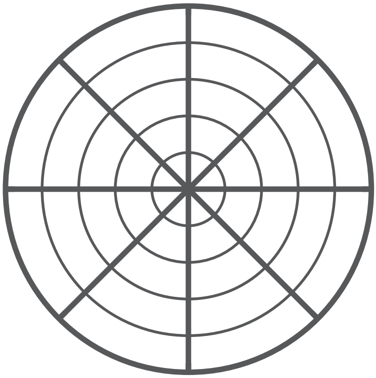


ARMY ANT´S

NOTES ON EFFECTIVE TACTICAL NAVIGATION WITH

SHARP´S METHOD

FOR HUNTING BLIND

REV 3.2
INCLUDES
TACNAV USF

VLFM 45611-D08723t64REF

Contents

Units used

The following units are used in this text, and you should use them as well.

Distance: Distance is measured in the unit Pico. On the tactical map, 1 Pico is 1 mm and on the navigational map, 10 Picos are 1 mm.

Speed: Speed is measured in Pico/minute. The unit of speed is always pronounced PPM

Acceleration: The tables below mean you never have to worry about the acceleration, but if you still do, Celestra's helm will accelerate and break Celestra with 1 PPM/s. But as I said, you only have to worry about that when recalculating the tables below.

<u>Constant speed and constant course</u>

Driving at constant speed is the easiest to do, yet that which requires the most of Navigation. This is how you do it.

1. Start the stopwatch when Helm reports that a new speed has been reached.

2. Draw a long line from the current position in the direction the ship is traveling.

3. Mark, with small dashes, the expected position at each future minute on the stopwatch. Do about 5 minutes. Always make sure you have at least 3 minutes into the future marked.

4. When passing one of these minute marks, cross it off. If time permits, write the wall-clock time when the position was passed. This is good if the stopwatch has an accident.

Use the table below to see how far Celestra has travelled each minute.

Speed (PPM)	Distance moved every minute on tactical map	Distance moved every minute on navigational map
0	0 mm	0 mm
10	10 mm	1 mm
20	20 mm	2 mm
30	30 mm	3 mm
40	40 mm	4 mm
50	50 mm	5 mm
60	60 mm	6 mm
70	70 mm	7 mm
80	80 mm	8 mm
90	90 mm	9 mm

When changing speed with constant course

Look up the starting and ending speeds in the table below. The distance traveled in the time that Helm activates the new speed until Celestra reaches that new speed is found in the table. Units are mm on the tactical map.

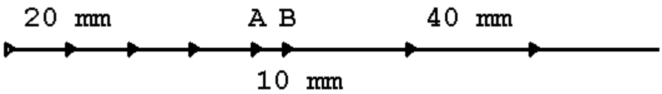
As long as the Captain sticks to these tabled speeds, and does not change course and speed at the same time, you don't need a stopwatch or anything when changing speed. Just use the table to know how far you moved by the time the new speed has been reached.

	Starting Speed										
Ending Speed	--	0	10	20	30	40	50	60	80	80	90
	0	--	0.8	3.3	7.5	13	21	30	41	53	68
	10	0.8	--	2.5	6.7	13	20	29	40	53	67
	20	2.2	2.5	--	4.2	10	18	27	38	50	64
	30	7.5	6.7	4.2	--	5.8	13	23	33	46	60
	40	13	13	10	5.8	--	7.5	17	28	40	54
	50	21	20	18	13	7.5	--	9.2	20	23	38
	60	30	29	27	23	17	9.2	--	11	23	38
	70	41	40	38	33	28	20	11	--	13	27
	80	53	53	50	46	40	23	23	13	--	14
	90	68	67	64	60	54	38	38	27	14	--

The formula is:
Distance = (Vend - Vstart) *
(Vend + Vstart) / A, where A = 60.

Example:

1. You are travelling at 20 PPM.
2. Captain orders acceleration to 40 PPM
3. From the position you have when Helm punches the accelerator (Point A), measure out 10 mm in the direction you are heading (Point B). Reset the stopwatch.
4. The same instant that Helm tells you the new speed has been reached, start the stopwatch and start marking out the minute-positions every 40 mm from point B and forward to know where you will be in the future.



When changing course with constant speed

Since the speed is constant, you will start moving in a circle. The radius of the circle is shown in the table below (Radius is in mm on tactical map). Do like this:

1. Draw a circle of the correct radius that touches the line you are moving along just at the position you have when starting the turn.
2. Drawn another line that has the angle of the target course that also touches the circle.
3. When the helm calls that you have the new course, you will be exactly where the second line touches the circle, and traveling in the direction of that second line.
4. Start the stopwatch as you are now moving with constant speed and constant course.

Hint: Make cardboard discs with these sizes to quickly place and thus save the time to actually draw the circle.
Note: These numbers do not account for

the drift when rotating. There is a small drift, but it is too small to matter in the space of space.

Turn Radius										
Speed	10	20	30	40	50	60	70	80	90	100
Radius	10	19	29	38	48	57	67	76	86	96

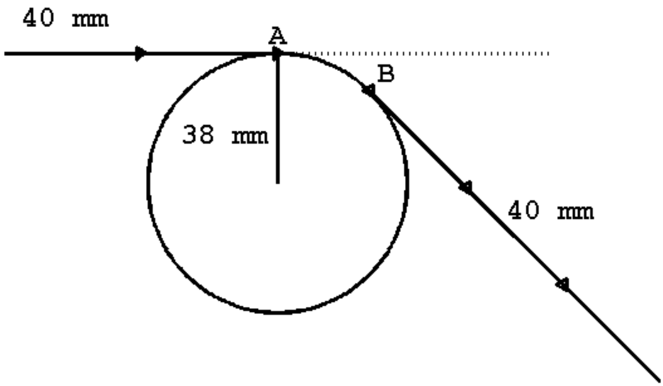
The formula is:
Radius = Speed*360/60/2/PI

An example:
(It looks scary, but check the image at the end, and you will understand)

1. You are traveling at a speed of 40 PPM with a course of 90 degrees
2. Captain orders a turn to 135 degrees.
3. Place a circle with diameter 38 mm along the line of which you are traveling so it just touches that line at the position you had when Helm punches the rotators (Point A). Trace around the circle to get the line you would travel along if you were to just keep rotating.
4. Use the protractor and ruler to draw another line with an angle of 135 degrees relative to galactic north that also touches the circle. Mark the position where this line touches the circle (Point B). This is the position

you will have when Helm calls out you have reached the new course. Reset the stopwatch.

5. When Helm calls out the new course has been reached, start the stopwatch.
6. Mark out positions every 40 mm from Point A and onwards in the new direction (135 degrees from Galactic North)



<u>When changing course and speed at the same time</u>

Sit back and cross your arms, because this is way too difficult to do.

<u>A note on communication</u>

Your life will be A LOT easier if Helm really gives you the info you need, in a way that cannot be misunderstood.

Here are a few suggestions for appropriate language. For changes of course, do exactly the same thing, but change the words.

1. Captain: "Set speed XX in 5, 4, 3, 2, 1, Mark!"
2. Helm: "Setting speed XX."
3. (Wait as ship changes speed)
4. Helm: "Reaching speed XX in 5, 4, 3, 2, 1, Mark!"

A note on tracking stationary targets

Tracking targets is easy. Just look where you are, use the protractor to find the absolute direction of where the target is, use the ruler to measure how far, and place a marker there.

Oh, and if Sensor stops giving you info, try to find a runner who can stand behind Sensor and take notes on angles and times. Every now and then they can come back to you and you can then retroactively track the targets.

Advanced tracking of moving targets

This is advanced stuff. You have been warned. Also, it only works for targets that move at constant speed straight ahead. Targets that haven't seen you should do this.

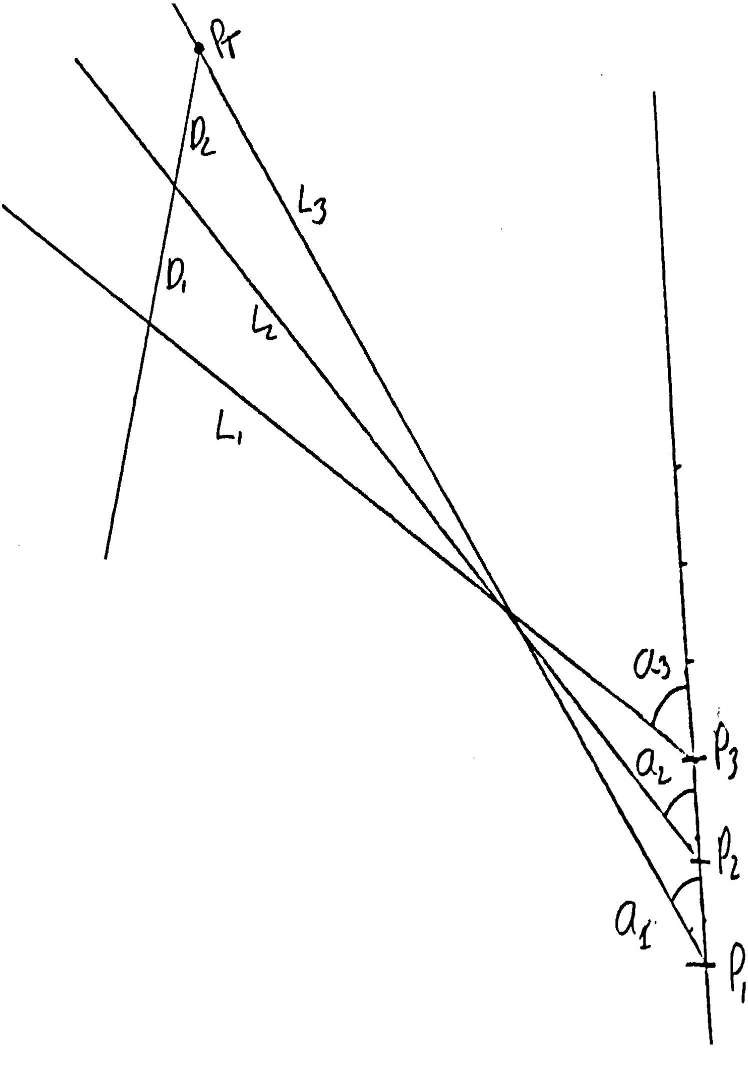
This is what you need to have noted down:

- At three of your known positions (P_1, P_2, P_3) you have got an accurate bearing to the target in question.
- At one of these positions, you have an indication of the distance the target had. This gives you an exact position of your target at one point in time. Call this position Pt.

1. At each of the three known positions (P_1, P_2, P_3) draw lines in the directions (A_1, A_2, A_3) you saw the target. Call these three lines L_1, L_2 and L_3.
2. For the position and direction where you had a distance, make a mark at that distance. This will be the position called Pt.
3. Now draw a line through Pt that crosses L_1, L_2 and L_3 at equal distances ($D_1 = D_2$). This is the line that your target is moving along.

Every now and then after this, draw a new line from your current position in the direction that the target is sensed. This will tell you immediately if the target changes direction or speed, even

if the HADES sensor cannot get a lock.
If the HADES sensor gets a lock, verify that the distances are as expected.



Tracking targets that change course

By drawing up the expected path of a tracked target and note down expected positions at given points in the future, expected DRADIS bearings in the future will be known. If, at any point, the target is not detected at the expected bearings, then the target has changed course or speed. Just reuse the method above to find the new speed and direction.

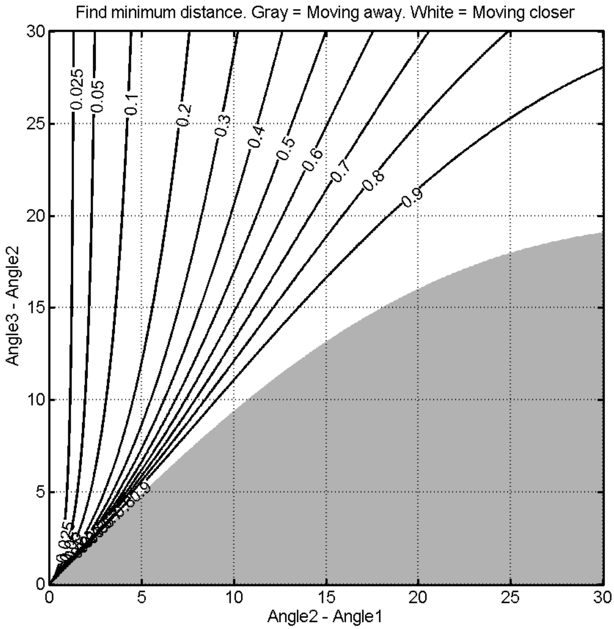
Sharp's Method for Hunting Blind

Sharp's Method is a way to find if targets are moving closer or further away using only Passive DRADIS and a stop-watch. If Hades can get a single distance measurement, then everything about the flight path will be known, given that the target moves ahead on a straight path. This method can be used by DRADIS and HADES together with only a stop-watch, pencil and paper. Even if HADES is out of order, just passive DRADIS is enough for you to track and hunt.

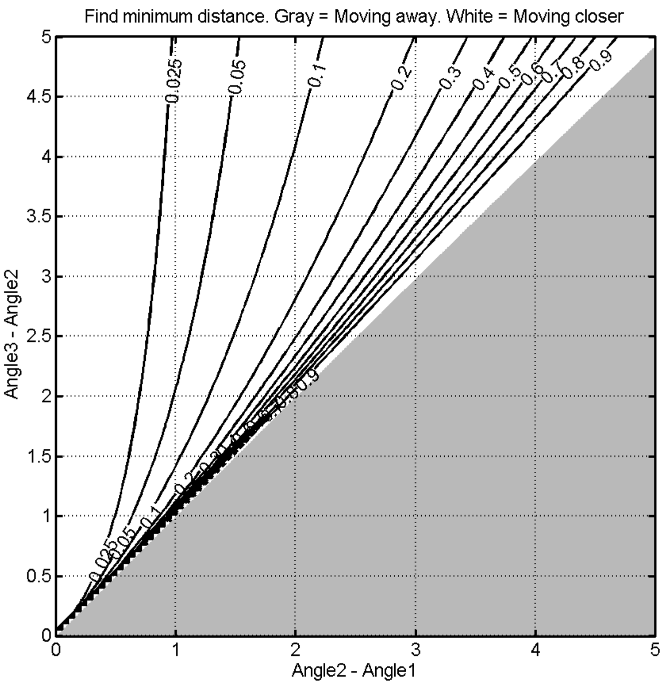
<u>This is how it works:</u>

1. Make three bearing measurements with equal time between (For example 15 seconds or 1 minute) with a stopwatch. Call them A, B and C.
2. Find the difference in bearing between measurement B and measurement A, called interval X, and between measurement C and measurement B, called interval Y.
3. Look up X and Y on the X- and Y-axis of the plot below.
4. If you end up in the white area, the target is coming closer. If you end up in the grey area, the target is moving away.
5. If the target is moving closer, then the lines tell how far away you will be when you are the closest. If you have the distance to the target when you did the first angle measurement, multiply that distance with the number on the line to get the closest distance you will have in Picos.

Table of angles for Sharp's Method



Zoom in of small angles



Example 1

1. Make bearing measurement A: 235°
2. Wait exactly 15 seconds
3. Make bearing measurement B: 239°
4. Wait exactly 15 seconds
5. Make bearing measurement C: 241°
6. Compute interval X (B-A):
   239° - 235° = 4°

7. Compute interval Y (C-B):
   241° - 239° = 2°
8. The point in the chart above with X-coordinate 4° and Y-coordinate 2° is in the grey area, so the target is moving away.

Example 2

1. Make bearing measurement A: 172°
2. Wait exactly 15 seconds
3. Make bearing measurement B: 169°
4. Wait exactly 15 seconds
5. Make bearing measurement C: 165°
6. Compute interval X (B-A):
   172° - 169° = 3°
7. Compute interval Y (C-B):
   169° - 165° = 4°
8. The point in the chart above with X-coordinate 3 and Y-coordinate 4 is in the white area. It is between the lines 0.3 and 0.4 meaning the target will pass us at about 1/3 the distance that it had when you took the bearing measurement A. If HADES can get a distance fix, you can estimate if this is a problem or not.