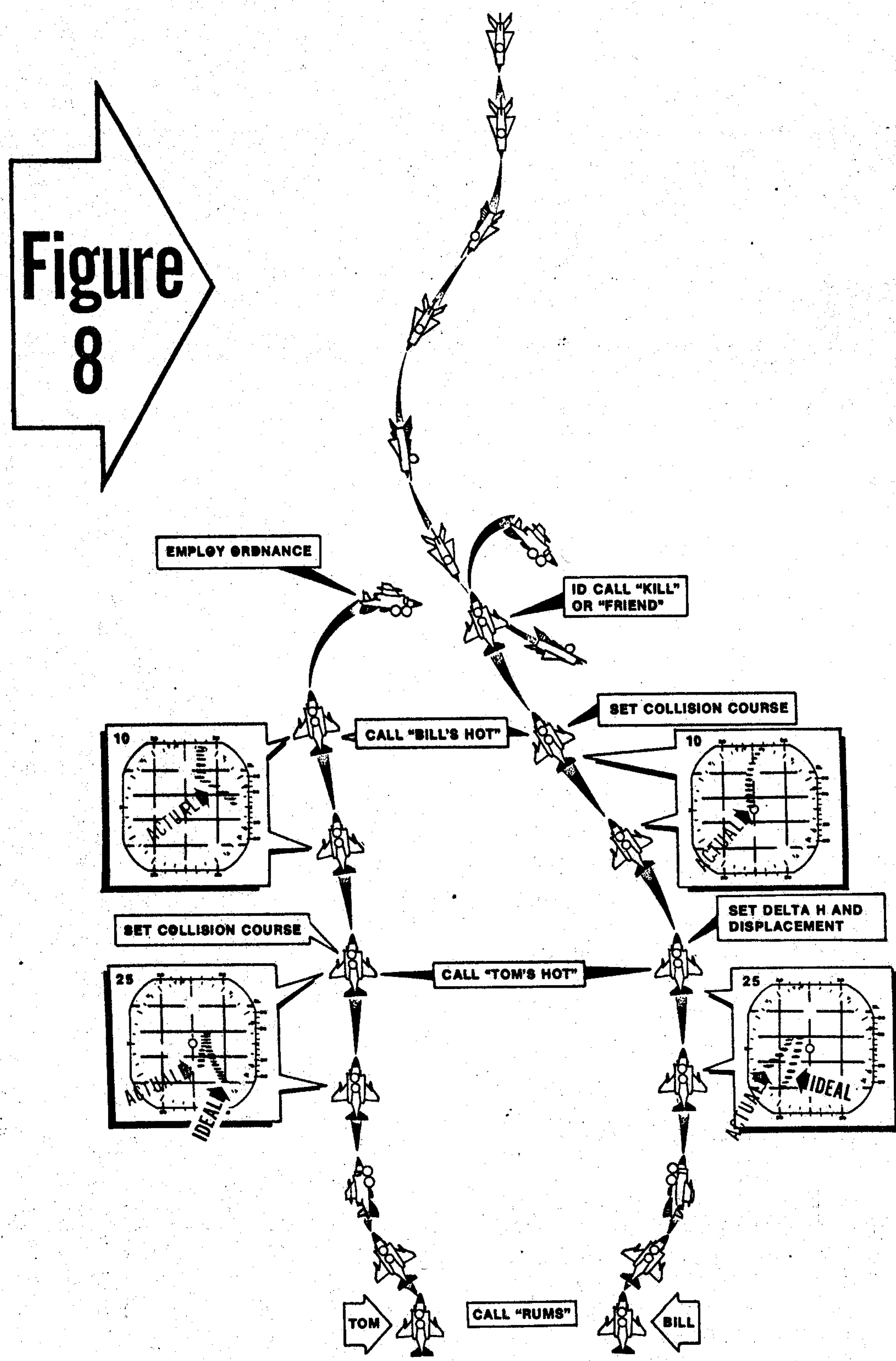


Figure 8
EMPLOY ORDNANCE
ID CALL "KILL" OR "FRIEND"
SET COLLISION COURSE
CALL "BILL'S HOT"
10
ACTUAL
10
ACTUAL
SET COLLISION COURSE
SET DELTA H AND DISPLACEMENT
CALL "TOM'S HOT"
25
ACTUAL
IDEAL
25
ACTUAL
IDEAL
TOM
CALL "RUMS"
BILL

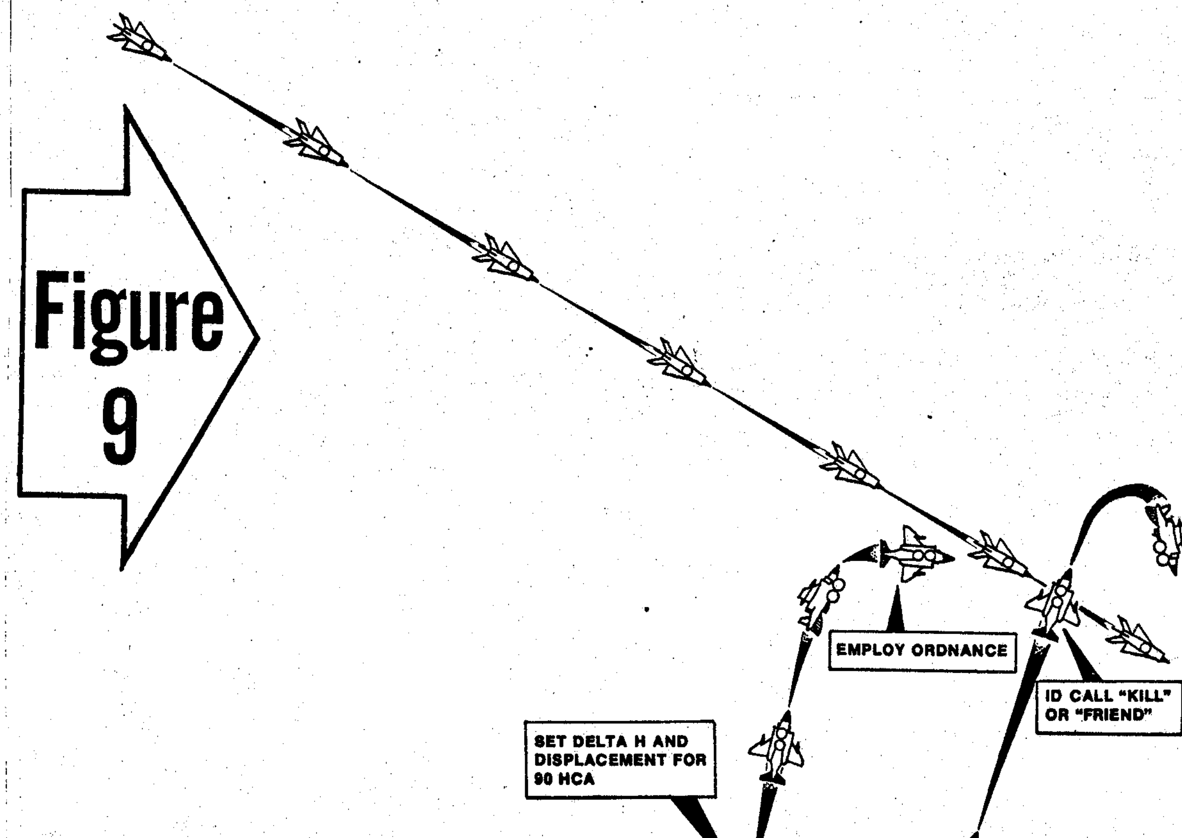
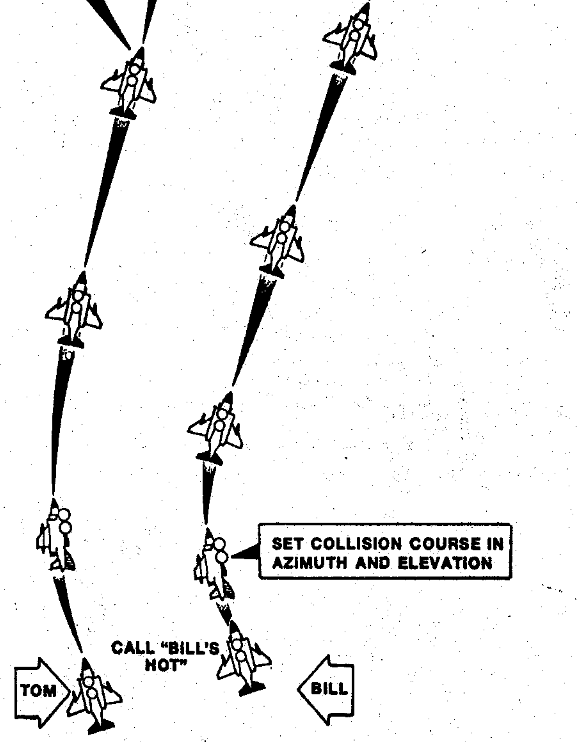


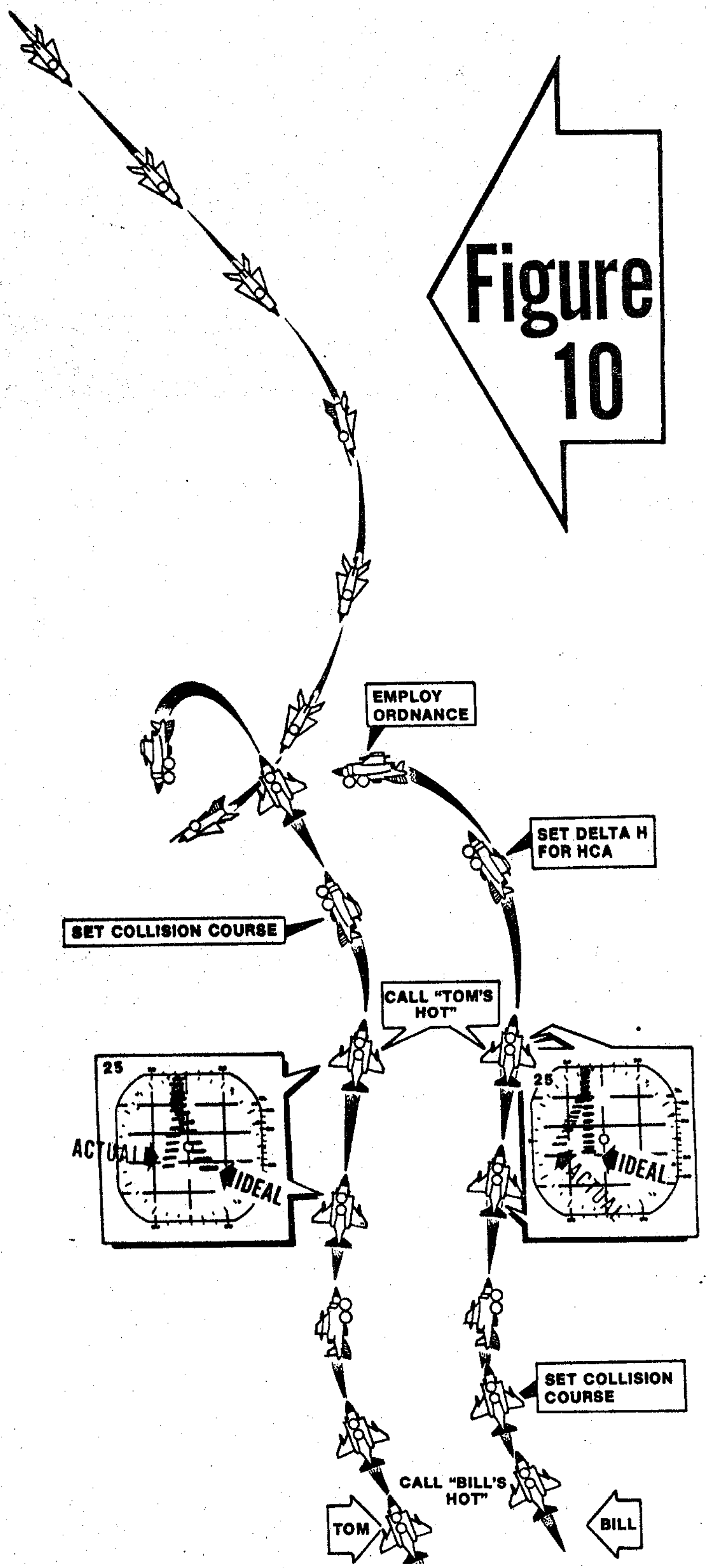
Figure 9



"BILL'S HOT"

The following techniques should be used to initiate RUMS against a target tracking on any HCA other than 180° with little displacement. After evaluation of the target's track and when both fighters have a radar contact, one specific UHF radio call will again assign specific roles for each fighter.

- The fighter best situated to place the target on a collision course will be designated that role by declaring that fighter "HOT" on UHF, e.g., "BILL'S HOT" *(see Figure 9)*. When either fighter transmits on UHF that one fighter is "HOT," the designated "HOT" fighter should place the target on a collision course in azimuth and elevation. The "HOT" fighter's role is again to identify the target, call "KILL" or "FRIEND," maneuver utilizing basic fighter maneuvers, and regain visual mutual support as quickly as possible.



• The second fighter is automatically assigned the role of converting on the target, placing the aircraft in an advantageous position to employ ordnance. The second fighter's altitude separation, displacement and turn-in azimuth/range depends on the HCA encountered. (See Figures 5, 5a, 6, and 6a for altitude separation, displacement and turn-in range/azimuth for differing HCAs.) The second fighter should complete the conversion, employing ordnance on the "HOT" fighter's "KILL" transmission on UHF.

• If the target evades to such an extent that roles must be reversed, a UHF call by either fighter that the fighter converting to the stern is "HOT" will reverse rolls for each *(see Figure 10.)*

GCI INTERFACE

Target evasive maneuvers should be detected and transmitted by GCI as evasion north, south, east, or west. The fighters must use this information expeditiously to assign roles if evasion is not yet apparent or recognized on their radar.

CONCLUSION

RUMS provides two fighters with operable radars an unattached mutually supportive tactic. It should effectively counter evasion by the target and automatically assign fighter responsibilities utilizing key words in a volatile communications jamming environment. Remember, how you employ your aircraft by effectively utilizing your radar will ultimately influence the outcome of any engagement. *Happy Hunting!!*