# Oil Spill Response: EQUIPMENT & TECHNIQUES

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# Topics

- ***Boom (Types, Components, Failure, Anchoring)***
- ***Boom Techniques***
- ***Sorbent materials***
- ***Skimming equipment***
- ***Pumps***
- ***Storage containers***
- ***Specialized equipment***

# BOOM

Types, Components, Failure, Anchoring

# Oil Boom Categories

## Conventional

- Open Water
- Harbor
- Inland
- Intertidal

## Specialty Boom

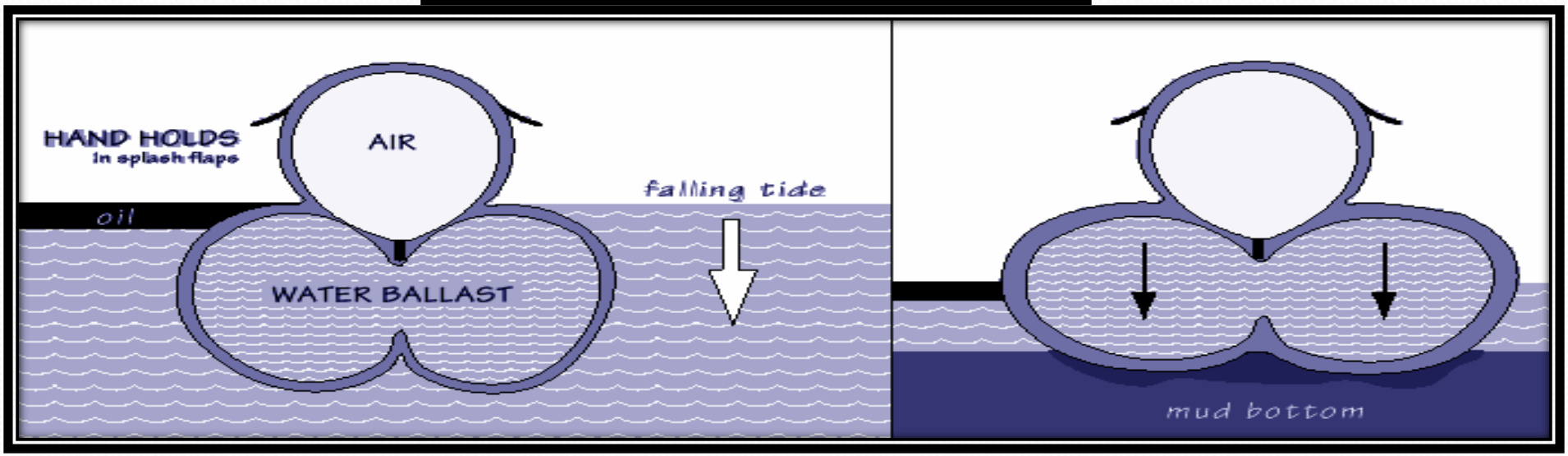
- Sorbent
- In-Situ Burning

## Open Water Boom

## Inland Boom

## Harbor Boom

# Intertidal Boom



# Boom Sizes and Capabilities

| *Category* | *Freeboard* | *Draft* | *Wave Height* |
|---|---|---|---|
| OPEN WATER | > 18" | > 24" | <6' |
| HARBOR | 10-18" | 12-24" | <3-4' |
| INLAND | 4-10" | 6-12" | <1' |
| INTERTIDAL | >0" | <6" | CALM |

# Oil Boom Topics

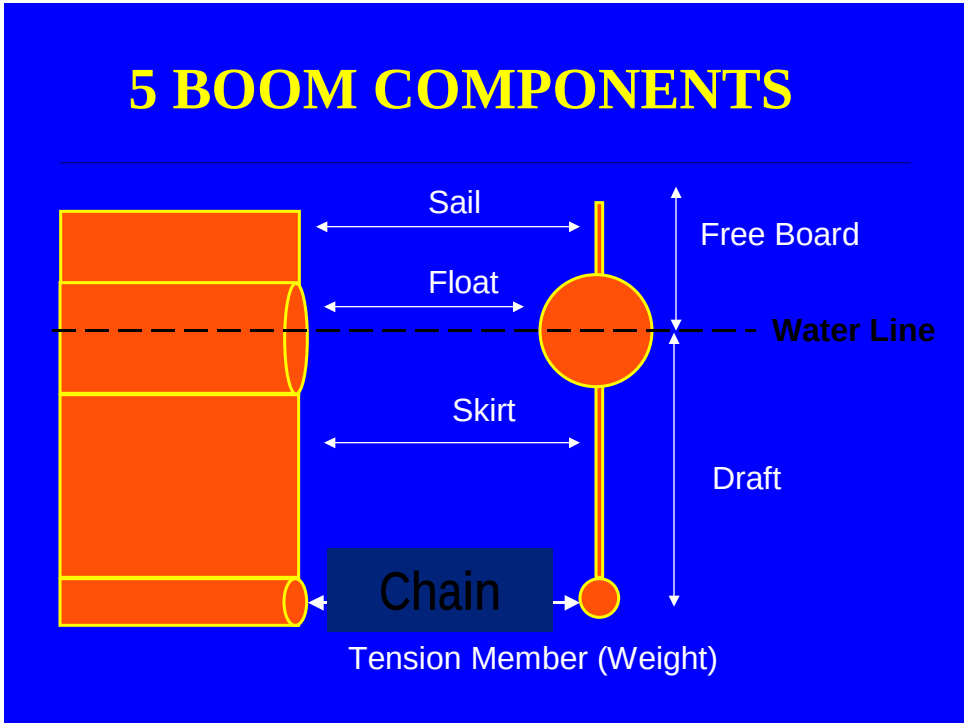
- Major Components
- Anchoring Systems
- Categories
- Special use Booms
  (brief overview)
- Common Boom/System Failures
- Protection Strategies

## Major Components

- Flotation
- Skirt
- Ballast
- Connector
- Tension Member

## Other Components:

- Tow Bridle
- Anchoring
- Lift Points
- Stiffeners
- Hinges



# Boom Components

## FREEBOARD

- Freeboard prevents splash over of oil.
- Wind forces on a boom increase with freeboard surface area.
  - If freeboard exceeds 4-8”, boom performance can be adversely affected by high winds (20+ knots )

## BALLAST

- Ballast (weighting material) helps keep the boom skirt vertical in water.
- Ballast often consists of a chain, wire cable, or lead weights located along a skirt bottom.
  - The chain or cable could also serve as a tension member.

# Boom Components

## TENSION MEMBER

- Tension members bear the load imposed by towing, winds, waves and currents.
- Chains, cables, or webbing that run the length of a skirt or flotation are used as the tension member.

## SKIRT

- Used to prevent oil from escaping below the boom.
- Forces from currents acting on a boom increase with skirt depth and can cause skirt failure, allowing oil to escape.

# Boom Components

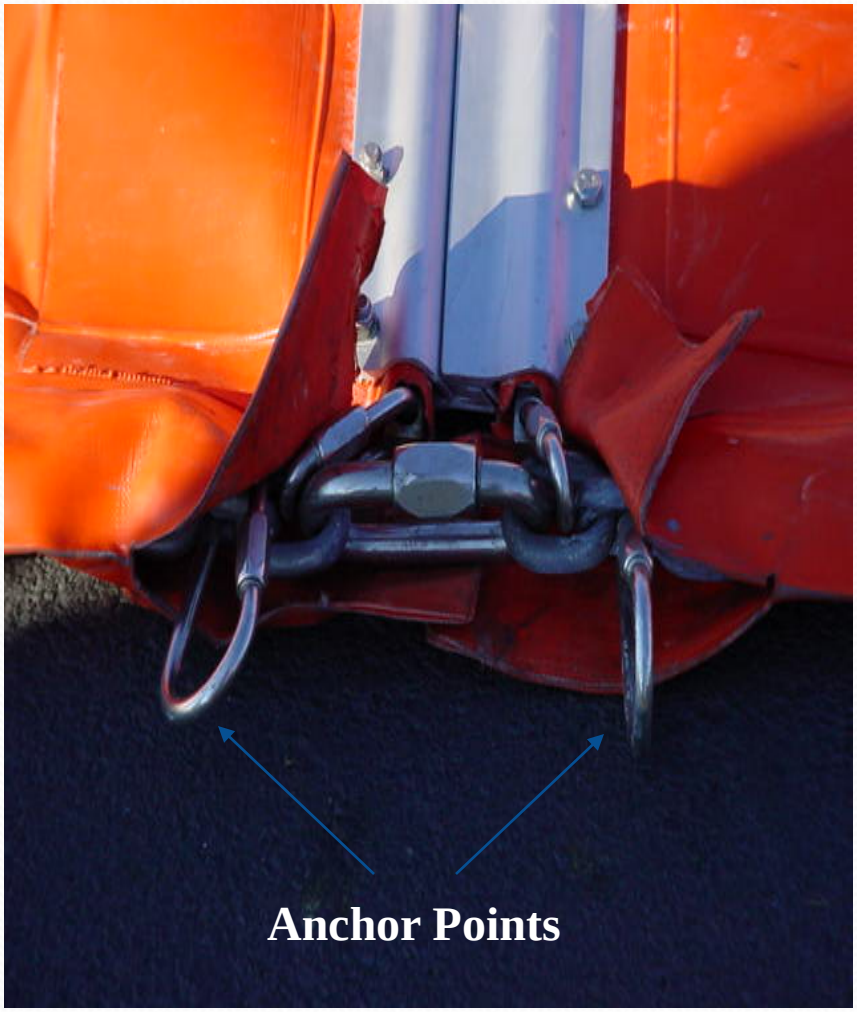
## FLOTATION

- Positions the boom at the water surface.
- Buoyancy chambers are usually filled with foam or air.
- Heavier boom should be used in rough, offshore conditions
- Lighter boom should be used in calm, inland waters

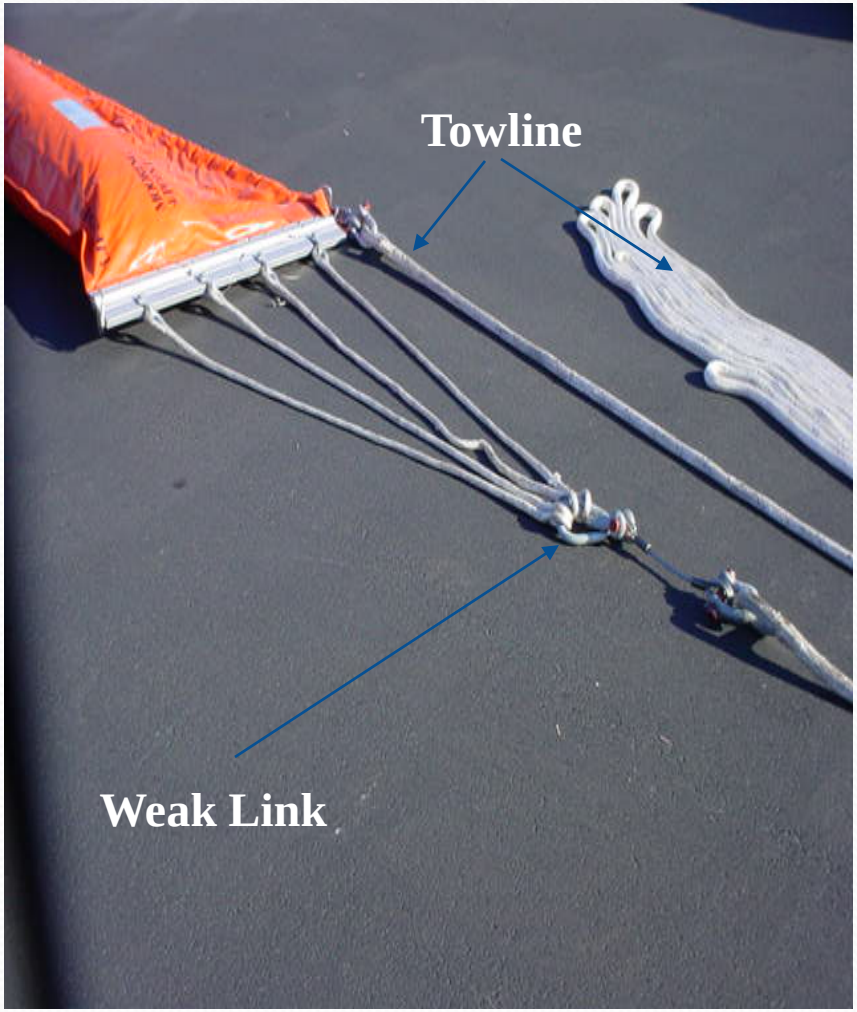
## DRAFT

- Boom draft prevents oil from escaping under a boom in low current conditions.
- Shallow draft skirts reduce tension on a boom.

## ANCHOR POINTS



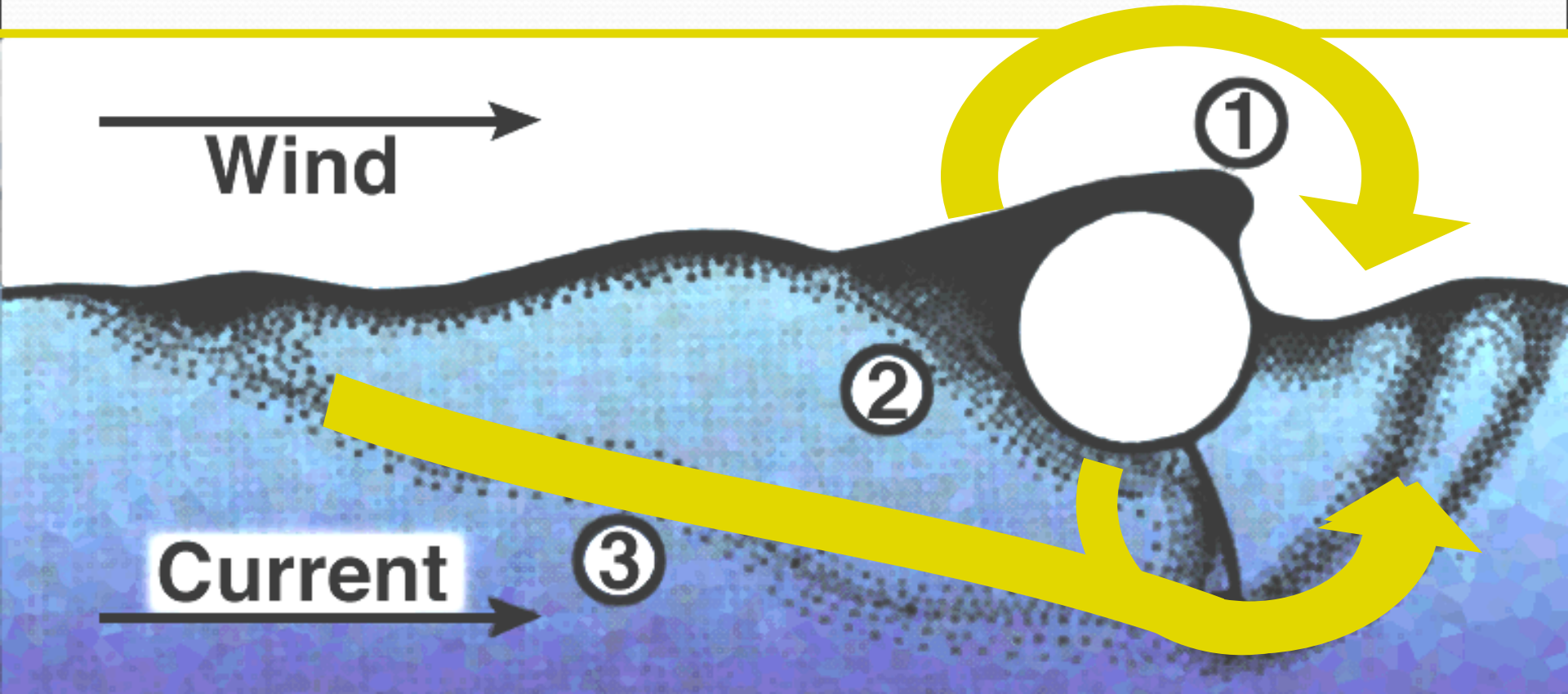

## TOWING BRIDAL



# Inflatable Boom

# FIRE BOOM

# 6 COMMON BOOM FAILURES



# Boom Failure

## SUBMERGENCE

- May occur when a boom is deployed or anchored in a fast current or is being towed at a high velocity.
- The tendency for boom to submerge at a given velocity is determined by the boom's reserve buoyancy.
- Higher reserve buoyancy reduces the tendency to submerge.

## ENTRAINMENT FAILURE

- Generally occurs at current velocities 0.7 - 1.0 kts
- Turbulence causes oil droplets to escape under a boom.
- May be prevented by deploying a boom at an angle < 90 degrees to the direction of flow or by using booms designed to operate in fast currents.

# Boom Failure

## SPLASH-OVER

- May occur in choppy water when wave height is greater than boom freeboard and wave length to height ratio is less than 10 to 1.

## DRAINAGE

- Can happen when a small boom is used to hold so much oil that its flows down the face of the boom, escaping to the other side.
- Increasing skirt depth and high freeboard are not usually solutions since they increase the potential for planning failure.

# Boom Failure

## PLANING

- The loss of oil due to a strong wind and strong current moving in opposite directions causing the boom to heel flat on the water surface.
- Most likely to occur when a boom has inadequate ballast or when an internal tension member is near or above the waterline.

## STRUCTURAL FAILURE

- High tension or stress can cause connectors to detach or break, or cause structural components

# Anchoring

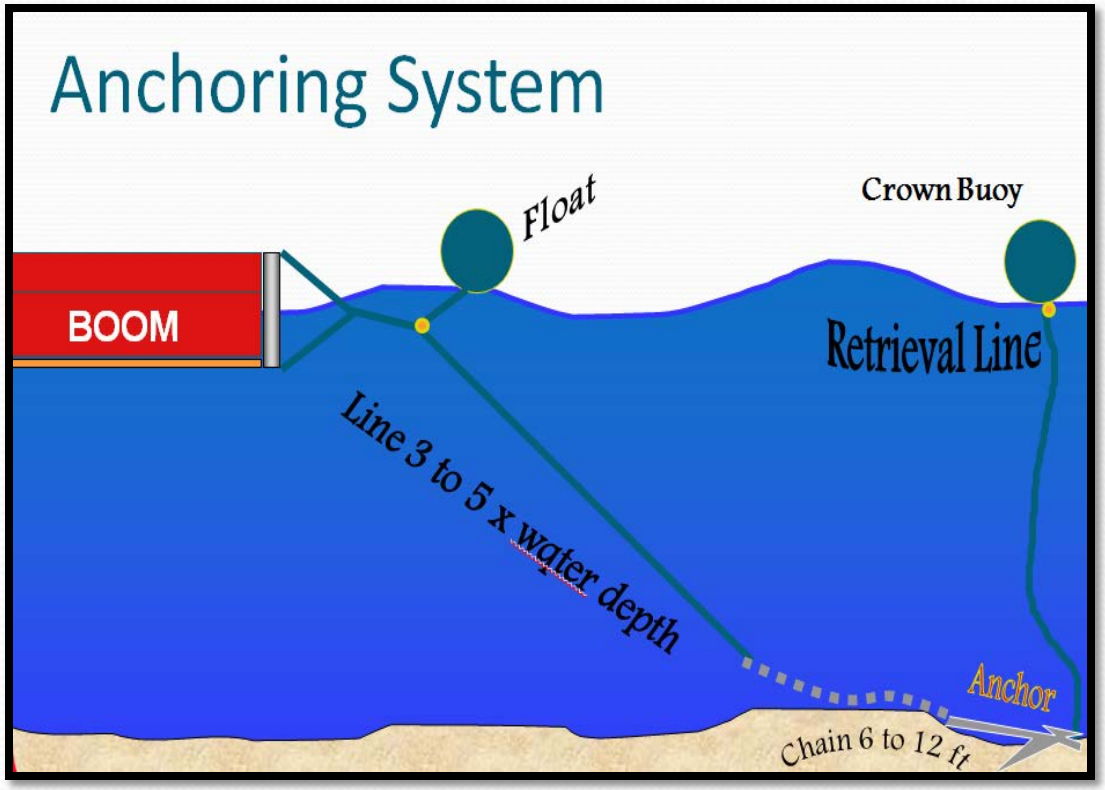
## COMPONENTS

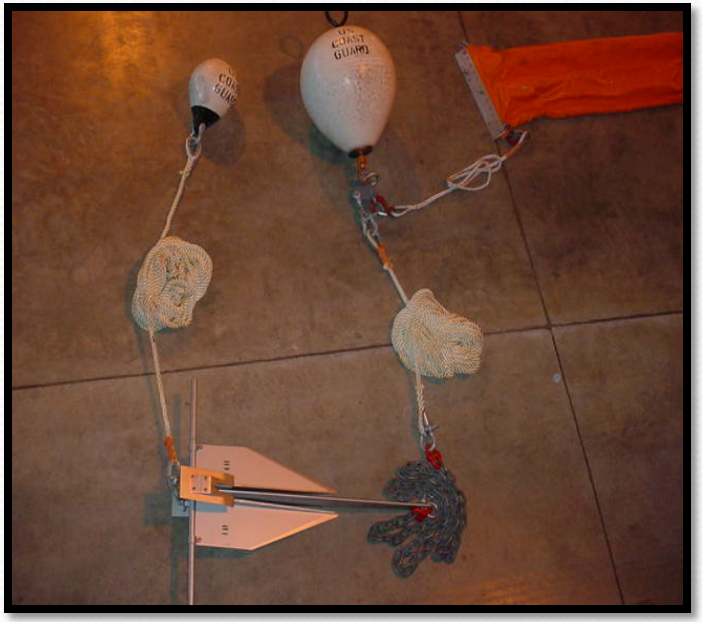
- Aluminum Danforth Anchors
- 12” and 24” Floats
- ¾” x 100’ Anchor lines
- ½” x 12’ Anchor chains
- Assorted ground tackle

## THINGS TO THINK ABOUT …

- Bottom conditions
- Depth of water
- Location
- Submerged objects
- Tide, current, wind, weather
- Duration
- De-con

# Anchoring Procedure



# Holding Power of Danforth Anchors

| Anchor Weight (LBS) | Holding Capacity (LBS) | | |
|---|---|---|---|
| | MUD | SAND | CLAY |
| 35 | 440 | 550 | 660 |
| 55 | 770 | 880 | 1100 |
| 80 | 1320 | 1540 | 1540 |

## BOOM FORCES EXAMPLE

- For a 100 foot section of boom (draft of one foot) at two knots of current, the force is over 250 pounds.

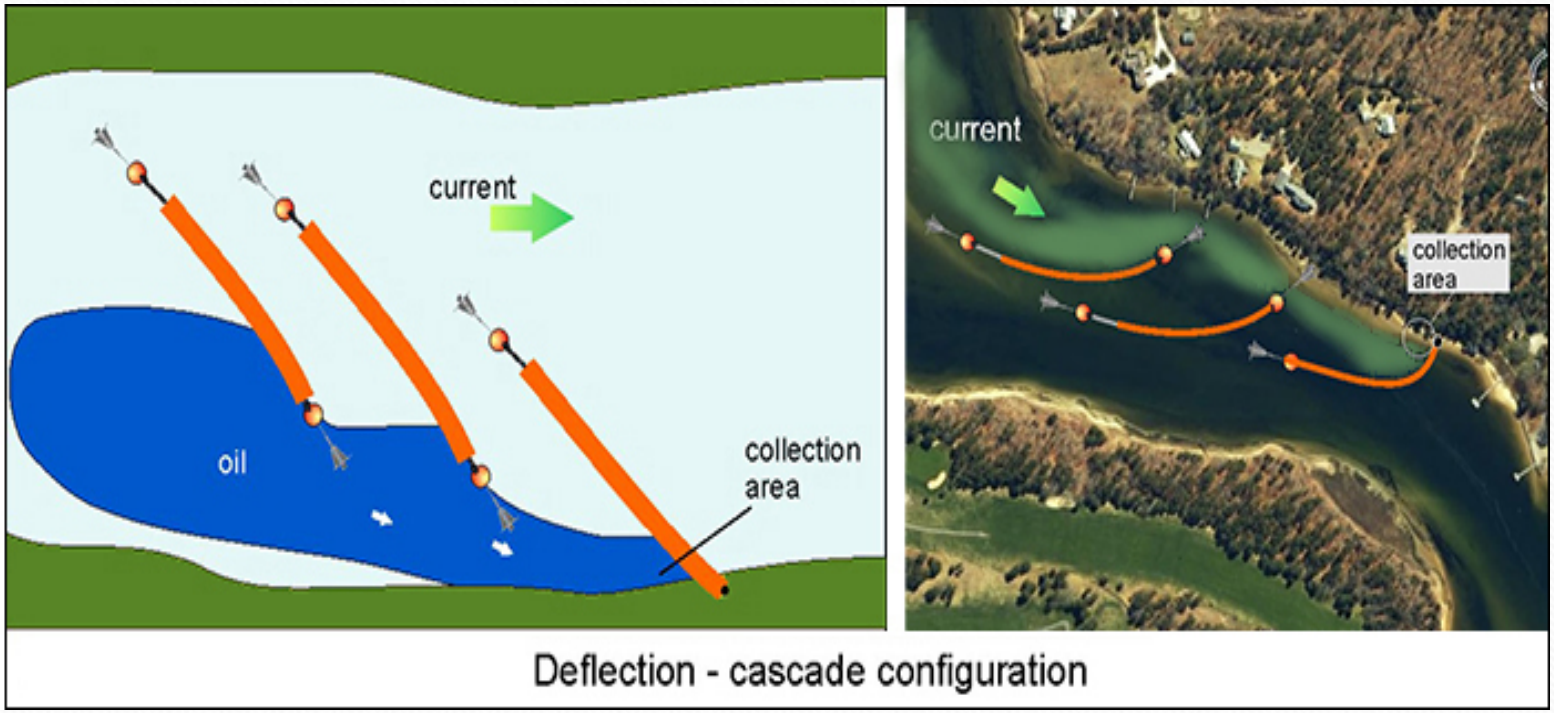
# BOOM TECHNIQUES

Now, how do we use all that cool equipment?

# CONTAINMENT BOOM

# EXCLUSION BOOM

# DEFLECTION BOOM:




Deflection - cascade configuration

# SORBENT MATERIAL

Pads, POM POMS, Sausage boom…

# SORBENT MATERIAL TYPES

# SORBENT CHARACTERISTICS

- Adsorbent material- Fluid "oil" adheres or simply "sticks" to the surface
- Absorbent material- Fluid permeates the material like a sponge
- Oleophilic – material has a strong affinity for oils
- Hydrophobic – material excludes water molecules
- Most sorbent material is constructed of polypropylene

## ADVANTAGES

- Can absorb a significant amount of light oil, diesel, #2 fuel
- Can be used with containment boom
- Can be wrung out and re-used

## DISADVANTAGES

- Heavy
- Difficult to recover
- Does not work well with heavy oils or sheens


# POM POMS & SNARES

**Advantages:**

- Adsorbs oil
- Constructed of plastic materials
- Works well on heavy oils, bunker C, # 6 fuel

**Disadvantages:**

- Can entangle wildlife
- Not re-usable
- Difficult to dispose of

# Pom poms

# SKIMMERS AND PUMPS

And their pros and cons…

# OIL SKIMMERS

**WEIR SKIMMER**

**DISC SKIMMER**

**DRUM SKIMMER**

# WEIR SKIMMERS

**ADVANTAGES**

- Easy maintenance
- Easy to deploy

**DISADVANTAGES**

- Oil collected can contain a large amount of water
- Skim height needs constant adjustment
- Affected by debris

# DRUM & DISC SKIMMERS

**ADVANTAGES**

- Collects relatively dry oil- little water
- Less susceptible to debris

**DISADVANTAGES**

- Expensive
- High maintenance
- Cumbersome to deploy

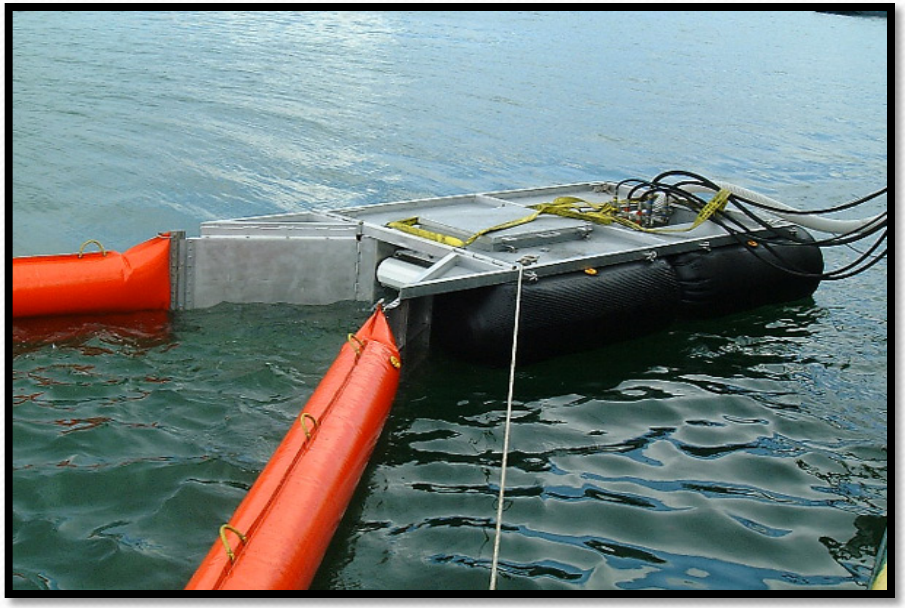
# BELT-DRIVEN SKIMMERS

**ADVANTAGES**

- Collects mostly oil-little water
- Good recovery efficiency
- Effective in waves

**DISADVANTAGES**

- High operating and maintenance cost
- Performance affected by debris



# PUMPING SYSTEMS

USED DURING A RESPONSE FOR:

- Dewatering
- Product Transfer
- Flushing/Herding Oil

******It's important to understand the capabilities and limitations of each pump so you can choose the best one for your needs.***

# TRASH PUMPS

**Advantages**

- High volumes for dewatering, good with light oils

**Disadvantages**

- Difficult to pump viscous products
- Not explosion proof or intrinsically safe

# DIAPHRAM & AIR DRIVEN PUMPS

**Advantages**

- Ability to pump sludge, small rocks and debris
- No need to prime

**Disadvantages**

- Low flow
- Compressor in needed
- Small pumps can run off SCBA air bottles

# TEMPORARY OIL STORAGE

- Barrels
- Drums
- Above ground storage tanks
- Vacuum truck
- Bladders
- Small pools

# SPECIALTY EQUIPMENT

## *Boom Vanes*

## *Boom Reels*

# The End


Questions?

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