RADAR Plotting Scenario Teacher's Guide

Teacher Note: For the purposes of this activity, we have taken a RADAR Maneuvering Board and overlaid it on a map of the Pacific Theater, centering the location at the island of Iwo Jima. Distances are rounded in order to simplify calculations. Like all simulations, some liberty has been taken with historical accuracy, but the process and concept is designed to help students understand both the challenges and benefits of RADAR.

This document serves as a guide and script for the teacher:

Teacher: Today, you will be working in teams to plot an attack on an enemy convoy in the Pacific Theater. You will be provided with a Convoy Attack Team Planning Guide and Map for Plotting handout. You will need to listen carefully as I explain and provide you with the information needed to plot your attack.

RADAR (RAdio Detection And Ranging) is a way to detect and study far off targets by transmitting a radio pulse in the direction of the target and observing the reflection of the radio pulse.

I will serve as the ping or pulse being sent out and reflected back to you. This means that I will give you the information about your enemy convoy as if I am the RADAR. Your job is to analyze the information I present you with and plot it on your Maneuvering Board and Map. From time to time, I will also pause and ask you to make calculations on your Convoy Attack Team Planning Guide Handout.

Step 1: Locate your own convoy. Your convoy is located in the center of the innermost circle on your Maneuvering Board. Please place a star on the location of your own convoy.

Step 2: Based on the provided Plotting Map, you must first determine the size of the region in which you are traveling (the area represented by the concentric circles.) If Iwo Jima is the center of the Maneuvering Board and the city of Davao, Philippines is at the outermost concentric circle of the Maneuvering Board, the radius line, showing the distance between the two points are 1,400 Nautical Miles or 2,575 kilometers.

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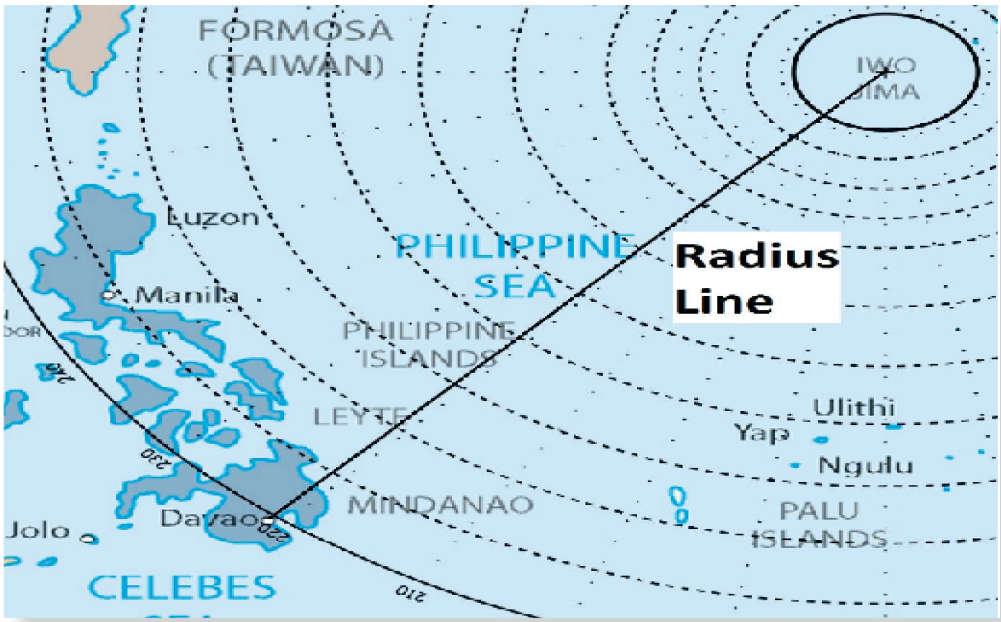

Using the following formulas, answer the following questions for both nautical miles <u>and</u> kilometers.

1. What is the diameter of the Maneuvering Board (radius x 2)?

Nautical Miles	Kilometers
1,400 x 2 = 2,800 NM	2,575 x 2 = 5,150 km

2. What is the circumference of the Maneuvering Board (π x diameter)?

Nautical Miles	Kilometers
3.14 x 2800 = 8,792 NM	3.14 x 5,150 = 16,171 km

3. What is the area of the Maneuvering Board (π x radius^2)?

Nautical Miles	Kilometers
3.14 x 1,400^2 = 6,154,400 NM	3.14 x 2,575^2 = 20,820,162 km

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When dealing with military operations, timing and location are of the utmost importance. Knowing the full area in which you are traveling (and more importantly, where the enemy is traveling) and your RADAR capabilities can be the difference between a sound victory or a bitter defeat.

Step 3: Your convoy is traveling in a northwest direction toward the enemy. We will begin by calculating your convoy's speed in knots. A knot is a unit of speed equal to one nautical mile (1.852 km) per hour. Your convoy is able to travel at a speed of 28 kph, or knots per hour. Calculate the speed in knots that your convoy is traveling.

Your Convoy's Speed in Knots: _____

Formula	*Answer*
KPH / NM	28 / 18.52 = 15.11 knots

Step 4: The enemy convoy is traveling at a speed of 20 knots. How many km/hour is the enemy convoy traveling?

The Enemy Convoy's Speed in kph: _____

- The methodology behind this question is the reverse of Step 3, here we are converting knots to KM. The necessary equation is #Knots multiplied by one nautical mile. 20 x 1.852 = 37.04kph.

Formula	*Answer*
Knots x 1 NM	20 x 1.852 = 37.04 kph

Step 5: Plot the following enemy convoys on your Plot/Map:
(One large concentric circle represents 400km, one small (inner) circle represents 200 km, Iwo Jima to first concentric circle is 400 km)
1. northwest 320 degrees, 1,200 kilometers from your convoy (Open Water)
2. southeast 150 degrees, 2,000 kilometers from your convoy (Guam)
3. southwest 245 degrees 3,200 kilometers from your convoy (400 KM from Manila)
4. northeast 20 degrees, 500 kilometers from your convoy (Open Water)

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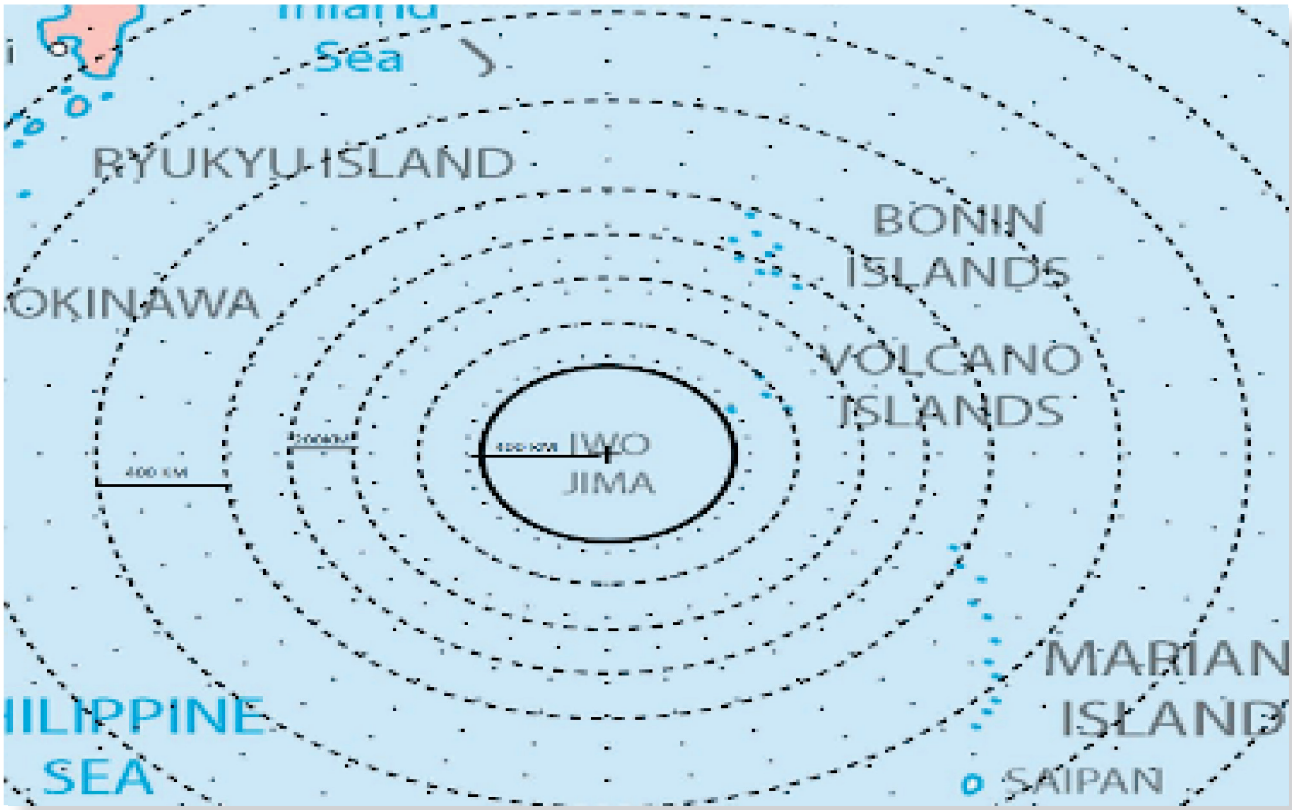
5. southeast 225 degrees, 3,200 kilometers from Your Convoy (Leyte)

- Begin with the centerpoint of the maneuvering Board (Iwo Jima) and count the necessary circles to reach each plot point. As stated above, one large concentric circle represents 400km, one small (inner) circle represents 200 km, Iwo Jima to the first concentric circle is 400 km. Some enemy convoy points have been selected due to their impact in the war (Guam, Leyte) while the remaining enemy convoy points were selected at random.



Step 6: If target 4 (from **Step 5** above) is traveling at 20 knots, how long will it take to intercept our convoy (presuming we are stationary at Iwo Jima)? The following metrics have been provided to assist with the following question.
Distance = Speed x Time
Time = Distance/Speed
Speed = Distance/Time

Time it Will Take to Intercept our Convoy: _____

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- Answer: 25 Hours. The equation needed is Time or Distance/Speed. As stated in Step 5, Target 4 is 500km way from our convoy. 500 km represents "distance." Next we have the rate of speed the enemy convoy is traveling, or 20 knots. As we currently have different measurements, we must now convert Knots to KPH or 20 x 1.852 = 37.04kph. 37.04 kph represents "speed." We now have the equation of distance/speed in kilometers. 500/37.04 = 13.5 or 13 hours, 30 minutes.

Step 7: In your team, plot your course of attack based on one of the enemy convoys location as seen in Step 5. You must decide how many vessels in your convoy will attack, how fast you will travel, and what path(s) you will take to get there. Please plot out your plan of attack on the Plot/Map provided. Please write out a justification for your decisions in the space provided.

- The Goal is for the students to select key strategic locations that were associated with the Pacific Theater (Guam and Leyte). Guam was selected due its strategic location, topography for airfields, harbors, and other strategic advantages. Leyte was chosen as it served as the site of the largest naval battle in the pacific.
- The teacher may want to share the following resources with students in order to help them see the strategic value in the locations of Guam and Leyte.
  - Map, *The Invasion of Leyte and the Battle for Leyte Gulf*
  - Strategic Value Cards for Plotting Team Activity

Teacher Note: The teacher may choose to add as many curve balls into the plotting process as they wish. You can change the locations of enemy ships based on updated RADAR information, adding to the number of enemy ships, etc.