



# U.S. NAVAL ACADEMY SAILING PROGRAM



**Offshore**



**Intercollegiate**



**CSNTS**



**P-100**

# *Practical Navigation 3*

CDR Gerard VandenBerg  
Deputy Director, Naval Academy Sailing



# Course Overview...

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- The Chart
  - Primary emphasis on chart preparation
- The Fix
  - Visual & Electronic
  - Accuracy and errors
- The DR
  - The most important thing on the chart
- Navigation Party
  - Organization, procedures & philosophy
- Making landfall
  - The Navigation Brief
- Navigation Practical



# The Chart Prep Checklist...

## Navy Sailing Chart Preparation Checklist

Chart Number \_\_\_\_\_

1. Note the chart's sounding datum (X the appropriate box).

Fathoms \_\_\_\_\_ Feet \_\_\_\_\_ Meters \_\_\_\_\_

2. Box the Sounding Datum. Highlight this in Orange and verify that it's visible after the chart is folded for use. If not - annotate it where it can best be seen.

3. Enter the vessel's draft (i.e., 7.5 feet) \_\_\_\_\_

- Use the same units as the chart's sounding datum

4. Round up \_\_\_\_\_

5. Define Your Risk Factor: \_\_\_\_\_

- Knowledgeable Crew/Racing Risk Factor = 1
- Novice Crew/Training Risk Factor = 2 or 3

6. Calculate minimum sounding line as follows:

- Multiply the number from Block 4 by the Risk Factor defined in Block 5

\_\_\_\_\_ X \_\_\_\_\_ = \_\_\_\_\_

(i.e., For a CSNTS Cruise: 8 feet times 2 = 16 ft)

6. Review the chart for actual sounding datum. Choose one based on Block 6 above (if required, round up): \_\_\_\_\_

7. Highlight this sounding line with a dark blue marker. Pay particular attention to the rate of change of depth, and mark the chart accordingly.

8. Visual Nav Aids: Carefully review the chart, and identify visual navaids:

- Circle, highlight in yellow, and label ABC (Where ABC is an easily spoken, unmistakable noun name)

9. Nav hazards: Carefully review the chart, and identify unlighted buoys and other nav hazards.

- Circle, highlight in pink, and label UNLIT ABC/NAVHAZARD ABC.

10. Radar Nav Aids: Carefully review the chart, and identify radar nav aids.

- Triangle, highlight in orange, and label ABC
- Pay particular attention for RACON buoys. These should have a circle and a triangle, and be labeled RACON ABC

11. Track: Draw and label the track.

- The track can be drawn down the center of the deep draft channel to alert the watchsection to the expected location of merchant traffic.

12. Shoal Water: Using the blue line defined in 7 above, slash the shoal water areas in blue, and double slash those areas where soundings won't provide meaningful backup.

13. Fold and label: Fold and label the chart as follows:

- Fold the chart in fourths
- Label the corner with the fold with the chart's noun name in large letters. Immediately above/below list the next chart along the north/southbound track

14. Verify Currency: Immediately prior to use, verify the chart is up to date by querying the NIMA Notice To Mariners Database at:

[http://pollux.nss.nima.mil/untm/untm\\_j\\_options.html?class\\_flag=N](http://pollux.nss.nima.mil/untm/untm_j_options.html?class_flag=N)

Latest Chart Edition \_\_\_\_\_ On-hand Chart Edition \_\_\_\_\_

Latest Notice To Mariners \_\_\_\_\_

CHART UPDATED THROUGH NOTICE TO MARINERS \_\_\_\_\_ / \_\_\_\_\_  
Number Date

Submitted: \_\_\_\_\_ Reviewed: \_\_\_\_\_  
Midshipman Navigator AOIC/Navigator

Approved: \_\_\_\_\_  
Officer In Charge



# Principles & Practice of Basic Navigation

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- Fix taking
- Fix evaluation
- “Minimum Cyclic Routine”
  - Plot, Label, DR.. Plot, Label, DR.. Plot, Label, DR...
- Situational Awareness & “Gut Feel”
- Watch Captain involvement
- Midshipman Navigator involvement
- Officer in Charge involvement



# The Handouts...

*Tenth Edition*

Fundamentals of

# Naval Science

NS 100

An aerial photograph showing several large naval training ships, likely the USNCGC fleet, in a harbor. The ships are white with dark hulls and are moving in a line. The background shows a cityscape and a large building, likely the United States Naval Academy.

United States Naval Academy  
Annapolis, Maryland



# The Six Rules Of Deduced Reckoning

---

1. Every hour on the hour
2. At the time of every course change
3. At the time of every speed change
4. At the time of obtaining a single line of position
5. At the time of obtaining a fix or running fix
6. A new course line shall be drawn from each fix or running fix as soon as it is determined

**YOU MUST KNOW THESE!!!**

***You Must Know How To Apply These!!!***



# The Fix...

The Fix is:

WHERE YOU WERE

And...

It's hardly ever really where you were



# The Fix...

---

The Fix is:

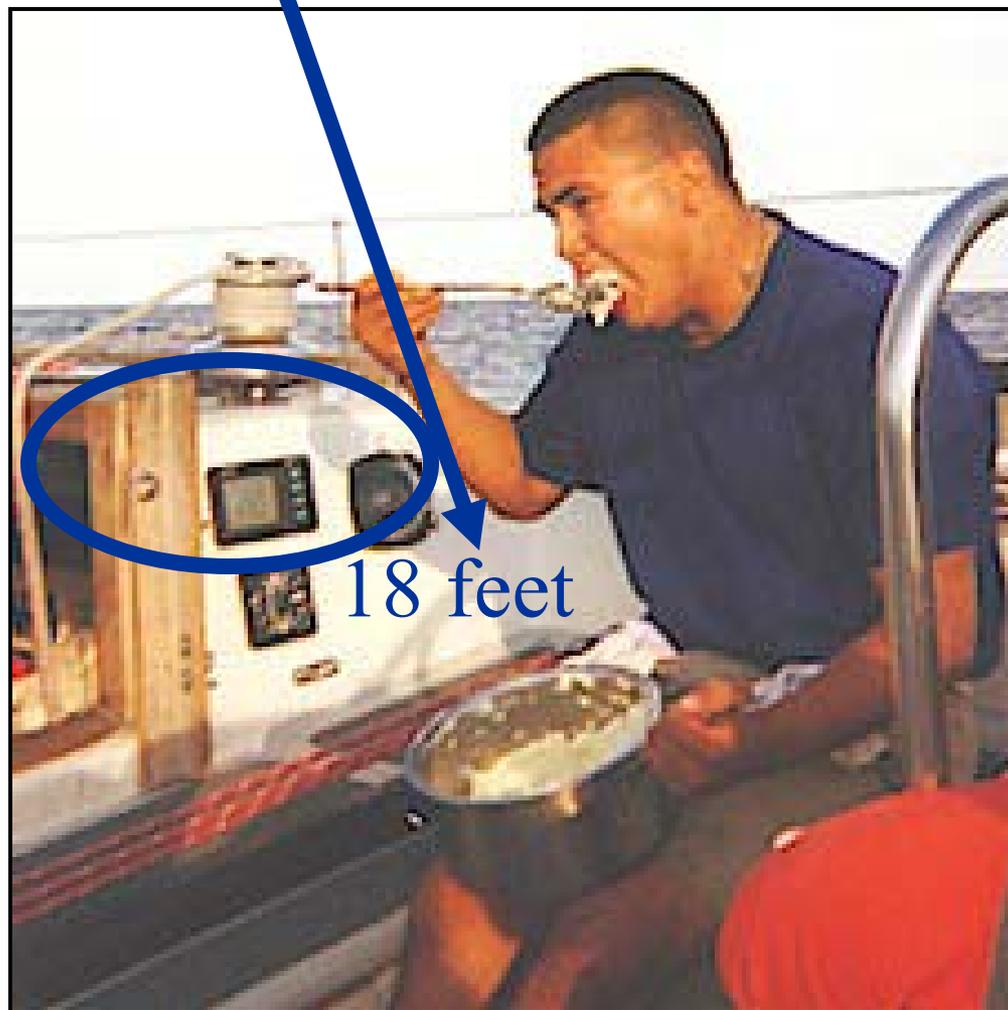
**THREE DIMENSIONAL**

“Sounding – Checks with chart”



# The Fatho....

Write the “No Go Sounding” In Grease Pencil Here





# The Fix...

## Fix Interval

Whatever you do, establish and maintain  
a consistent fix interval

Need to be able to step back and see the  
trend, and respond if the trend changes



# The Fix...

---

- What interval is required?
  - Hourly?
  - Half hourly?
  - Fifteen minutes?
  - Ten Minutes?
  - Five Minutes?
- It depends
  - However, it should be obvious when looking at the chart when it changes – and why
- The OIC determines Fix Interval!



# The Fix...

---

- Open ocean – outbound
  - 1 hour maximum
- Open ocean – inbound
  - Frequently enough so you can see you approach develop
- The Bay
  - Where are you???
- Remember – these are fully crewed yachts
  - Whose mission is to train on navigation



The Fix...

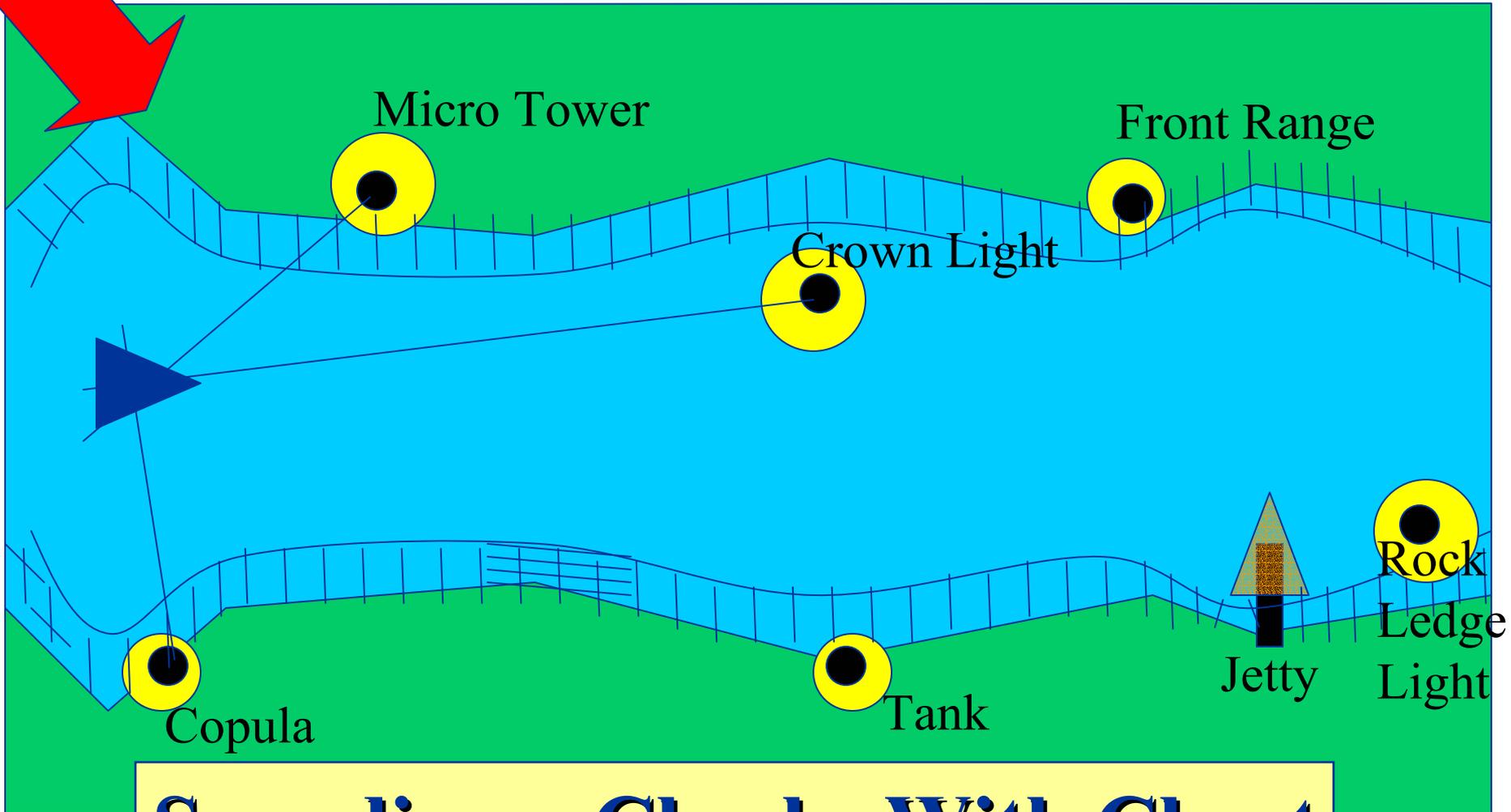
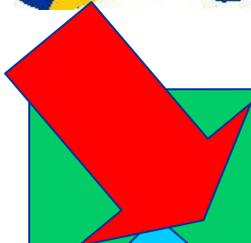
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Treat Every Fix With

**Suspicion**



# Visual Fixes...



**Sounding – Checks With Chart**



# “Taking A Round Of Bearings”

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- The Mids are taught to shoot the most rapidly changing bearing first
  - Typically the beam bearing
  - May not be...
  - Why - Shooting at a given time
- In the sail training craft context, shoot the most rapidly changing bearing last
  - Mark the time
  - Why – Most up to date information

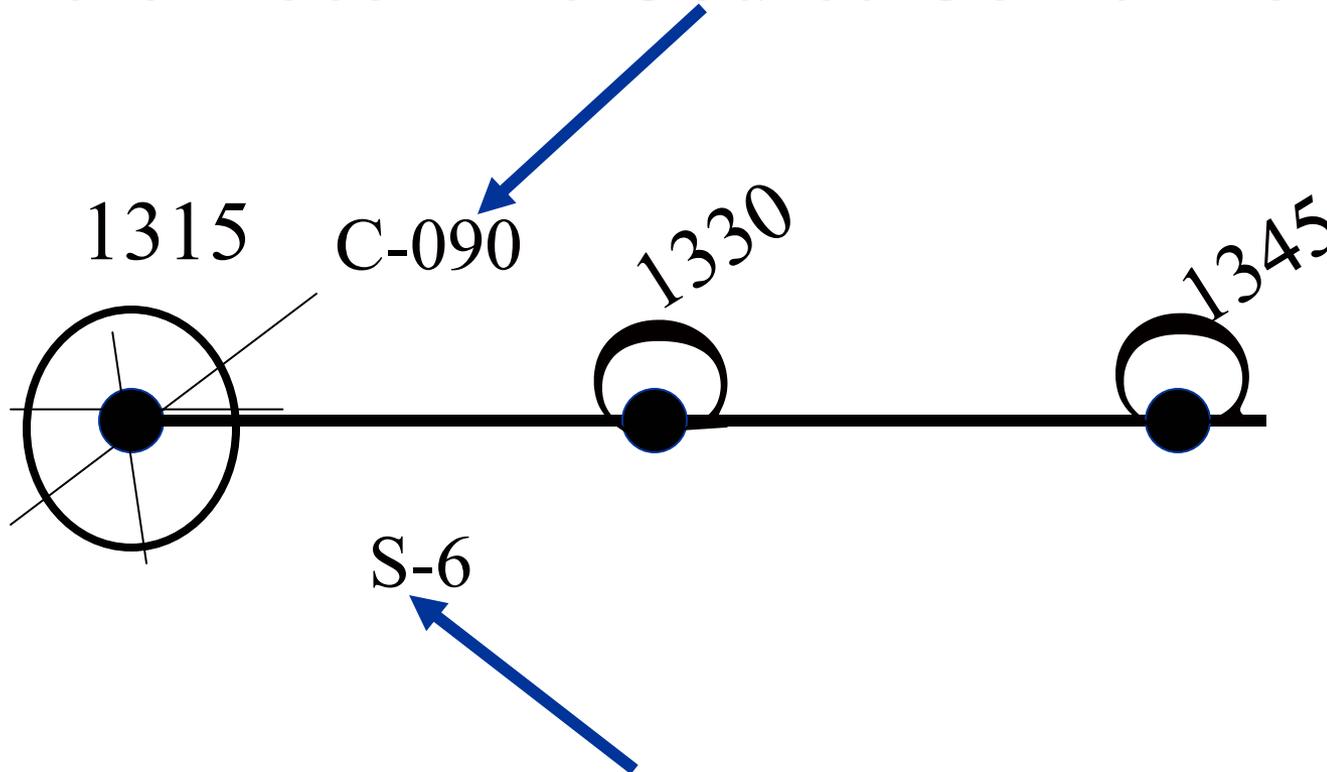




Plot, Label, DR... Plot, Label,  
DR... Plot, Label, DR...

---

Where Does This Course Come From???



Where Does This Speed Come From???

**Sounding – Checks With Chart**



# The Fix & The DR...

## The DR Is Based on Onboard Instrumentation



Do Not Use Loran C or GPS  
Course Over Ground/Speed Over Ground

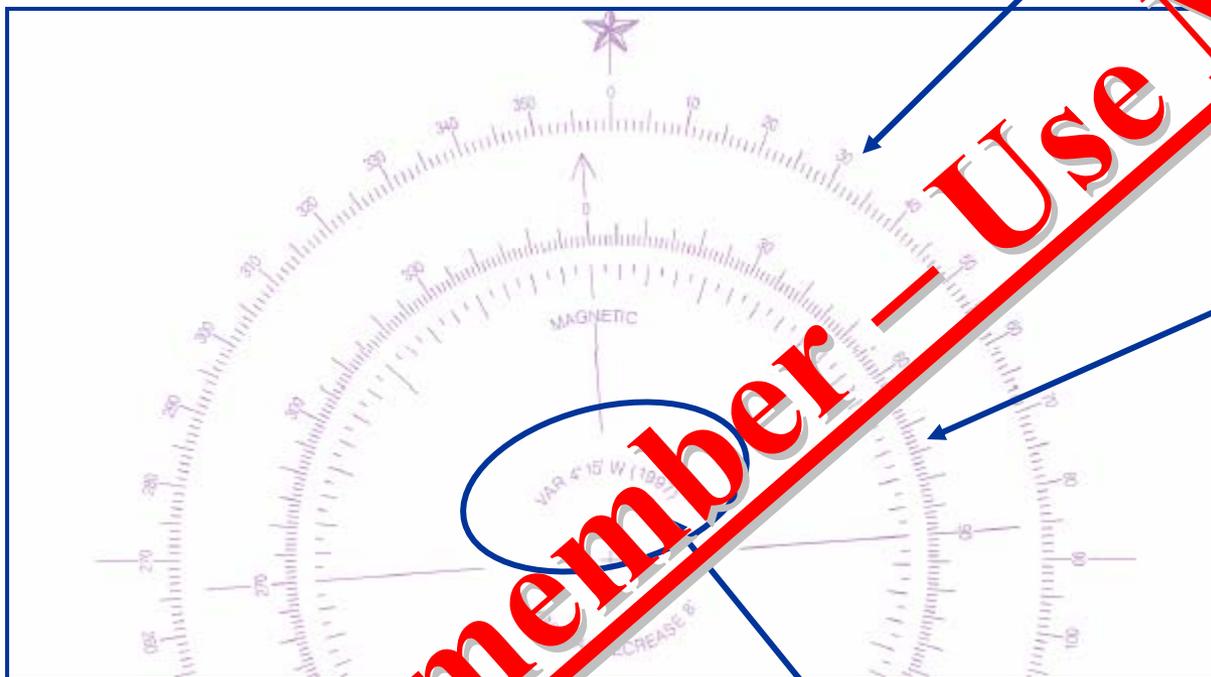
“Weighted Averages...”



# The Compass Rose...

Degrees True

- Don't use this one...



Degrees Magnetic

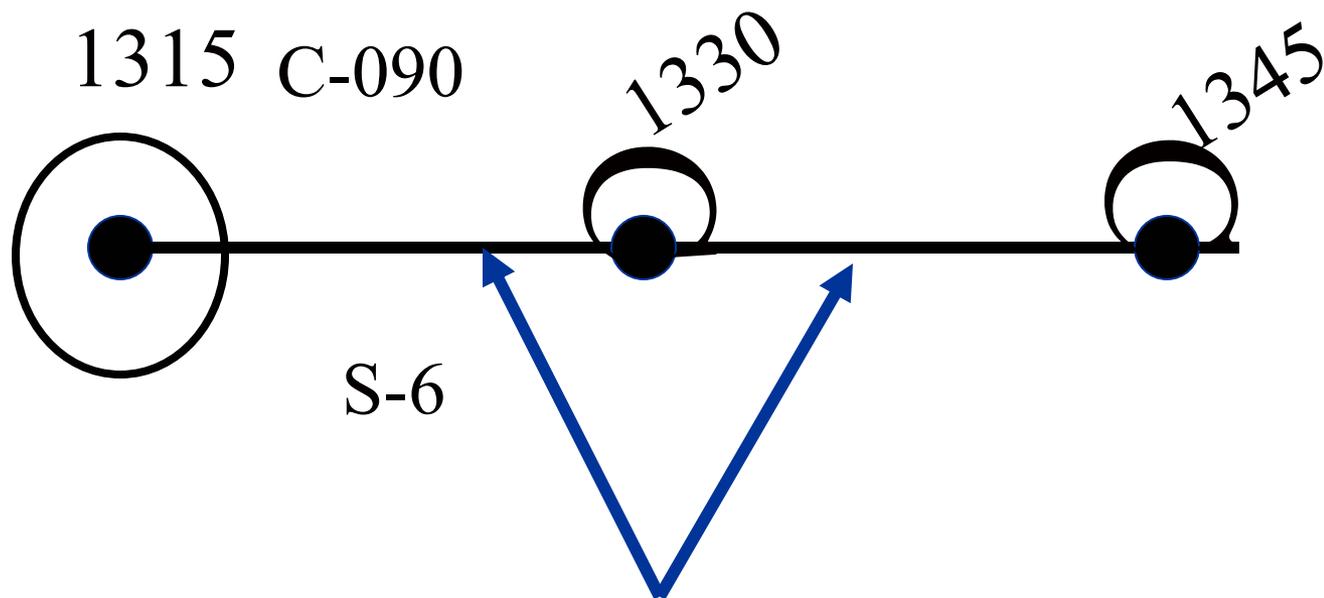
- Use this one!!!

Variation...

- What do you need to know?



# The Fix & The DR...



How Long Are These Segments???

**Sounding – Checks With Chart**



# How Far Can You Go... Before You Plot A Fix Again?

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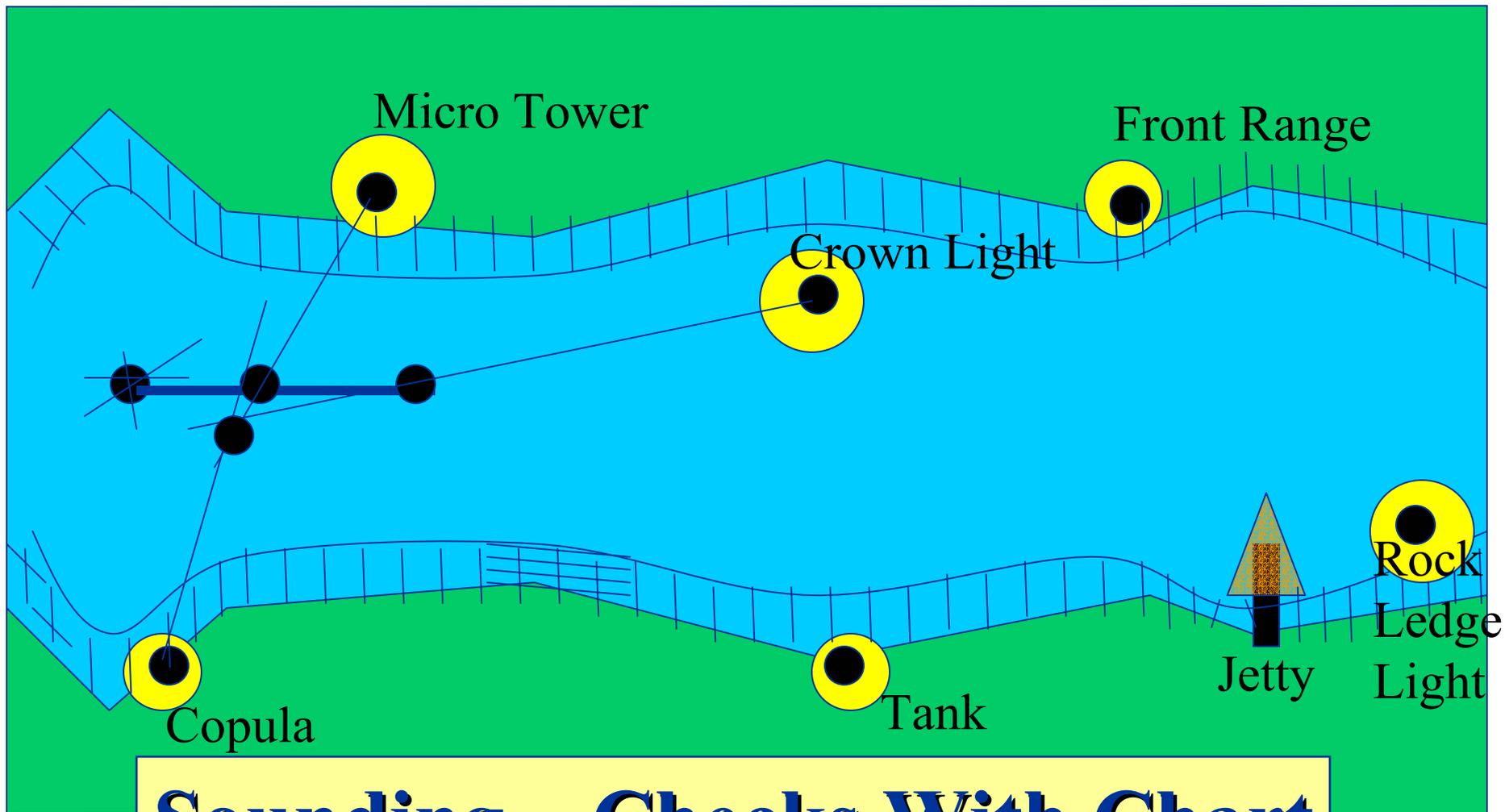
The Nautical Slide Rule

$$\underline{\text{Speed X Time = Distance}}$$



# The Fix & The Dr...

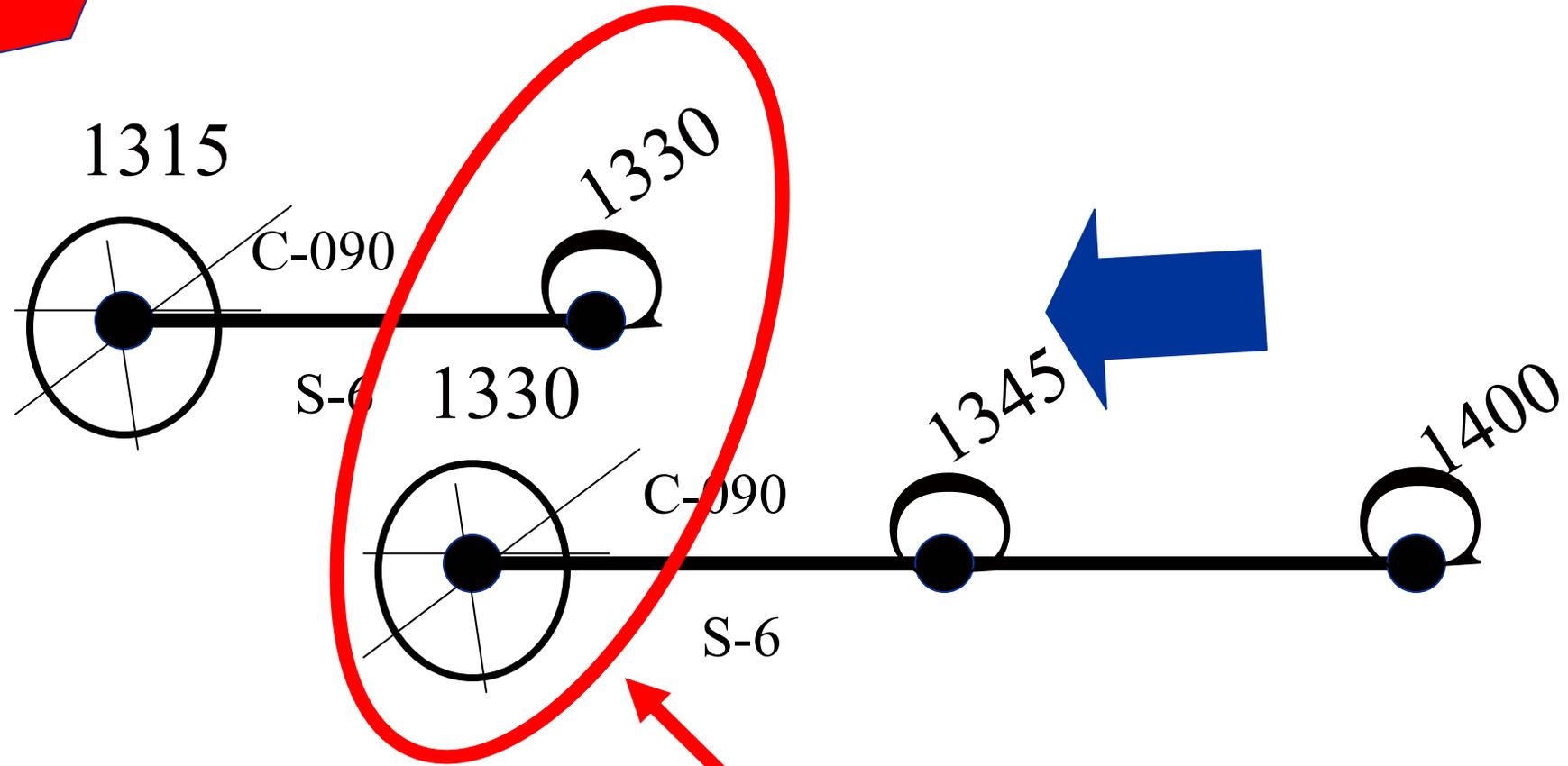
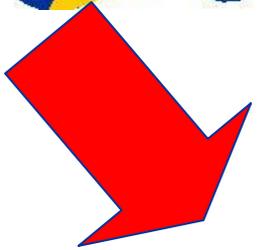
## The Process



**Sounding – Checks With Chart**



# The Fix & The DR...

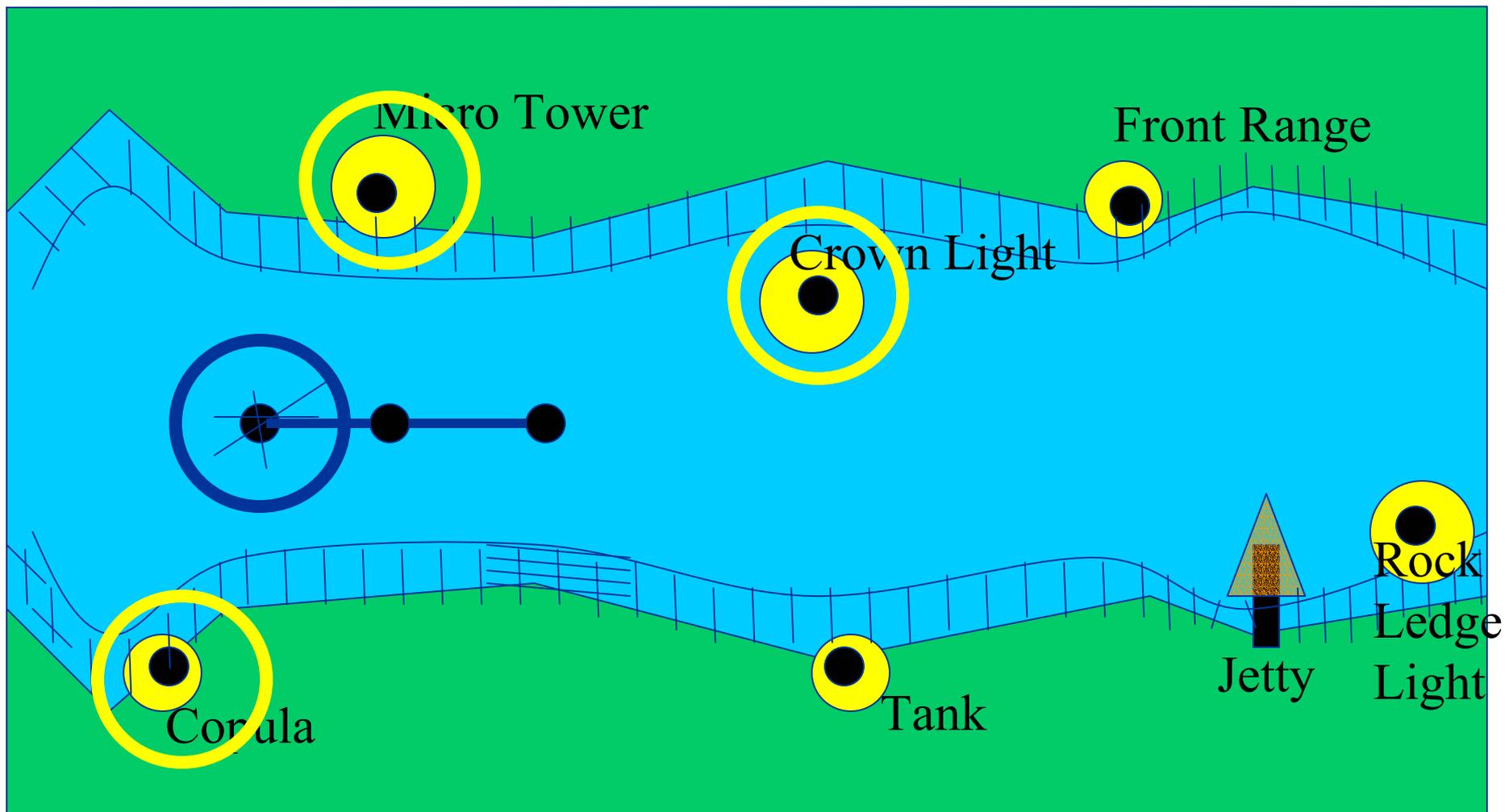


Does This Make Sense???



# We Move...

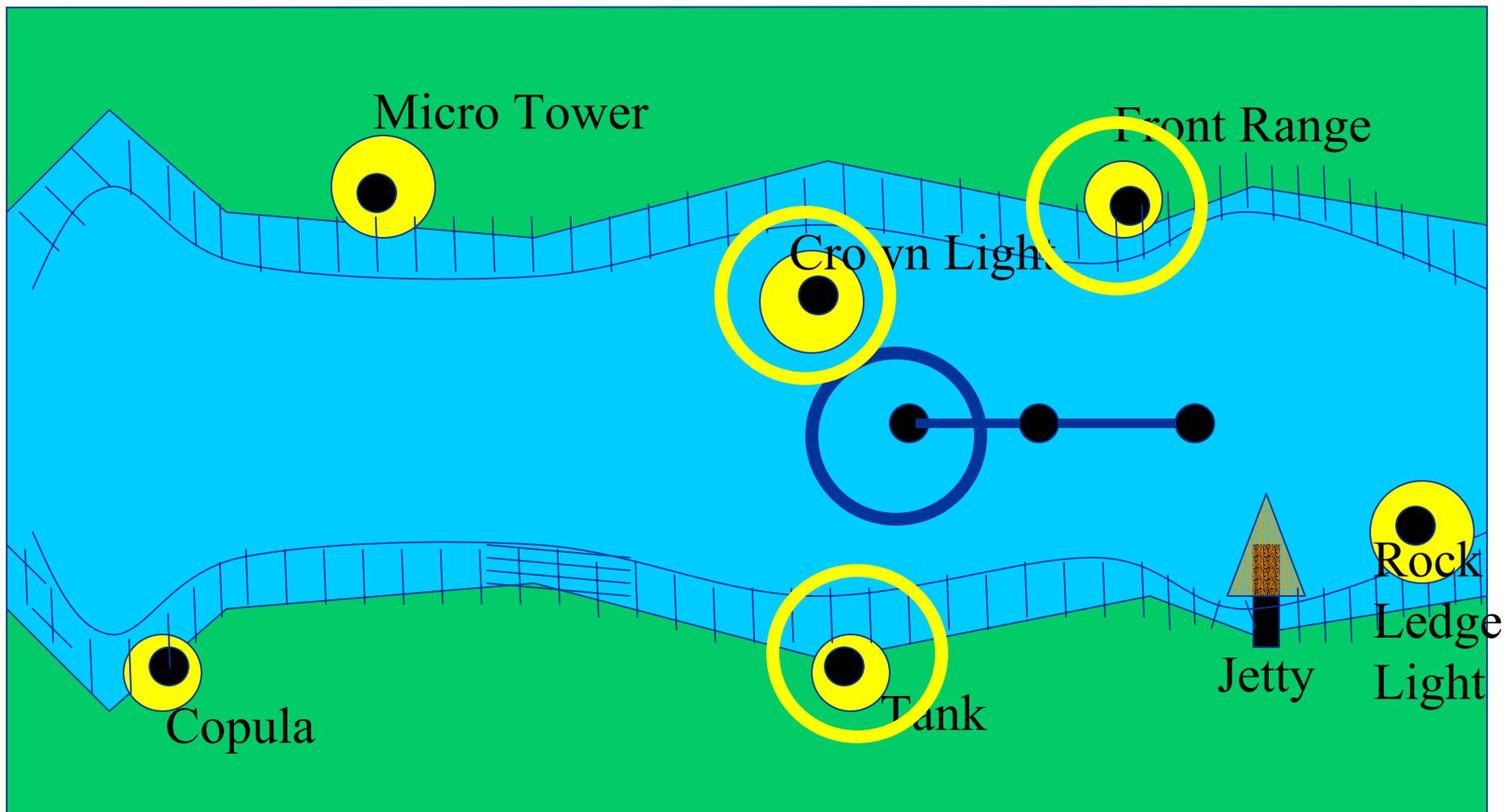
## Gaining and Dropping Nav Aids





# Skip Ahead...

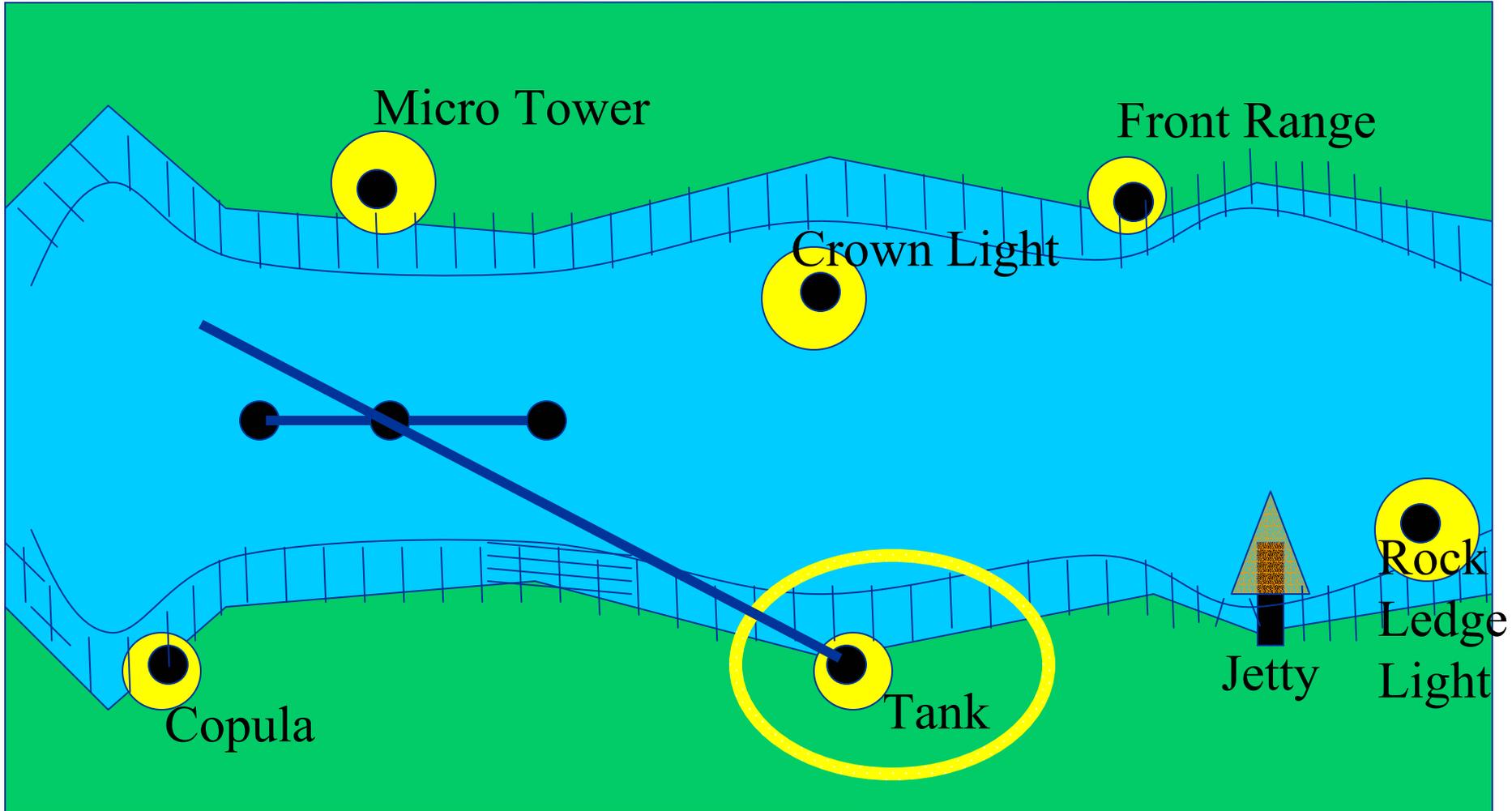
## Gaining and Dropping Nav Aids





# Gaining & Dropping Nav Aids...

## Step 1: Sight & Identify



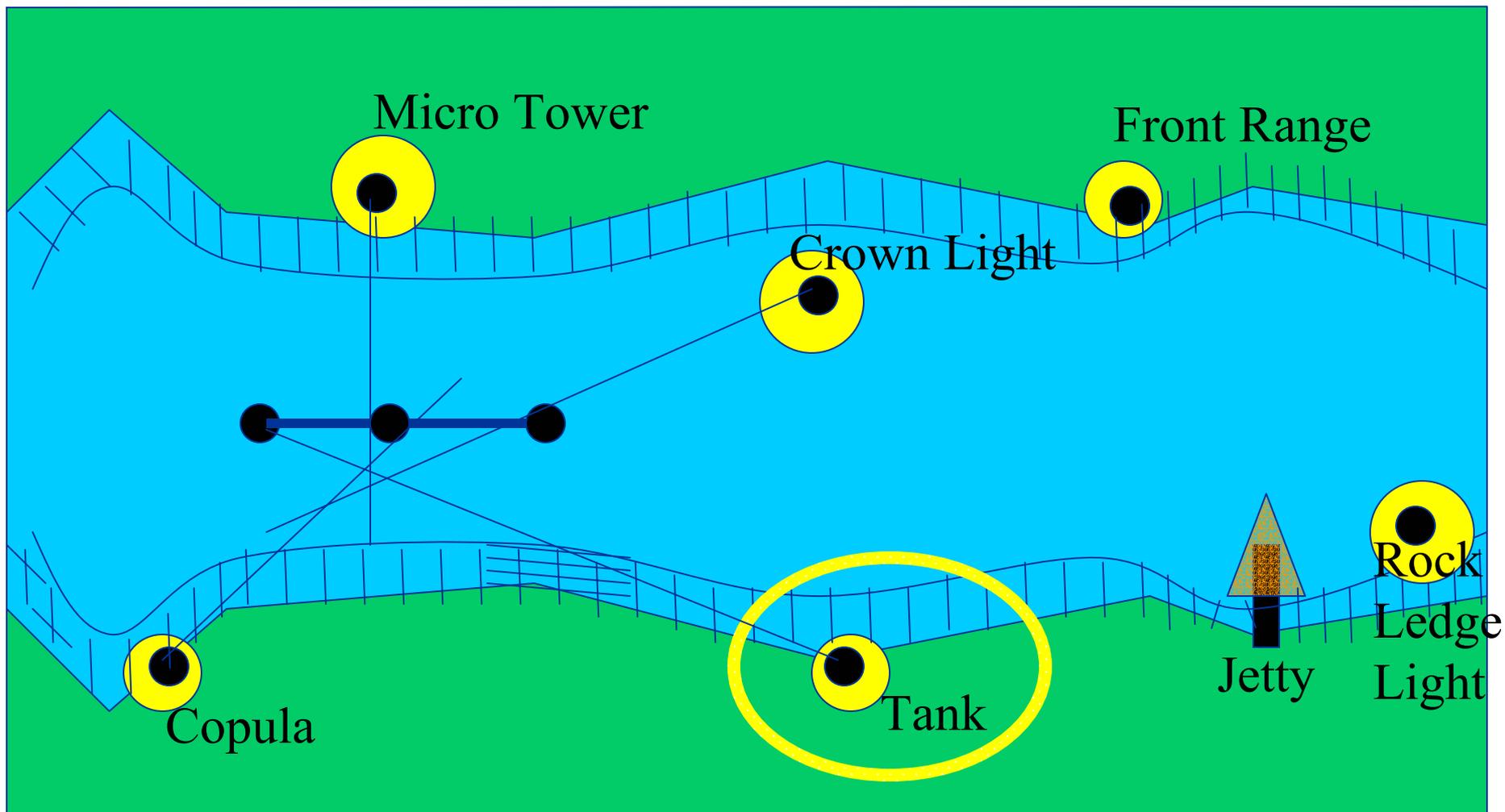






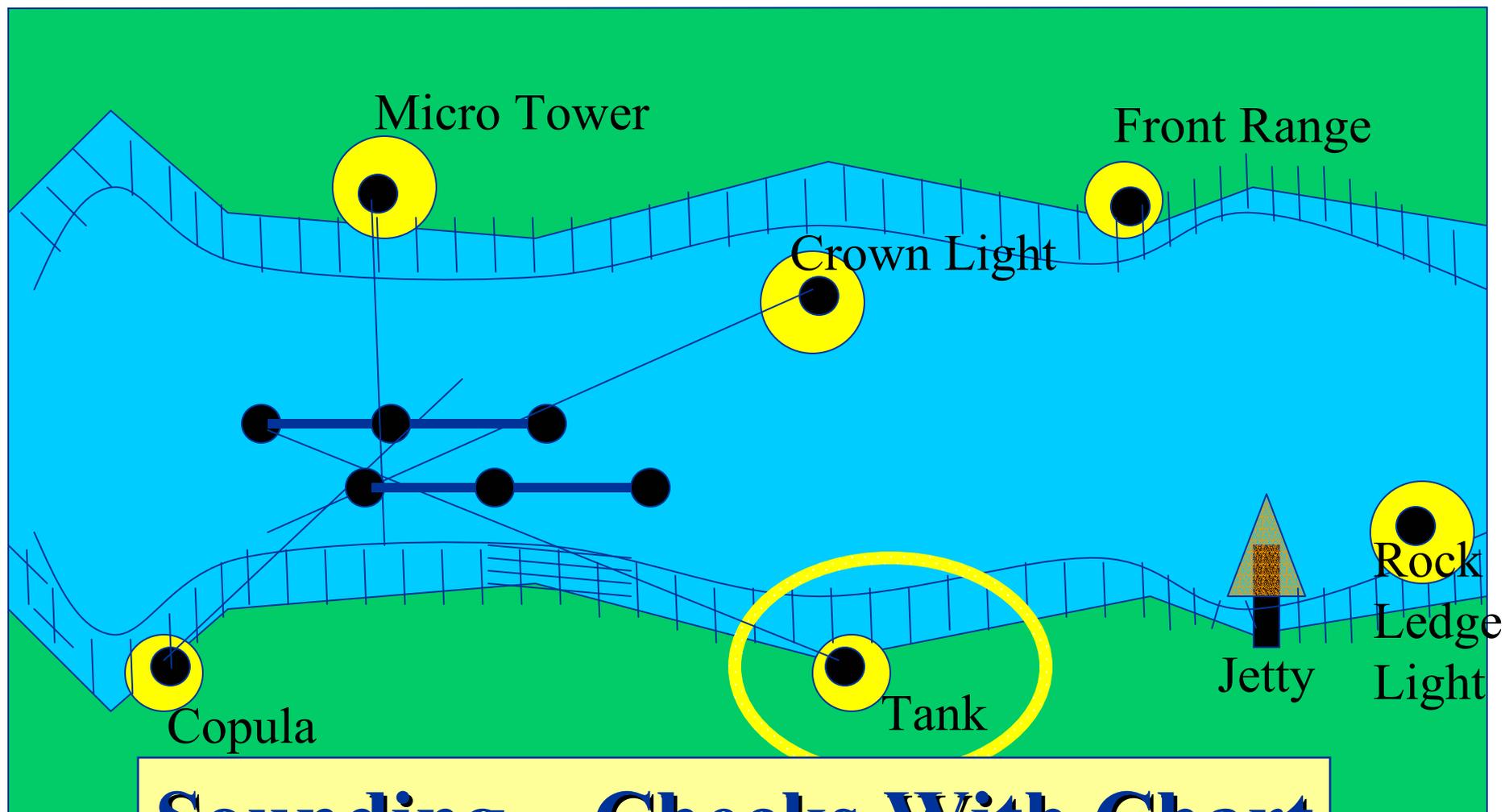
# Gaining & Dropping Nav Aids...

## Step 2: Confirm With Fix



# Gaining & Dropping Nav Aids...

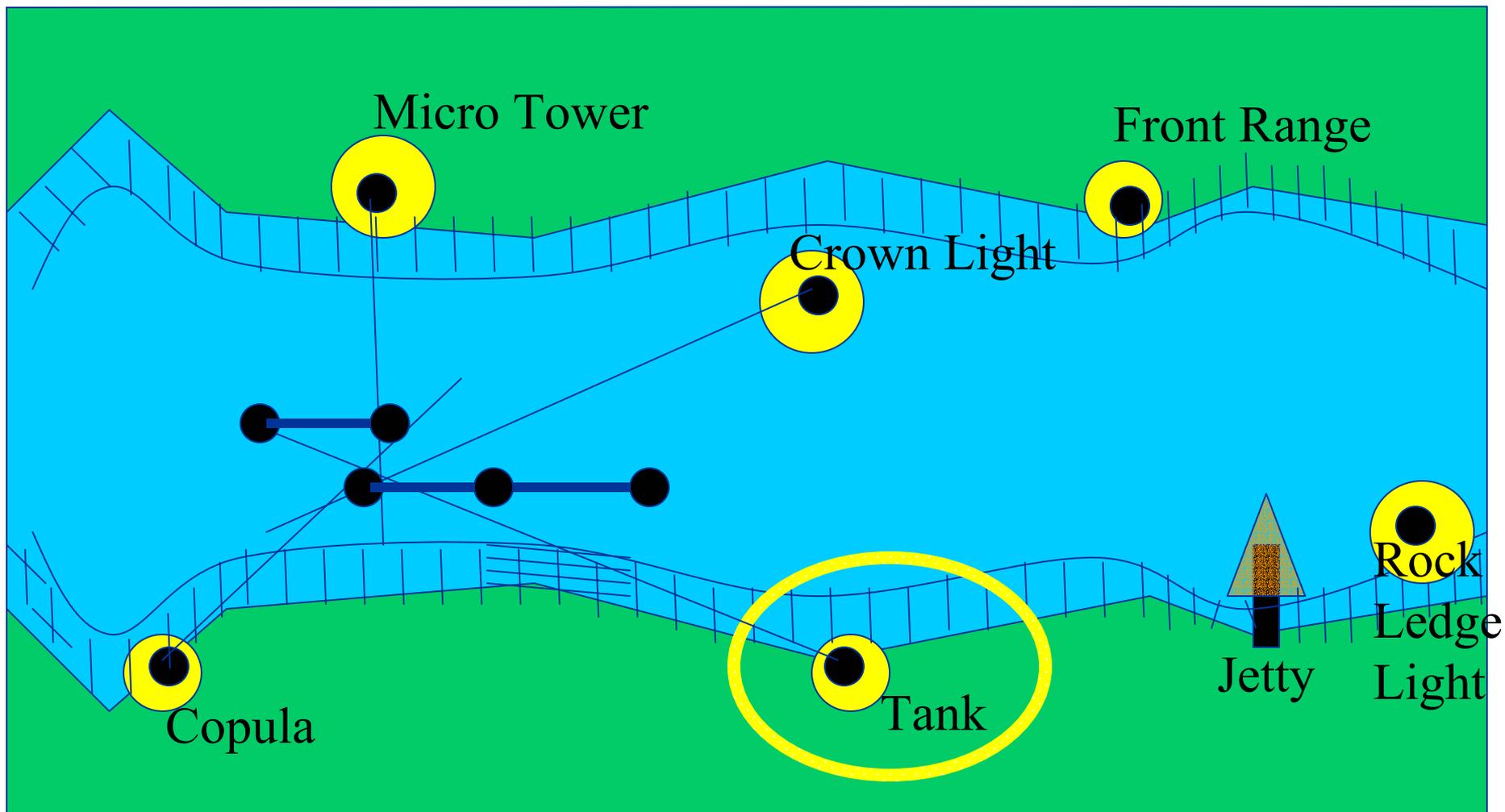
## Step 2: Confirm With Fix



**Sounding – Checks With Chart**

# Gaining & Dropping Nav Aids...

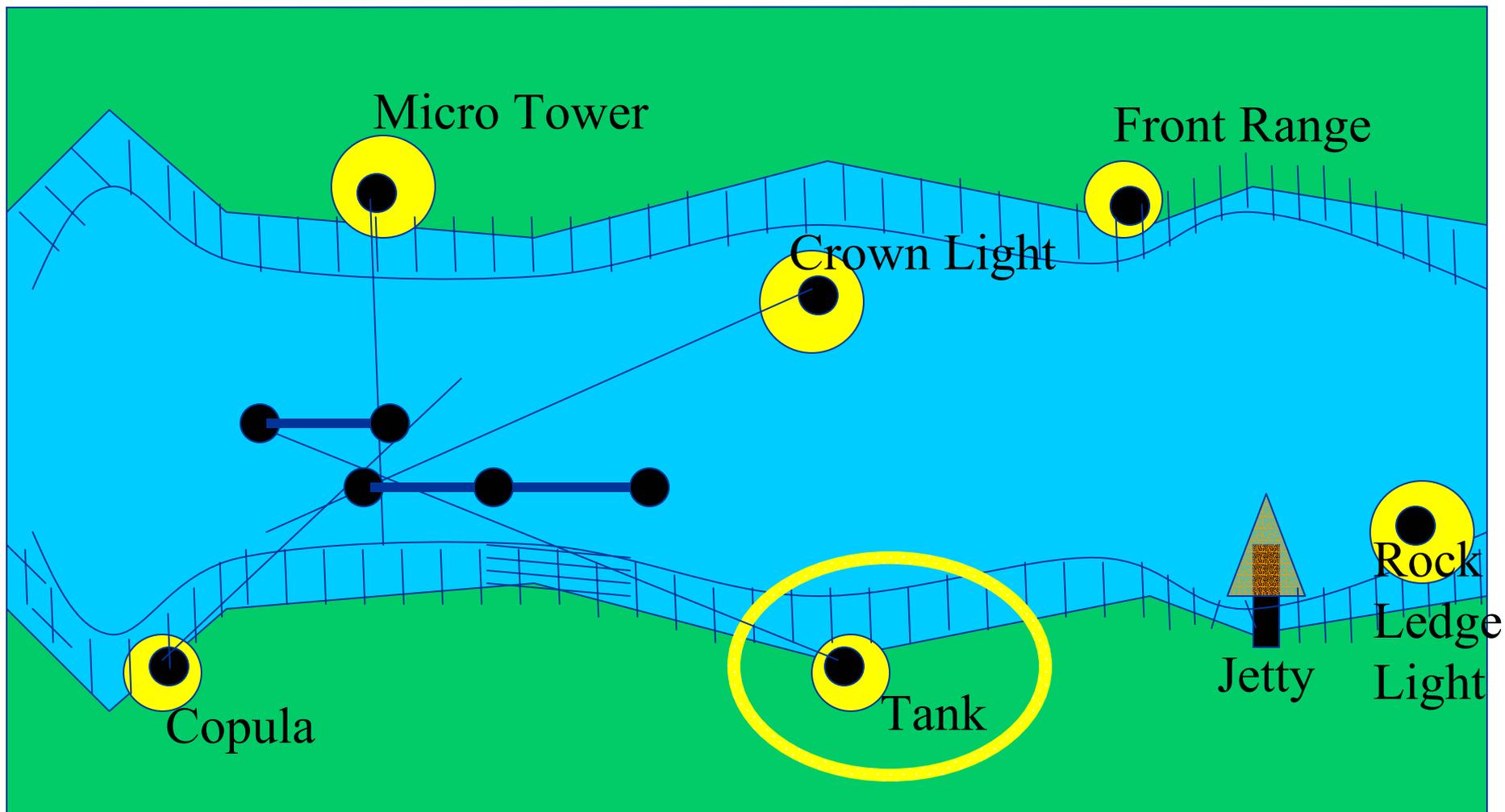
## Step 2: Confirm With Fix





# Gaining & Dropping Nav Aids...

## Step 3: Gain & Drop

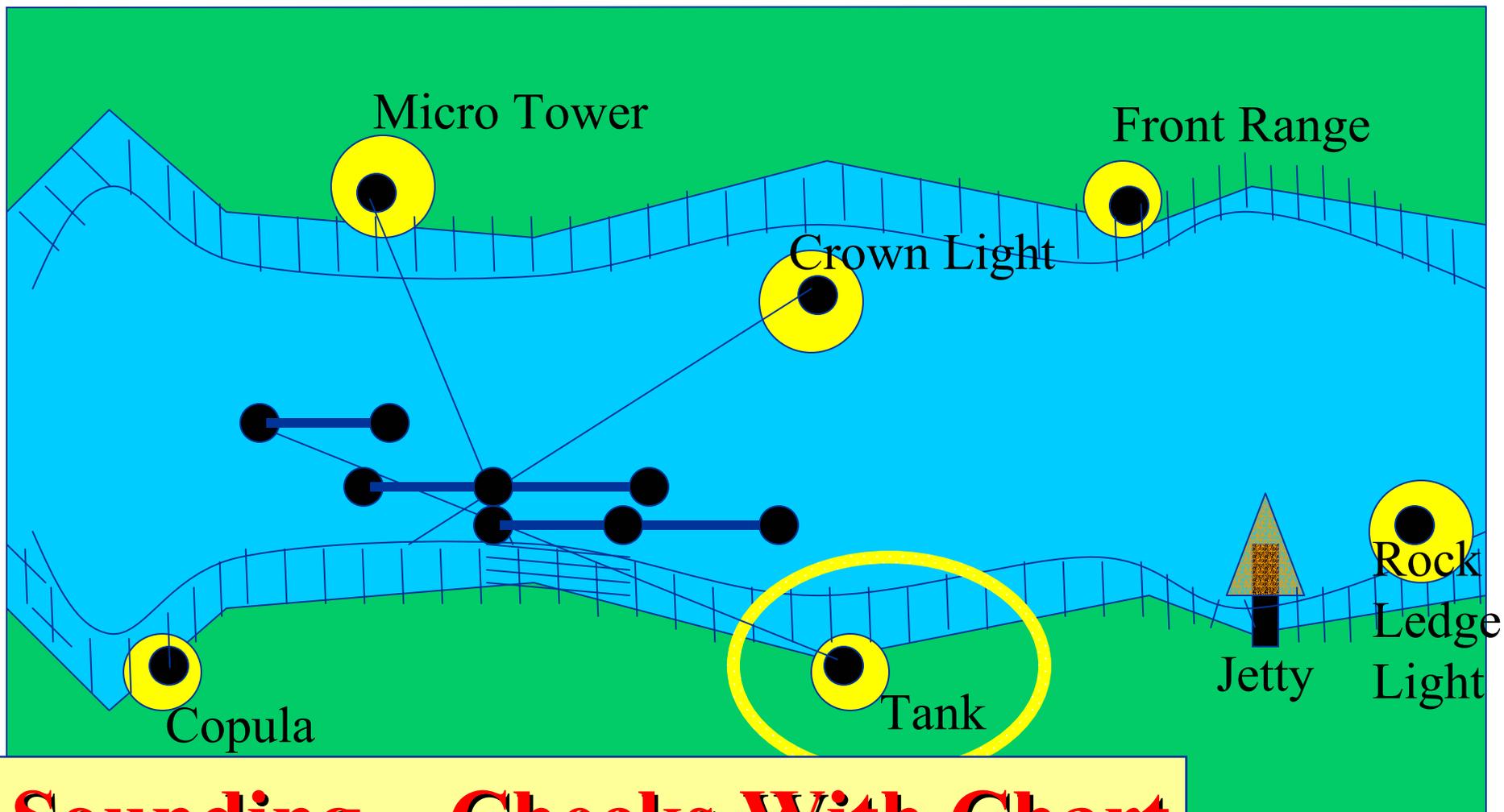






# Gaining & Dropping Nav Aids...

## Step 3: Gain & Drop





# The Chart Shift....

Reviewed in the context of “Making Landfall”



# The Bottom Line...

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The DR is:

The Single Most Important Thing On the Chart



# Course Overview...

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- The Chart
  - Primary emphasis on chart preparation
- The Fix
  - Visual & Electronic
  - Accuracy and errors
- The DR
  - The most important thing on the chart

- Navigation Party
  - Organization, procedures & philosophy
- Making landfall
  - The Navigation Brief



# The Navigation Party





# The Crew...

- Officer in Charge
- Assistant Officer in Charge
- Midshipman Watch Captain – Section 1
- Midshipman Watch Captain – Section 2
- Watch Section 1 – 3 Third Class Midshipmen
- Watch Section 2 – 3 Third Class Midshipmen



# The OIC/AOIC...

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The safe and proper navigation of Sail Training Craft (STC) is, at all times, the responsibility of the assigned Officer in Charge (OIC).

The OIC shall delegate navigational authority to the embarked midshipmen whenever possible in order to enhance their training; however, ultimate responsibility will

*reside permanently with the OIC*



# The OIC/AOIC...

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The OIC is responsible directly to DNAS  
for compliance with directives  
contained in the applicable OORDER  
and will serve as Safety Officer  
during underway watchstanding



# The OIC/AOIC...

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The AOIC is responsible directly to the OIC for compliance with applicable directives, and together with the OIC will fulfill the role of  
Safety Officer  
during underway watchstanding



# Firstie Number 1

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- Midshipman Skipper???
- No – Midshipman Watch Captain...
- See SOP, Page 2-6
- Key issue:

During CSNTS training evolutions and cruises a Midshipman Skipper will not normally be assigned.

In that case, Firstie Number 1 will perform all the duties of Skipper and XO...



## Firstie Number 2

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- Assigned as Navigator
- See SOP, Page 2-7

### As Navigator...

- Report to the OIC
- Ensure all required charts, navigation instruments and references are prepared and aboard prior to getting underway
- Create a Navigation Plan prior to getting underway and measure progress underway with respect to the plan



## Firstie Number 2

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### As Navigator...

- Ensure the watch teams maintain an accurate plot of the boat's position by all available means (visual, celestial and electronic)
- Train and supervise watch team navigators in the principles of visual, celestial and electronic navigation
- Train the ANAV as a navigator



# Youngster Number 1...



- 
- 
-



# The Watch Section

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## On Deck...

- OIC or AOIC
- Watch Captain
- Navigation Plotter
- Helm
- Lookout

**Note:**  
**The Watch Captain cannot  
serve as Navigation Plotter  
Or  
Lookout!!!**



# The Watch Captain...

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## Overarching concepts...

- The key supervisory position in the conduct of the watch.
- Has overall responsibility for the safe operation of the STC, the efficient performance of the watch and the progress of the daily routine.
- Relieves LAST!!!



# The Watch Captain...

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## Overarching concepts...

- The on-watch Watch Captain is responsible directly to the OIC for the safe and accurate navigation of the STC for the duration of the assigned watch.

**Note: It doesn't say OIC or AOIC!!!**

- The offgoing Watch Captain shall include a complete navigational update during the face-to-face turnover process between oncoming and offgoing Watch Captains.



# The Watch Captain...

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## Duties and Responsibilities...

- Remain attentive to external conditions at all times; anticipate and respond to changes early (Navigation hazards nearby)
- Train the watch team
- Supervise the watch team navigator

*And much, much more...*



# The Navigation Plotter...

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## Overarching concepts...

- The Navigation Plotter shall be a distinct station in the watch rotation. The Watch Captain may assign the Navigation Plotter for the duration of the watch, or may rotate the position among watch team members (not to include the Watch Captain).

**The OIC must ensure the crew understands the rotation policy prior to getting underway.**



# The Navigation Plotter...

---

## Overarching concepts...

- In no case shall an STC go for more than one hour without fixing its position.
- In piloting waters, the Navigation Plotter shall plot a fix at an interval that does not exceed half the time it would take the STC to reach the nearest navigational hazard at current speed.



# The Navigation Plotter...

---

## Duties and Responsibilities...

- The Navigation Plotter Serves as the Watch Team Navigator
- Fix the position of the STC in accordance with the fix interval established by the OIC.
- Maintain the navigation plot adhering to the six rules of DR.
- DR two fix intervals ahead to ensure the boat is not standing into danger
- Make course-to-steer recommendations to the helmsman



# The Navigation Plotter...

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## Duties and Responsibilities (continued)...

- Monitor HF/VHF radios and advise the Watch Captain of pertinent radio traffic
- Maintain a radar watch (if warranted)
- Maintain The Offshore Yacht Log...

Printed Neatly In **BLACK INK**

*And much, much more...*



# The Helmsman...

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## Duties and Responsibilities...

- Maintain a good lookout
- Maintain the ordered course. Inform the Watch Captain and Watch Team Navigator if unable to maintain the ordered course.
- Monitor sail trim

*And much, much more...*



# The Lookout...

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## Duties and Responsibilities...

- Reports to the Watch Captain
- Maintain a proper lookout – See COLREGS
- Report all contacts to the Helmsman

*And...*

***Not Much More!!!***



# Watch Relief...

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## Watch relief...

- Prior to relieving the watch the oncoming watchstanders shall:
  - Review the navigation plot with emphasis on current position, expected navigation aids and hazards and desired course.
- Determine the following once topside:
  - Identity and location of all visible and expected nav aids/hazards



Ponder This:

*If you're struggling to comply with the minimum requirements just discussed, should you be...???*



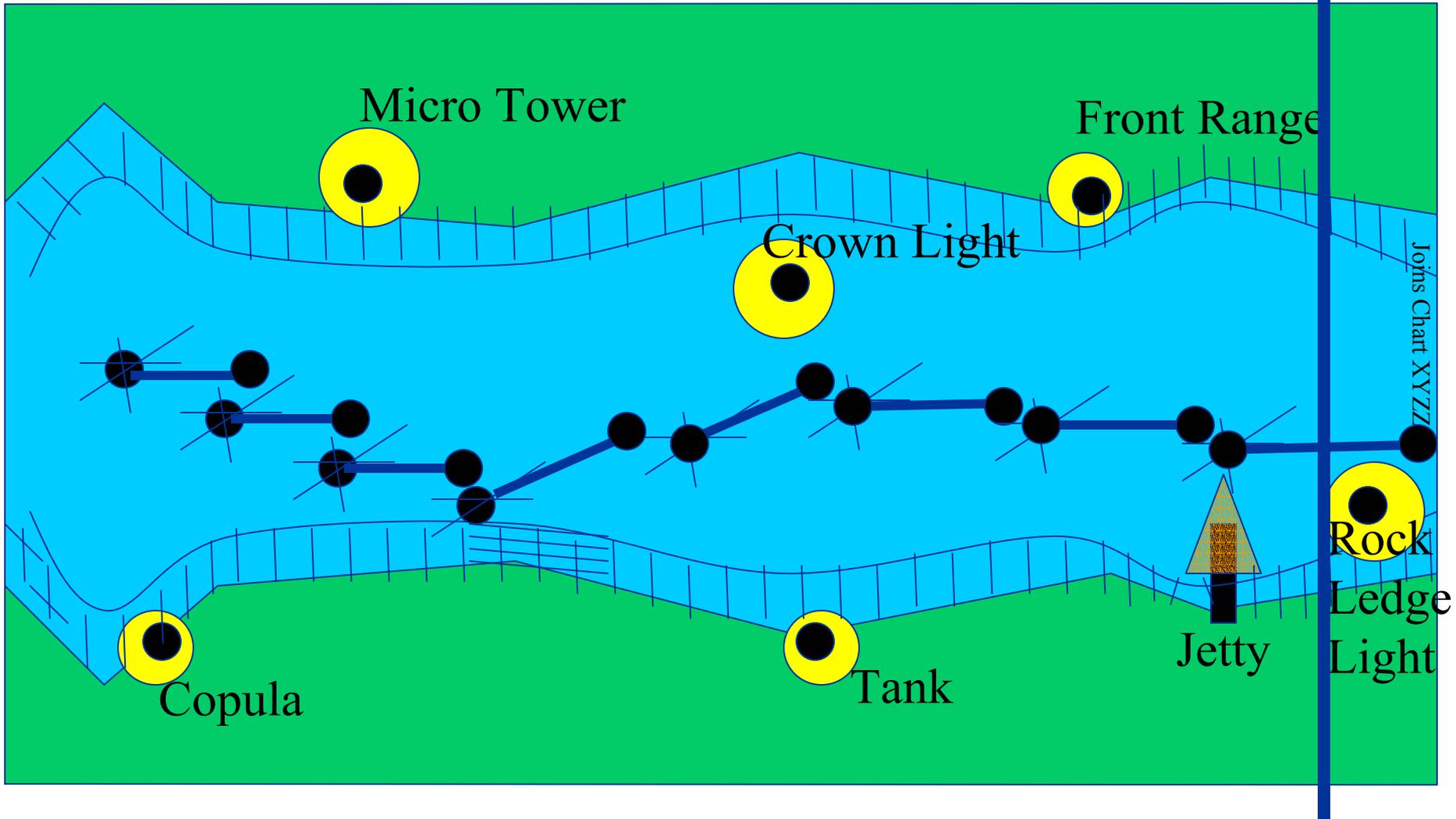
# Course Overview...

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- The Chart
  - Primary emphasis on chart preparation
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  - The most important thing on the chart
- Navigation Party
  - Organization, procedures & philosophy
- { • Making landfall
  - The Navigation Brief



# The Chart Shift





# Making Landfall...

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## The Chart Shift

- Many navigation mistakes occur at the chart shift point
- OIC should approve Chart Shift – as follows:

“Officer in Charge, my DR holds us leaving this chart in 30 minutes. Recommend shifting to chart 12224”

“Very well. Shift to Chart 12224.”

“Shift to Chart 12224, Aye.”



# How Do You Do The Shift???

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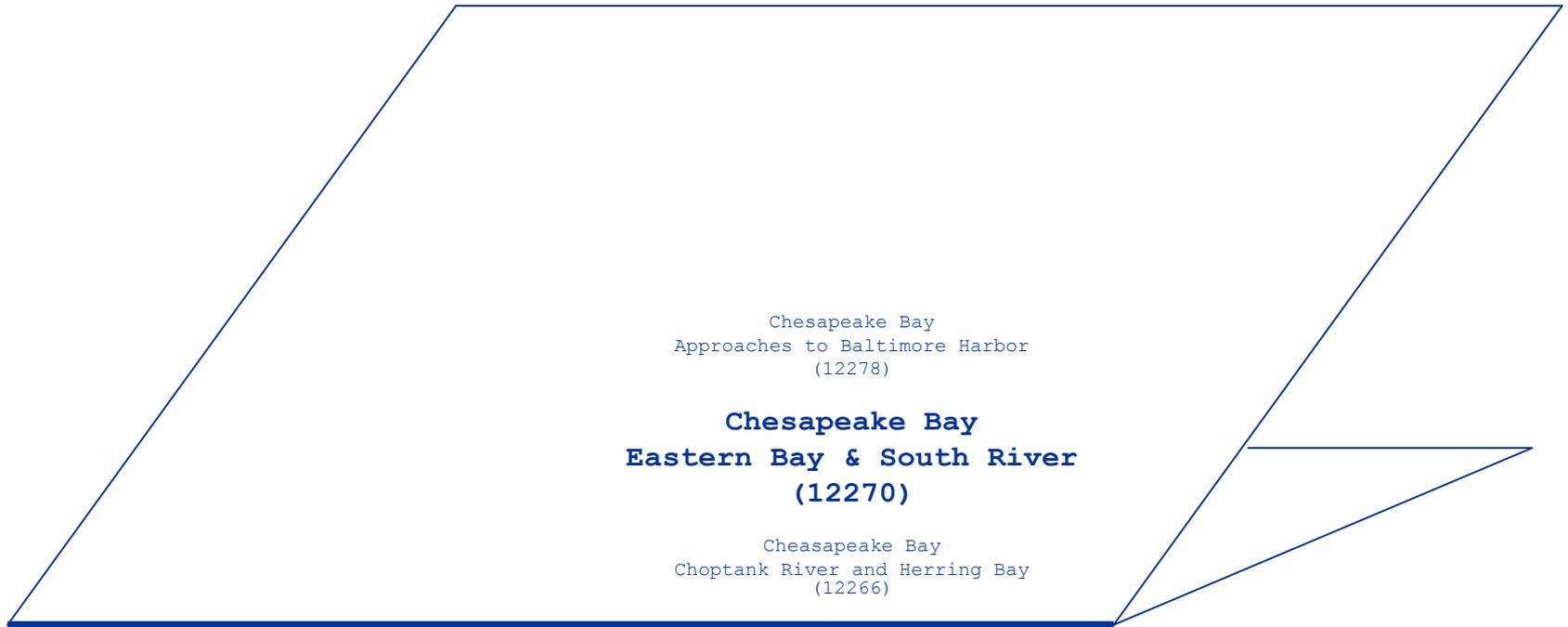
What should you look for personally to make sure this is done correctly?

- The **back** of the current chart – Make sure the number matches what you calculated when warm, dry and rested!!!
- Remember these???



# How Do You Fold A Chart?

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# How's It Labeled?

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Chesapeake Bay  
Approaches To Baltimore Harbor  
(12278)

**Chesapeake Bay**  
**Eastern Bay & South River**  
**(12270)**

Chesapeake Bay  
Choptank River & Herring Bay  
(12266)



# How Do You Do The Shift???

---

What should you look for personally to make sure this is done correctly?

- The chart is ready for use
  - The Chart Prep Checklist
- Remember this???



# The Chart Prep Checklist...

## Navy Sailing Chart Preparation Checklist Chart Number \_\_\_\_\_

1. Note the chart's sounding datum (X the appropriate box).

Fathoms \_\_\_\_\_ Feet \_\_\_\_\_ Meters \_\_\_\_\_

2. Box the Sounding Datum. Highlight this in Orange and verify that it's visible after the chart is folded for use. If not - annotate it where it can best be seen.

3. Enter the vessel's draft (i.e., 7.5 feet) \_\_\_\_\_

9. Nav hazards: Carefully review the chart, and identify unlighted buoys and other nav hazards.

- Circle, highlight in pink, and label **UNLIT ABC/NAVHAZARD ABC**.

10. Radar Nav Aids: Carefully review the chart, and identify radar nav aids.

- Triangle, highlight in orange, and label **ABC**
- Pay particular attention for RACON buoys. These should have a circle and a triangle, and be labeled **RACON ABC**

11. Track: Draw and label the track

**Did you, in fact, sign off on this chart???**

**If not – reverse course and do it right!!!**

\_\_\_\_\_ X \_\_\_\_\_ = \_\_\_\_\_

(i.e., For a CSNTS Cruise: 8 feet times 2 = 16 ft)

6. Review the chart for actual sounding datum. Choose one based on Block 6 above (if required, round up): \_\_\_\_\_

7. Highlight this sounding line with a dark blue marker. Pay particular attention to the rate of change of depth, and mark the chart accordingly.

8. Visual Nav Aids: Carefully review the chart, and identify visual nav aids:

- Circle, highlight in yellow, and label **ABC** (Where ABC is an easily spoken, unmistakable noun name)

enter of the deep draft  
to the expected location

lined in 7 above, slash  
slash those areas where

chart as follows:

the chart's noun name  
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Latest Chart Edition \_\_\_\_\_ On-hand Chart Edition \_\_\_\_\_

Latest Notice To Mariners \_\_\_\_\_

CHART UPDATED THROUGH NOTICE TO MARINERS \_\_\_\_\_ / \_\_\_\_\_

Number \_\_\_\_\_ Date \_\_\_\_\_

Submitted: \_\_\_\_\_ Reviewed: \_\_\_\_\_

Midshipman Navigator

AOIC/Navigator

Approved: \_\_\_\_\_

Officer In Charge



# How Do You Do The Shift???

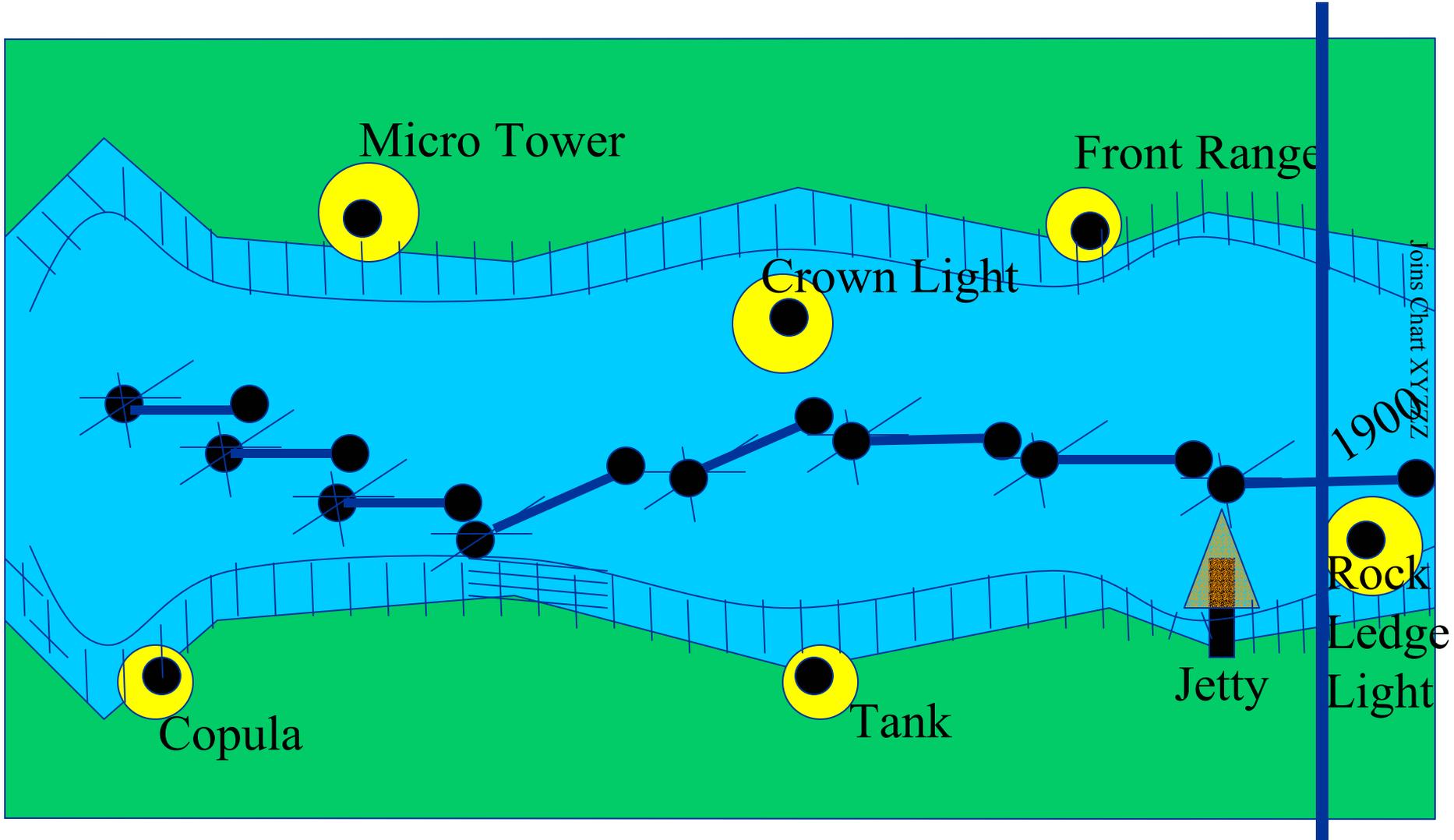
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What should the plotter do?

- Determine the Latitude and Longitude of the **DR** that will be advanced onto the new chart
- Write it in the log
- “Shifted to chart 12224. Advanced DR position  $34^{\circ}17.8'N$   $074^{\circ}16.4'W$ ”
- Check you didn't make a transcription error
- Plot this DR position on the new chart
- See the homework problem



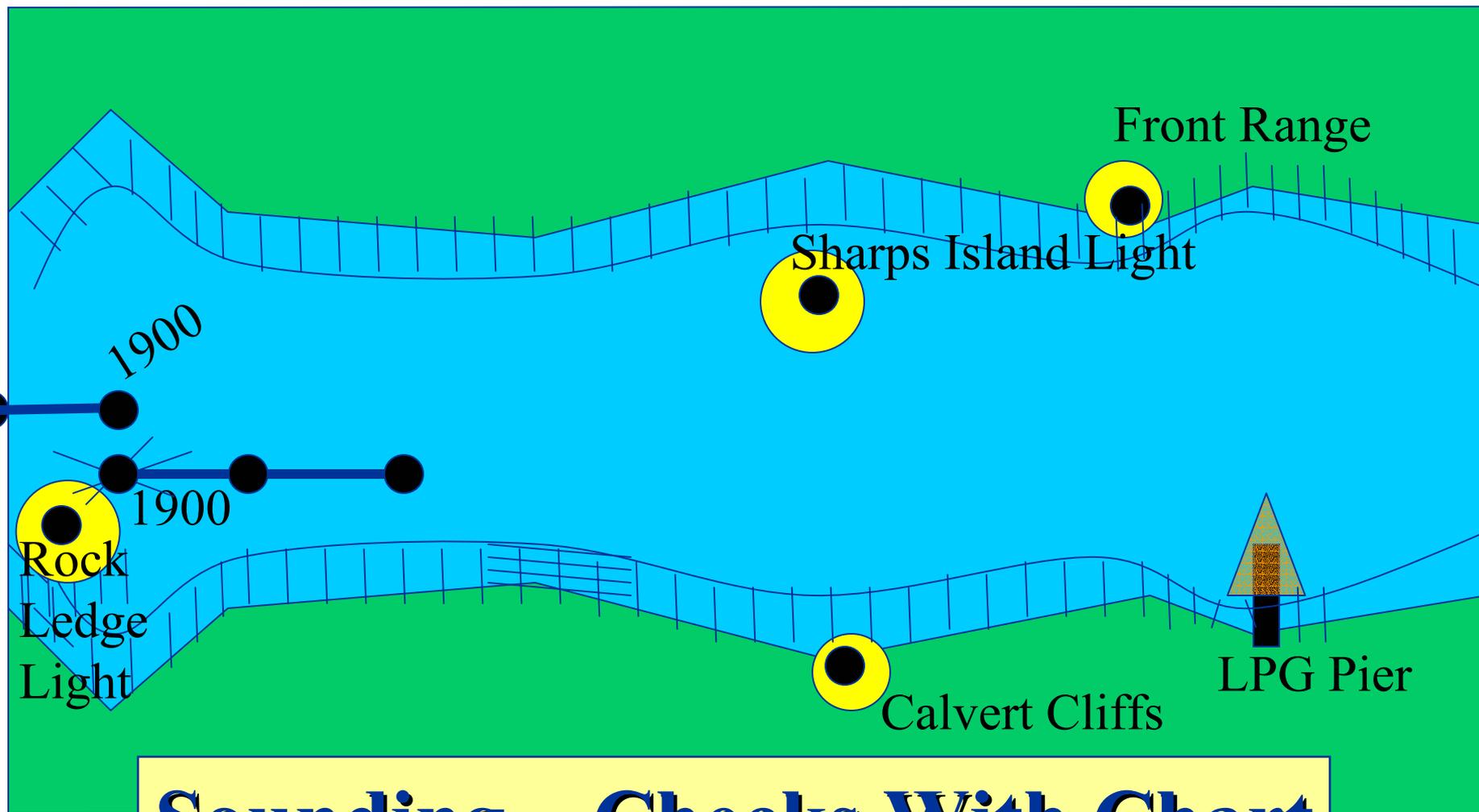
# The Chart Shift







# The Chart Shift



**Sounding – Checks With Chart**



# How Do You Do The Shift???

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## What should the plotter do?

- Fix the vessel's position at OR BEFORE the time of the advanced DR
- Compare and contrast those two posits
- Sounding???
- Does this make sense?
- DR
  - Minimum cyclic routine: Plot Label DR
  - Six rules of DR
    - Don't plot a fix on the new chart without something to compare it to



# How Do You Do The Shift???

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## What should the plotter do?

- Invite Watch Captain and OIC/AOIC to check the shift.
- “Officer in charge. Shifted to Chart 12224. Fixed the ship’s position at time 1240 by Loran C, checks with DR. Request you lay below to check the chart.”
- Check it – and not in a perfunctory manner



# How Do You Do The Shift???

---

Check it – and not in a perfunctory manner

- What do I mean by that?
  - Check the log entry – It's your logbook!!!
  - Compare what's written to the displayed data
  - Break out the dividers and plot it - yourself
  - Or, shoot a round – yourself
  - Then initial the log book





## Caution!!!

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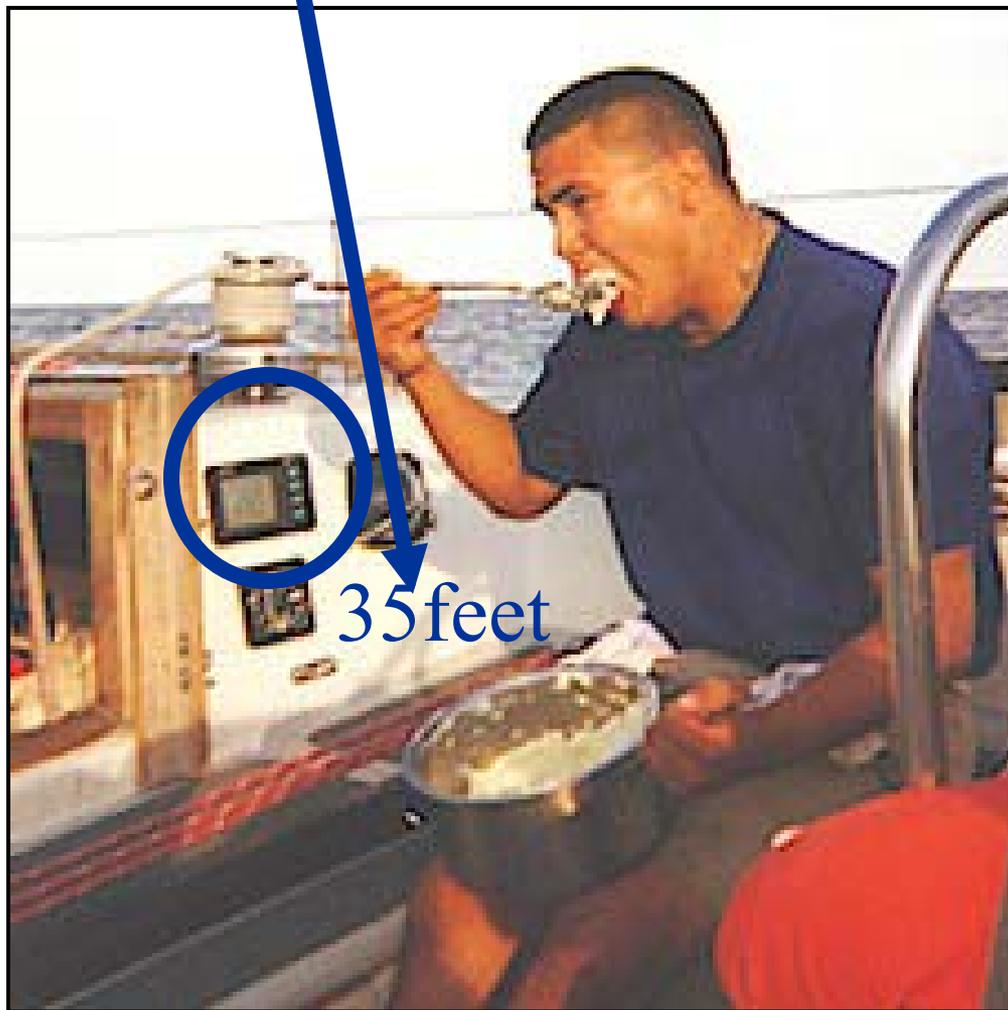
When you make the chart shift **UPDATE YOUR INSTRUMENTATION** to match the chart exactly:

- Open Ocean Charts are often in Degrees, Minutes and Tenths
- Piloting Charts are often in Degrees, Minutes and Seconds
- Sounding datum – fathoms, feet or meters???
- Tell everyone the new “No go sounding”
- Make sure they acknowledge



# The Fatho...

Write the NEW “No Go Sounding” In Grease Pencil Here





# The Nav Brief

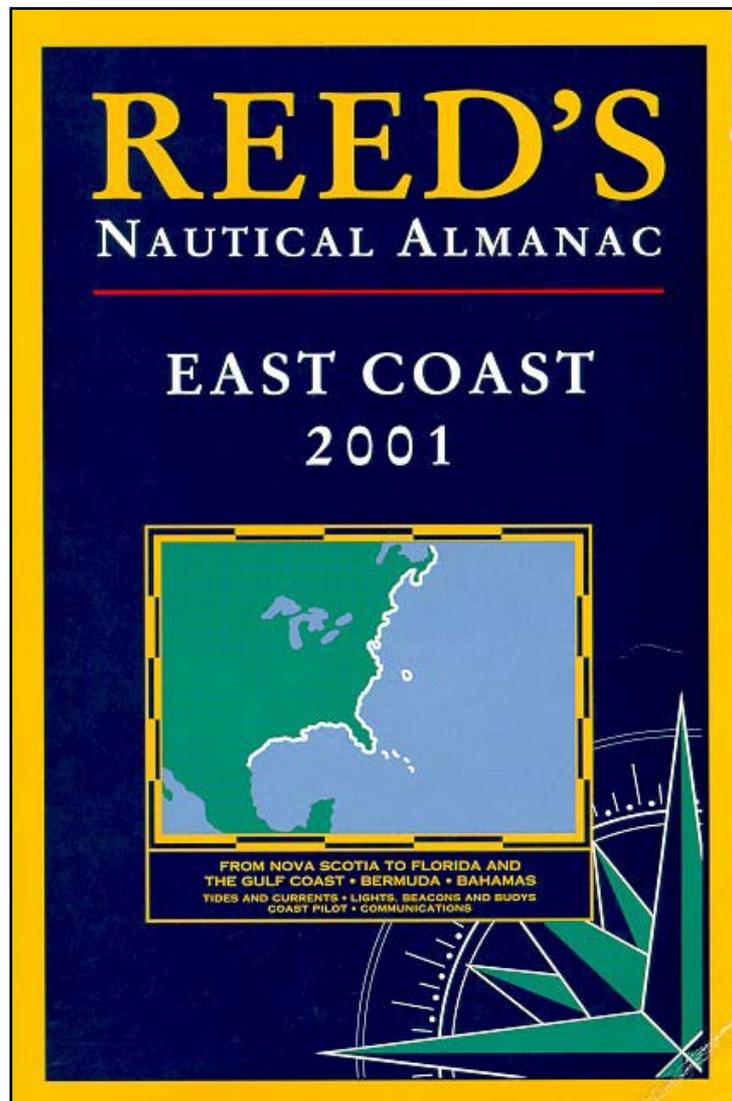
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## Break out & use the Navigation Brief Checklist

- This checklist was derived from those used in the fleet, but was modified for use in the Navy Sailing Program
- Who is responsible for the busy work?
- What do you read to make sure you know what you need to know?



# What Pub should you use?

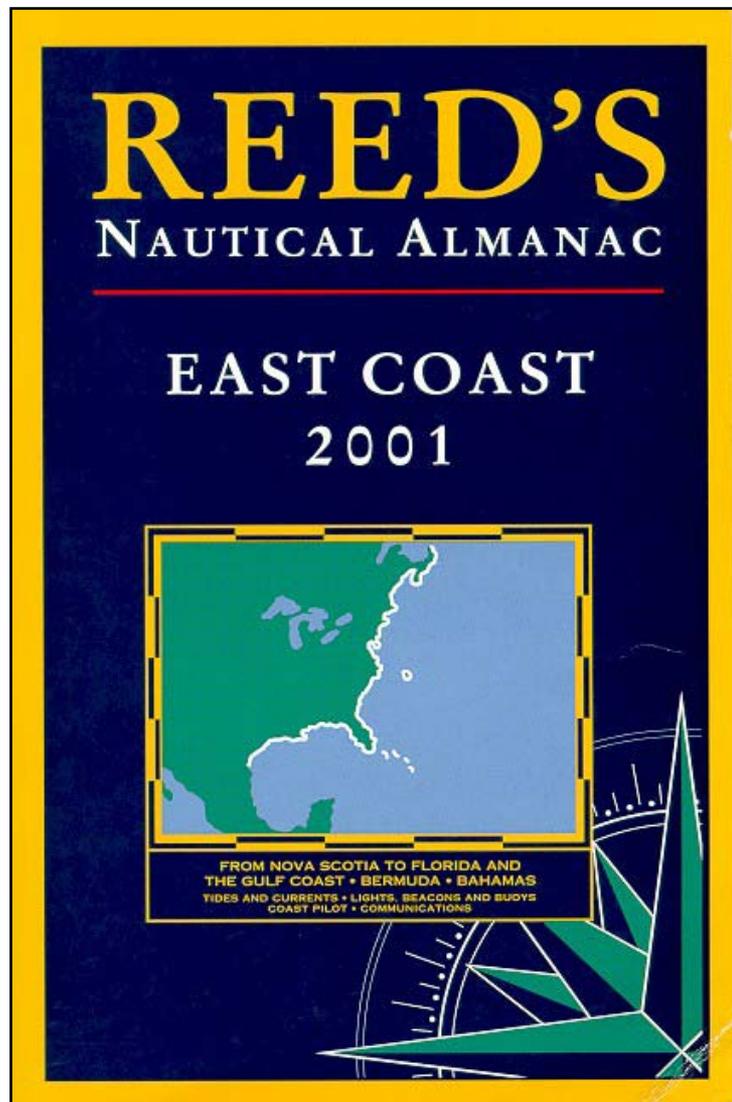


## Truly one stop shopping

- Chapter 1 – The Coast Pilot
- Chapter 2 – Tides
- Chapter 3 – Currents
- Chapter 4 - Resources



# What Pub should you use?

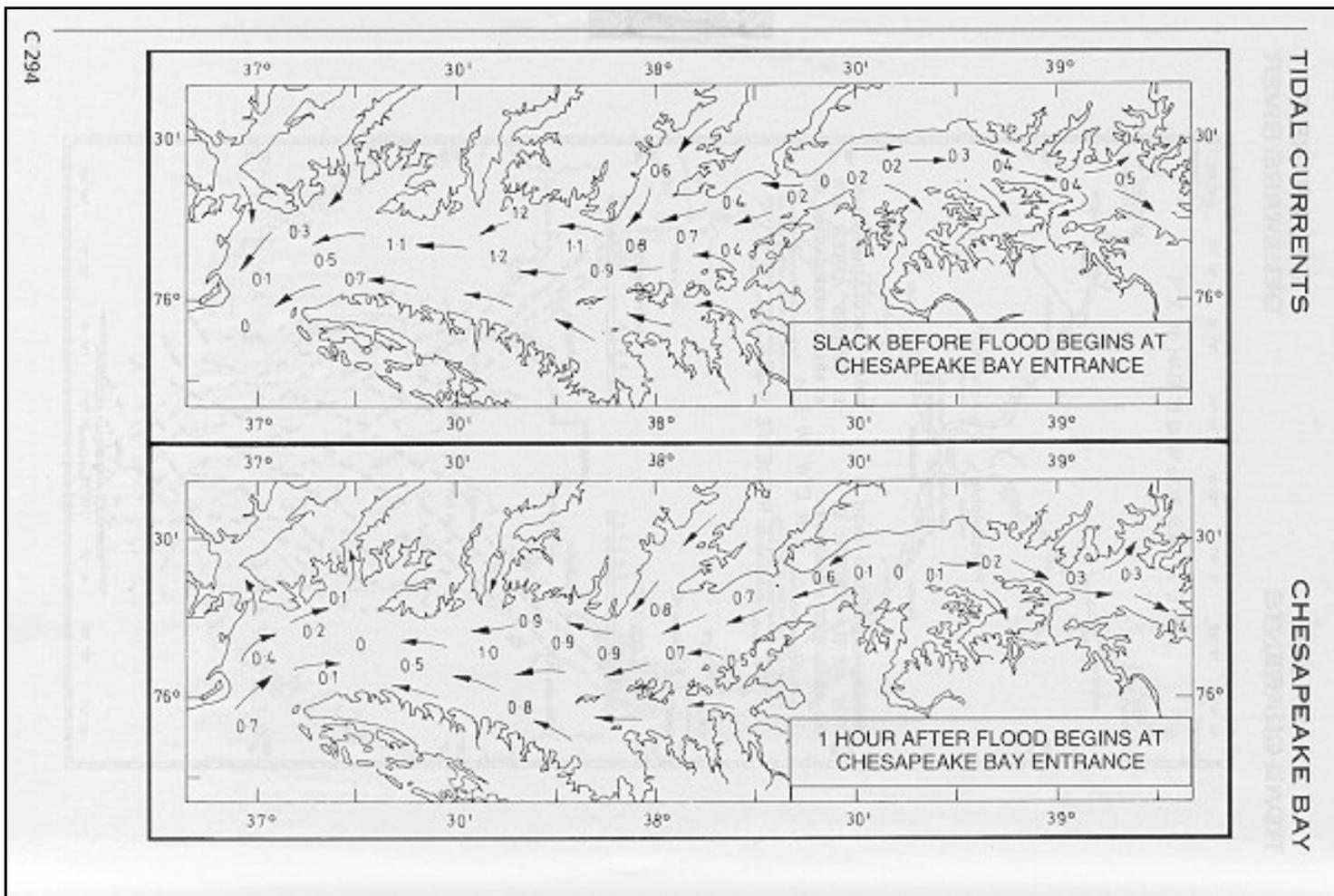


## Tides & Currents

- We haven't talked about it in this course, but Reed's presents the material in an easily understood format



# Reed's Tides & Currents





# What Pub should you use?

## United States Coast Pilot 2

Atlantic Coast:  
Cape Cod to Sandy Hook

30th Edition



U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Ocean Service

It's essentially Reed's  
Chapter 1



# What Pub should you use?

PUB. 940

## FLEET GUIDE



### ATLANTIC

2000



Second Edition

\*\* CD-ROM  
INCLUDED \*\*

NSN 7642014413588  
NIMA REF. NO. FG PUB940ATL

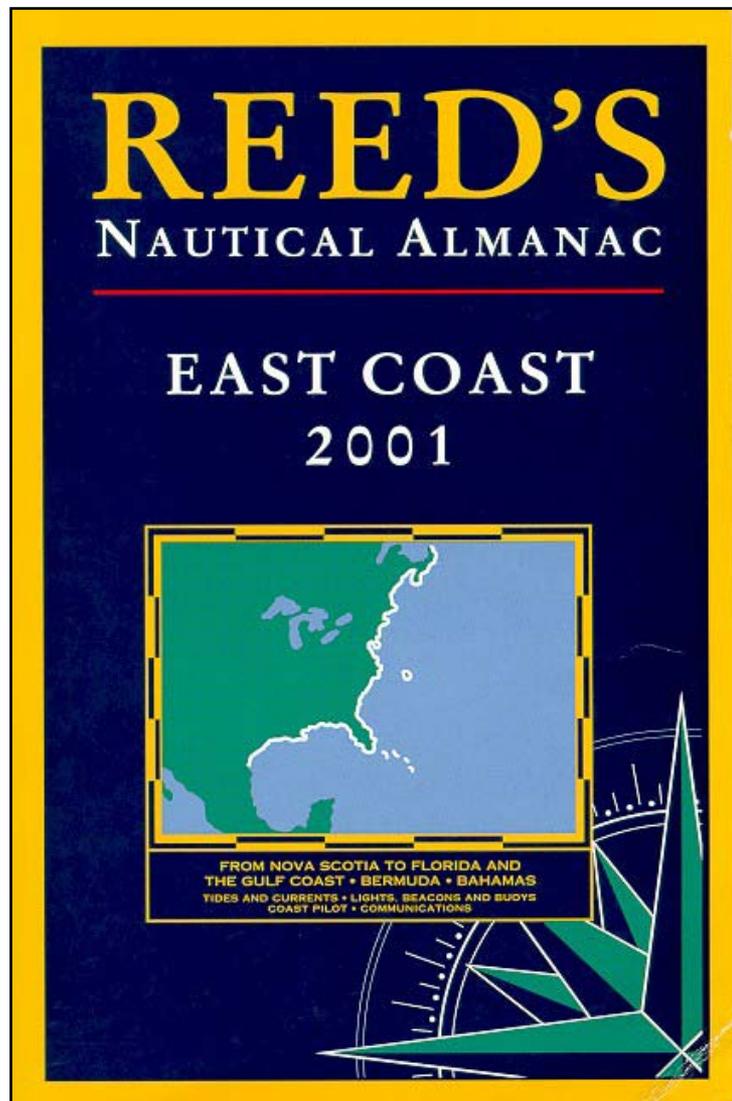
ED. NO. 002

Read this to ensure you don't do something stupid in a Navy controlled port like:

- Newport
- New London
- Boston



# Again – This one Pub covers every day of the passage



Truly one stop shopping

- Chapter 1 – The Coast Pilot
- Chapter 2 – Tides
- Chapter 3 – Currents
- Chapter 4 - Resources



# The Nav Brief

## When, Where, Why & How

- When?
  - Early. Typically late afternoon on the day prior to arrival
- Where?
  - In the cockpit
  - Caution: The only time you should allow the chart topside
- Why?
  - There's always one stupid question
- How?



Too Late...



Review The Forecast...



# How???

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- Wake everyone up
- Review the Watch Quarter & Station Bill
  - SOP, Appendix
- **USE THE CHECKLIST**



# What Do The OIC/AOIC Need To Know?

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You should be able to sketch the key elements of the chart from memory

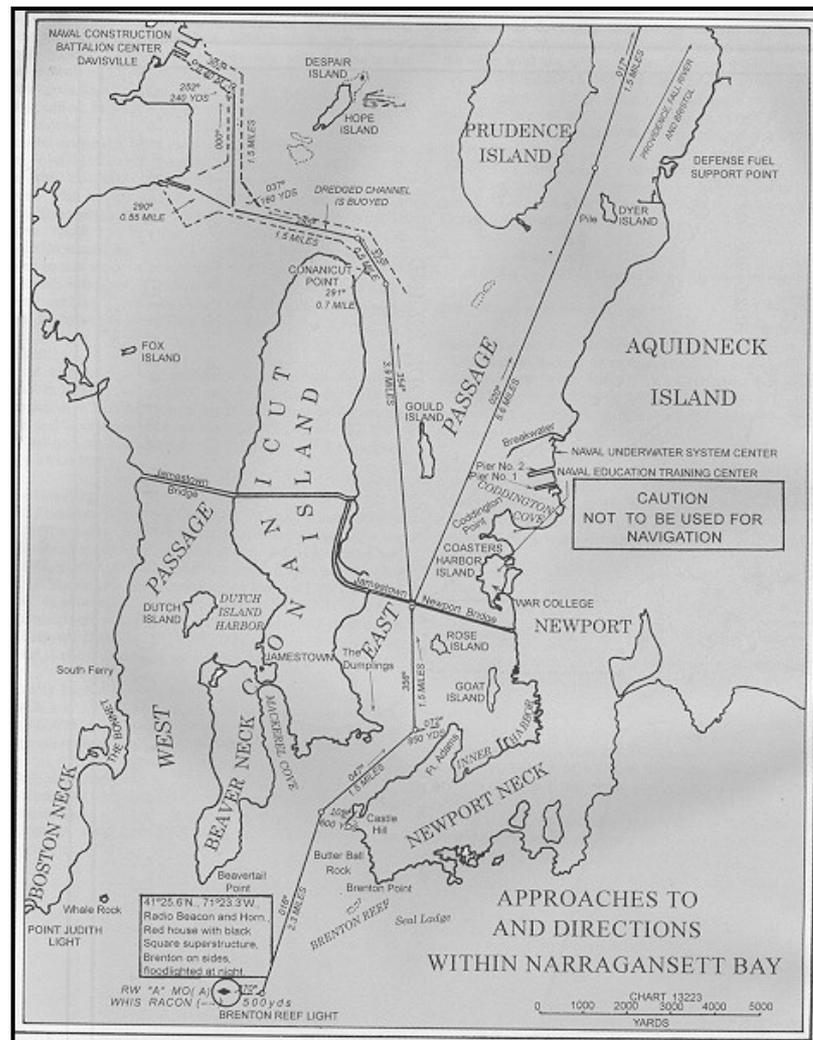
- Pay particular attention to expected nav aids, nav hazards and courses to steer (memorize the dots)

If you're mentally challenged, and after several days off shore you may be...

- Make a gouge
  - You can copy (and better laminate) sections of the chart, pages from Reed's and/or the Fleet Guide
- Write notes to yourself on the reverse



# For example...





# How you get in trouble...

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# The Six Rules Of Deduced Reckoning

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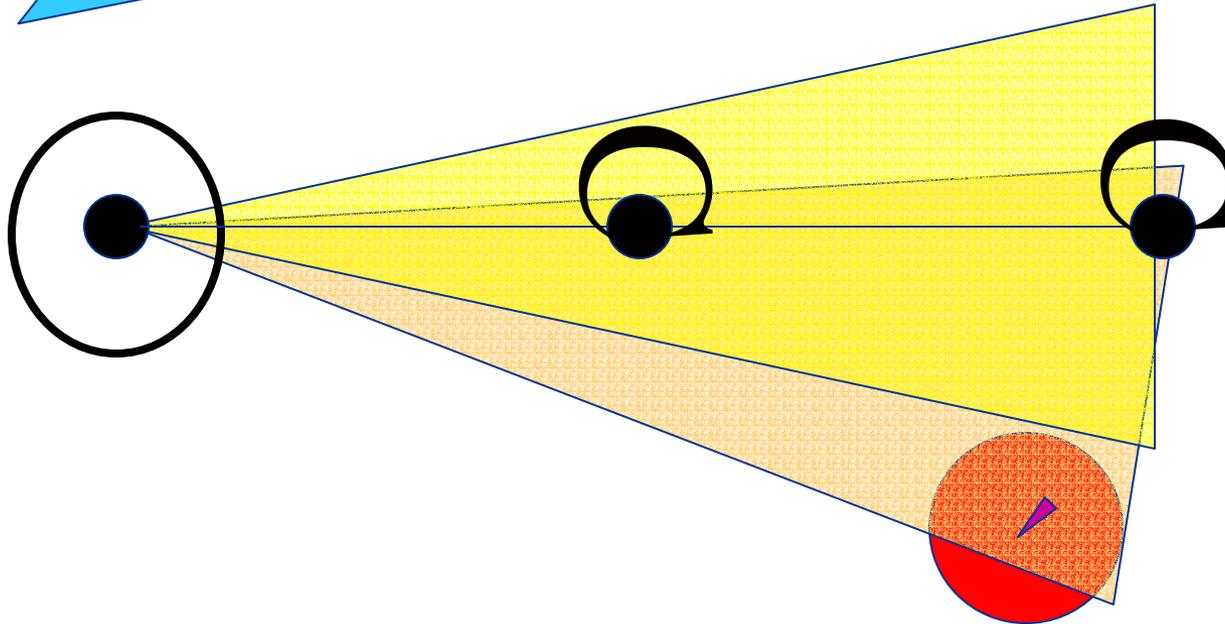
1. Every hour on the hour
2. At the time of every course change
3. At the time of every speed change
4. At the time of obtaining a single line of position
5. At the time of obtaining a fix or running fix
6. A new course line shall be drawn from each fix or running fix as soon as it is determined

**YOU MUST KNOW THESE!!!**

***You Must Know How To Apply These!!!***



# The Fix & The DR...





# Uncertainty...

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- Any time you aren't sure where you are – what do you do??
  - One average guy calls for the chart to be brought topside
  - No, No, No...
  - Another average guy goes below to look at the chart
  - No, No, No...
  - Turn around and go back down your track
  - Figure it out, then turn back around



# A Few More **No No Nos...**

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## Buoy Hopping

- Fully crewed yacht whose mission it is to teach Navigation

## Play “Follow the leader”

- Never turnover navigational responsibility to an external agent
- Don't misunderstand – This doesn't mean ignore local knowledge

## Drive at night without your headlights on

- DR always, always ahead of the boat



# A Few More No No Nos...

---

## Go Faster Than Your Team Can Support

- Fully crewed yacht
- How well are they trained???

However...

**Your job is to push them...**

**But make sure you have a safety net!!!**





# Practical Exam...

## Most frequently noted errors

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- The Chart Shift - Advancing the DR
- The three Line Of Position Fix
  - The LOPs are construction lines...
- The DR
  - Bold and obvious
- Six Rules of DR
  - Know and apply
  - The single line of position
- Latitude and Longitude
  - Determining latitude and longitude
  - Logging it:  $38^{\circ} 14' 46''$  N       $076^{\circ} 38' 14''$  W



# People...

- Key to success, And **Failure**
- Some quotable quotes...



# Homework

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- Read the SOP, Chapter 2
- Read the SOP, Appendices A & B
- Finish the Practice Navigation Problem
  - On the CSNTS Website
- Read, study and think about the Incident Report
- Prepare for the Nav Practical



# U.S. NAVAL ACADEMY SAILING PROGRAM



**Offshore**



**Intercollegiate**



**CSNTS**



**P-100**

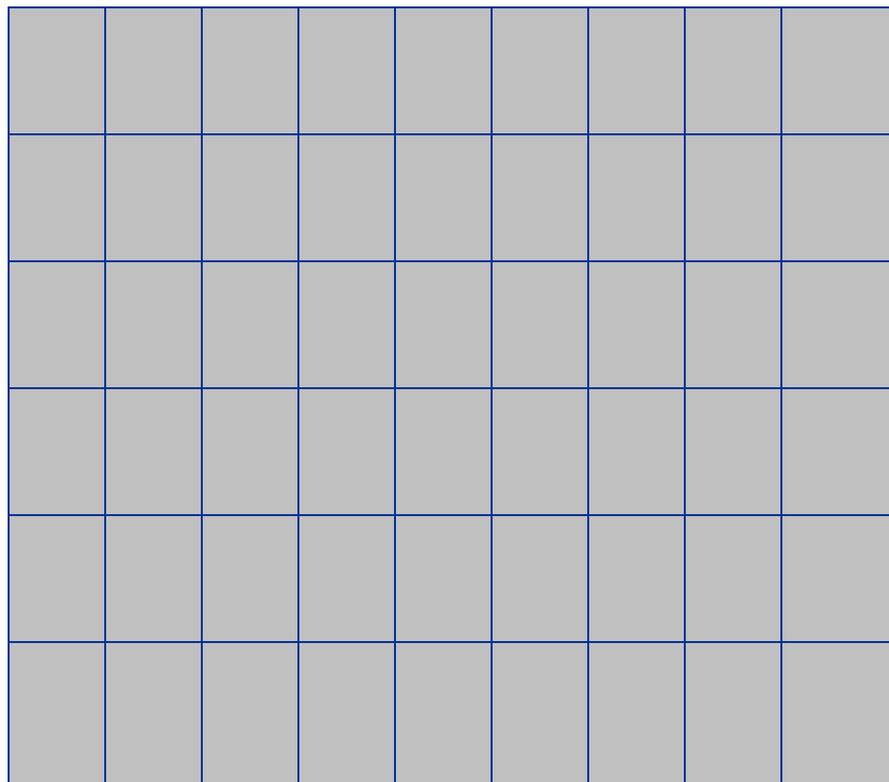
# Questions???



# A Few Tricks Of The Trade...

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## The Magic Of Mylar

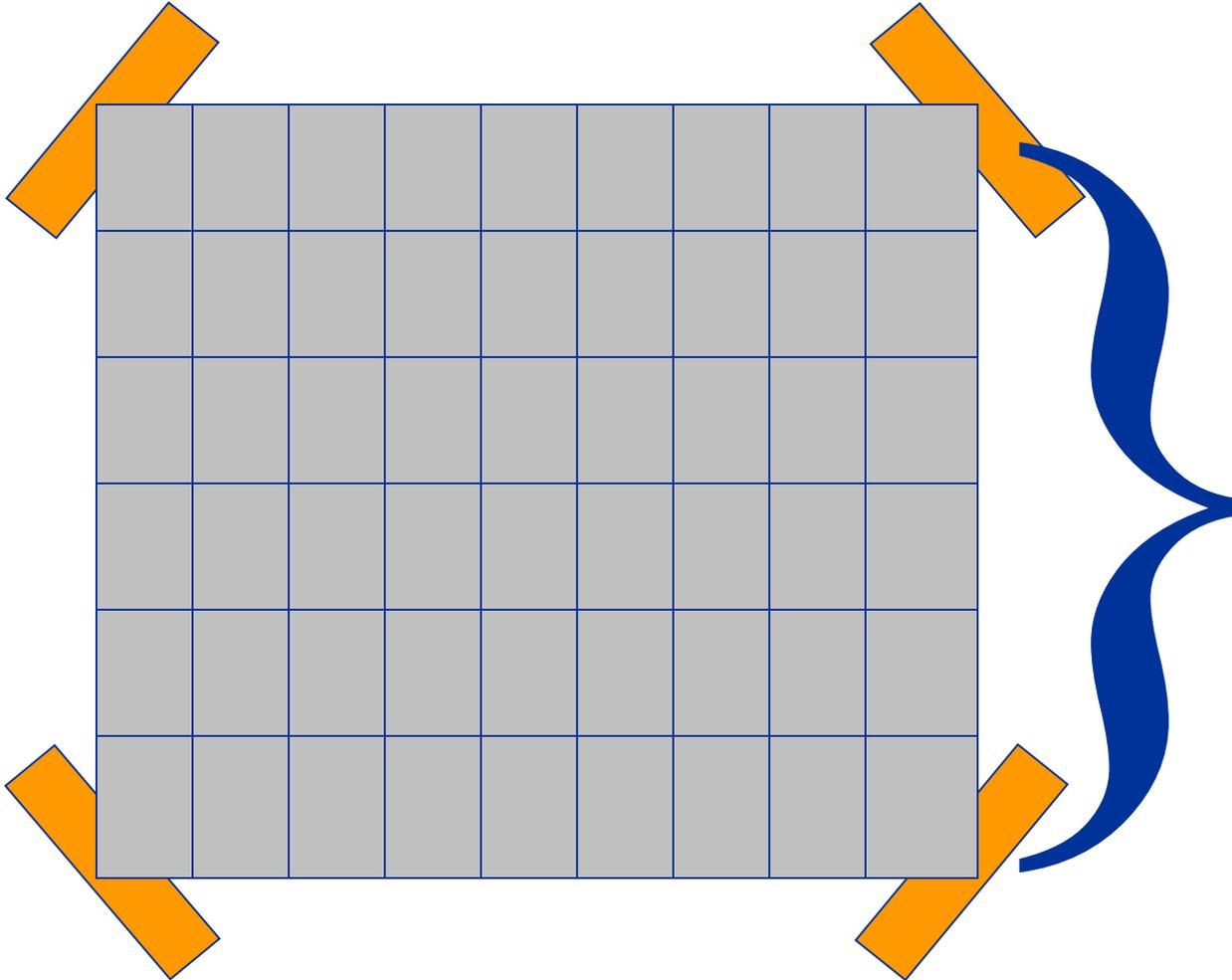


Make Sure  
these are  
right!!!



# Now What?

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Make Sure  
these are  
right!!!



# Ready For Use...

