

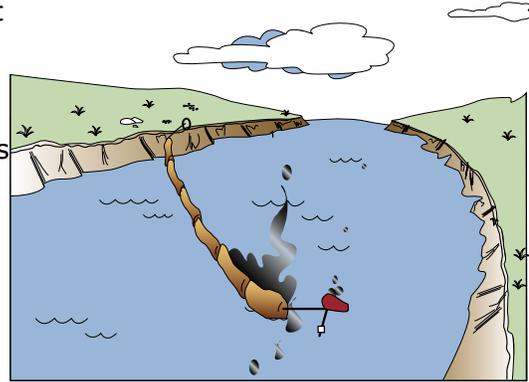


DEFLECTION BOOM

OBJECTIVE & STRATEGY

DF

The objective of Deflection Boom is to direct spilled oil away from a location to be protected or simply to change the course of the slick. For the purposes of maintaining consistent and clear terms, “deflection” is used to describe the tactic where oil is redirected away from an area but not recovered, in contrast with the term “diversion”, which is always associated with oil recovery.



TACTIC DESCRIPTION

The Deflection Boom tactic is for water-born spills where there is some current, usually from 0.5 to 3.0 knots. The boom is placed at an optimum angle to the oil trajectory, using the movement of the current to carry oil along the boom and then released it into the current again with a new trajectory. The angle is chosen to prevent oil from entraining beneath the boom skirt. Boom may be held in place by anchors, vessels, or a boom control device.

Deflection Boom may be used to temporarily avoid impacts to a sensitive area, but there is no recovery associated with the tactic, thus no oil is removed from the environment. For this reason, Diversion Boom or Free-oil Recovery is preferable to Deflection Boom whenever feasible. However, Deflection Boom may be more effective than Exclusion Boom at protecting a sensitive location, where currents over 0.75 knots exist.

The two alternatives for this tactic are Fixed Deflection and Live Deflection. In Fixed Deflection, boom is anchored to the shoreline or bottom. In Live Deflection, the boom is attached to vessels and held in position by the power of the vessels or one end of the boom is anchored and the other end held in position with a vessel. Live deflection is a very difficult tactic to execute. It should only be utilized where fixed deflection cannot be achieved, usually because deep water precludes anchoring.

The general strategy is to:

1. Identify the location and trajectory of the spill or potential spill.
2. Identify, prioritize, and select sensitive areas to be protected from impact.

Deflection Boom



3. Select a deployment configuration that best supports the operating environment and available resources.
4. Mobilize to the location and deploy the tactic.
5. Place boom using secure anchor system or mooring points.
6. Monitor and adjust the boom on an appropriate basis.

Boom Angle

Figure DF-1 is used to select the appropriate boom angle to keep oil from entraining under the boom. Note that the angle relative to the current decreases rapidly as the current increases. Where currents exceed 3 knots the boom must be almost parallel to the current to prevent entrainment. In currents exceeding 3 knots, a cascade of boom arrays may be used; the first boom array will slow the velocity of the slick allowing subsequent arrays to deflect the oil.

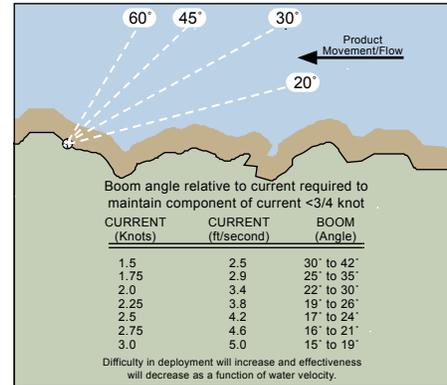


Figure DF-1. Boom angle relative to current.

Anchor Systems

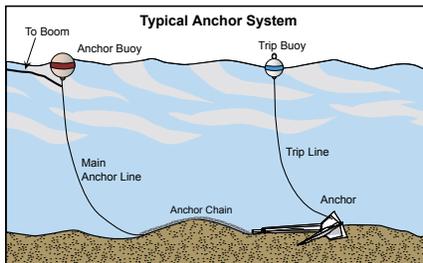


Figure DF-2. Typical anchor system components.

Boom is secured in place using standard anchoring systems that are shown in Figure DF-2. Anchor sizes vary depending on the boom type and the operating environment.

Boom Control Devices

Boom control devices are an alternative to anchoring deflection boom on the offshore end. Boom control devices have the advantage of allowing continuous control over the angle and position of the boom. They can also allow the boom to be moved to allow a vessel or drifting debris to pass by without interfering with the deflection operation. One type of boom control device is a vessel, which continuously controls the offshore end of the boom. Controlling a deflection boom with a vessel takes considerable skill and a vessel suited for the purpose. Another type of boom control system is a trolley. Trolleys require that a line be strung from one shoreline to another, thus they are mostly used in rivers. Trolleys may block a river to passage by vessels and they are susceptible to impacts from debris. A relatively new type of boom control device is built on the principle of a wing or rudder. Devices such as the BoomVane™, allow the boom to

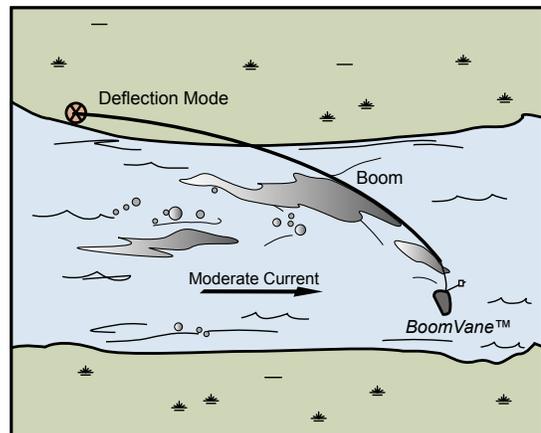


Figure DF-3. Using the BoomVane™ in deflection mode.

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be deployed and controlled from the shoreline (Figure DF-3). This decreases the need for vessels and anchor systems, while allowing superior control of the boom angle.

Operating Environments

DF-O OPEN WATER

Fixed deflection boom systems are not recommended for the open water environment because of the high probability of fixed boom failure and the difficulty of anchoring in this environment. The Live Deflection Booming and On-water Free-oil Recovery tactic may work better in this environment, due to their inherent mobility.

Deflection boom system components (vessel and boom) for open water operations should be able to withstand seas up to 6 feet and winds up to 30 knots.

DF-P PROTECTED WATER

Boom, anchors and vessels for protected water deflection boom systems should be able to withstand seas up to 3 feet and winds up to 25 knots. Vessels deploying deflection boom systems may be deep draft or shallow draft, depending on the water depth.

DF-C CALM WATER

Calm water deflection boom systems are composed of boom and anchors that can operate in seas of 1 foot and in winds up to 15 knots. Vessels deploying calm water deflection boom systems typically work in depths as shallow as three feet.

DF-F FAST WATER

Fast water deflection boom systems are designed to operate in moving water where the current exceeds 0.8 knots. This includes rivers and areas with significant tidal current. Vessels, boom, and anchors used in tidal waters should be able to deploy and operate in seas up to 1 foot and in winds up to 15 knots. Vessels, boom, and anchors used in river waters should be able to deploy and operate in waves up to 2 feet and in winds up to 15 knots.

DF-B BROKEN ICE

Deflection boom systems may be difficult for the broken ice environment because of the high probability of boom failure and loss due to ice encounters.

Deployment Configurations

There are many variations for deployment of Deflection Boom. Several configurations are described below, but responders should consider the actual conditions and modify their deployment accordingly.



Deflection Boom



SINGLE BOOM

Boom is deployed from a site at an optimum angle to the current and anchored to deflect the oil away from a location.

CASCADE

Several booms are deployed in a cascade configuration when a single boom cannot be used because of fast current or because it is necessary to leave openings in the boom for vessel traffic, etc. This configuration can be used in strong currents where it may be impossible to effectively deploy one continuous section of boom. Shorter sections of boom used in a cascade deployment are easier to handle in faster water, thereby increasing efficiency. Additional equipment may be required to set and maintain this system as compared to the single boom configuration.

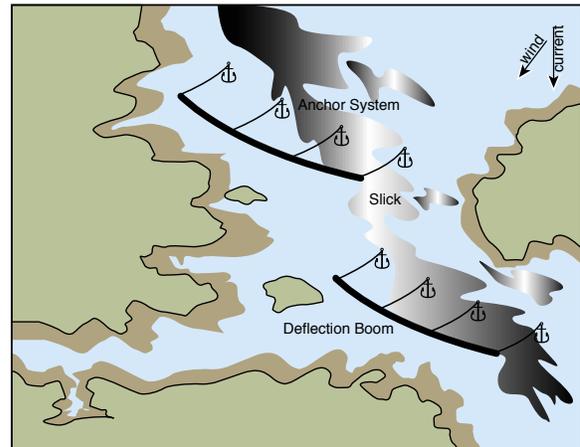


Figure DF-4. Deflection booming, fixed cascaded array.

LIVE

Booms are held in position by vessels. It takes practice and considerable skill in vessel handling to execute this effectively.

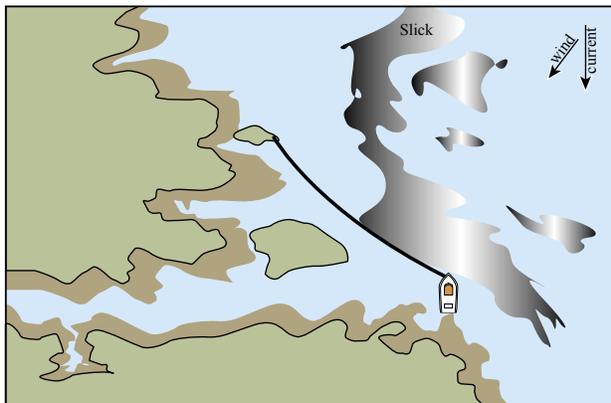


Figure DF-5. Deflection booming, half-live.

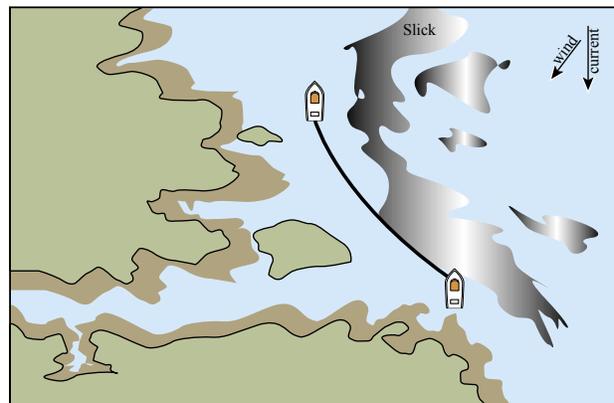


Figure DF-6. Deflection booming, live.

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DEPLOYMENT CONSIDERATIONS AND LIMITATIONS

SAFETY

- Daily fair and foul weather evaluations are recommended, and should include distance to safe harbor, transit times and exposure of vessels.
- Vessel masters should have experience in the appropriate operating environment. Local knowledge is preferred.
- Vessels, including skiffs, must have a minimum of two crew aboard.
- Vessels setting and tending the boom should be able to safely transit seas which exceed the boom’s operating limitation.

DEPLOYMENT

- Calm/Protected water boom (6” x 24” / 18” x 42”) are most commonly used for this tactic.
- Do not assume 100% efficiency with one boom system.
- Readjust angles and widths between boom sections as necessary to meet changing conditions (tides, currents, and winds).
- Constant monitoring of system efficiency is required.
- Deployment planning should be based on average high tidal conditions.
- If oil is being deflected away from the shoreline, tide-seal boom is not usually required.

REFERENCES TO OTHER TACTICS

Other tactics associated with Deflection Boom include:

- DV** • Diversion Boom
- C** • Containment Boom



Deflection Boom



EQUIPMENT AND PERSONNEL RESOURCES

Commonly used resources for this tactic include vessels; boom; anchoring, mooring, or control systems; and response personnel. Configuration and specific resources required will be determined by site conditions, spilled oil type and volume, area of coverage, as well as resource availability. Resource sets may need to be refined as site-specific requirements dictate.

Open Water Deflection Boom System¹

DF-O

| Typical Equipment | Function | Quantity | Notes |
|---|---|---------------|---|
| Oil Boom, > 36" height | Deflect oil slick | Site-specific | Depending on configuration, currents, sea states, and oil concentration |
| Large anchor systems, boom control devices, or shore-based anchors | Keep boom in selected configuration | Site-specific | Depending on configuration, currents, and sea states |
| Typical Vessel | Function | Quantity | Notes |
| Class 2, 3, 4, 5, or 6 At least one vessel with a crane is recommended | Deploying/tending anchors and boom | 2 to 4 | Depending on configuration, currents, and sea states |
| Typical Personnel | Function | Quantity | Notes |
| Field Team Leader | Supervises operations | 1 | May not always be on-site |
| Vessel Operators, open water | Masters of response vessels | 2 to 4 | Depending on number of vessels |
| Skilled Technicians | Crew vessels and operate response equipment | 2 to 4 | Depending on number of vessels and configuration |
| General Technicians | Work under the direction of skilled technicians or vessel operators | 2 to 8 | Depending on number of vessels and configuration |

Protected Water Deflection Boom System

DF-P

| Typical Equipment | Function | Quantity | Notes |
|--|---|--|---|
| Oil Boom, 18" to 42" height | Deflect oil slick | Site-specific | Depending on configuration, currents, sea states, and oil concentration |
| Medium anchor systems, boom control devices, or shore-based anchors | Secure boom in selected configuration | Rule of Thumb – 1 anchor per 200 ft. of boom | Depending on configuration, currents, and sea states |
| Typical Vessel | Function | Quantity | Notes |
| Class 3, 4, 5, or 6 At least one vessel with a crane is recommended | Deploying/tending anchors and boom | 2 to 4 | Depending on configuration, currents, and sea states |
| Typical Personnel | Function | Quantity | Notes |
| Field Team Leader | Supervises operations | 1 | May not always be on-site |
| Vessel Operators, protected/calm water | Masters of response vessels | 2 to 4 | Depending on number of vessels |
| Skilled Technicians | Crew vessels and operate response equipment | 2 to 4 | Depending on number of vessels and configuration |
| General Technicians | Work under the direction of skilled technicians or vessel operators | 2 to 4 | Depending on number of vessels and configuration |

¹ Not recommended, see Operating Environment.



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Deflection Boom

Calm Water Deflection Boom System

DF-C

| Typical Equipment | Function | Quantity | Notes |
|--|---|--|---|
| Oil Boom, 6" to 24" height | Deflect oil slick | Site-specific | Depending on configuration, currents, sea states, and oil concentration |
| Small anchor systems, boom control devices, or shore-based anchors | Secure boom in selected configuration | Rule of Thumb – 1 anchor per 200 ft. of boom | Depending on configuration, currents, and sea states |
| Typical Vessel | Function | Quantity | Notes |
| Class 3, 4, 5, or 6 | Deploying/tending anchors and boom | 1 to 3 | Depending on configuration, currents, and sea states |
| Typical Personnel | Function | Quantity | Notes |
| Field Team Leader | Supervises operations | 1 | May not always be on-site |
| Vessel Operators, protected/calm water | Masters of response vessels | 1 to 3 | Depending on number of vessels |
| Skilled Technicians | Crew vessels and operate response equipment | 1 to 3 | Depending on number of vessels and configuration |
| General Technicians | Work under the direction of skilled technicians or vessel operators | 0 to 3 | Depending on number of vessels and configuration |

Fast Water Deflection Boom System

DF-F

| Typical Equipment | Function | Quantity | Notes |
|---|---|--|---|
| Oil Boom, 8" to 24" height | Deflect oil slick | Site-specific | Depending on configuration, currents, sea states, and oil concentration |
| Medium anchor systems, boom control devices, or shore-based anchors | Secure boom in selected configuration | Rule of Thumb – 1 anchor per 200 ft. of boom | Depending on configuration, currents, and sea states |
| Typical Vessel | Function | Quantity | Notes |
| Class 3, 4, 5, or 6 | Deploying/tending anchors and boom | 1 to 3 | Depending on configuration, currents, and sea states |
| Typical Personnel | Function | Quantity | Notes |
| Field Team Leader | Supervise operations | 1 | May not always be on-site |
| Vessel Operators, protected/calm water | Masters of response vessels | 1 to 3 | Depending on number of vessels |
| Skilled Technicians | Crews vessels and operates response equipment | 1 to 3 | Depending on number of vessels and configuration |
| General Technicians | Work under the direction of skilled technicians or vessel operators | 0 to 3 | Depending on number of vessels and configuration |

Broken Ice Deflection Boom System

DF-F

| Typical Equipment | Function | Quantity | Notes |
|--|---|--|---|
| Oil Boom, 8" to 42" height | Deflect oil slick | Site-specific | Depending on configuration, currents, sea states, and oil concentration |
| Anchor systems, boom control devices, or shore-based anchors | Secure boom in selected configuration | Rule of Thumb – 1 anchor per 200 ft. of boom | Depending on configuration, currents, and sea states |
| Typical Vessel | Function | Quantity | Notes |
| Class 1, 2, or 3 | Deploying/tending anchors and boom | 1 to 3 | Depending on configuration, currents, and sea states |
| Typical Personnel | Function | Quantity | Notes |
| Field Team Leader | Supervises operations | 1 | May not always be on-site |
| Vessel Operators, open/protected/calm water | Masters of response vessels | 1 to 3 | Depending on number of vessels |
| Skilled Technicians | Crew vessels and operate response equipment | 1 to 3 | Depending on number of vessels and configuration |
| General Technicians | Work under the direction of skilled technicians or vessel operators | 0 to 3 | Depending on number of vessels and configuration |

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