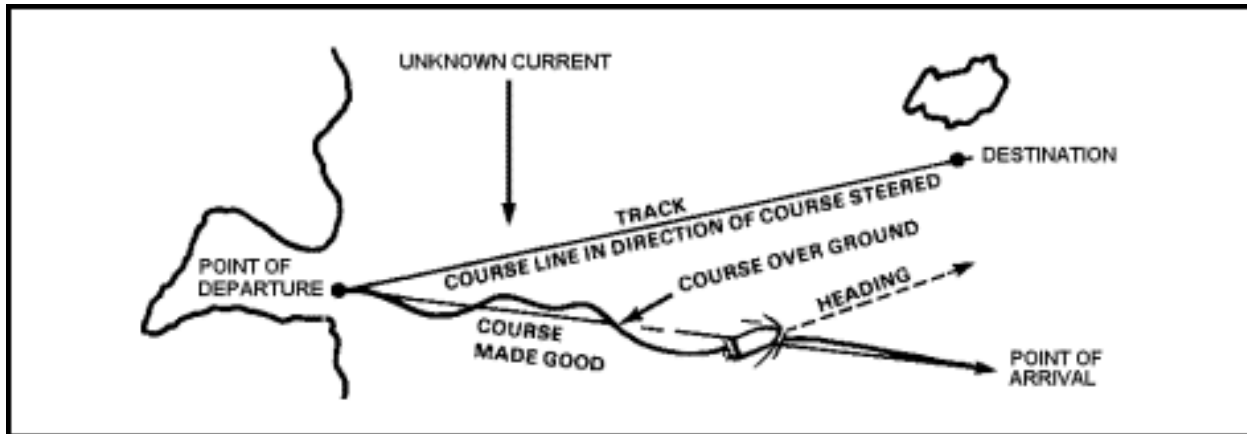


Chapter 9 - Set & Drift and Leeway

- **Set & Drift**
 - A DR track is based on an assumption of making good an exact course and speed.
 - There are many factors, such as the wind and current, that work for or against the vessel thus changing where the vessel actually travels.
- **Wind & Current**
 - Current – The horizontal movement of the water.
 - ✓ Set - The direction toward which the current is flowing, measured in degrees.
 - ✓ Drift - The velocity of the flow, normally measured in knots.
 - Wind – The horizontal movement of the air.
 - ✓ Leeway – the leeward (down wind) motion of a vessel due to that component of the wind vector perpendicular to the vessel's track.
 - ✓ Wind direction is labeled in the opposite manner as current is labeled. **Wind comes from, current goes to.** A Northerly wind blows from North to South (pushing the vessel to the south) where as a Northerly current is flowing from South to North (pushing the vessel to the north).
- **Track**
 - The intended horizontal direction of travel with respect to the earth, taking into consideration known or predicted offsetting effects such as current, wind, and seas. (COA)
 - ✓ Course Made Good - CMG is the resultant direction from a given point of departure to a subsequent position. It is the direction of the net movement from one point to another, disregarding any intermediate course changes en route. This will differ from the track if the correct allowance for current was not made.
 - ✓ Course Over The Ground - COG is the actual path of the vessel with respect to the earth. This may differ from CMG if there are intermediate course changes, steering inaccuracies, varying offsetting influences, and so forth. In current sailing triangles, CMG (not COG) is used. COG and SOG take into account all the zigs and zags of the vessel, including those caused by the wind, waves, current and the helmsman's ability.



- **Speed**

- Speed of Advance - This is the intended speed with respect to the earth, taking into consideration the effect of known or predicted current. SOA is also used to designate the average speed that must be made good to arrive at a destination at a specified time.
- Speed Made Good - SMG is the net speed based on distance and time of passage directly from one point to another, disregarding any intermediate speed change. SMG is speed along the CMG.
- Speed Over The Ground - SOG is the ship's actual speed with respect to the earth along the COG. In current sailing, SMG (not SOG) is used.

- **Current**

- In navigation, it is customary to use the word "current" to include all factors that introduce geographical error in dead reckoning, including:
 - ✓ Wind
 - ✓ Wave action
 - ✓ Steering inaccuracy
 - ✓ Undetermined compass or gyro error
 - ✓ Error in engine or shaft RPM
 - ✓ Excessively fouled bottom
 - ✓ Unusual conditions of loading trim
- When a fix is obtained, one assumes that the current has **set** from the DR position at the same time as the fix and the **drift** equals the distance in miles between these two positions divided by the hours since the last fix.
- This is true, regardless of the number of changes of course and speed since the last fix.

- **Set & Drift**

- If set and drift can be estimated, a better position is obtained by applying the correction to the DR position. This is referred to as an estimated position.
- If a current is setting in the same direction as the course of the ship or its reciprocal, the course made good is the same, only the speed changes.
 - ✓ If course and set are in the same direction, the speeds are added.
 - ✓ If in opposite directions, the smaller speed is subtracted from the larger.
- This is a common situation for ships encountering tidal currents when entering or leaving port.
- Using a simple vector diagram, the navigator can determine how the vessel is being Set in the current and/or what to steer in order to make good a desired course.
- The vectors can be drawn out and measured on the chart or on a maneuvering board or on a plain sheet of paper.

- **Current Sailing**

- Current Sailing refers to the methods used to account for the effects of current when directing a ship's movement.
- There are two phases of current sailing:
 - ✓ Pre-sailing or planning phase
 - Estimated effects of current are applied to the intended track to find the optimum ordered course and speed.
 - Determine Course to Steer
 - ✓ Post sailing
 - The actual current that has acted on the ship is computed.
 - This computed current is used as an estimate for the next leg of the track, if the current is expected to remain unchanged.
 - Determine CMG or Set & Drift

- **Set & Drift Example**

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C

You are underway on course 160°T at 10 knots. The current is 210°T at 0.9 knots. What is the course made good?

- A. 156°T
- B. 160°T
- C. 164°T
- D. 169°T

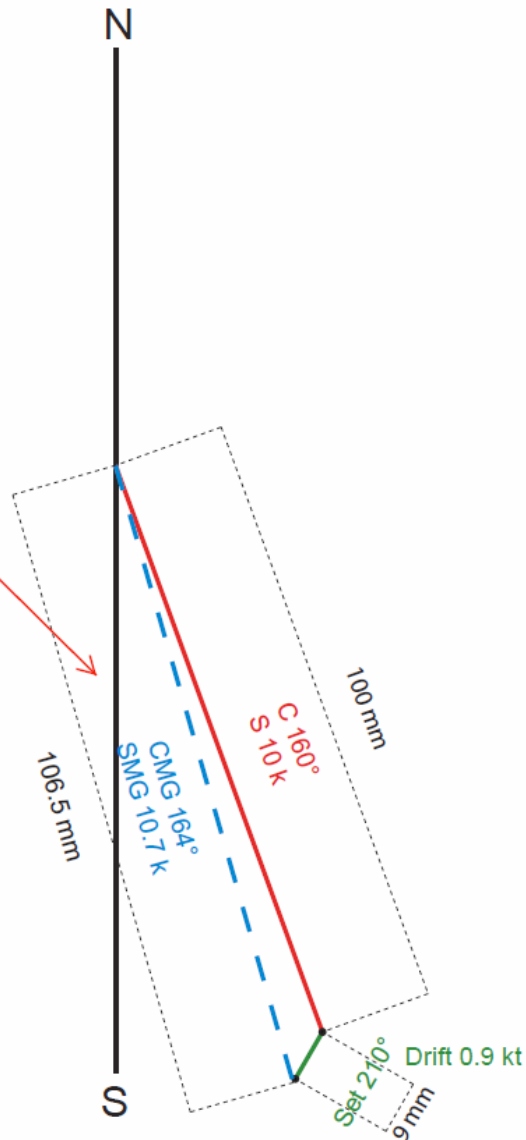
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A

You are underway on course 160°T at 10 knots. The current is 210°T at 0.9 knots. What is the speed being made good?

- A. 10.7 knots
- B. 11.0 knots
- C. 11.6 knots
- D. 12.3 knots

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NOT TO SCALE.
SEE ORIGINAL
SOLUTION



➤ **Solution:**

- ✓ Draw the line C 160° and represent the speed (10 knots) using a length of 100 mm.
- ✓ From the 100 mm mark, draw in Set in the direction of 210°. Represent the drift of 0.9 k using the length of 9 mm.
- ✓ The direction and length of dashed line are the course made good (164°) and speed made good (1.07 knots).

- **Set & Drift Example**

13 053454

C

You wish to make good a course of 300°T while turning for an engine speed of 11 knots. The set is 350°T , and the drift is 2.1 knots. Which course should you steer?

- A. 278°T
- B. 288°T
- C. 292°T
- D. 308°T

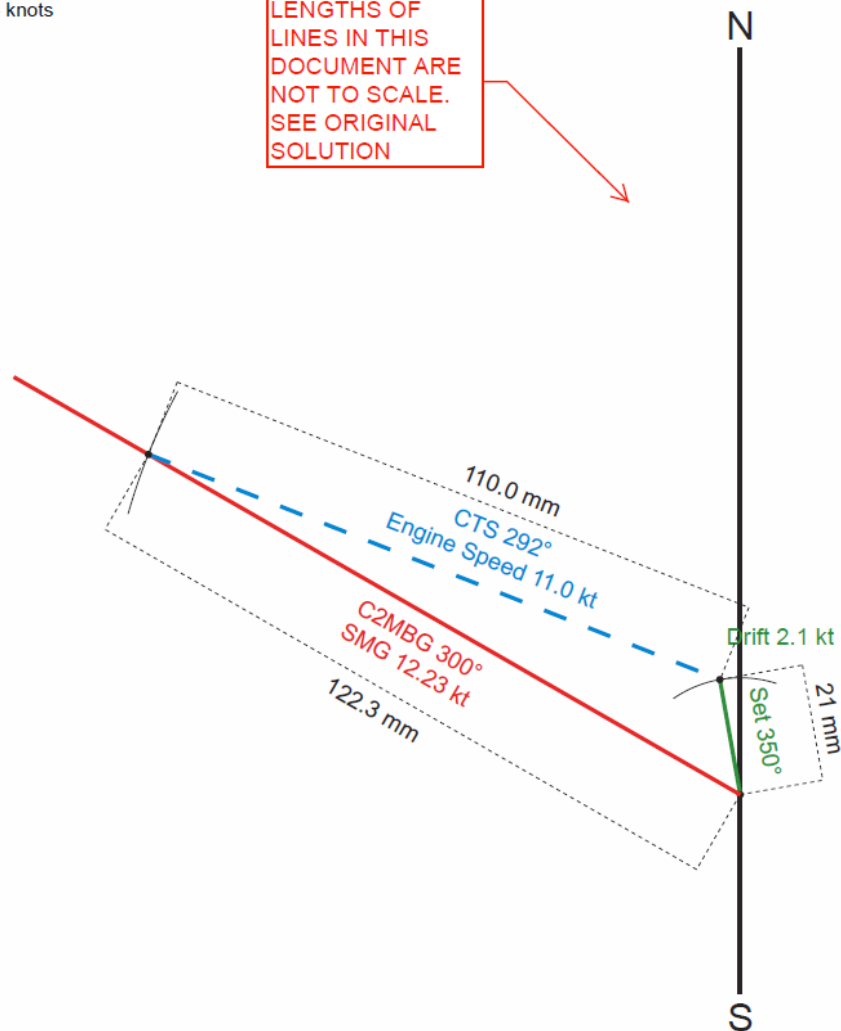
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A

You wish to make good a course of 300°T while turning for an engine speed of 11 knots. The set is 350°T , and the drift is 2.1 knots. What speed will you make good along the track line?

- A. 12.2 knots
- B. 12.7 knots
- C. 12.9 knots
- D. 13.4 knots

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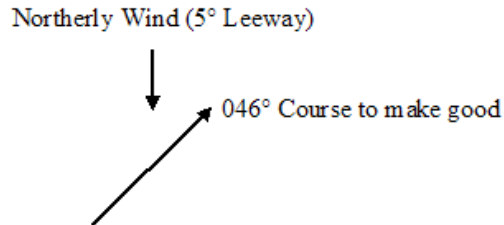
➤ **Solution:**

- ✓ Draw the C2BMG extending in the direction of 300° (indefinite length).
- ✓ From a point along the C2BMG, draw in Set in the direction of 350° . Represent the drift of 2.1 k using the length of 2.1 mm and make a mark.
- ✓ From the 21 mm mark, fit in the engine speed of 11.0 k using the length of 110 mm and make a mark.
- ✓ Measure the direction of the CTS, the dashed line of 292° . Measure the length along the C2BMG of 122.3 or a SMG 12.2k, the speed made good.

- **Leeway Example**

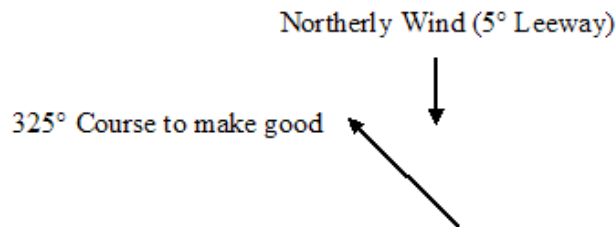
- You wish to make good a course of 046° but a Northerly wind is producing a 5° Leeway. What is the course to steer to make good the desired course?

- Solution:



- ✓ You desire to steer a NE'y course but the wind will push you from the North toward the South approximately 5° .
 - ✓ You need to steer a bit more toward the North in order to obtain the desired results.
 - ✓ To make good 046° you must steer 5° more toward the North $046^\circ - 5^\circ = 041^\circ$
- You wish to make good a course of 325° but a Northerly wind is producing a 2° Leeway. What is the course to steer to make good the desired course?

- Solution:



- ✓ You desire to steer a NW'y course but the wind will push you from the North toward the South approximately 2° .
- ✓ You need to steer a bit more toward the North in order to obtain the desired results.
- ✓ To make good 325° you must steer 2° more toward the North $\rightarrow 325^\circ + 2^\circ = 327^\circ$

• Combined Leeway/Set & Drift

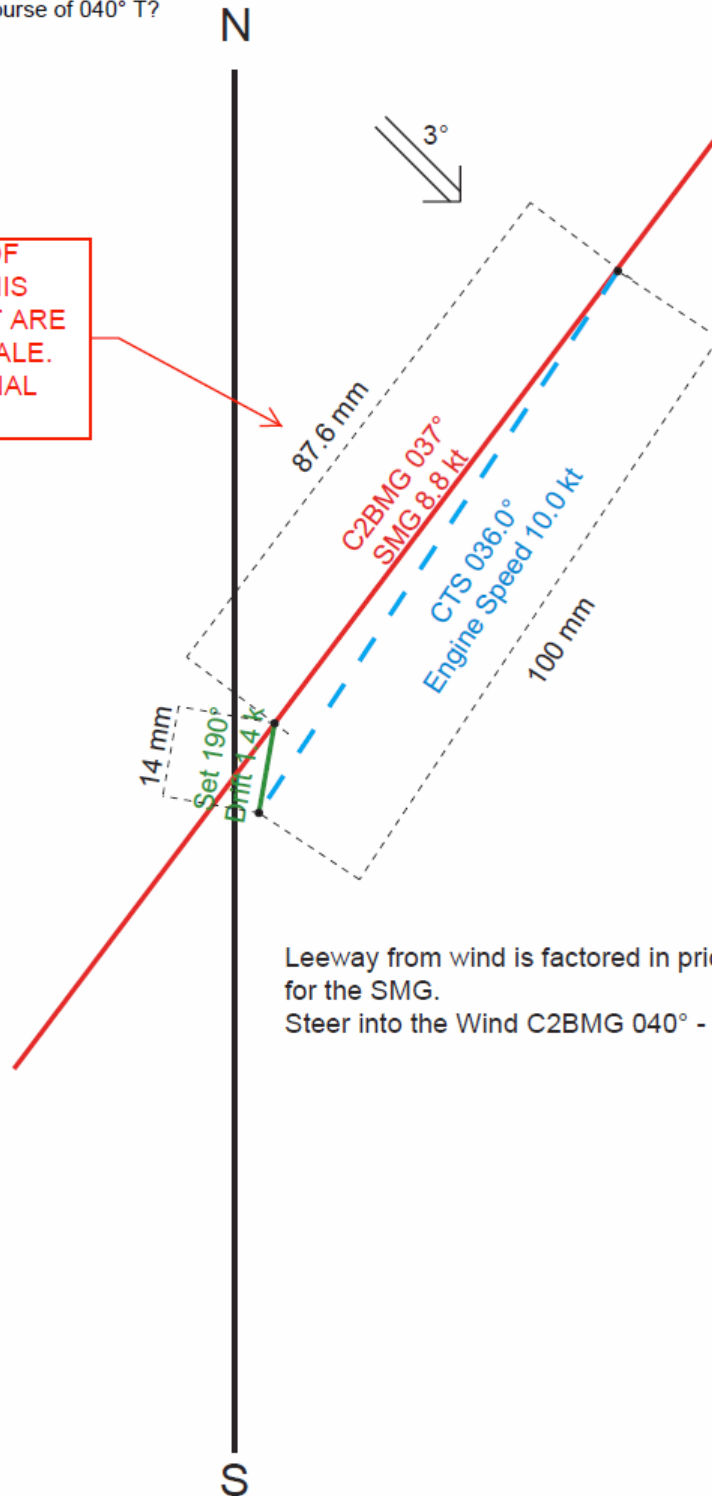
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B

You are underway and intend to make good a course of 040° T. You experience a current with a set and drift of 190° T at 1.4 knots, and a northwest wind produces a leeway of 3°. You adjust your course to compensate for the current and leeway, while maintaining an engine speed of 10 knots. What will be your speed made good over your intended course of 040° T?

- A. 7.8 knots
- B. 8.8 knots
- C. 9.8 knots
- D. 11.0 knots

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Leeway from wind is factored in prior to solving for the SMG.
Steer into the Wind C2BMG 040° - 3° into the NW wind.

- Solution:
 - ✓ In actual practice aboard ship, it is difficult to differentiate between the effects of current vs. wind.
 - ✓ Current normally includes all factors causing the vessel to be off the DR track.
 - ✓ However, in this problem, the Set & Drift is separate from the Leeway.
 - First, apply the Leeway.
 - Then treat it as a typical Set & Drift problem.