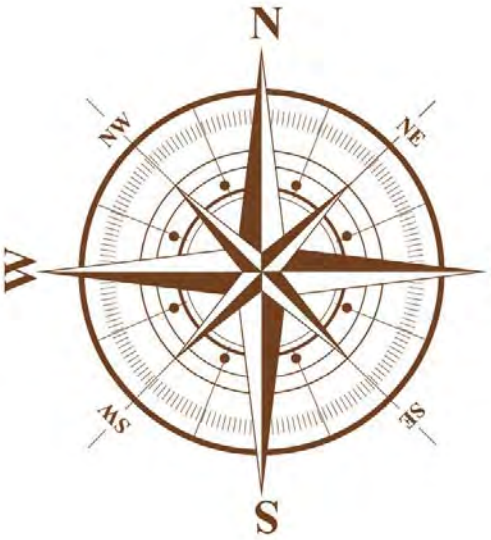

Officer of the Watch

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“Let’s start at the very beginning”

The Basic Allowing Problem

There are 3 things that could make our ship move with respect to the land:-

- Our engines pushing us in the direction we are steering.
- The wind could push us off course.
- The water could be moving.

How to find where we should be

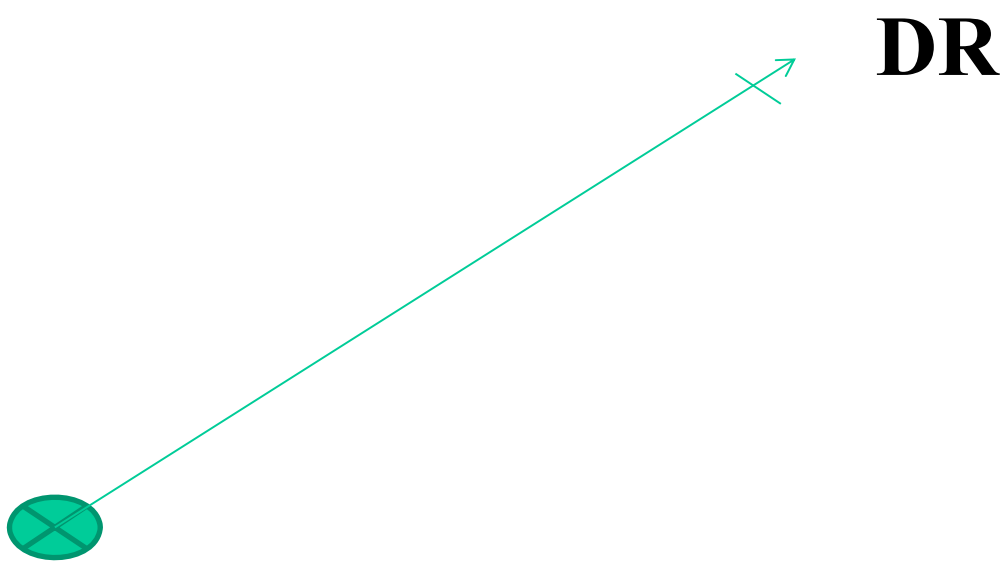
1. From a **position** draw in your **course and speed** for one hour. This brings you to a **DR** –a Dead Reckoning position- one hour later.
2. Apply your **Leeway**. This is the amount the wind will push your ship to one side of your intended track. This brings you to a **SP** –a Sea Position. This direction is the **Watertrack**.
3. From the **SP** construct the **current or tide** for one hour to bring you to an **EP** –an Estimated Position.
4. The line joining your original **Position** with your **EP** is your **C & SMG** – Course & Speed Made Good.
5. This is for one hour, for any other time value, simply extend (or shorten) the CMG line.
6. So, whilst your ship is heading in the direction of your DR, at the ship's speed, she is actually progressing along the CMG line at the SMG (called the **Groundtrack**).
7. **NB** Your Leeway should eventually be applied to the course in your answer book, not on your chart, to avoid confusion.

TOO MUCH!!!!!!!!!!!

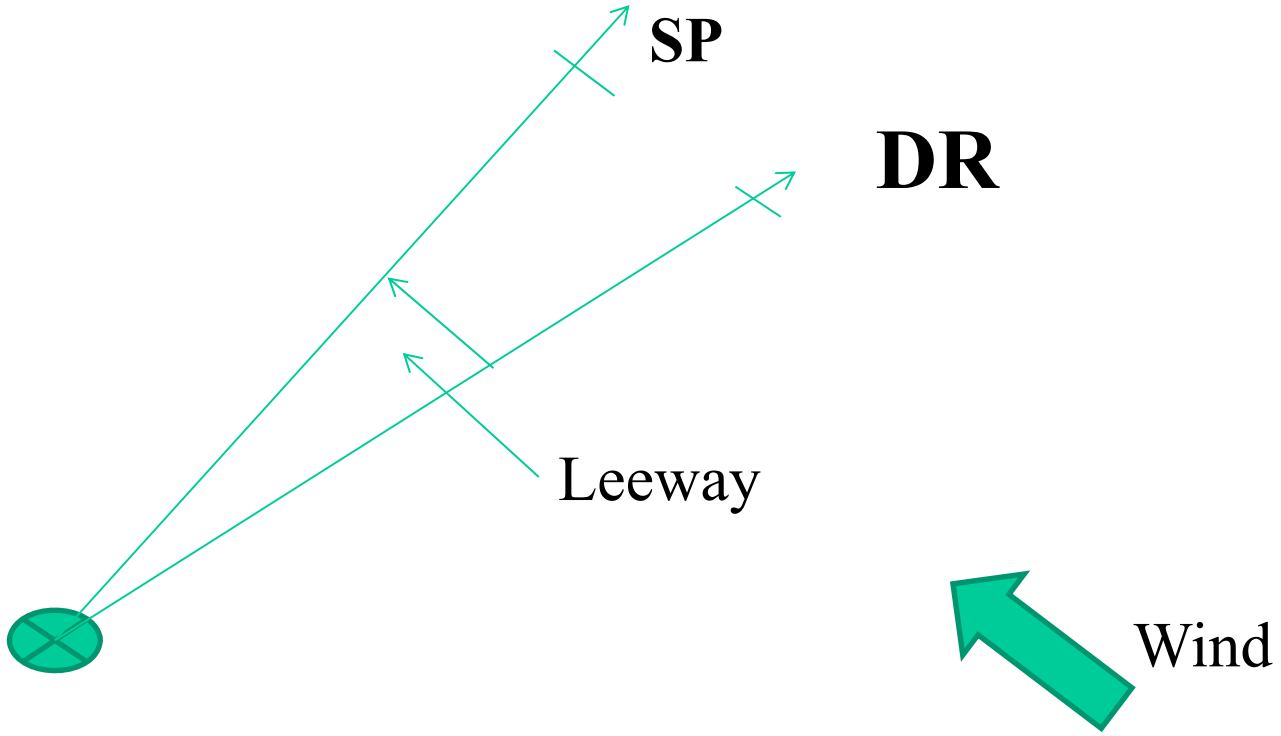
So let's take it step-by-step:-

(but all we are doing is solving a triangle!)

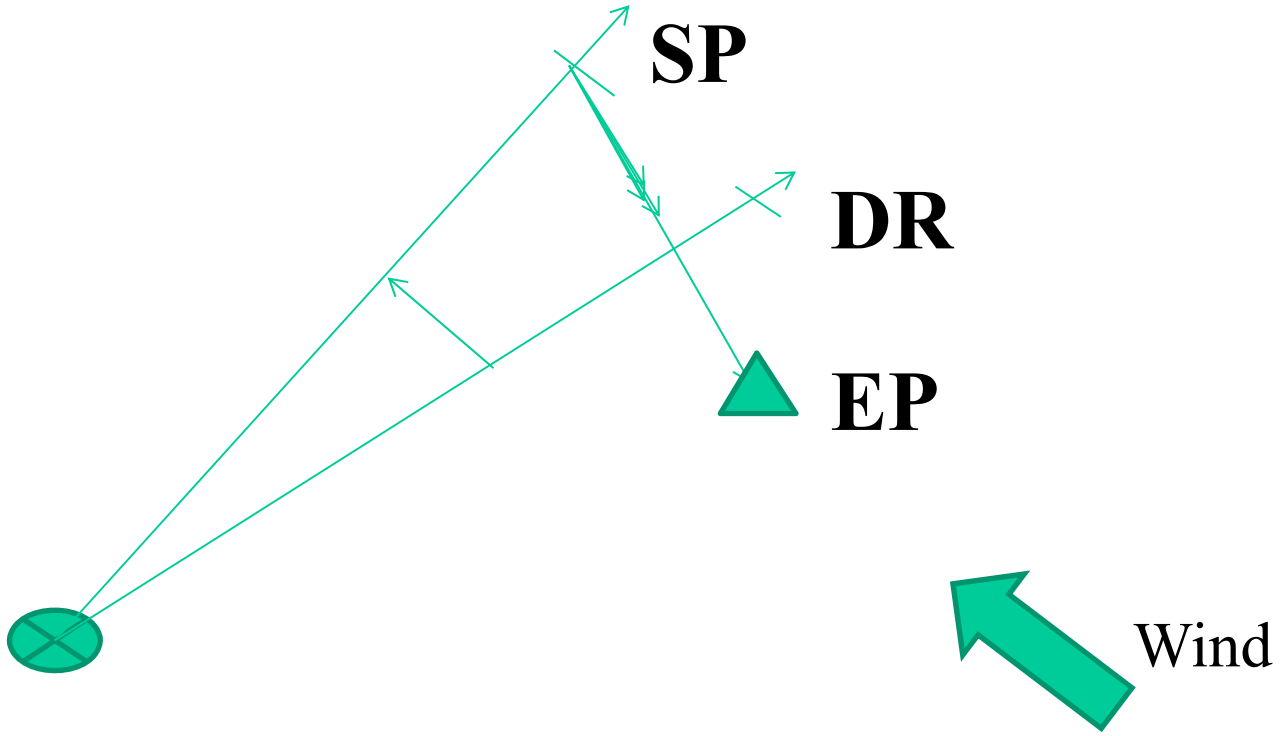
From a **position** draw in your course and speed for one hour. This brings you to a **DR** – a **Dead Reckoning** position- one hour later.



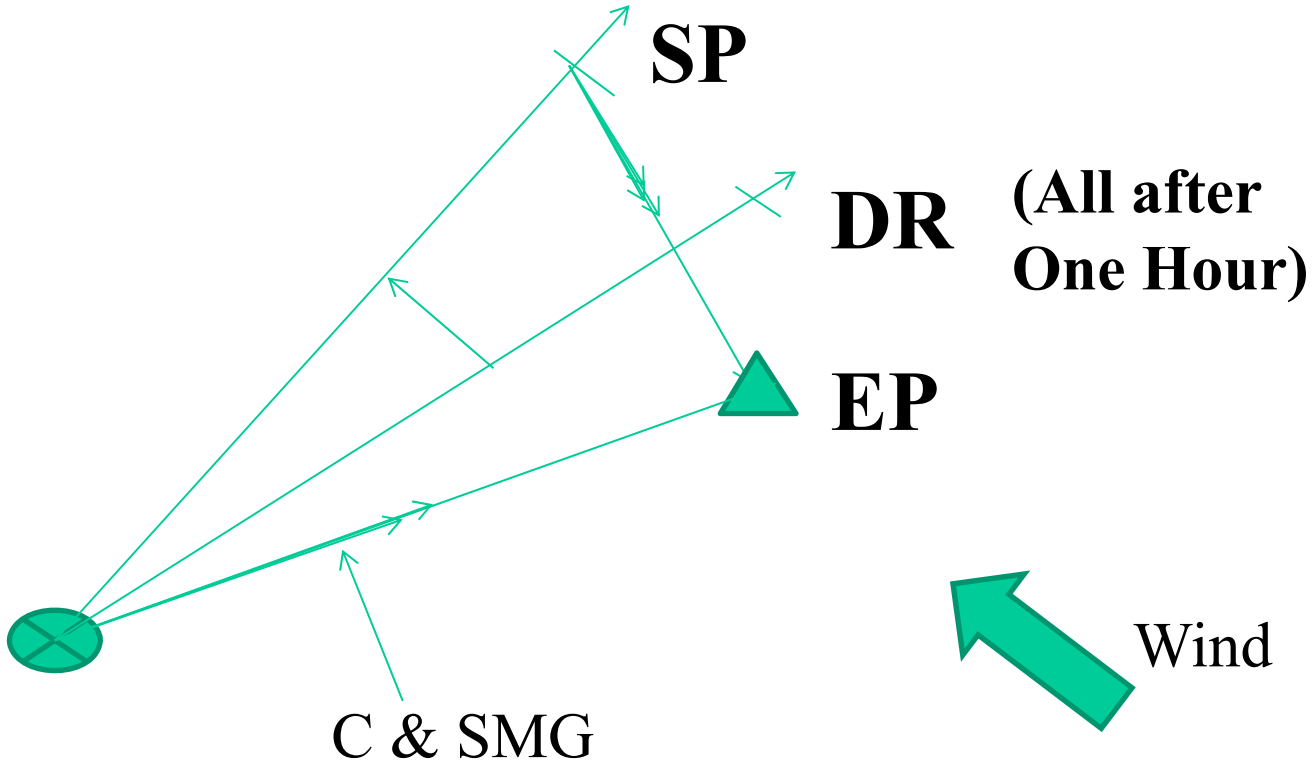
Apply your Leeway. This is the amount the wind will push your ship to one side of your intended track. This brings you to a **SP** –a **Sea Position**. This direction the **Watertrack**.



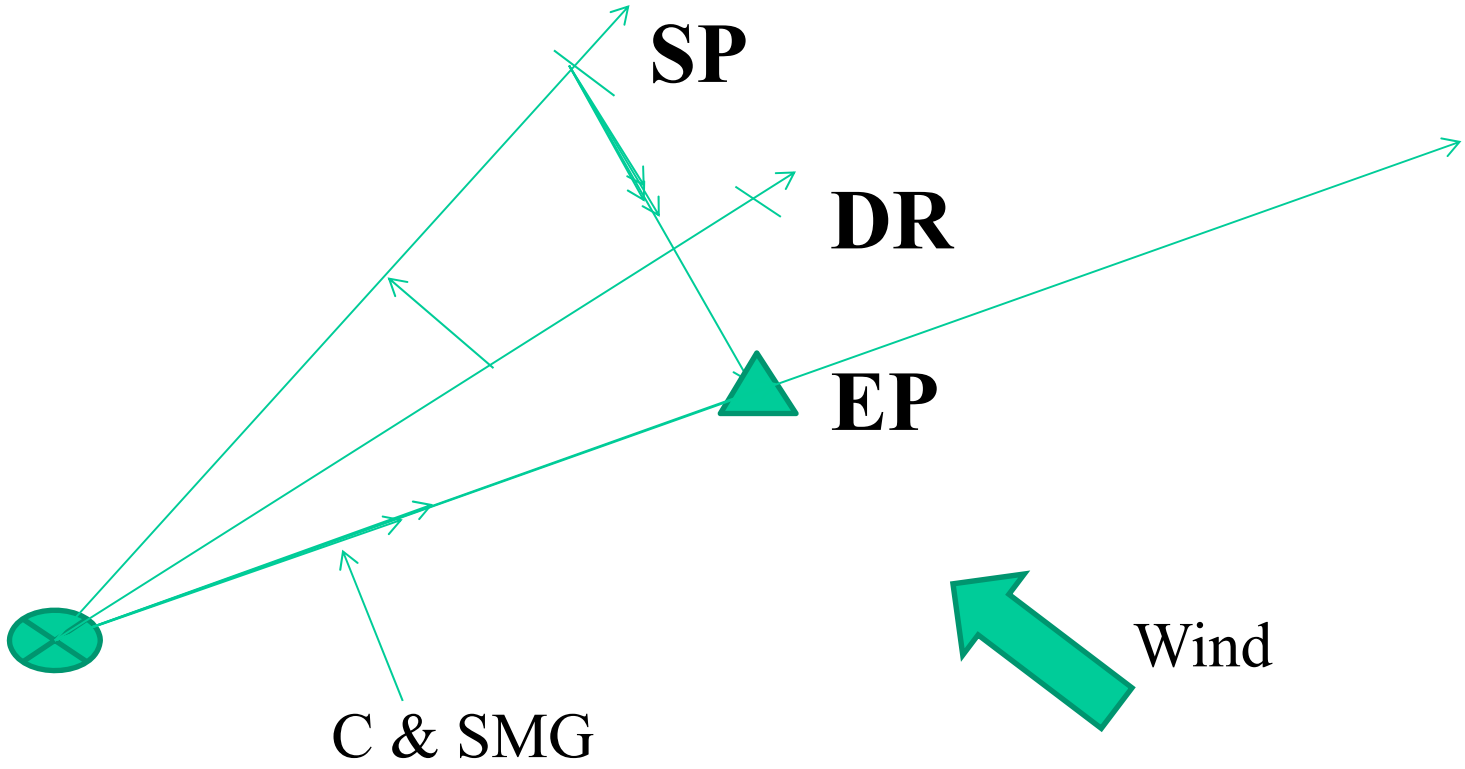
From the **SP** construct the current or tide for one hour to bring you to an **EP** –an **Estimated Position**.



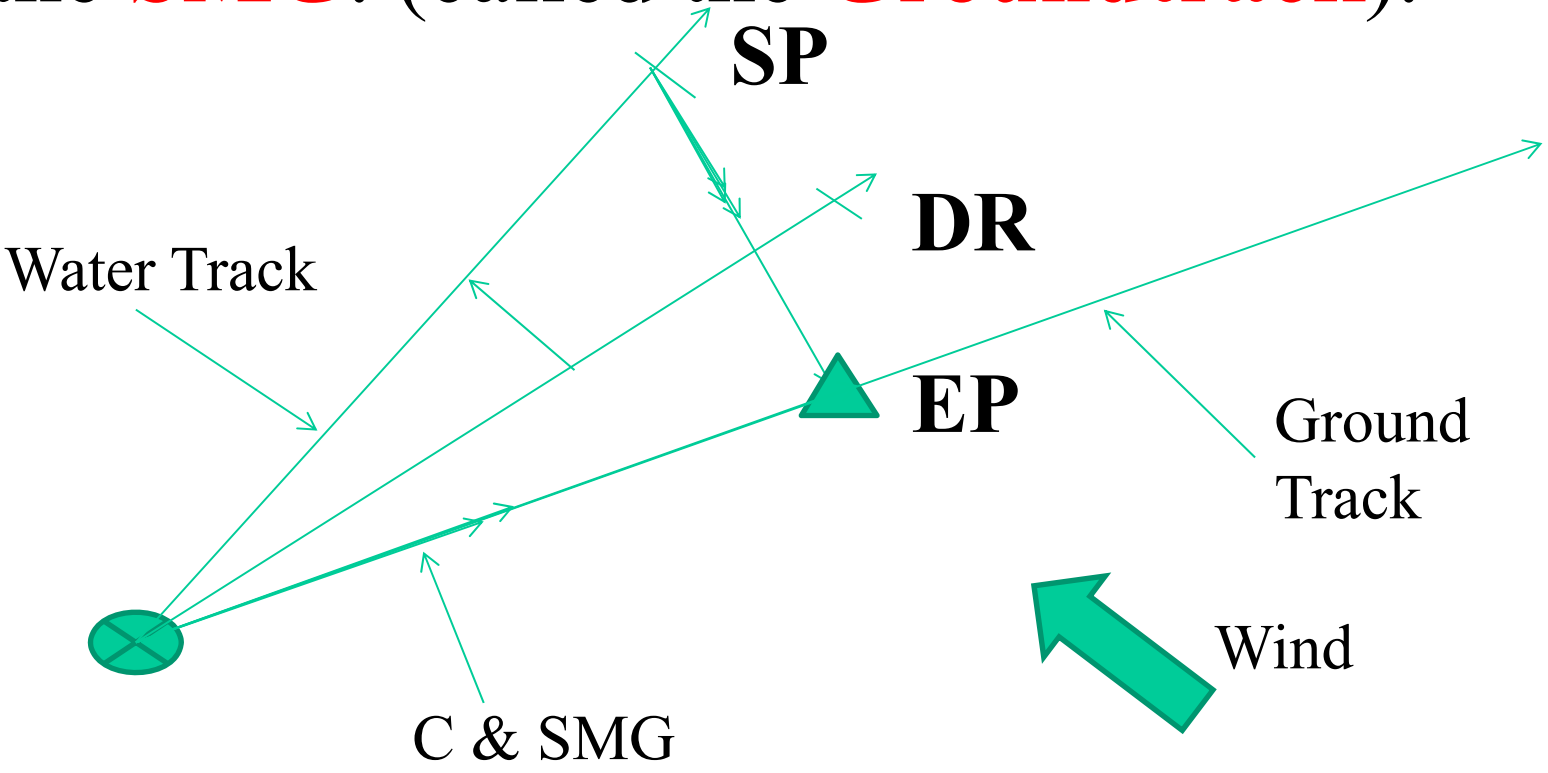
The line joining your original **Position** with your **EP** is your **C & SMG** – **Course & Speed Made Good**.



This is for one hour, for any other time value, simply extend (or shorten) the CMG line.



So, whilst your ship is heading in the direction of your **DR**, at the ship's speed, she is actually progressing along the **CMG** line at the **SMG**. (called the **Groundtrack**).



Recap:-

From	Starting Position
We Add	+ Course & Speed
To Get	DR (Dead Reckoning) Position
We Add	+ Leeway
To Get	SP (Sea Position)
We Add	+ Current &/or Tide
To Get	EP (Estimated Position)

But!!!

If I gave you a **start position**, a **course & speed** and a **2nd position**; could you find the value of the current?

Going back to the last slide, what is the difference between a DR & an EP?

The wind & tide!

So the **direction** of the **2nd position away from** the **DR** (for the **same time**) is the **direction of the current, the distance is the drift, & the distance divided by time is the rate**.

But!!! (ctd)

The wind & tide!

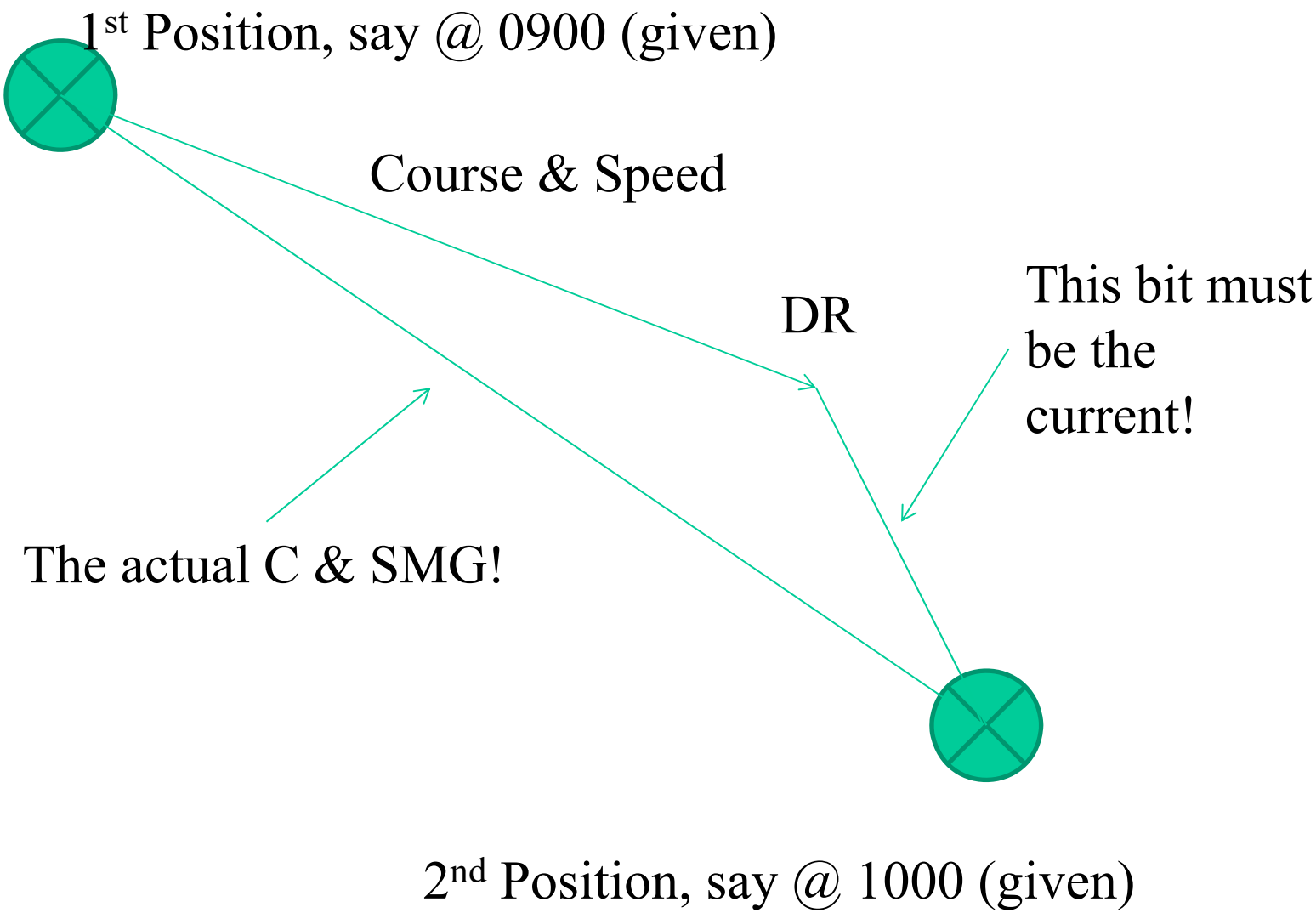
So the **direction** of the **2nd position away from** the **DR** (for the **same time**) is the **direction of the current, the distance is the drift, & the distance divided by time is the rate**.

All we (you!) are doing is solving a triangle!

When you were finding the C&SMG you found the third side, now I'm giving you the 1st & 3rd bits, -you are finding the 2nd one!

For the **“find the set rate & drift problem”**

From	Starting Position	**We have**
We Add	+ Course & Speed	**We have**
To Get	DR Position	**We can construct**
We Add	+ Leeway	(ignore it!)
To Get	SP (Sea Position)	
We Add	+ Current &/or Tide	**Is the 3rd bit of the triangle**
To Get	EP or 2nd position	**We have**


1st Position, say @ 0900 (given)
Course & Speed
DR
This bit must be the current!
The actual C & SMG!
2nd Position, say @ 1000 (given)

Recap:- (repeated –but worth it!)

From	**Starting Position**
We Add	**+ Course & Speed**
To Get	**DR (Dead Reckoning) Position**
We Add	**+ Leeway**
To Get	**SP (Sea Position)**
We Add	**+ Current &/or Tide**
To Get	**EP (Estimated Position)**

Recap:-

The Watertrack is the direction and speed after the effect of the wind has been taken into consideration.

The Groundtrack is the direction and speed after the effect of the wind and the current has been taken into consideration.

Wind & Current directions:

-of the **Wind** is where it is coming **FROM**.

-of the **Current or Tide** is where it is going **TO**.

==========

Set is the direction measured in **degrees**.

Drift is the distance measured in **miles**.

Rate is the speed measured in **Knots**.

Chartwork -

Easy!

Isn’t it?

If U RTFQ!

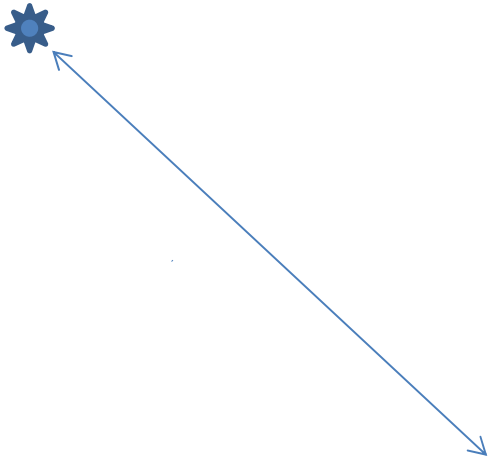
Seven Steps to solving the Transferred Position Line Problem

1. Draw the 1st Position Line (P/L) at the time of the 1st observation.
2. Choose any position on that line.
3. From that position run your course & speed (& leeway & current if applicable) an EP.
4. Transfer your 1st P/L through your EP.
5. Draw your 2nd P/L at time of 2nd observation.
6. Where (4) & (5) cross is your position at time of 2nd observation.
7. To find position at time of 1st observation, run your Course Made Good (CMG) back from (6).

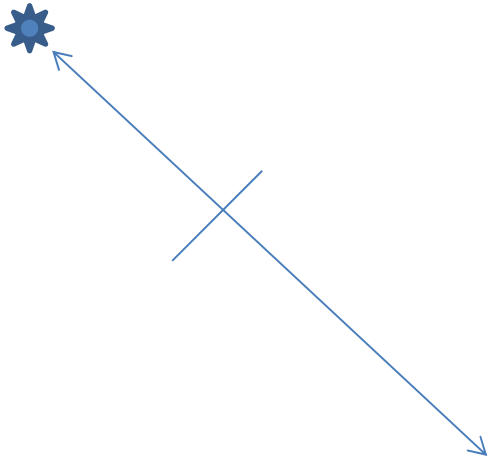
Too Much to handle in One Go?

Let’s take it step by step . . . . . .

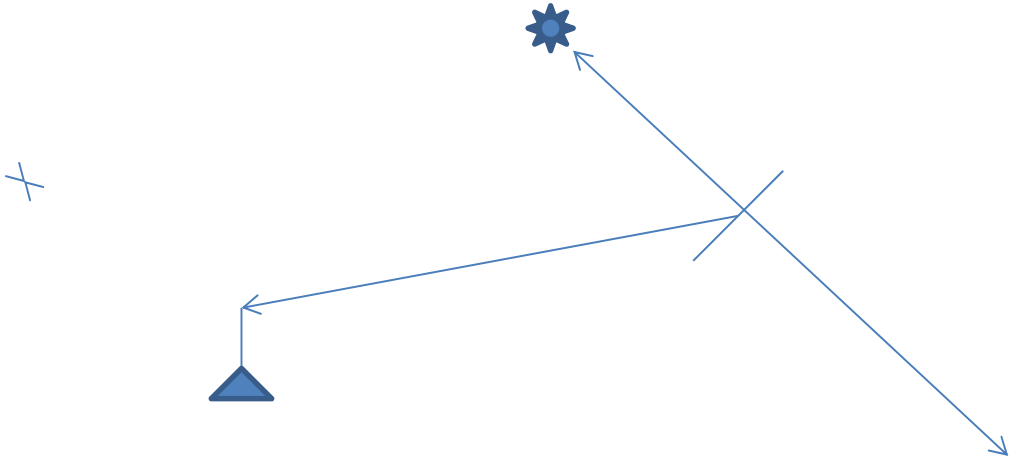
Draw the 1st Position Line (P/L) at the time of the 1st observation.



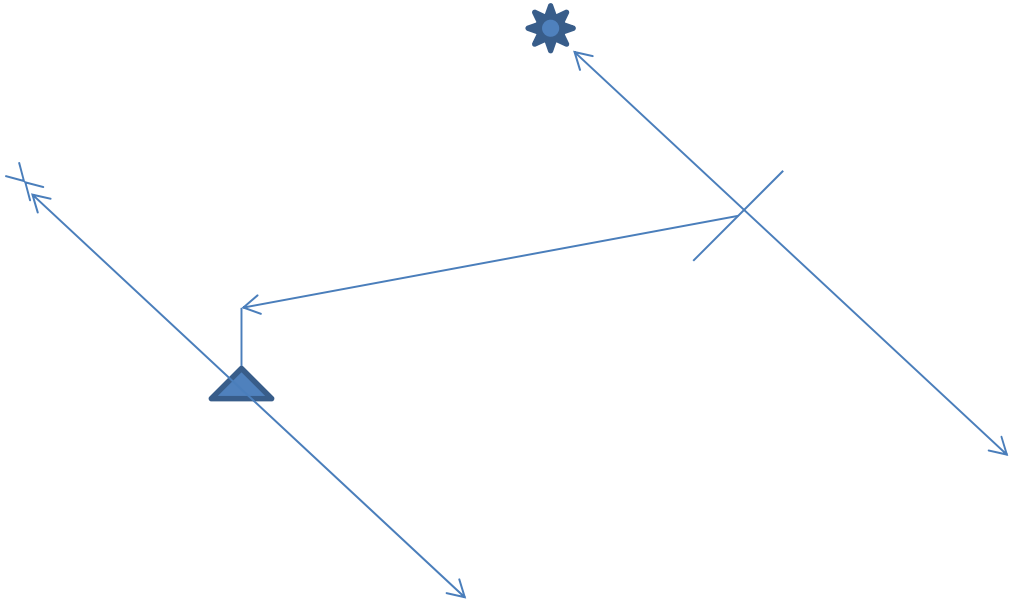
Choose any position on that line.



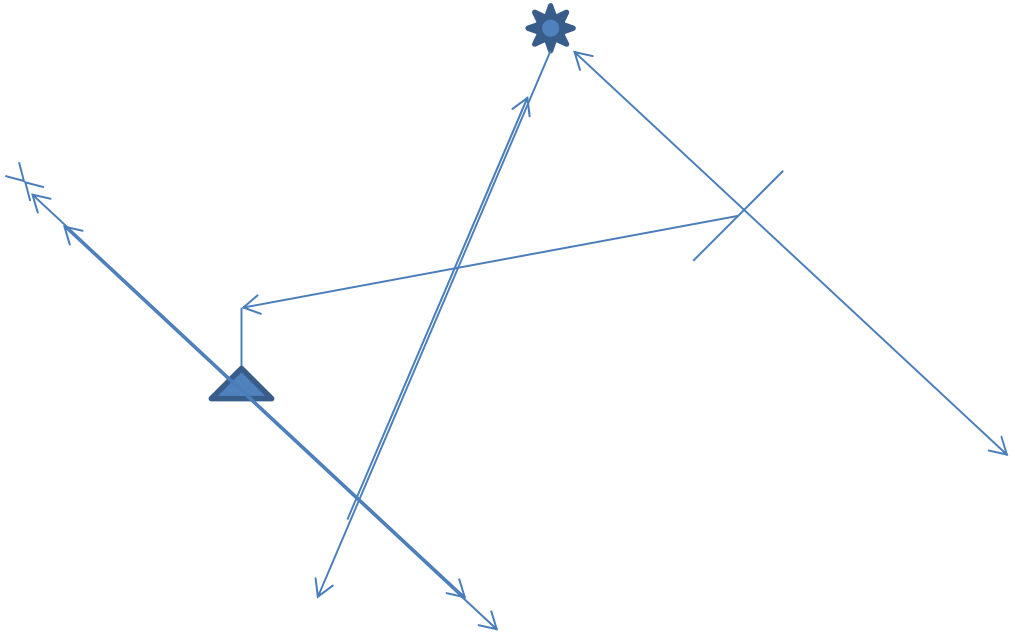
From that position run your course & speed (& leeway & current/tide if applicable) to an EP.



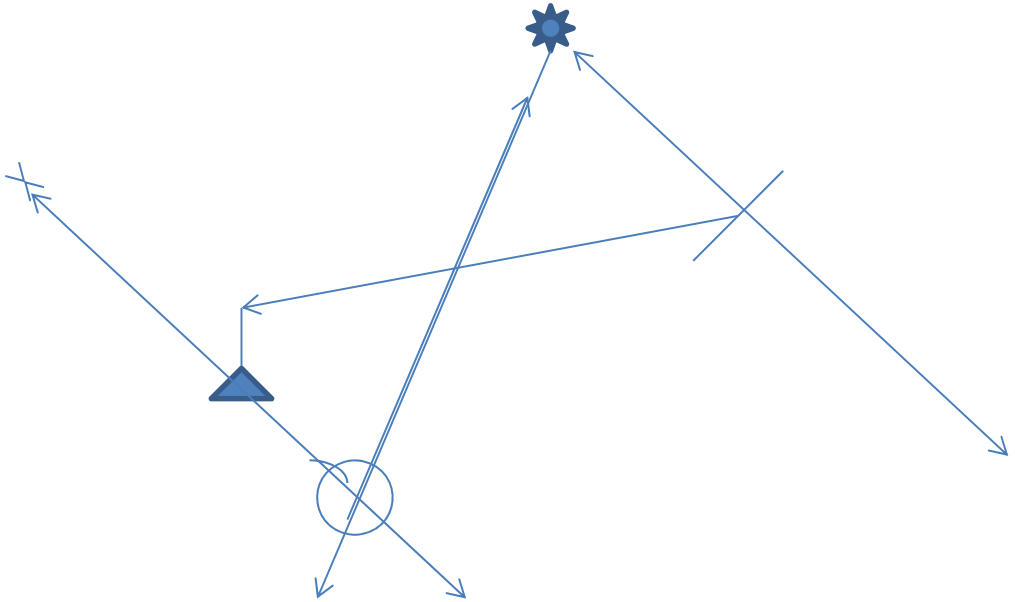
Transfer your 1st P/L through your EP.



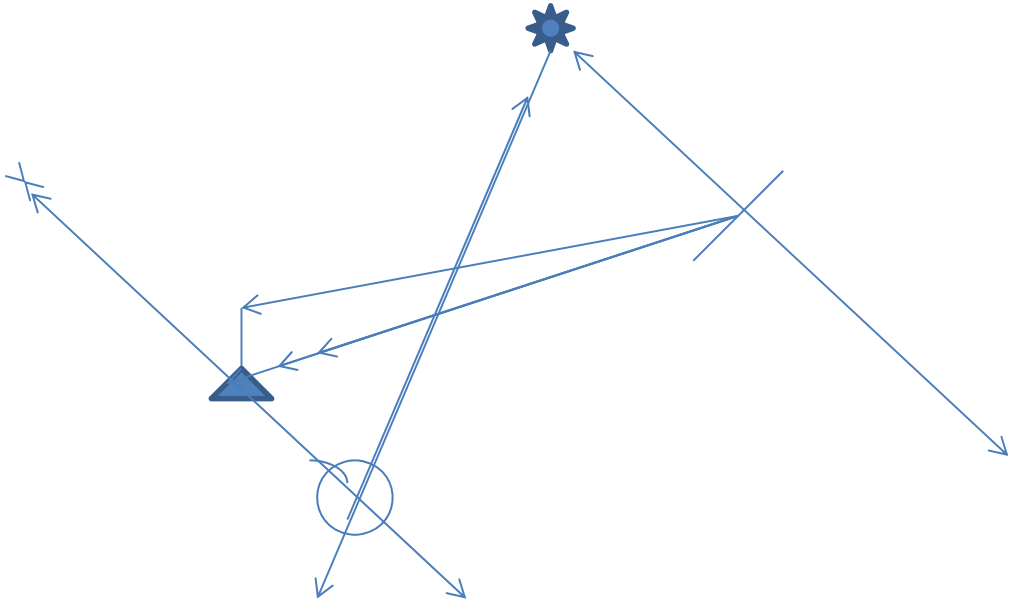
Draw your 2nd P/L at time of 2nd observation.



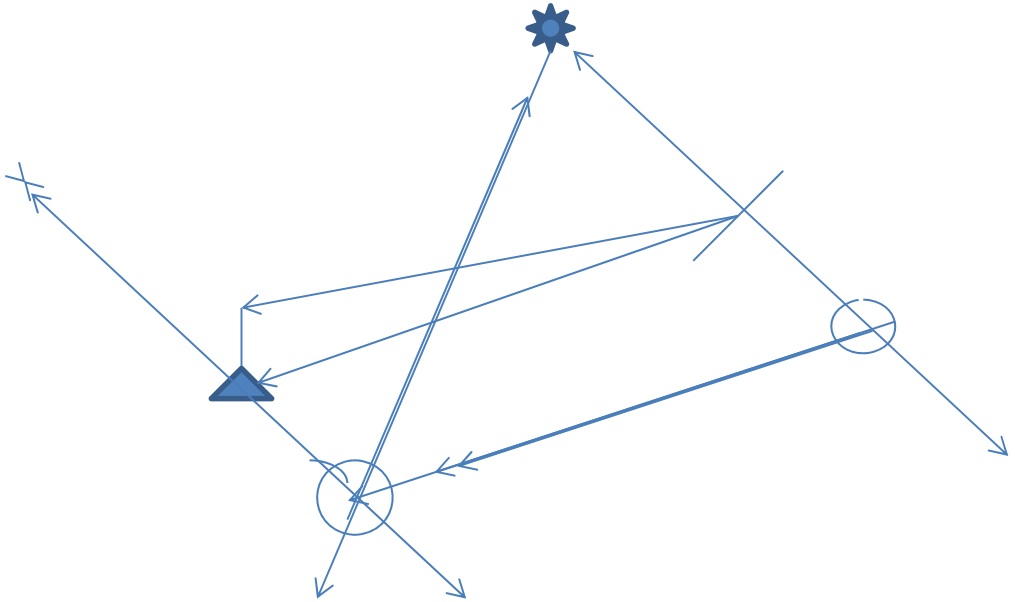
Where (4) & (5) cross is your position at time of 2nd observation.



Your C & SMG is from where you started to your EP.



Move Your C & SMG from your position back to find the position at the 1st observation.



This

Chartwork!

It’s ***EASY***

Isn’t It?

Eight Easy Steps to solving the Transferred Position Circle Problem

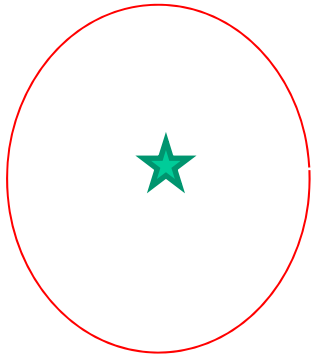
1. Draw the 1st Position Circle **(P/C)** at the time of the 1st observation.
2. **Pick the position of the observed object (ie the centre of the circle).**
3. From that position run your course & speed (& leeway & current if applicable) to an **EP**.
4. Transfer the centre of your 1st P/C to your **EP,** & draw your Transferred Position Circle around your EP**.**
5. Draw your 2nd P/C at time of 2nd observation.
6. Where these circles cross is your position at time of 2nd observation.
7. To find position at time of 1st observation, run your Course Made Good **(CMG)** back from your positions.
8. You will find that there are two positions where the P/Cs cross. **The solution will be given as a clue in the question.**

Too Much Too Fast?

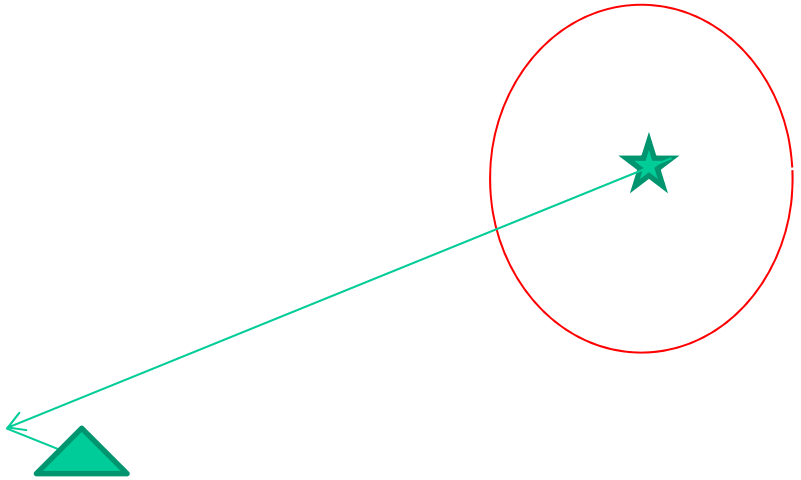
OK

Step by step

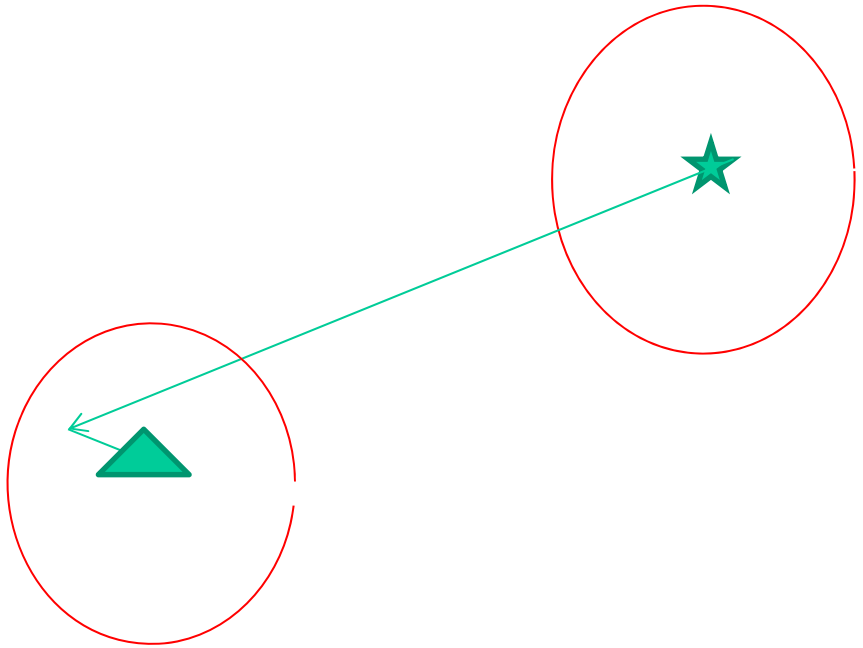
Draw the 1st Position Circle **(P/C)** at the time of the 1st observation.



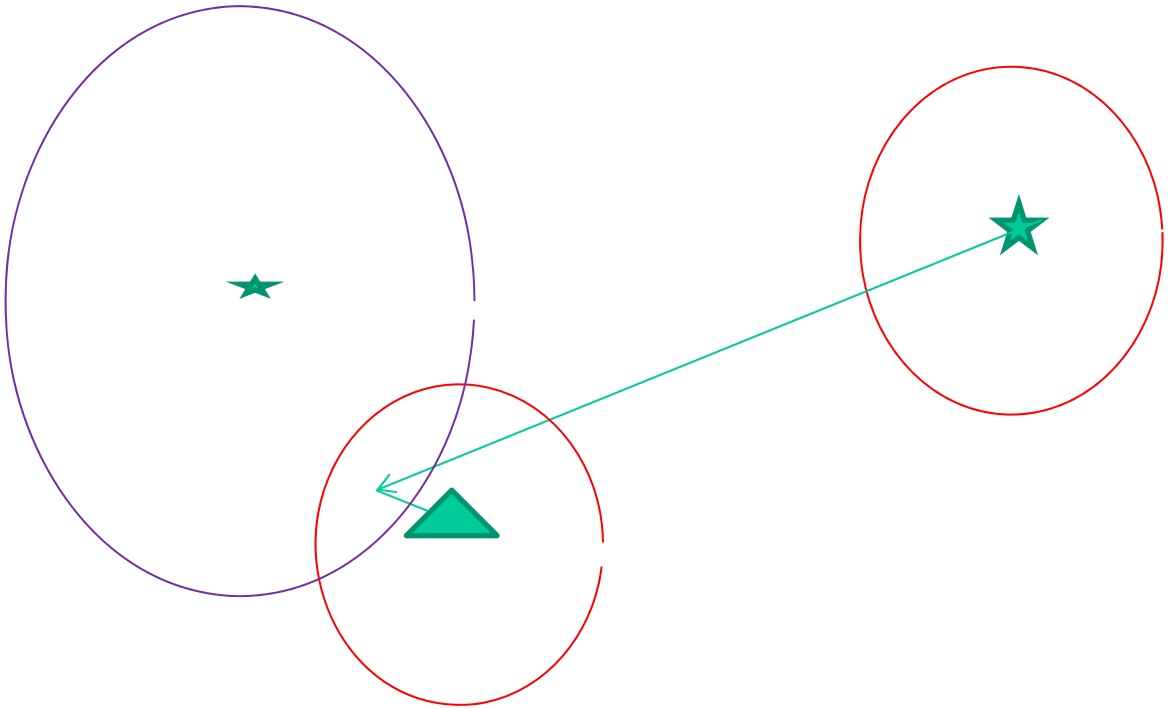
Pick the position of the observed object (ie the centre of the circle). From that position run your course & speed (& leeway & current if applicable) to an EP.



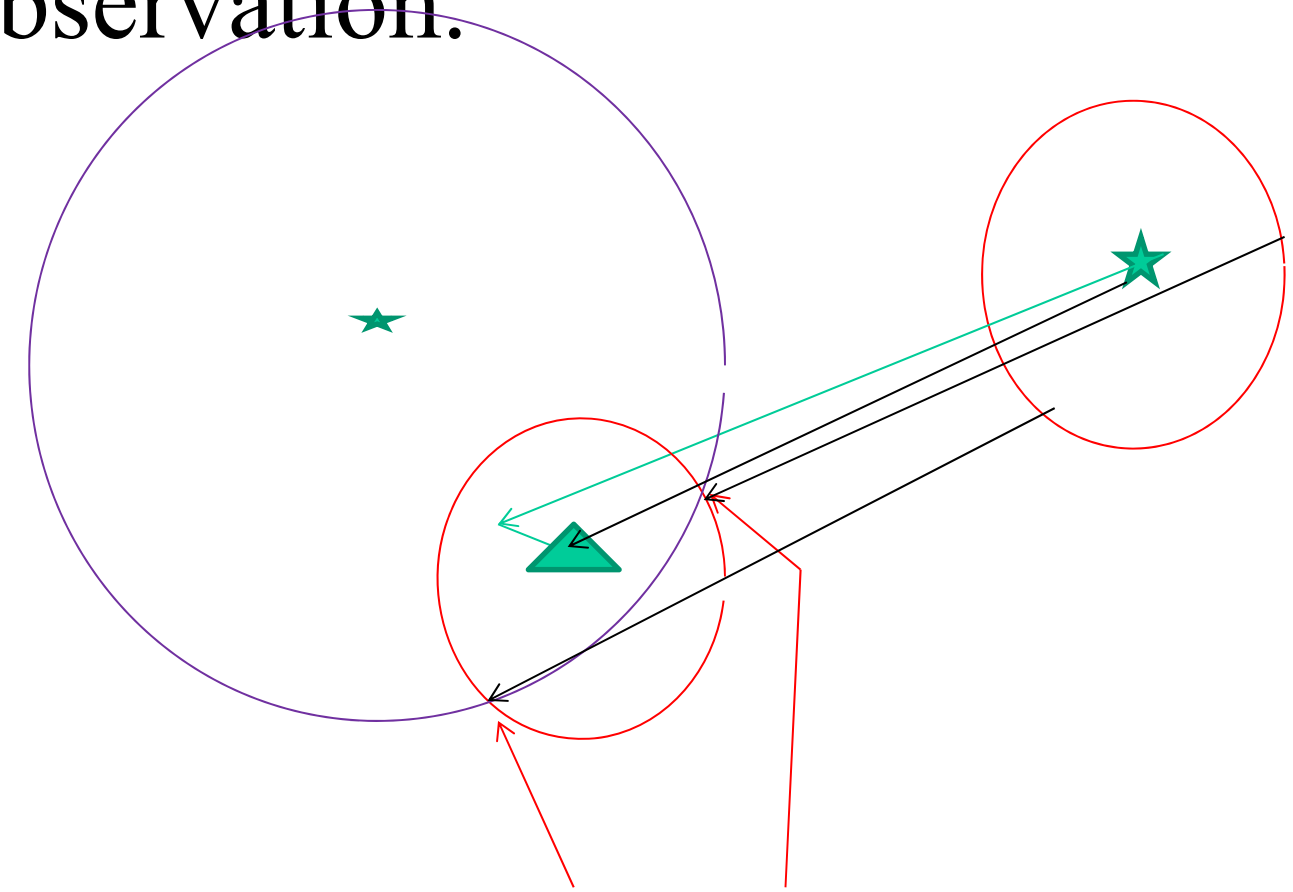
Transfer the centre of your 1st P/C to your EP, & draw your Transferred Position Circle around your EP.



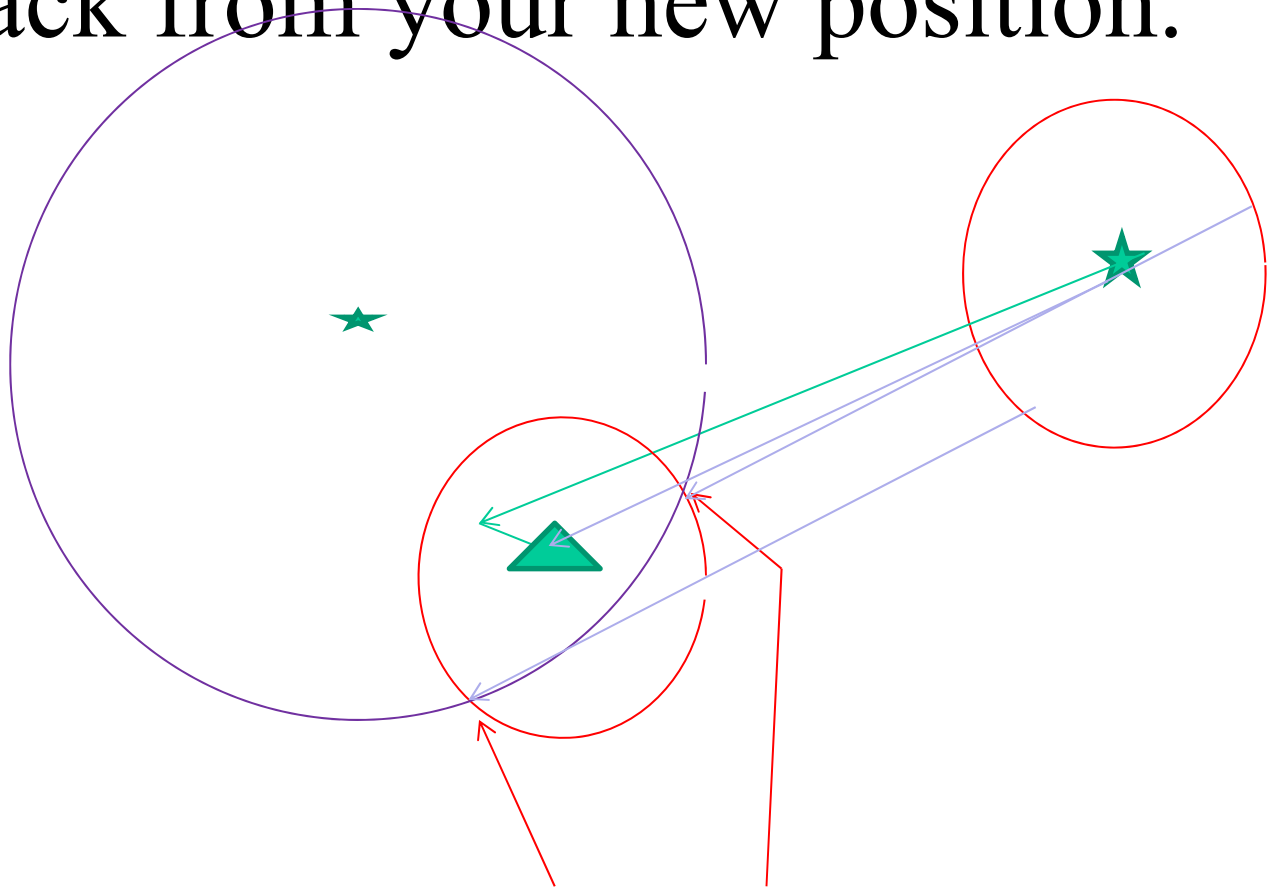
Draw your 2nd P/C at time of 2nd observation.



Where these two circles cross is your position at the time of 2nd observation.



To find your position at the time of the 1st position, run your C&SMG back from your new position.



Important!

Please remember:-

Obviously (?), the two circles will intercept twice, the clue as to which is your position will be obvious (ie one will be on land) or the question have the information. (eg on port side).

Important! (2)

Please remember:-

With the **T/P/L** you could choose **anywhere** on the 1st bearing to run to your EP, but with a **T/P/C** you have to run to your EP from **the centre of the circle (ie the object that the range is taken from, eg lighthouse)**.

TPC – Example Q – Chart 5047

At 0800 vessel observes Scarweather Lt Vl at a range of 5Nmls to starboard.

Vessel is steering 245°T at 12kts. Current is setting 300° at 2kts.

At 1000 vessel observes Lundy Is N Lt Hs at 10Nmls.

What are 0800 & 1000 positions?

0800 51-26.4N 3-48.1W

1000 51-18.3N 4-27.8W

TPC – Example Q – Chart 5047

At 1700 Helwick Lt Vl is observed at a distance of 6Nmls on the starboard quarter.

Vessel is steering 190°(T) at 10kts. The current is setting 090° at 1.5kts.

At 1900 Hartland Point is observed at a distance of 8Nmls.

What are the 1700 & 1900 positions?

1700 51-25.7N 4-20.4W

1900 51-06.2N 4-21.1W

TPC – Example Q – Chart 5047

At 1300 Bull Point is observed at a distance of 4Nmls.

Vessel steering 230°(T) at 8kts.

Currents setting 120° at 1kt.

A NW'ly wind is causing 5° leeway.

At 1430 Hartland Point is observed at a distance of 4Nmls. Find the 1300 & 1430 positions.

1300 51-13.9N 4-17.6W

1430 51-04.9N 4-28.9W

Easy this chartwork!

isn’t it?

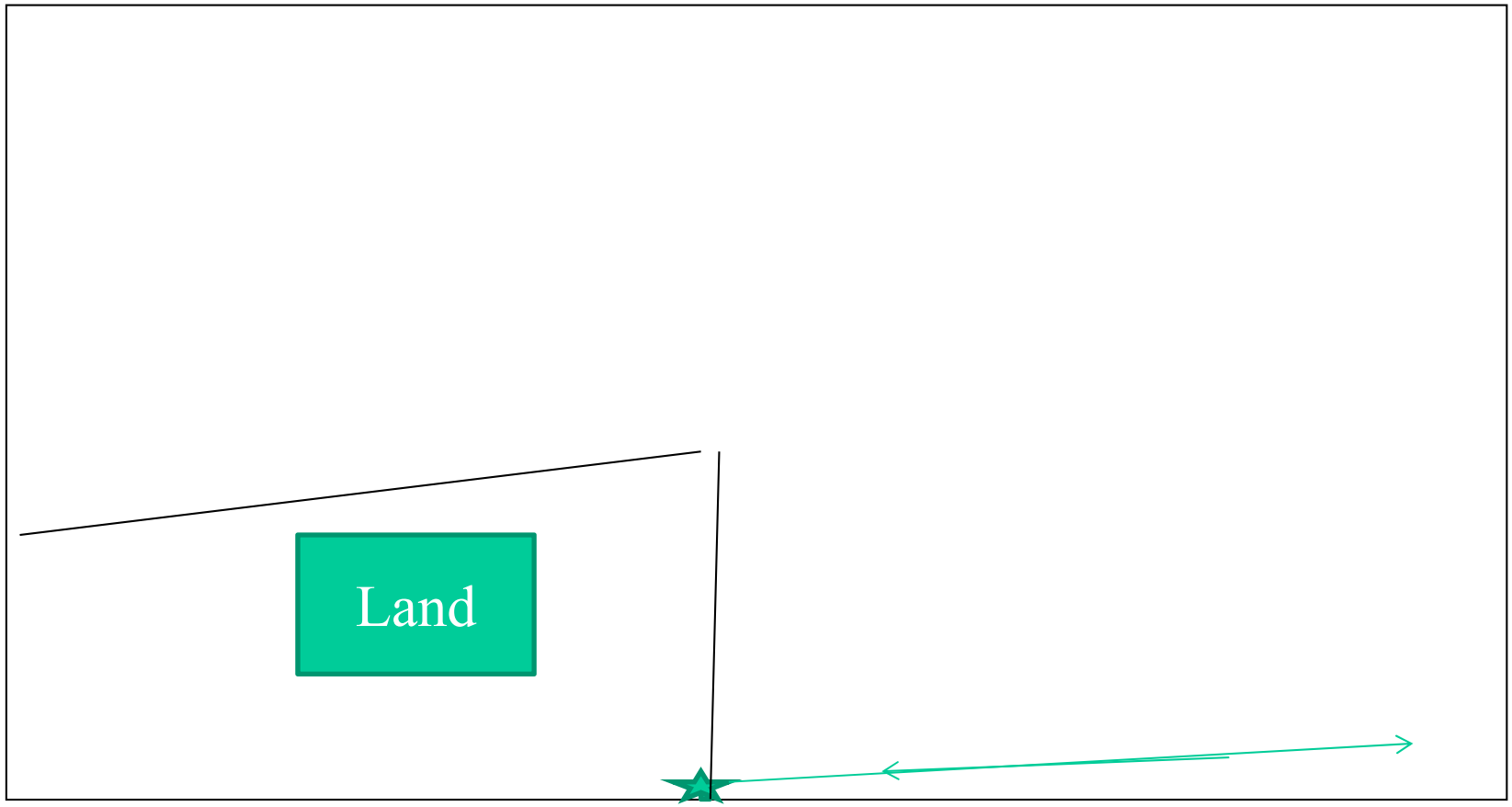
How to solve the "Single Alteration" Problem In Six Easy steps

A variation on a

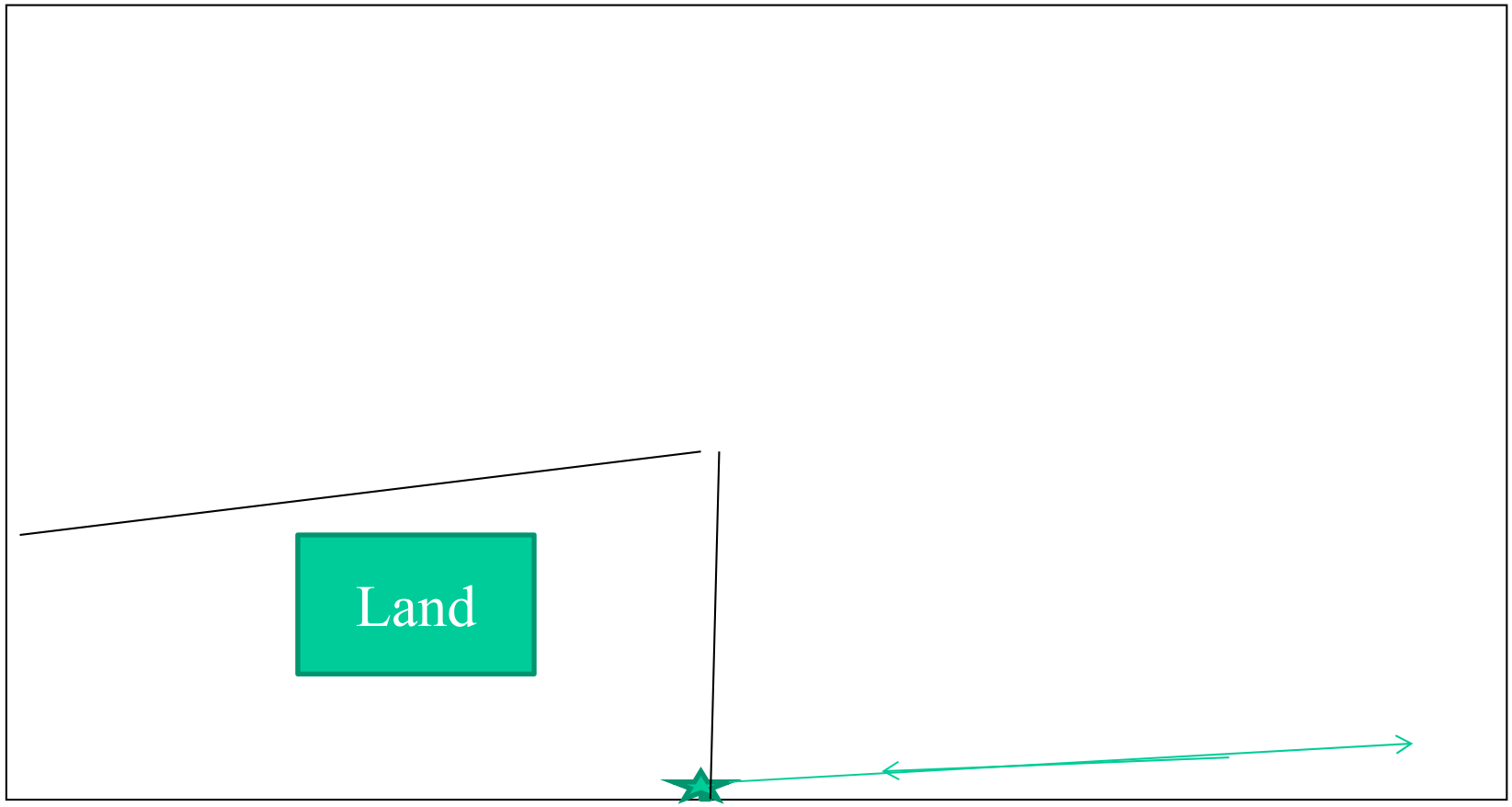
"Transferred Position Line"

theme.

You will be given a Position Line.



You will be asked “When to make a single alteration to pass .” EG 3Nmls North off the headland



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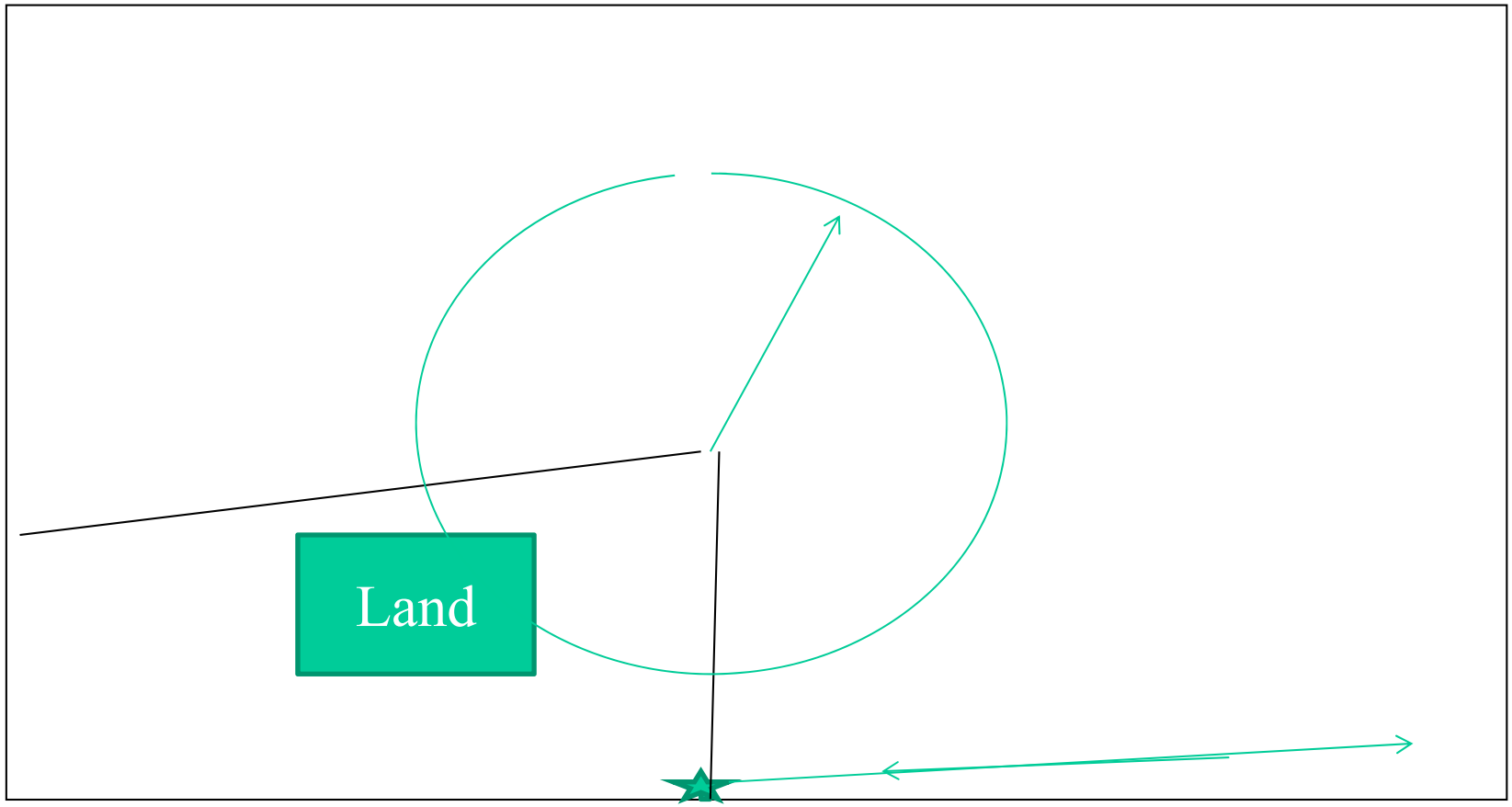
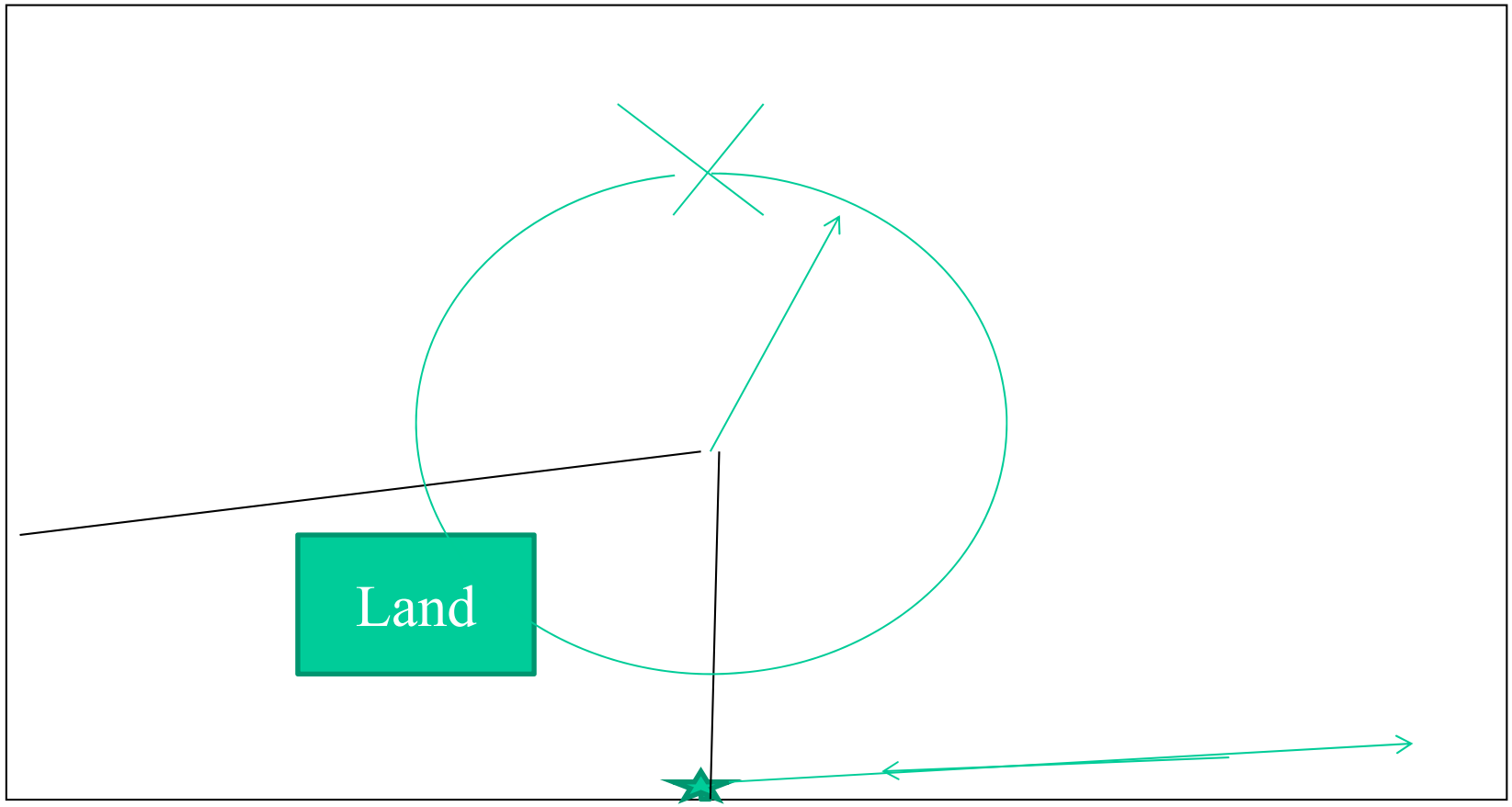
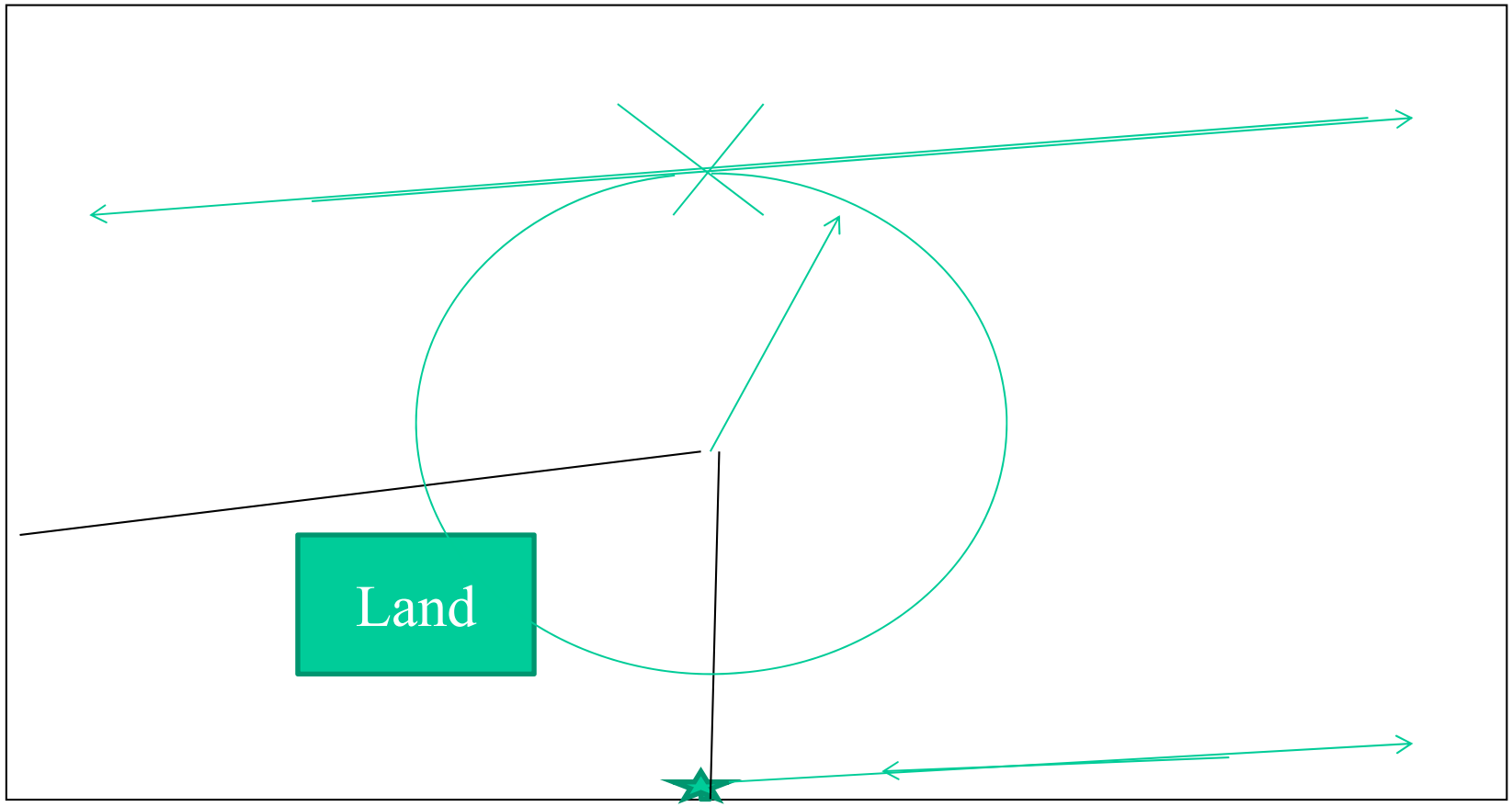


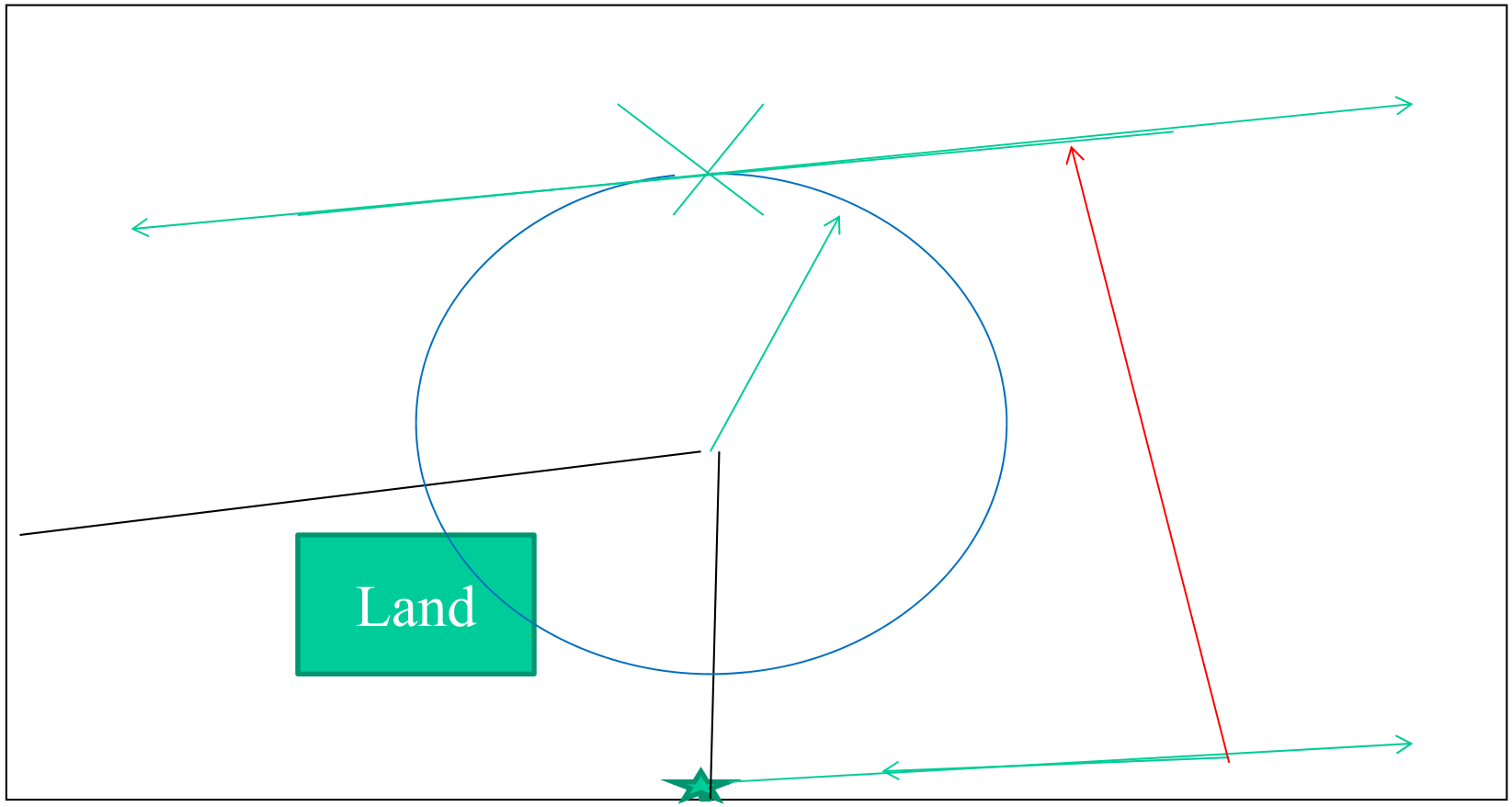
Draw in the position you are required to achieve.



Transfer the P/L through your required position.

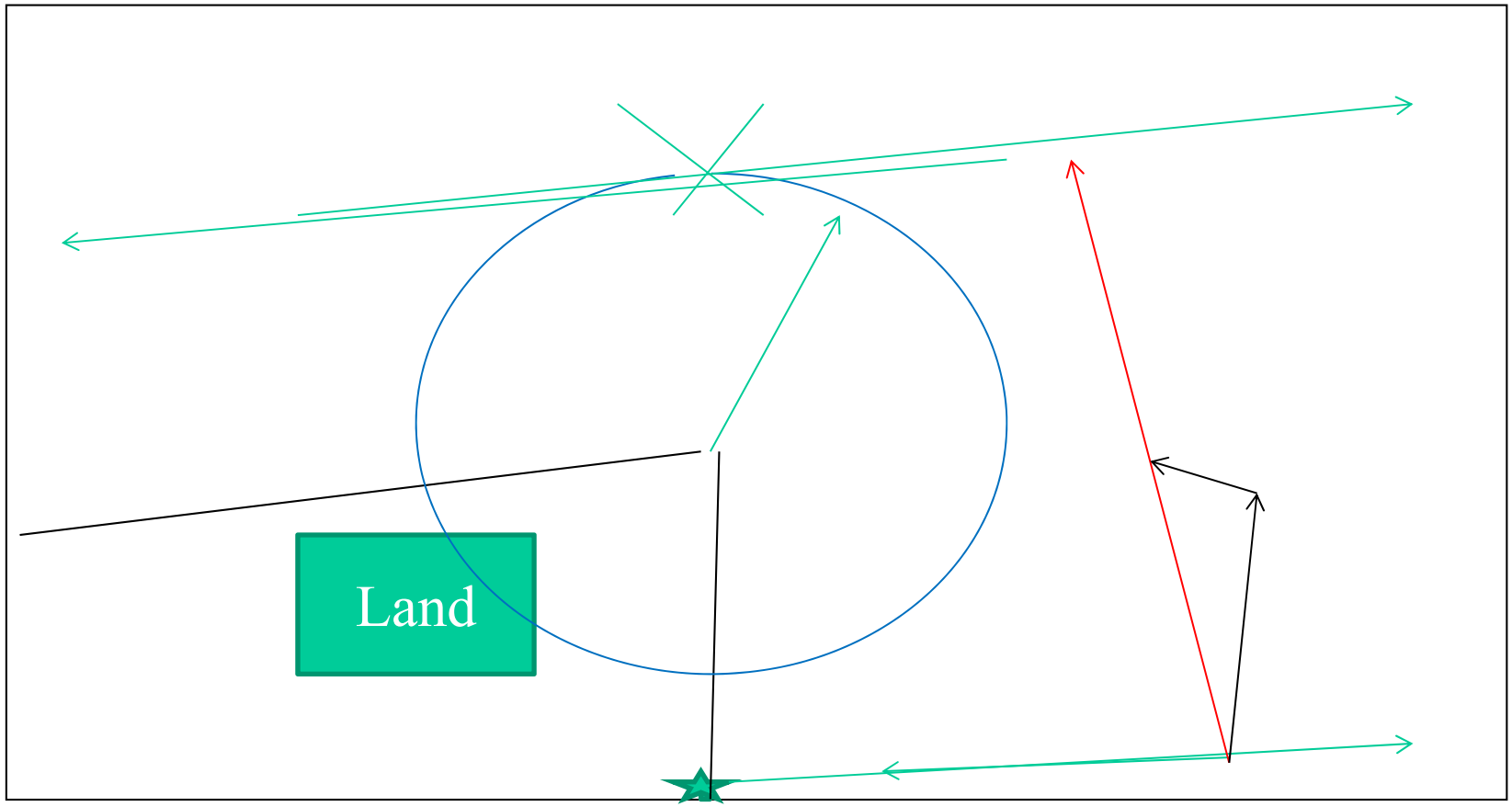


The distance between these two position lines is the distance you have to “Make Good”.

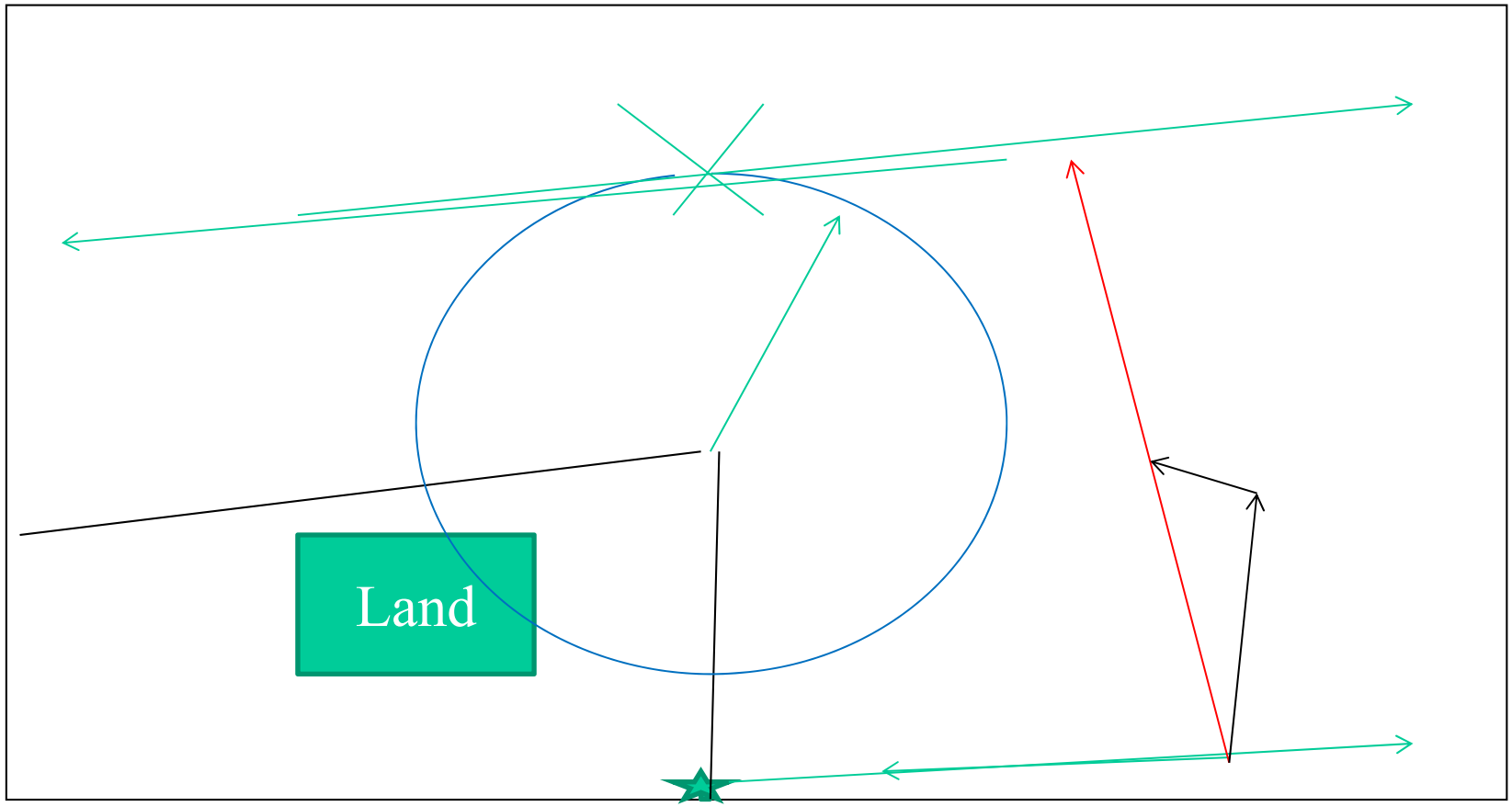


How long is it going to take to "Make Good" this distance?

Construct your 1Hr triangle to find your C & SMG.



How long is it going to take?
Distance divided by Speed Made Good = Time.



When you reach the T/P/L, you can alter course, the new Course to be Made Good will be the same as your original bearing.

You may have to:-

- Counteract for current and wind to achieve this new course.
- Convert it to a compass course.

When you reach the T/P/L, you can alter course, the new Course to be Made Good will be the same as your original bearing.

You will have to:-

- Counteract for current and wind to achieve this new course.
- Convert it to a compass course.

Easy this Chartwork, Isn't it?

If you Read The Question!

Ten Steps to find a P/C from a Horizontal Sextant Angle (With 2 you get a Position!) (& with a Position you can find the Deviation for the Ship's Head!)

1. You will be given the bearings of two charted objects.

NB These bearings will not be "True" ie they may be "Compass" or "Relative"

so they can't be put on the chart –can they?

2. So, you **need the angle between** these two charted objects.
3. Construct a **Baseline** between the two objects.
4. Subtract the observed angle from **90**.

5. From each of the objects, measure that angle from the baseline towards you.
6. If your angle ends up as zero, your centre is in the middle of the base line.
7. If your angle is negative, measure it on the far side of the base line.
8. Where these **two lines cross is the centre of your circle.**
9. Draw the circle with the metal bit on the centre and the pencil bit on either object.
10. This circle is your Position Line.

Too Much? Too Fast?

OK

Let’s take it step by step.

You will be given the bearings of two charted objects.

We are only looking for the angle between them.

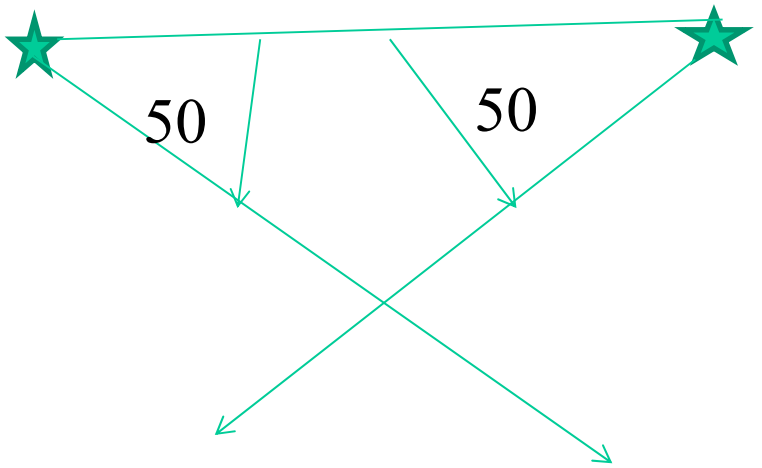
For Example: 40°

Construct a Baseline between the two objects.

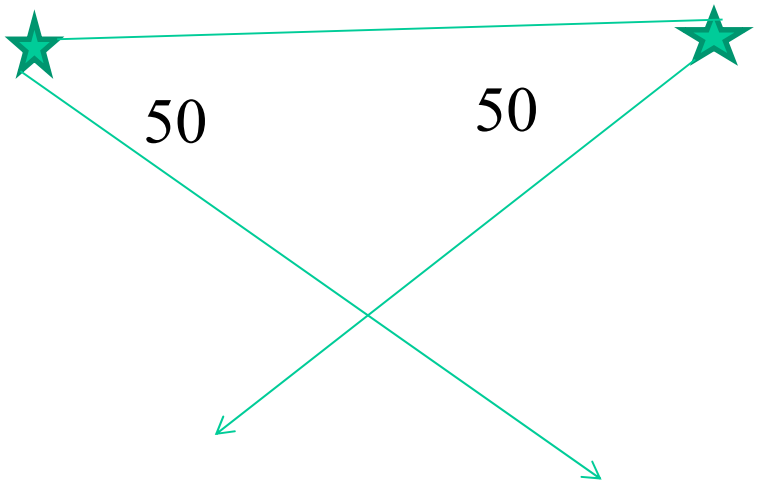
Subtract the observed angle from 90.

$$90 - 40 = 50$$

From each of the objects, measure that angle from the baseline towards you.

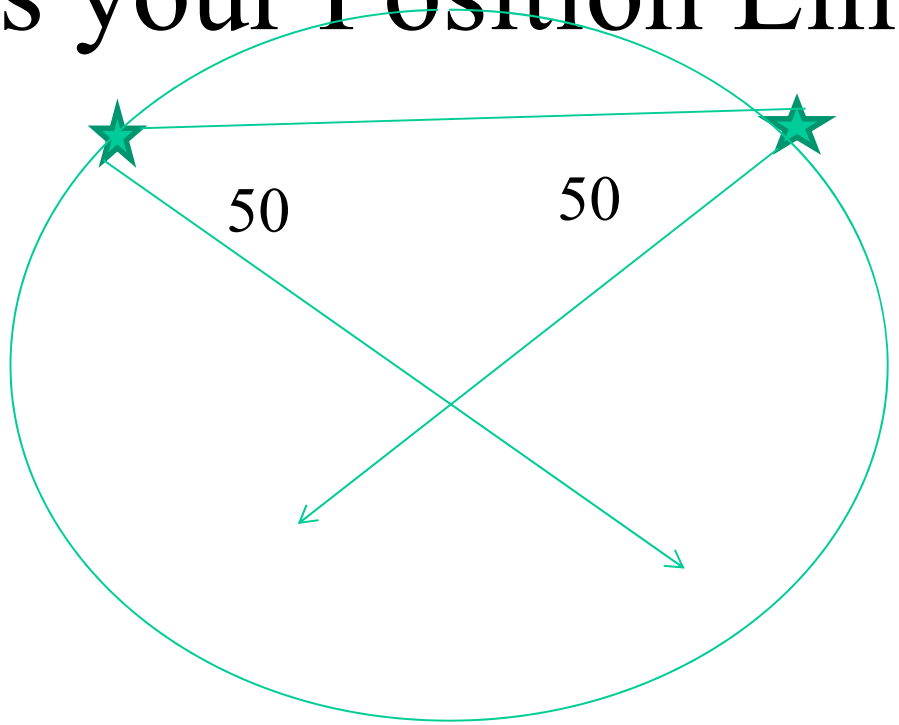


Where these two lines cross is the centre of your circle.

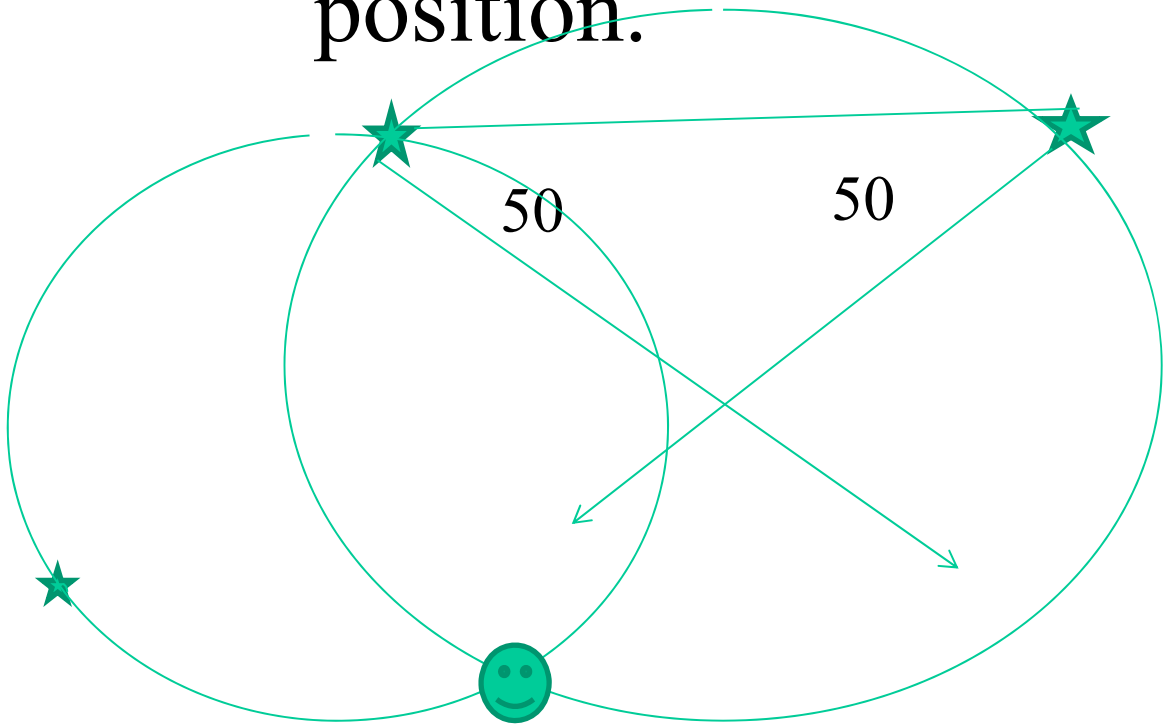


Draw the circle with the metal bit on the centre and the pencil bit on either object.

This circle is your Position Line.



So now we have a position circle;
If another subtended angle is given we can construct a 2nd circle.
The two circles will cross, giving us a position.



Well worth repeating:-

If subtended angle:-

- **Is less than 90, (ie "90–angle" is +ve) centre of circle is towards you,**
- **Is 90, (ie 90-90=0) centre of circle is on the base line.**
- **Is more than 90, ("90-angle" is –ve) centre of your circle is on other side of base line.**
- **Is 180, your base line is your position line!**

Finding Deviation for Ship's Head

If you were given **Compass Bearings**:-

From the position obtained, a **True bearing of the object can be measured on the Chart.**

Compare this True with the Compass to find the **Compass Error.**

Apply the **Variation** to get the **Deviation** for the ship's head.

Proof "Angle at centre of circle between two objects on the circumference is twice the angle at the circumference".

E.G.

Angle at circumference is 40deg.

Thr4 angle at centre is 2 x 40 = 80deg.

Take Triangle ABC of centre (A) and both objects (B) & (C).

Degrees in a triangle = 180

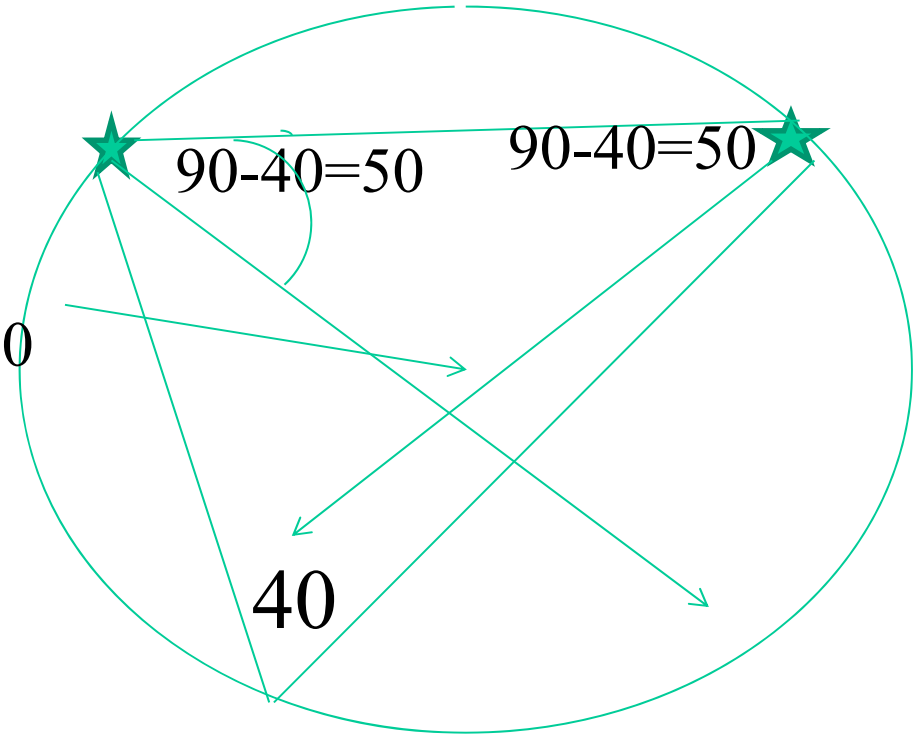
If angle at centre (A) = 80, other two (B) & (C) must add upto 180 – 80 = 100

Both sides (centre to each object) (AB & AC) are equal, thr4 both angles (ACB & ABC) must be equal.

So each angle from the baseline is 100 / 2 = 50.

The Proof

-As if you didn't believe me!



2 x 40 =80 &
180-(2x50)=80

Now try some more

Q6

Caldey Is Lt	004°C
Helwick Lt Vl	076°C
Lundy Is N Lt	184°C

What is Deviation? (Variation as per chart)

(51-27.5N 4-41W. Devn 1.5E)

Q7

Lundy Is N Lt	276°R
Bull Point Lt Hs	103°R
Hartland Point Lt Hs	215°R

What is the symbol?

(51-12.6N 4-22.4W

Wreck dangerous to surface navigation depth of 18.3 m obtained by dragwire)

Q8

St Gowan Lt Vl	Abeam to port
Helwick Lt Vl	Dead Ahead
Lundy Is N Lt Hs	10° Abaft Strbrd Beam

Position?

(51-20N 4-47W)

Q9

Bull Point Lt Hs 188°C

Helwick Lt Vl 311°C

Mumbles Head Lt Hs 031°C

Position? What is nature of sea bed?

Var = 4°W, What is Deviation?

(51-21.8N 4-09.6W. Shells Shingle.

Devn = 5°E)

Easy this Chartwork, Isn't it?

If you Read The Question!

The Vertical Sextant Angle

1. Imagine the triangle ABC, where A is you, B is the light, & C is the water level beneath the light.
2. You will be given the angle subtended when the sextant brings the light down to the sea level (Angle A).
3. We know the minimum height of the light –it is given on the chart (BC).
4. If we take the angle at the base (C) as a right-angle, then
5. **Tan A = height / distance**
6. Transposing this formula we get
7. **Distance = height / Tan A**
8. Don't forget that you measured the height in metres, so the distance will also be in metres. Divide by 1852 to get Nautical Miles.

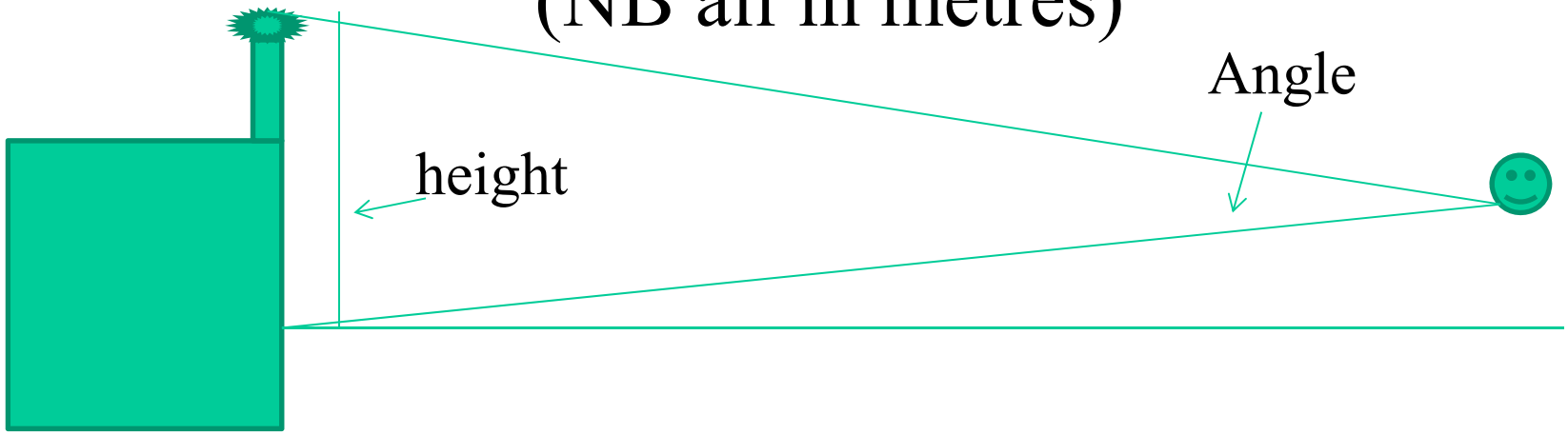
Do I need to explain it?

Do I need to explain it?

We know the height, we measure the angle, we take the angle at the cliff to be 90°.

Simple trig! (tan angle = h / d)

(NB all in metres)



A quick example

Lundy Island South Lt Hs is observed having a **VSA** (Vertical Sextant Angle!) of 0°19.7’ How far is the ship away from the lighthouse?

LIS height is 53m **(from the chart!)**

So we have: **h / d = Tan angle**

We want **d** so **h / Tan angle = d**

53 / Tan 0°19.7’ = 9248 (wow!)

Don’t forget: the lighthouse is measured in metres, so is the distance!

So **divide by 1852** (metres in a Nml) = **5Nmls**

7 Steps to solve the Counteracting Problem

Identify **the counteracting problem**

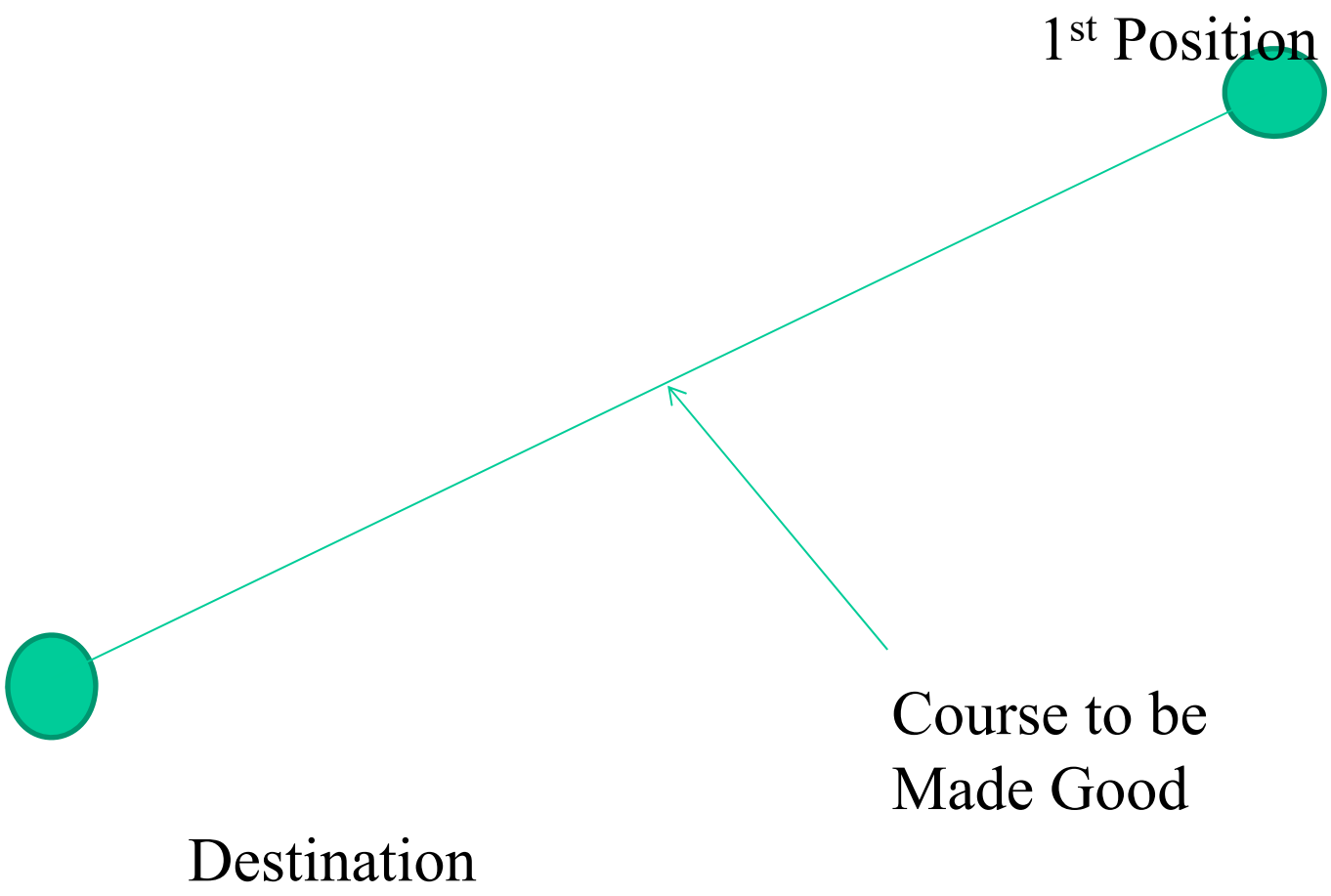
This is by looking for the phrase

“Find the course to steer”

Step One:

From your position draw a line to your destination, this is your

“Course to be Made Good” (CMG).


1st Position
Course to be
Made Good
Destination

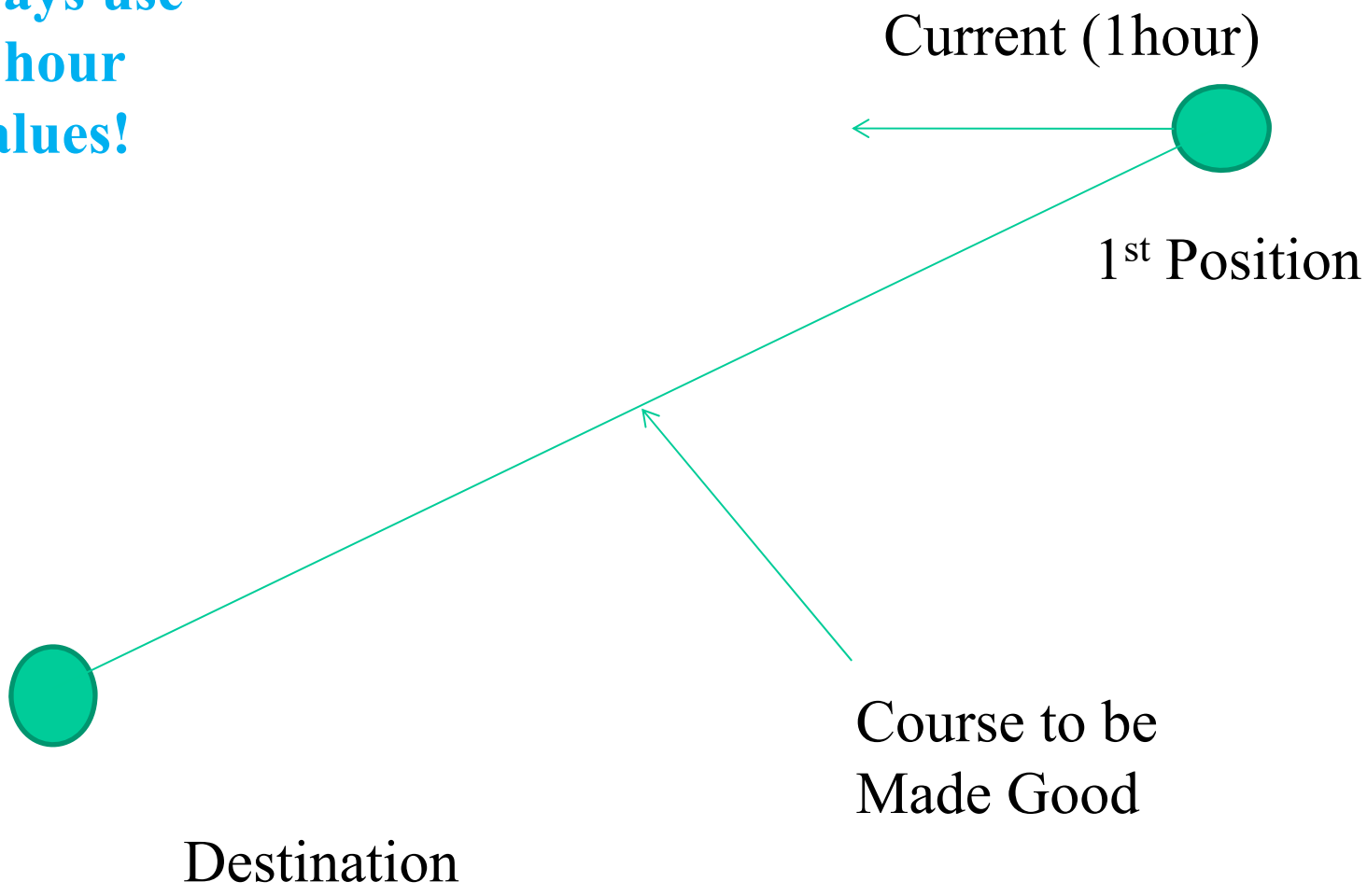
Step Two:-

Draw your expected current for one hour from your start position.

"If I do nothing for an hour -Where will I be?"

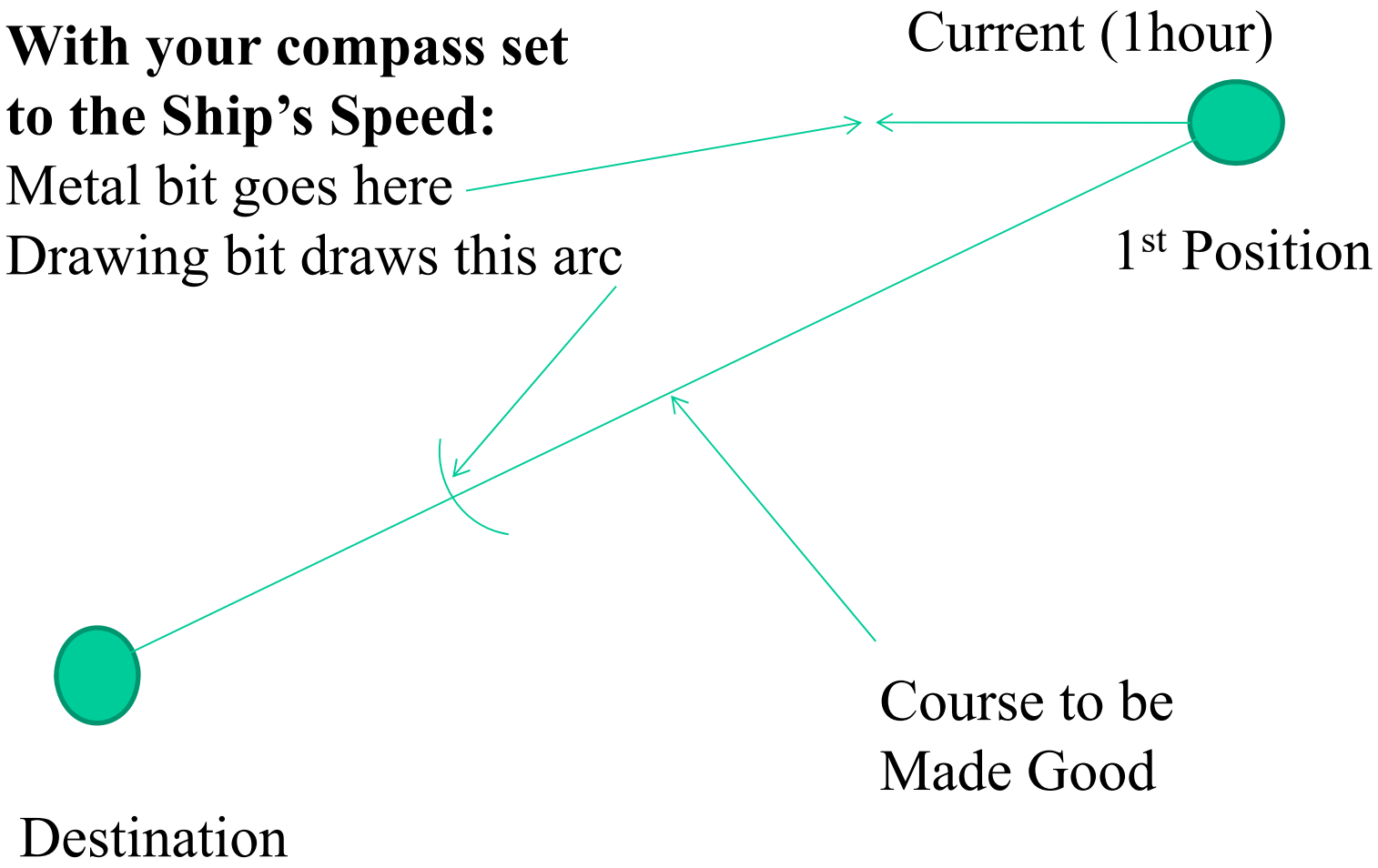
"Set" will be the direction; the "drift" will be the distance.

Always use 1 hour values!



Step Three:-

Set your compasses to your ship's speed. Draw an arc with the metal bit at the end of your current line, the pencil bit should draw an arc across your CMG.


With your compass set to the Ship's Speed:
Metal bit goes here
Drawing bit draws this arc
Current (1hour)
1st Position
Course to be Made Good
Destination

Step Four:-

Join the end of your current to the arc you have made crossing your CtbMG.

The direction of this line is the Course To Steer To Counteract The Current.

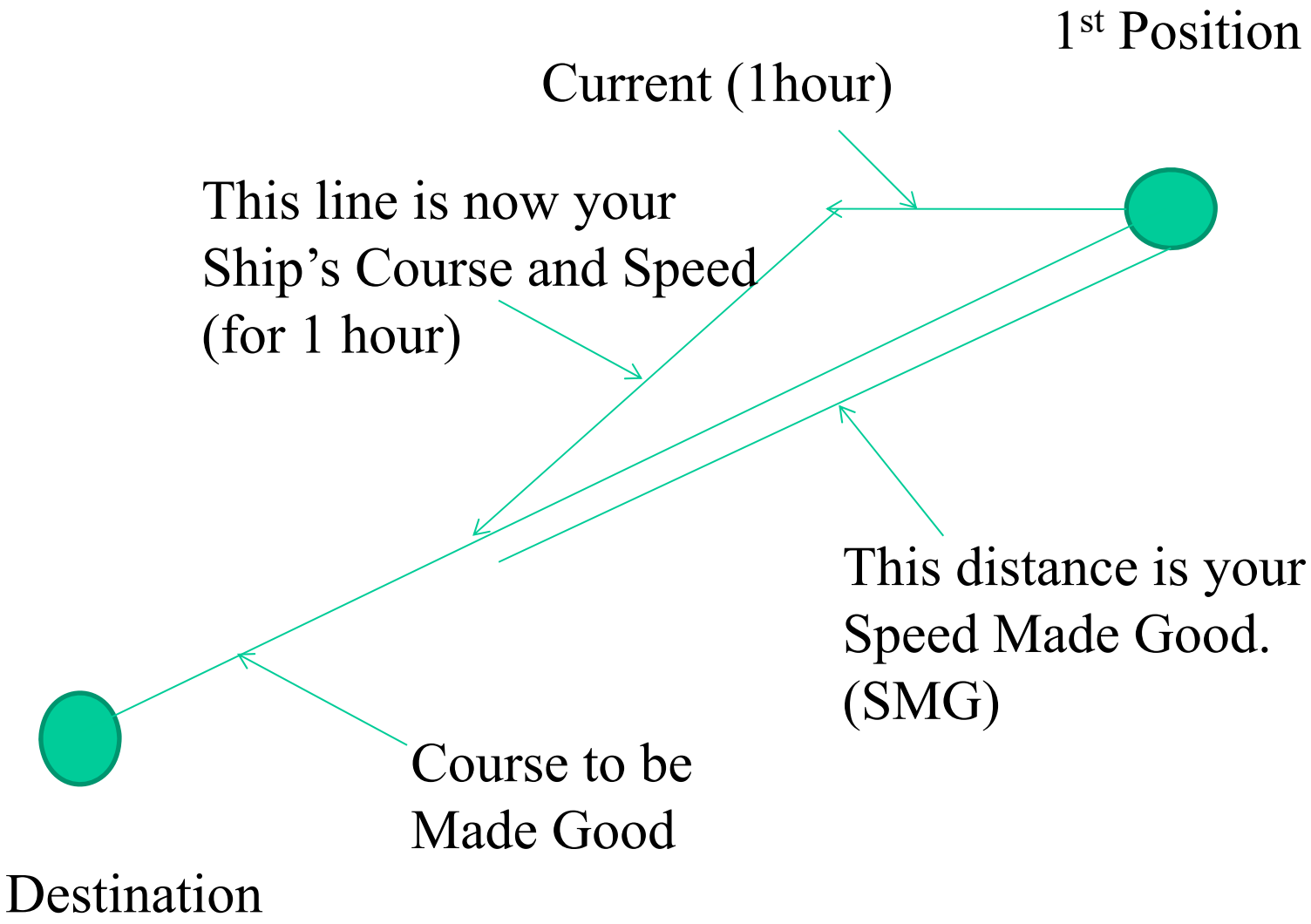
Step Four:-

It is in °True because it is on the Chart

–everything you put on or take off the Chart is True.

It might not be correct,

But it is True!


1st Position
Current (1hour)
This line is now your
Ship's Course and Speed
(for 1 hour)
This distance is your
Speed Made Good.
(SMG)
Course to be
Made Good
Destination

Step Five:-

If leeway is mentioned, simply apply the amount to your answer (into the wind!);

(on your answer paper, not on the chart.)

(From Chart) True Course to

steer to counteract Current

(TCtstC/Acur) =

Leeway allowance =

(into the wind!) ----------

True Course to steer to

Counteract current & wind =

(TCtstC/A C+W)

This is now the SHIP'S HEAD –so all relative bearings will now be taken from this value

Step Six:-

If compass course is required, simply (!?!) apply the correct Variation then the Deviation values,

(in the correct order!)

TrueVirginsMakeDullCompanions!

(Compass, Add East to True)

Step 6 ctd

So your working & answer should look like this:-

From **P**lot

TCtstC/a Cur	=	**°T**	
Leeway	=	**°**	
TCtstC/a C+W	=	**°T**	**(here we can put**
Variation	=	**°**	**the interpolation**
	=	**°M**	**for the deviation)**
Deviation	=	**°**	
Compass Course	=	**°C**	

P L V D = DeVeloP backwards!

Step Seven:-

The distance from your start position to where the arc crosses your CMG (step 3) is your Speed Made Good (SMG), this (& only this!) is used for calculating ETAs.

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The distance from your start position to where the arc crosses your CMG (step 3) is your Speed Made Good (SMG), this is used for calculating ETAs.

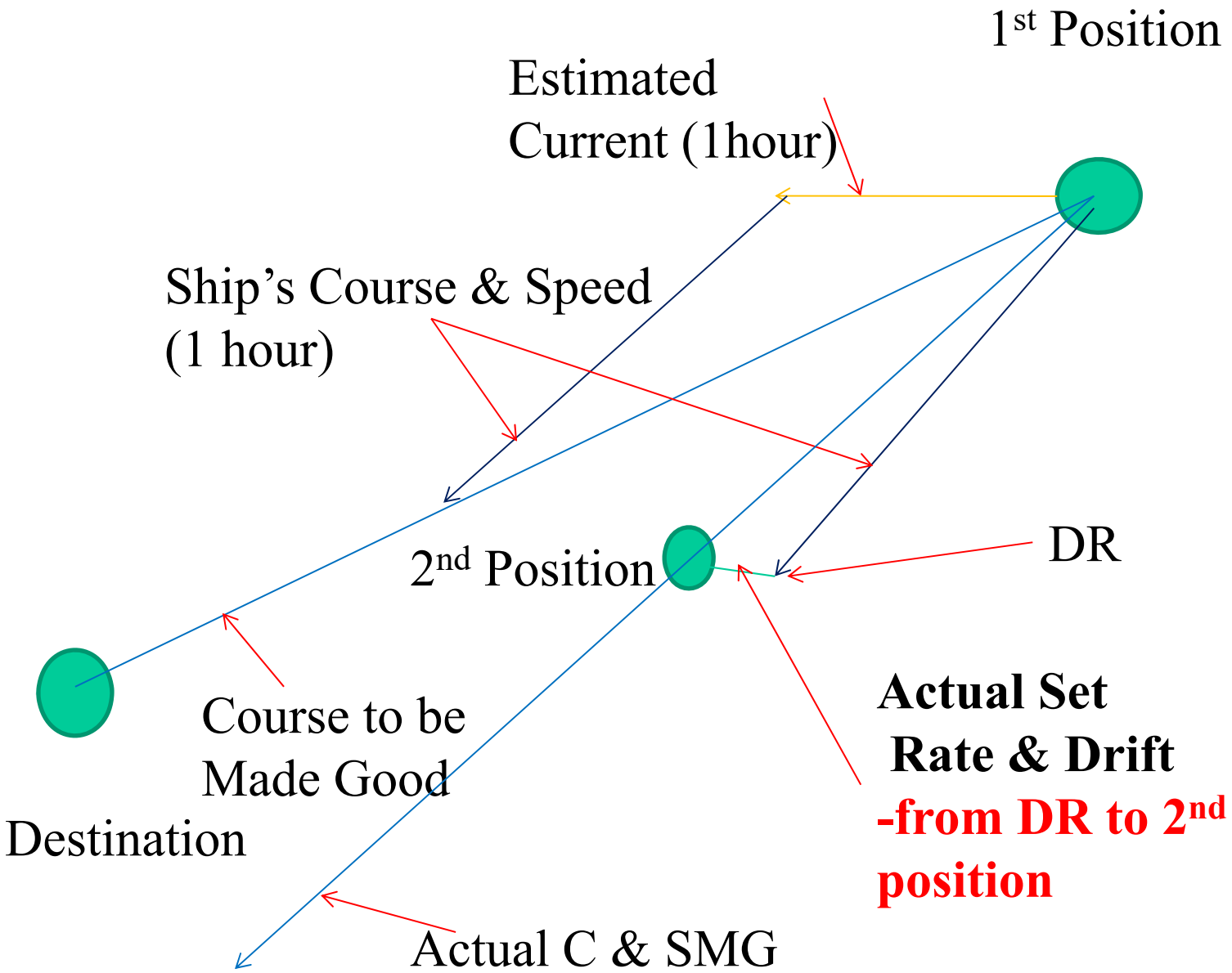
SMG is the *ONLY* speed for ETAs

Step Eight:- (OK –so I lied!)

You may be asked to find the actual Set Rate & Drift experienced:

You need to construct your Course Steered (TCtstC/Ac) (in °True!!!) from your 1st position to find a DR (where would I be if there was no current?) for the time of the 2nd position. (Ignore the wind!)

The direction from the DR to the 2nd position is the Set, the distance is the Drift, the distance divided by the time is the Rate.


1st Position
Estimated
Current (1hour)
Ship's Course & Speed
(1 hour)
2nd Position
DR
Course to be
Made Good
Destination
Actual Set
Rate & Drift
-from DR to 2nd
position
Actual C & SMG

Easy this Chartwork, Isn't it?

If You Read The Question (RTQ)!
If you Understand The Question (UTQ)!
If You Answer The Question (ATQ)!

The Allowing & Counteracting Problems

What order do we do the work?

	The way we work	Where we do the job	What we have	What we are measuring in?	Where we do the job		The way we work
ALLOWING	DeVeLoP	Work on your Answer Book	Ship's Head	Degrees Compass	Now go into your answer book	GNITCARETNUOC	
			Deviation	Degrees East or West			
				Degrees Magnetic			
			Variation	Degrees East or West			
			Course Steered	Degrees True			
			Leeway	Degrees			
		Plotted on the Chart	Water Track	Degrees True			
			Current	Rate & Direction (True)			
			Ground Track	Degrees True	Work on the chart		

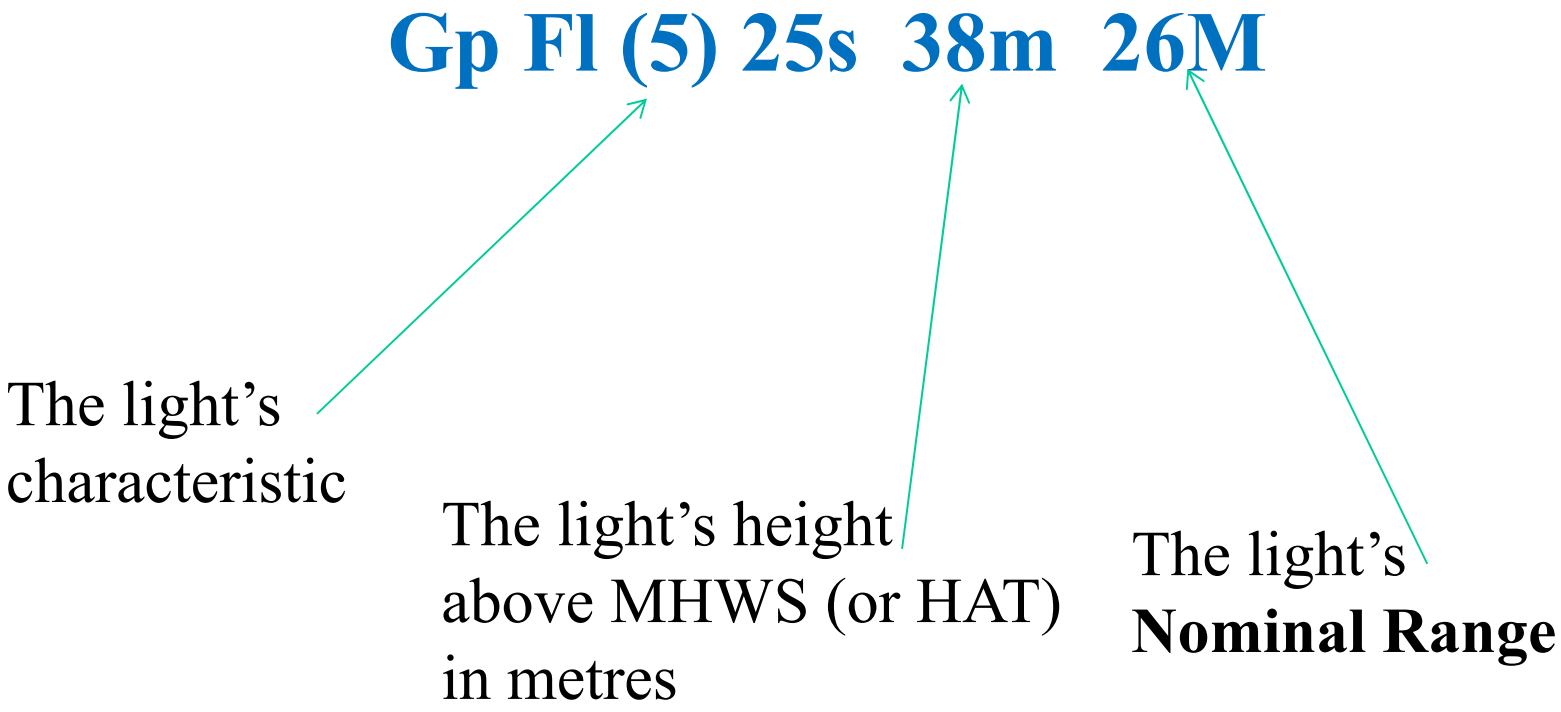
Ranges

Nominal (NR)

Luminous (LR)

Geographical (GR)

1st we need to take some Information from the Chart



Luminous Range (LR)

Take the **Nominal Range** from the chart.

Nominal Range is defined -so far as the Brits (the important people) are concerned- the distance that you can see the light with a horizontal meteorological visibility of 10Nmls.

There is a graph in the front of ALoL called

"The Luminous Range" Diagram,

this is reproduced for you at the back of the Deviation Cards.

Enter the graph with this **NR** along the top, drop down until you reach your **visibility curve**.

Go across to the **left** to read your **Luminous Range.**

Geographical Range (GR)

This is “the distance at which you can

physically 1st see the light (bulb)”.

(Don’t forget, line of sight does not bend, especially over the horizon, also you are looking for the light bulb, not the light reflecting off the atmosphere –the loom.)

So, it is solely dependant upon the charted object’s height & your height above the water. You know how high you are, the object’s will be on the chart. **Simple!**

The table is to be found at the front of the ALoL.

Geographical Range (GR)

Go into the Geographical Range table (with **Elevation of the lighthouse at the side** –the row, with your **Height of eye along the top** –the column).

Don't get confused between feet & metres!

Where the row meets the column is your **Geographical Range**.

If the heights are not given exactly on the table, you should interpolate, perhaps both ways.

Comparing the two

Compare the **GR** & the **NR**.

You should obviously take the smallest.

Ranges (Recap)

With	From	Go To	To Get
Charted Height & Height of Eye	Chart Given	**Geographical Range Table**	**Geographical Range**
Luminous Range & Horizontal Visibility	Chart Given	**Luminous Range Graph**	**Luminous Range**

So how will this appear in a question?

This range will be when the light will be:-

- Be 1st Sighted
- Is “Rising”
- Be Last Seen
- Is “Dipping”

The **first two** will be when you are travelling **towards** an object, the **last two, away from** an object.