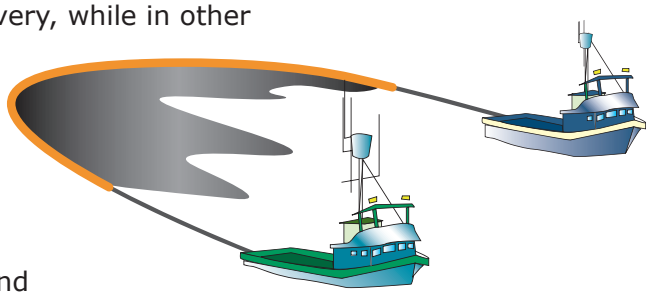
ON-WATER FREE-OIL RECOVERY

OBJECTIVE & STRATEGY

FO

The objective of the Free-Oil Recovery tactic is to contain and recover spilled oil on the water, thus minimizing impact to the environment. In some situations, the Unified Command may task the free-oil recovery team with maximizing oil recovery, while in other situations the objective may be to maximize protection of a sensitive area by encountering oil that is on a trajectory to impact that area.



The general strategy is to:

1. Identify the trajectory and location of the spilled oil by performing over-flight surveillance and trajectory analysis.
2. Select a deployment configuration that best supports the operating environment and available resources.
3. Mobilize to a location downstream and upwind of the slick and deploy free-oil recovery teams.
4. Encounter the oil and concentrate it in oil containment boom.
5. Recover the oil with available skimming systems.
6. Store the recovered fluid in a primary storage device, until it can be transferred to secondary storage.

TACTIC DESCRIPTION

Free-oil recovery systems are comprised of vessels with oil boom for containment and concentration, skimming systems for recovery, and primary storage devices for temporary storage. There is a great variation in the way these systems are configured depending on the operating environment, type of oil and state of weathering, and the available deployment platforms. Examples of skimming systems and primary storage devices may be found in the Marine Recovery tactic.

Operating Environments

FO-D FO-O OPEN WATER

Free-oil recovery system components (vessels, boom, and skimmers) for open water operations should be able to deploy and operate in seas up to 6 feet and in winds up to 30 knots. Vessels deploying, towing,

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and tending the boom should be able to safely transit seas which exceed the boom's operating limitation. Open water free-oil recovery systems are usually based on large vessels with high volume skimmers and large primary storage devices, such as barges (see Figure FO-1). In many cases, the components of these systems are dedicated to oil spill response. Open water systems are usually deep draft, operating at depths of greater that 6 feet.

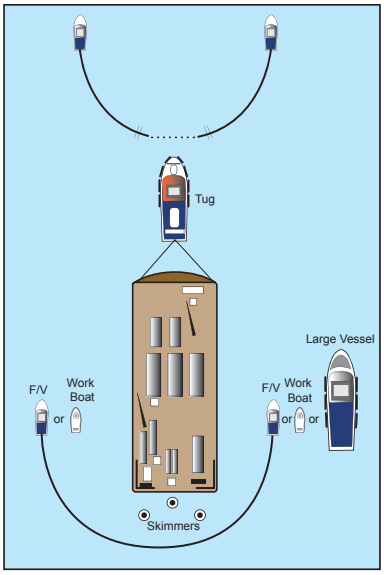

Figure FO-1. Open water barge-based free-oil recovery system.

FO-P PROTECTED WATER

Vessels, boom and skimmers for protected water free-oil recovery systems should be able to deploy and operate in seas up to 3 feet and in winds up to 25 knots. Vessels deploying, towing, and tending the boom should be able to safely transit seas which exceed the boom's operating limitation. Protected water free-oil recovery systems are often based on vessels of opportunity, such as fishing vessels, fitted with portable skimmers and primary storage devices. Protected water systems may be deep draft or shallow draft, depending on the water body.

FO-C FO-S CALM WATER

Calm water free-oil recovery systems are composed of vessels, booms and skimmers that should be able to deploy and operate in seas of 1 foot and in winds up to 15 knots. Vessels deploying, towing, and tending the boom should be able to safely transit seas which exceed the boom's operating limitation. Calm water free-oil recovery systems are usually based on small fishing vessels, work boats or skiffs fitted with portable skimmers and primary storage devices. Calm water free-oil recovery systems typically work in depths as shallow as 3 feet.

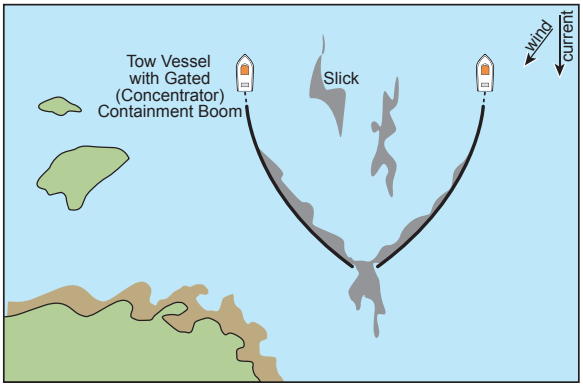

Figure FO-2. Gated U-boom concentrator boom, towed in front of free-oil recovery system.

FO-F FAST WATER

Fast water free-oil recovery 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 skimmers 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 skimmers used in river waters should be able to deploy and operate in waves up to 2 feet and in winds up to 15 knots. Vessels deploying, towing, and

tending the boom should be able to safely transit seas which exceed the boom's operating limitation. Fast water current free-oil recovery systems are equipped with high-current boom and skimmers. These systems are usually deployed from small vessels or skiffs.

FO-B

BROKEN ICE

Free-oil recovery in broken ice may be difficult to deploy and operate because of ice interfering with the boom and skimming system. Free-oil recovery systems deployed in broken ice should be highly maneuverable, utilizing vessels that can safely operate in ice. Sometimes, ice leads can act to contain and concentrate oil so that a Marine Recovery system can be used for collection. Oleophilic rope skimmers are preferred over brush or weir skimmers in broken ice, because ice tends to clog weir and brush skimmers. Skimming system efficiency is generally reduced in broken ice.

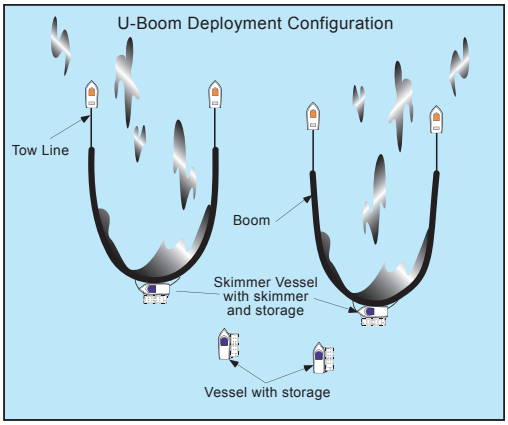

Figure FO-3. U-boom configuration.

Deployment Configurations

There are three typical deployment configurations for Free-Oil strike teams.

U-BOOM CONFIGURATION

The U-Boom System consists of vessels towing boom in a "U" configuration concentrating spilled oil into the back of the pocket formed by the boom (see Figure FO-3). This technique can also be used solely for oil concentration by leaving an opening secured by chain in the apex of the boom (see Figure FO-2). This is referred to as a "gated U–Boom." Typically, combinations of these configurations are used to enhance concentration and containment effectiveness. The spilled oil is then collected with a recovery device (skimmer), typically deployed by an additional vessel, and stored in a primary storage device.

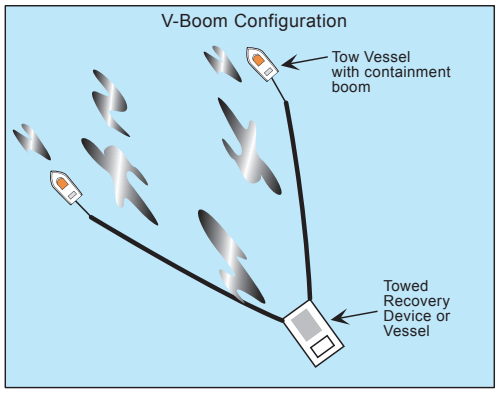

Figure FO-4. V-boom Configuration.

V-BOOM CONFIGURATION

The V-Boom Configuration consists of vessels towing boom and a recovery device (skimmer) in a "V" configuration (see Figure FO-4). The spilled oil is concentrated by the boom toward the back apex where a skimmer is located for oil recovery. Typically, these recovery systems are designed with a limited amount of storage built in and are either offloaded frequently or are augmented with additional storage devices and transfer systems.

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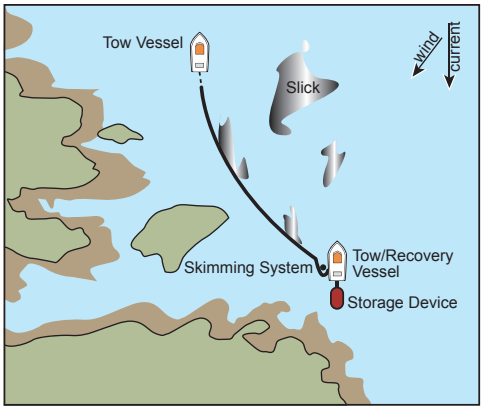

Figure FO-5. J-boom configuration.

J-BOOM CONFIGURATION

The J-Boom Configuration consists of vessels towing boom in a "J" configuration, concentrating the spilled oil for recovery into the back of the pocket formed by the boom (see Figure FO-5). The rear towing vessel is outfitted with a recovery device (skimmer) for deployment along the vessel side where the apex of the boom is formed. The oil is then collected with the skimmer and stored in a primary storage device, such as a mini barge. This system is often utilized in place of the U-Boom system, when the response is limited by the amount of vessels available, when maneuverability is not as critical, and when the oil is concentrated in windrows.

BOOM CONTROL AND ENHANCED RECOVERY DEVICES

Recent improvements in boom control devices, such as the Boom Vane™, allow a single vessel to deploy and control a U-Boom system (Figure FO-6). Enhanced recovery devices, such as the Current Buster™, allow for greater speed of advance for the boom system and concentrate oil to a deeper depth for more efficient collection (Figure FO-7). These configurations can improve system efficiency and reduce the costs of operation, however, they may limit the maneuverability of the recovery system.

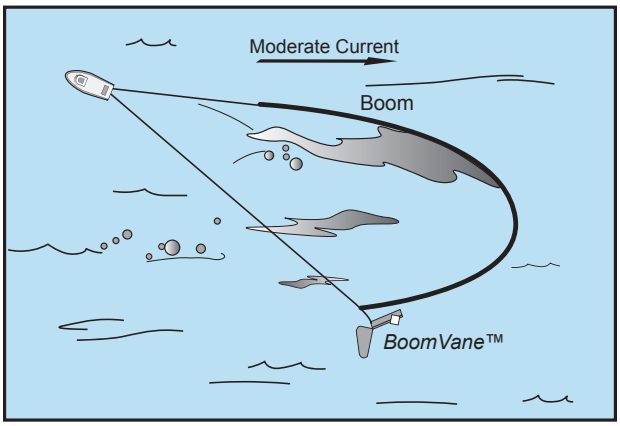

Figure FO-6. Free-oil recovery using a BoomVane™ to control one end of a U-boom.

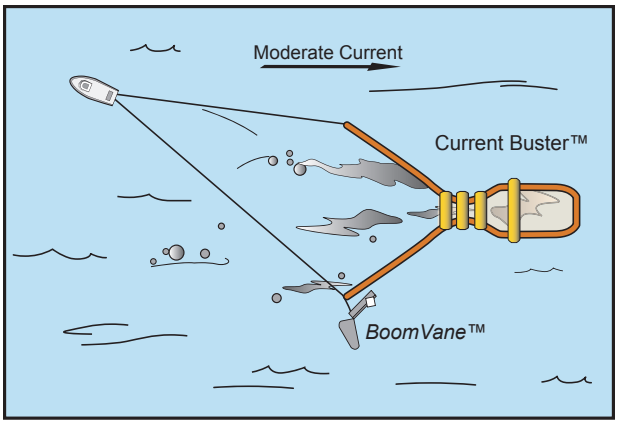

Figure FO-7. Free-oil recovery using a BoomVane™ to control one end of a Current Buster™.

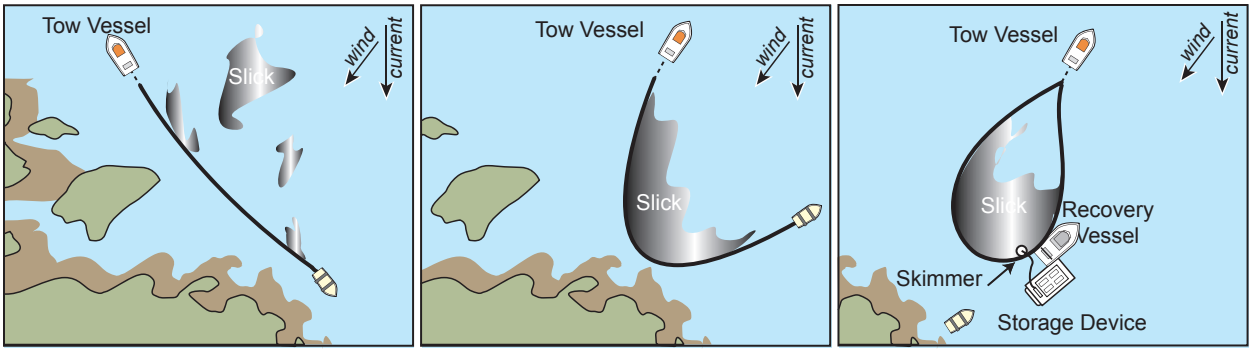

Figure FO-8. Nearshore trapping, boom-towing boats collect oil then tow the trapped oil to deeper water for recovery.

NEARSHORE TRAPPING

Shallow draft vessels can be used to capture oil in shallow water by encircling it and slowly dragging the slick into deep water. A marine recovery system is then used to remove the oil (see Figure FO-8).

DEPLOYMENT CONSIDERATIONS AND LIMITATIONS

SAFETY

- Daily weather evaluation is recommended, and should include distance to safe harbor, transit times and exposure of vessels.
- Vessel masters should have experience in the appropriate operating environment and tactic. Local knowledge is preferred.
- Vessels setting and tending the boom should be able to safely transit seas that exceed the boom's operating limitation.
- If possible, vessels in transit to/from an operation or staging area should transit in pairs.
- A communications schedule should be established and followed, between vessels in transit and the Operations Section or Radio Dispatcher.
- Vessels, including skiffs, must have a minimum of two crew aboard.
- Response personnel should wear PPE as required by the incident-specific Site Safety Plan.

DEPLOYMENT

- Site conditions may influence deployment configuration options.
- Combinations of Free-oil Recovery and Diversion tactics are often used together.
- Combinations of configurations may optimize recovery.
- Procedures and permits for decanting recovered water should be considered.

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- Open water systems, typically operate two 12-hour shifts per day. Other systems typically operate one 12-hour shift per day.
- Logistics for oil transport and disposal should be considered.

REFERENCES TO OTHER TACTICS

Other tactics associated with On-water Free-oil Recovery include:

- MR Marine Recovery
- DV Diversion Boom
- MST Marine Based Storage and Transfer

EQUIPMENT AND PERSONNEL RESOURCES

Commonly used resources for this tactic include vessels, boom, skimmers, primary storage devices, and personnel. Configuration type and quantity of strike teams required will be determined by site conditions, spilled oil type and volume, area of coverage, and resource availability. Resource sets may need to be refined as site-specific requirements dictate.

FO-D FO-O

Open Water Free-oil Recovery System

Typical Equipment	Function	Quantity	Notes
Oil boom, > 42” height	Contain and concentrate oil	1,000 to 3,000 ft.	Depending on configuration and oil concentration
Skimming system(s), open water	Remove concentrated oil	1 minimum	Type and capacity of skimmer depends on oil type, oil weathering state, and operating environment
Enhanced recovery device	Concentrate oil	1 optional	Type and capacity of skimmer depends on oil type, oil weathering state, and operating environment
Primary storage device	Store recovered fluid	2 times the effective daily recovery capacity of the skimming system(s)	Typically large barges or bladders are used for open water systems
Decanting system	Removing recovered water	1 optional	Permit is required to decant
Typical Vessel	**Function**	**Quantity**	**Notes**
Class 1 or 2	Platform for skimming and handling recovery device	1 or 2	Depending on configuration
Class 3, 4, 5 or 6	Boom towing	1 to 4	Depending on configuration
Typical Personnel	**Function**	**Quantity**	**Notes**
Field Team Leader	Supervises operations	1	
Vessel Operators, open water	Masters of response vessels	2 to 5	Depending on number of vessels
Skilled Technicians	Crew vessels and operate response equipment	4 to 7	Depending on number of vessels
General Technicians	Work under the direction of skilled technicians	2 to 5	Depending on number of vessels

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Protected Water Free-oil Recovery System

FO-P

Typical Equipment	Function	Quantity	Notes
Oil boom, 18" to 42" height	Contain and concentrate oil	500 to 1,000 ft.	Depending on configuration and oil concentration
Enhanced recovery device	Concentrate oil	1 optional	Examples are: Current Buster™ or River Lagoon™
Boom control device	Control one end of boom array	1 optional	May be used in place of one vessel, however, a larger vessel may be required
Skimming system(s), protected water	Remove concentrated oil	1 minimum	Type and capacity of skimmer depends on oil type, oil weathering state, and operating environment
Primary storage device	Store recovered fluid	2 times the effective daily recovery capacity of the skimming system(s)	Typically mini-barges or small bladders are used for protected water systems
Decanting system	Removing recovered water	1 optional	Permit is required to decant
Typical Vessel	**Function**	**Quantity**	**Notes**
Class 1, 2, or 3	Platform for skimming and handling recovery device	1	Depending on configuration
Classes 3, 4, 5, or 6	Boom towing	1 to 3	Depending on configuration
Typical Personnel	**Function**	**Quantity**	**Notes**
Field Team Leader	Supervises operations	1	
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	1 to 4	Depending on number of vessels
General Technicians	Work under the direction of skilled technicians	1 to 4	Depending on number of vessels

Calm Water Free-oil Recovery System

FO-S FO-C

Typical Equipment	Function	Quantity	Notes
Oil boom, 6" to 24" height	Contain and concentrate oil	200 to 1,000 ft.	Depending on configuration and oil concentration
Enhanced recovery device	Concentrate oil	1 optional	Examples are: Current Buster™ or River Lagoon™
Boom control device	Control one end of boom array	1 optional	May be used in place of one vessel, however, a larger vessel may be required
Skimming system(s), calm water	Remove concentrated oil	1 minimum	Type and capacity of skimmer depends on oil type, oil weathering state, and operating environment
Primary storage device	Store recovered fluid	2 times the effective daily recovery capacity of the skimming system(s)	Typically mini-barges or portable tanks are used for calm water systems
Decanting system	Removing recovered water	1 optional	Permit is required to decant
Typical Vessel	**Function**	**Quantity**	**Notes**
Classes 4, 5, or 6	Platform for skimming and handling recovery device	1	Depending on configuration
Classes 4, 5, or 6	Boom towing	1 to 3	Depending on configuration. Use of a boom control device, such as a Boom-vane™, may necessitate less vessels.
Typical Personnel	**Function**	**Quantity**	**Notes**
Field Team Leader	Supervises operations	1	
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	1 to 2	Depending on number of vessels
General Technicians	Work under the direction of skilled technicians	0 to 4	Depending on number of vessels

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Fast Water Free-oil Recovery System — FO-F

Typical Equipment	Function	Quantity	Notes
Oil boom, 8" to 24" height	Contain and concentrate oil	200 to 500 ft.	Depending on configuration and oil concentration
Enhanced recovery device	Concentrate oil	1 optional	Examples are: Current Buster™ or River Lagoon™
Boom control device	Control one end of boom array	1 optional	May be used in place of one vessel, however, a larger vessel may be required
Skimming system(s), calm water current	Remove concentrated oil	1 minimum	Type and capacity of skimmer depends on oil type, oil weathering state, and operating environment
Primary storage device	Store recovered fluid	1	Typically mini-barges or small bladders are used for fast water systems
Decanting system	Removing recovered water	1 optional	Permit is required to decant
Typical Vessel	**Function**	**Quantity**	**Notes**
Classes 5 or 6	Platform for skimming and handling recovery device	1	Depending on configuration
Classes 5 or 6	Boom towing	1 to 2	Depending on configuration. Use of a boom control device, such as a Boom-vane™, may necessitate less vessels.
Typical Personnel	**Function**	**Quantity**	**Notes**
Field Team Leader	Supervises operations	1	
Vessel Operators, protected/ calm water	Masters of response vessels	2 to 3	Depending on number of vessels
Skilled Technicians	Crew vessels and operate response equipment	1 to 3	Depending on number of vessels
General Technicians	Work under the direction of skilled technicians	0 to 3	Depending on number of vessels

Broken Ice Free-oil Recovery System — FO-B

Typical Equipment	Function	Quantity	Notes
Oil boom, 8" to 24" height	Contain and concentrate oil	200 to 500 ft.	Depending on configuration and oil concentration
Enhanced recovery device	Concentrate oil	1 optional	Examples are: Current Buster™ or River Lagoon™
Skimming system(s), calm or protected water	Remove concentrated oil	1 minimum	Type and capacity of skimmer depends on oil type, oil weathering state, and operating environment - oleophilic rope/brush skimmer preferred
Primary storage device	Store recovered fluid	1 or 2	Typically mini-barges with sufficient hull strength for ice
Decanting system	Removing recovered water	1 optional	Permit is required to decant
Typical Vessel	**Function**	**Quantity**	**Notes**
Classes 2, 3, or 4	Platform for skimming and handling recovery device	1	Depending on configuration. Steel hull required.
Classes 2, 3, or 4	Boom towing	1 to 2	Depending on configuration. Steel hull required.
Typical Personnel	**Function**	**Quantity**	**Notes**
Field Team Leader	Supervises operations	1	
Vessel Operators, open/ protected/calm water	Masters of response vessels	2 to 3	Depending on number of vessels
Skilled Technicians	Crew vessels and operate response equipment	1 to 3	Depending on number of vessels
General Technicians	Work under the direction of skilled technicians	0 to 3	Depending on number of vessels