

**Summary Report for Individual Task**  
**551-88K-4739**  
**Define Basic Radar Principles and Definitions**  
**Status: Approved**

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DISTRIBUTION RESTRICTION: Approved for public release; distribution is unlimited.

DESTRUCTION NOTICE: None

**Condition:** Assigned as a small Tug Master, Mate or a Boatswain. Given a complete risk assessment, an Operational Plan/Operations Order ( OPLAN/OPORDER), a vessel in port or at sea, all applicable publications, forms, records, tools, materials, personnel, and equipment in all weather conditions, day or night and all MOPP levels in an operational environment scenario, and an operational radar or radar simulator in standby mode, that meets the standards of 33 CFR 164.38 and other applicable national and international performance standards. Some iterations of this task should be performed in MOPP 4.

**Standard:** On order, Soldier will identify the basic radar principles and definitions, IAW references.

**Special Condition:** None

**Safety Level:** Low

**MOPP:** Sometimes

<b>Task Statements</b>
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**Cue:** None

<b>DANGER</b>
None

<b>WARNING</b>
None

<b>CAUTION</b>
None

**Remarks:** None

**Notes:** None

## Performance Steps

### 1. Determine the principles of the Marine Radar.

Note: The marine radar is a pulse modulated to allow it to work on the echo principle. It transmits electro-magnetic energy in the form of short powerful bursts or pulses then shuts down in the receive mode for a relatively long period of time waiting for a return echo. If in fact a return echo is detected, the modulator notes the elapsed time between transmission and reception of the return, and the bearing of the antenna at the time of reception and indicates that point, (PIP) on the radar as a target.

a. Radar is an acronym, meaning RADIO DETECTION AND RANGING.

b. The speed of a radar wave: 161,830 Nautical Miles Per Second and A radar nautical mile is: 80,915 Nautical Miles.

c. The radar nautical mile is the constant by which the radar works.

d. The FCC (Federal Communications Commission) had authorized the commercial marine navigational radar to operate in 2 different frequency bands.

e. 10,000 MHz: Central operating frequency 9410 MHz  $\pm$  30 MHz. Wave length 3 measured in centimeters(cm).

f. 3,000 MHz: Central operating frequency 3050 MHz  $\pm$  30 MHz. Wave length 10 measured in centimeters(cm).

### 2. Identify the main differences between the two radar sets.

a. The 10cm Radar uses Lower frequency, has a Longer wavelength and Greater detection range.

b. The 3cm Radar uses a Higher frequency, has a Shorter wavelength and Higher definition.

### 3. Identify the main components of the Marine Radar.

a. Identify the Modulator.

b. Identify the Transmitter.

c. Identify the Receiver.

d. Identify the Wave Guide.

e. Identify the Scanner.

f. Identify the Slotted Wave Guide.

### 4. Determine factors effecting Maximum Range.

a. Identify Pulse Repetition Rate.

b. Identify Beam Width.

c. Identify Target Characteristics.

d. Identify Receiver Sensitivity.

e. Identify Antenna Rotation Rate.

- f. Identify Height of Antenna.
5. Determine factors effecting Minimum Range.
- a. Identify Pulse Length.
  - b. Identify Sea Return.
  - c. Identify Vertical Beam Width.
6. Determine factors effecting Range Accuracy.
- a. Identify Fixed Error/Fixed Time Delay.
  - b. Identify Frequency Drift.
  - c. Identify Line Voltage (temporary power interruption).
  - d. Identify PIP/VRM Alignment.
  - e. Identify Calibration.
  - f. Identify Range Scale (higher range scale, greater the error).
  - g. Identify Radar Scope Interpretation.
  - h. Identify Persistence.
7. Determine factors effecting Range Resolution.
- a. Range resolution is the ability of the radar to distinguish as two different PIPs, two targets on the same bearing, but at different ranges. While using a one micro-second pulse length, to be seen as two separate PIPs, two vessels must be separated by a minimum of 164 yards per micro-second of pulse length.
  - b. Good range resolution is accomplished by Short Pulse Length, Correct Gain and the shortest possible range scale.
8. Determine factors effecting Bearing Accuracy.
- a. Identify Horizontal Beam Width.
  - b. Identify Target Size.
  - c. Identify Rate of Movement of the Target.
  - d. Identify Heading Flash Alignment.
  - e. Identify Type of Display: Heads-Up/Gyro Stabilized.
  - f. Identify Parallax.
  - g. Identify Sweep Centering Error.

h. Identify Persistence.

9. Determine factors effecting Bearing Resolution.

Note: Bearing resolution is the ability of the radar to distinguish as two different PIPs, two targets on the same range, but at different bearings. While using a 2° beam width, at a distance of 5 miles, targets must be separated by a minimum of 350 yards to be seen as two different targets. At a distance of ten miles those same targets must be separated by a minimum of 700 yards.

a. Identify Horizontal Beam Width.

b. Identify CRT Spot size.

c. Identify Target Characteristics.

d. Identify Gain.

10. Determine factors and errors that will effect the operation of the Marine Radar.

Note: Proper use of the Fast Time Constant (FTC) and the receiver gain control may lessen the effects of weather interference to your scope. The 3 cm radar is more greatly affected by adverse weather than the 10 cm radar.

a. Identify weather (rain, sleet, snow, hail, and high seas).

b. Identify Indirect Echoes.

c. Identify Multiple Echoes.

d. Identify Second Trace Echoes.

e. Identify Multi-Trace Echoes.

f. Identify Side-Lobe Echoes.

g. Identify Interference.

h. Identify Diffraction.

i. Identify Sectoring.

j. Identify Spoking.

k. Identify Serrated Range Rings.

(Asterisks indicates a leader performance step.)

**Evaluation Guidance:** Score the soldier a GO if all performance measures are correctly completed/pass (P). Score the Soldier a NO-GO if any of the performance measures are missed or incorrectly performed/fail (F).

**Evaluation Preparation:** Test this task in conjunction with the Vessel Operations assessment. Ensure Soldier understands why this task is important to the overall safe navigation of the vessel.

PERFORMANCE MEASURES	GO	NO-GO	N/A
1. Determined the principles of the Marine Radar.			
2. Identified the main differences between the two radar sets.			
3. Identified the main components of the Marine Radar.			
4. Determined factors effecting Maximum Range.			
5. Determined factors effecting Minimum Range.			
6. Determined factors effecting Range Accuracy.			
7. Determined factors effecting Range Resolution.			
8. Determined factors effecting Bearing Accuracy.			
9. Determined factors effecting Bearing Resolution.			
10. Determined factors and errors that will effect the operation of the Marine Radar.			

**Supporting Reference(s):**

Step Number	Reference ID	Reference Name	Required	Primary
	978-0160888885	CFR TITLE 33 NAVIGATION AND NAVIGABLE WATERS: (Part 104 and 105)	No	No
	AR 56-9	Watercraft	No	No
	CFR TITLE 33 PART 159	CFR Title 33 Part 159	No	No
	DMA CHART NO 1	DMA CHART NO 1	No	No
	DUTTON	DUTTON'S NAVIGATION AND PILOTING 14th EDITION	Yes	No
	FM 4-01.502	ARMY WATERCRAFT SAFETY	No	No
	HOBBS	Marine Navigation Piloting & Celestial & Electronic Navigation, Fourth Edition	Yes	No
	PUB. NO. 9	The American Practical Navigator - Bowditch	Yes	Yes
	TC 4-15.51	MARINE CREWMAN`S HANDBOOK	Yes	Yes

**Environment:** Environmental protection is not just the law but the right thing to do. It is a continual process and starts with deliberate planning. Always be alert to ways to protect our environment during training and missions. In doing so, you will contribute to the sustainment of our training resources while protecting people and the environment from harmful effects. Refer to FM 3-34.5 Environmental Considerations and GTA 05-08-002 ENVIRONMENTAL-RELATED RISK ASSESSMENT. AR 200-1 delineates TRADOC responsibilities to integrate environmental requirements across DOTMLPF and ensures all training procedures, training manuals, and training doctrine includes sound environmental practices and considerations. The Army's environmental vision is to be a national leader in environmental and natural resource stewardship for present and future generations as an integral part of all Army missions. Environmental protection is never completed. Continuously be alert to ways to protect our environment and reduce waste.

Leaders must ensure that their unit has an active and strong environmental program. They must understand the laws and know what actions to take. Leaders bring focus, direction, and commitment to environmental protection. Commanding officers should ensure the following environmental programs are in place and are being maintained:

- Hazardous materials program.
- Hazardous waste program.
- Hazardous communications program.
- Pollution prevention and hazardous waste minimization recycling program.
- Spill prevention and response plan program.

**Safety:** In a training environment, leaders must perform a risk assessment in accordance with FM 5-19, Risk Management. Leaders will complete a DA Form 7566 COMPOSITE RISK MANAGEMENT WORKSHEET during the planning and completion of each task and sub-task by assessing mission, enemy, terrain and weather, troops and support available-time available and civil considerations, (METT-TC). Note: During MOPP training, leaders must ensure personnel are monitored for potential heat injury. Local policies and procedures must be followed during times of increased heat category in order to avoid heat related injury. Consider the MOPP work/rest cycles and water replacement guidelines IAW FM 3-11.4, Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection, FM 3-11.5, Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and

Nuclear Decontamination. All operations will be performed to protect and preserve Army personnel and property against accidental loss. Procedures will provide for public safety incidental to Army operations and activities and safe and healthful workplaces, procedures, and equipment. Observe all safety and/or environment precautions regarding electricity, cable, and lines. Provide ventilation for exhaust fumes during equipment operation and use hearing protection when required IAW AR 385-10, the Clean Air Act (CAA) and the CAA amendments, and the OSHA Hazard Communication standard.

Accidents are an unacceptable impediment to Army missions, readiness, morale, and resources. Decision makers at every level will employ risk management approaches to effectively preclude unacceptable risk to the safety of personnel and property affiliated with this task.

- (a) Take personal responsibility.
- (b) Practice safe operations.
- (c) Recognize unsafe acts and conditions.
- (d) Take action to prevent accidents.
- (e) Report unsafe acts and conditions.
- (f) Work as a team.

**Prerequisite Individual Tasks :**

Task Number	Title	Proponent	Status
551-88K-3515	Enforce Vessel Pre-Sail Requirements	551 - Transportation (Individual)	Approved
551-88K-1705	Operate a Vessel's Electric Gyro System	551 - Transportation (Individual)	Approved

**Supporting Individual Tasks :**

Task Number	Title	Proponent	Status
551-88K-2710	Conduct Operation of Navigational Equipment Onboard a Class B Vessel	551 - Transportation (Individual)	Approved
551-88K-2706	Conduct Operation of a Vessel's Electric Gyro System	551 - Transportation (Individual)	Approved
551-88K-2713	Conduct Plotting Techniques Onboard a Class B Vessel	551 - Transportation (Individual)	Approved
551-88K-3706	Monitor a Vessel Electronic Gyro System	551 - Transportation (Individual)	Approved
551-88K-3708	Monitor Navigational Duties Onboard a Vessel	551 - Transportation (Individual)	Approved
551-88K-1513	Observe Aids To Navigation (ATON) Onboard a Vessel	551 - Transportation (Individual)	Approved
551-88K-3709	Enforce Navigational Rules Onboard a Vessel	551 - Transportation (Individual)	Approved
551-88K-2715	Apply Navigational Rules Onboard a Class B Vessel	551 - Transportation (Individual)	Approved

**Supported Individual Tasks :**

Task Number	Title	Proponent	Status
551-88K-3511	Monitor Watch Standing Procedures Onboard a Vessel	551 - Transportation (Individual)	Approved
551-88K-1504	Perform Vessel Pre-Sail Requirements	551 - Transportation (Individual)	Approved
551-88K-4715	Monitor Operations of Navigational Equipment Onboard a Vessel	551 - Transportation (Individual)	Obsolete
551-88K-4715	Monitor Operations of Navigational Equipment Onboard a Vessel	551 - Transportation (Individual)	Approved
551-88K-3708	Monitor Navigational Duties Onboard a Vessel	551 - Transportation (Individual)	Approved
551-88K-1517	Perform Watch Standing Procedures Onboard a Vessel	551 - Transportation (Individual)	Approved

**Supported Collective Tasks :**

Task Number	Title	Proponent	Status
55-2-1503	Prepare Vessel for Sea	55 - Transportation (Collective)	Approved
55-2-0036	Prepare Vessel for Towing Operations.	55 - Transportation (Collective)	Approved
55-2-1508	Conduct Vessel Operations	55 - Transportation (Collective)	Approved

**ICTL Data :**

<b>ICTL Title</b>	<b>Personnel Type</b>	<b>MOS Data</b>
MOS 88K Watercraft Operator SL 4	Enlisted	MOS: 88K, Skill Level: SL4, Duty Pos: TFJ