

# Petroleum Association of Japan 2011 Oil Spill Response Workshop

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## The Controlled Burning of Oil During the Deepwater Horizon Oil Spill



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Spiltec



# Topics

Brief History of Controlled Burning  
Trade-offs and Constraints  
Deepwater Horizon Burn Operations  
Lessons Learned



# Very First "Fire Boom"

## April 5, 1983

Kenai, Alaska



Al Allen, Spiltec

Wayne Simpson, Shell Oil



# Tank Tests – 1980's & 1990's

Products Burned:  
Diesel, Crude oil  
& Propane

Temperatures:  
~ 1100°C (> 2000°F)

Flame Durations:  
Typically 2 to 3 hours



# Field Trials

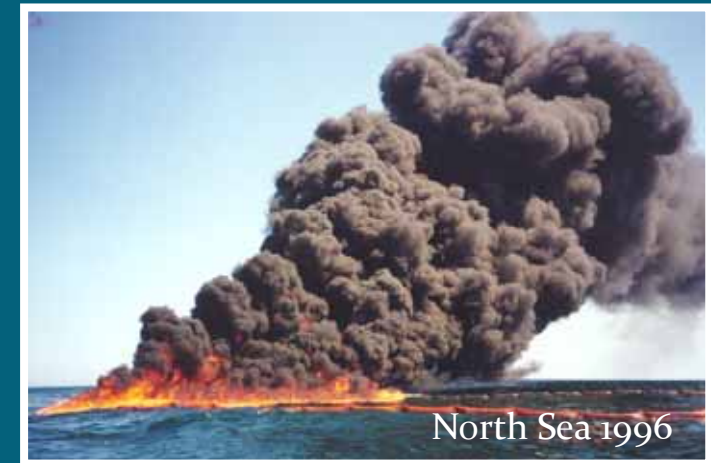
Full-Scale Burns  
Aerial & Surface Ignition  
Burn times: 2 to 3 hours



Newfoundland 1993



Svalbard 1988



North Sea 1996

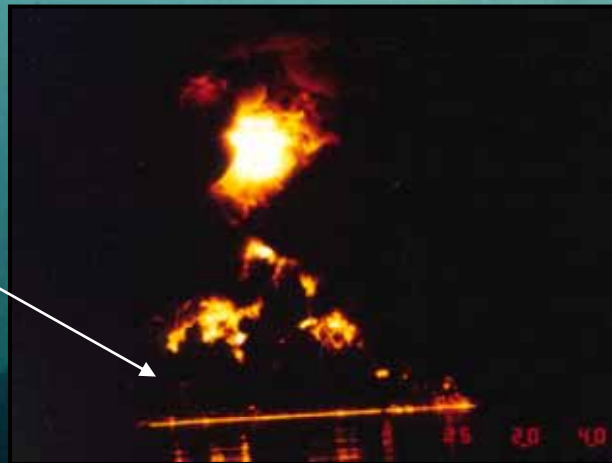
# Actual Spill Event – 1989

Prince William Sound, Alaska

Exxon Valdez

~ 17 km<sup>2</sup> (> 6 ½ miles<sup>2</sup>)  
of continuous dark oil

Day 2: Controlled  
burn in a towed "U"  
configuration with  
fire boom



Spiltec

# Controlled Burning

- Disadvantages
  - Authorization Required
  - Oil Encounter Rate for Wide-Spread Slicks
  - Smoke Plume & Burn Residue
  - Proximity Constraints for Populated Areas
  - Limited Availability of Fire Boom & Expertise
  - Potential Secondary Fires

# Controlled Burning

- Advantages

- High oil elimination rate ( $0.171 \text{ m}^3/\text{Hr}/\text{m}^2$ ,  $0.07 \text{ gpm}/\text{ft}^2$ )
- Very High Efficiency of Removal (typically 90% -95%)
- Risk reduction (hazardous/flammable vapors)
- Minimal logistics and equipment requirements
- Effective over wide range of oil types & conditions
- Specialized equipment (fire boom) cost effective, easily maintained and transportable
- Storage/Disposal not required (except for burn residue)
- Minimal environmental impact (short-term & localized)



# Deepwater Horizon Oil Spill

Burn Locations: ~ 25 to 55 miles off shore

Timing: April 28<sup>th</sup> – July 19<sup>th</sup> 2010

Source: Continuous Release, 5,000' deep, dispersant injection

Surface Slicks: Light crude, widely spread, unstable emulsion



# Special Operational Considerations

## Oil Access or "Encounter Rate"

(Enhancements for Efficient, High-Volume Elimination)

## Surveillance & "Spotting"

## Vessels of Opportunity (VOO)

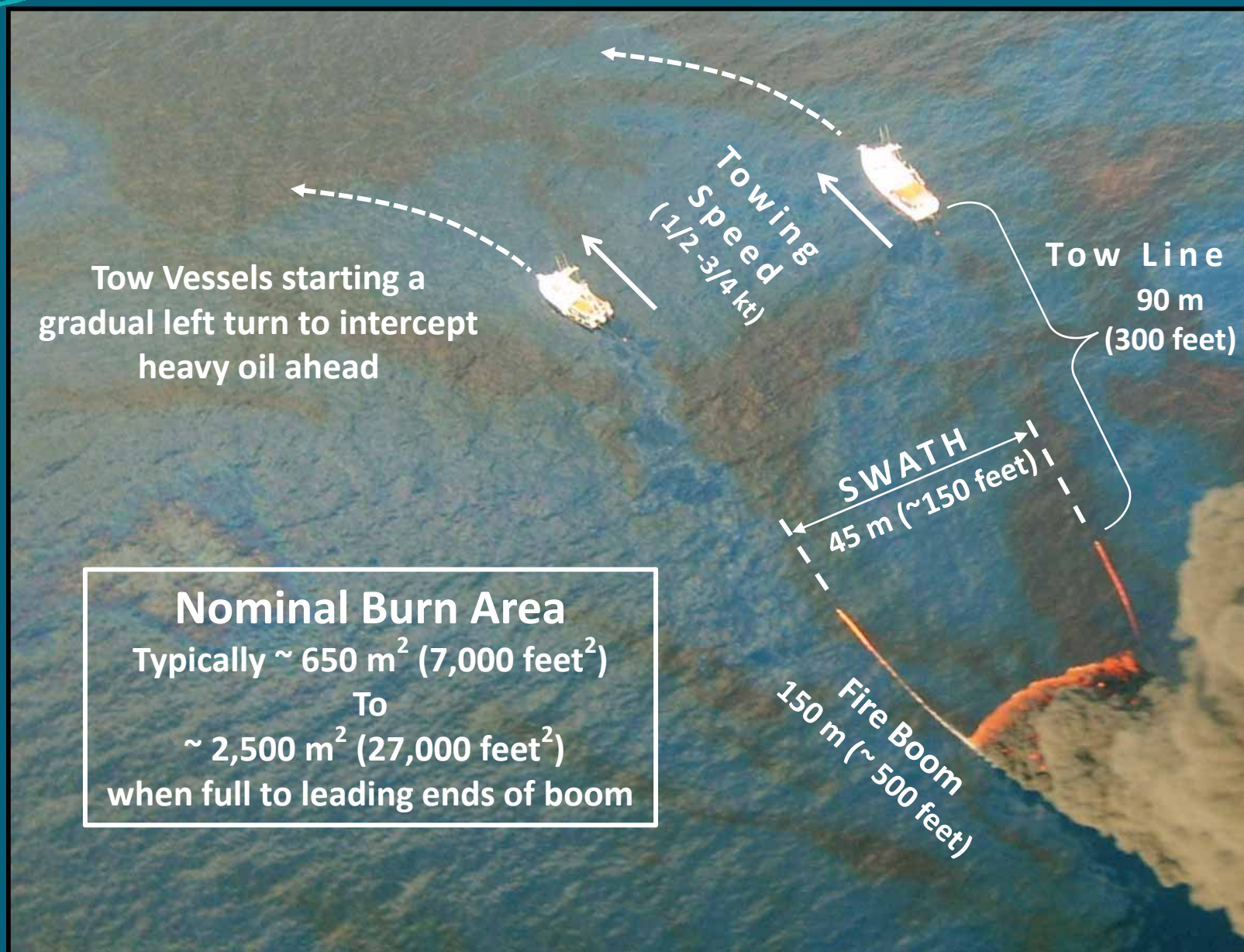
## Broad Tactical Capability

(Feeding burns, Multiple burns, Burning outside boom, etc.)

## Integration of Response Options

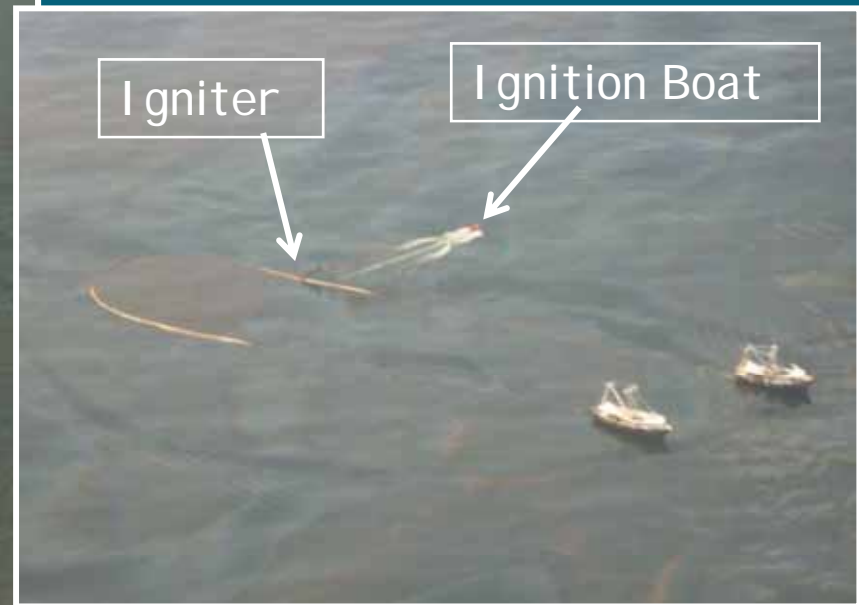
(Spatial & Temporal)

# Towed Fire Boom Configuration





# Controlled Burning – Capture, Ignition & Burn





# Surveillance & “Spotting” Critical for Effective Operations



Alan A. Allen, Spiltec

# Vessels of Opportunity

Local fishing vessels provided the “core” of the Controlled Burn Fleet



Captains & Crews received HAZWOPER training as well as classroom and hands-on training for Controlled Burning



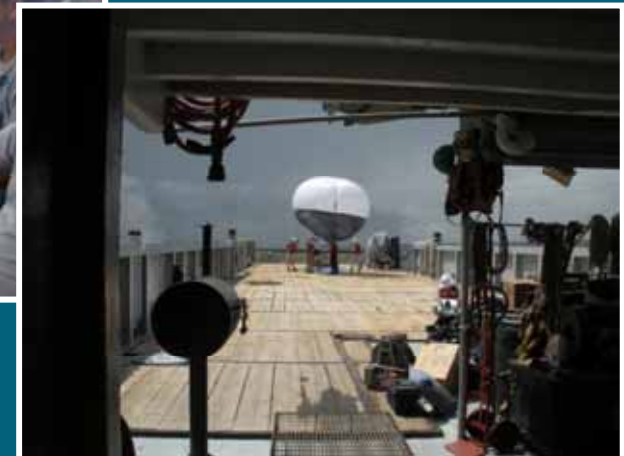
# Wildlife & Responder Protection



Personnel are trained to watch for and protect wildlife prior to, during and after burns.



Specialists from federal and local agencies travel with the burn teams and monitor smoke particles, volatile organic compounds & any exposure to oil.





# All Ignitions with Hand-held Igniters





# Igniter Release, Heating of Oil, and Flame Spread



# Burn Residue

Stiff, taffy-like, material

Typically a few % of the original volume burned

Depleted of its volatile hydrocarbons





# Oil “even emulsions” Could be fed to Ongoing Burns



# Long – Duration Burns

**BURN # 224**  
**Lasted for 11**  
**Hours And Forty**  
**Eight Minutes**



**06/16/2010 15:05**



# Burning Outside of Fire Boom

If sufficient volumes of oil collect directly downstream, burning may continue outside the boom. Such burning is normally small and can be controlled with boat wakes and fire monitors.

Rising hot air may draw oil into the fire helping to sustain fire that would normally burn out within minutes.

# Many days involved multiple simultaneous burns

On June 18<sup>th</sup>, 2010, the burn teams conducted 16 burns resulting in the elimination of ~ 50,000 to 70,000 bbl of oil.



# Burn Area/Duration



**MC-252- Incident**

Controlled Burning Field Data Collection/Air Operations

Site:	Team:	Burn #:
Latitude:	Sea State:	Post Observed Time/Qualities:
Longitude:	Visibility:	Last Observed Time/Qualities:

NOTES:

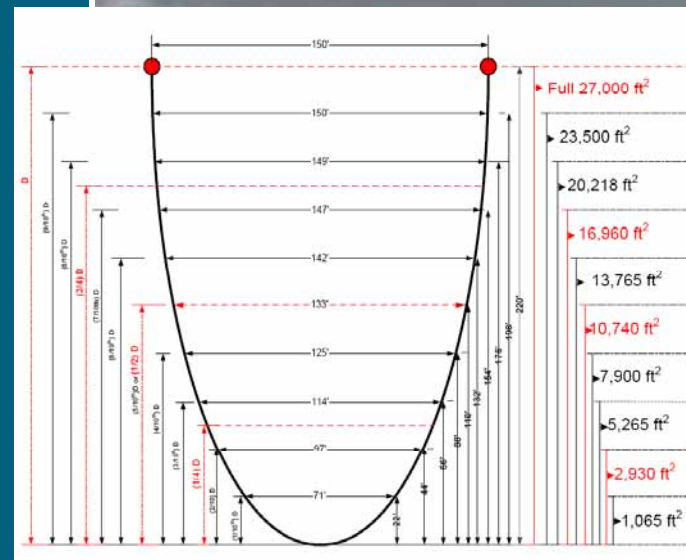
Time

Area ft<sup>2</sup>

Area ft<sup>2</sup> outside Boom

Comments

Revised by: \_\_\_\_\_ Signature: \_\_\_\_\_

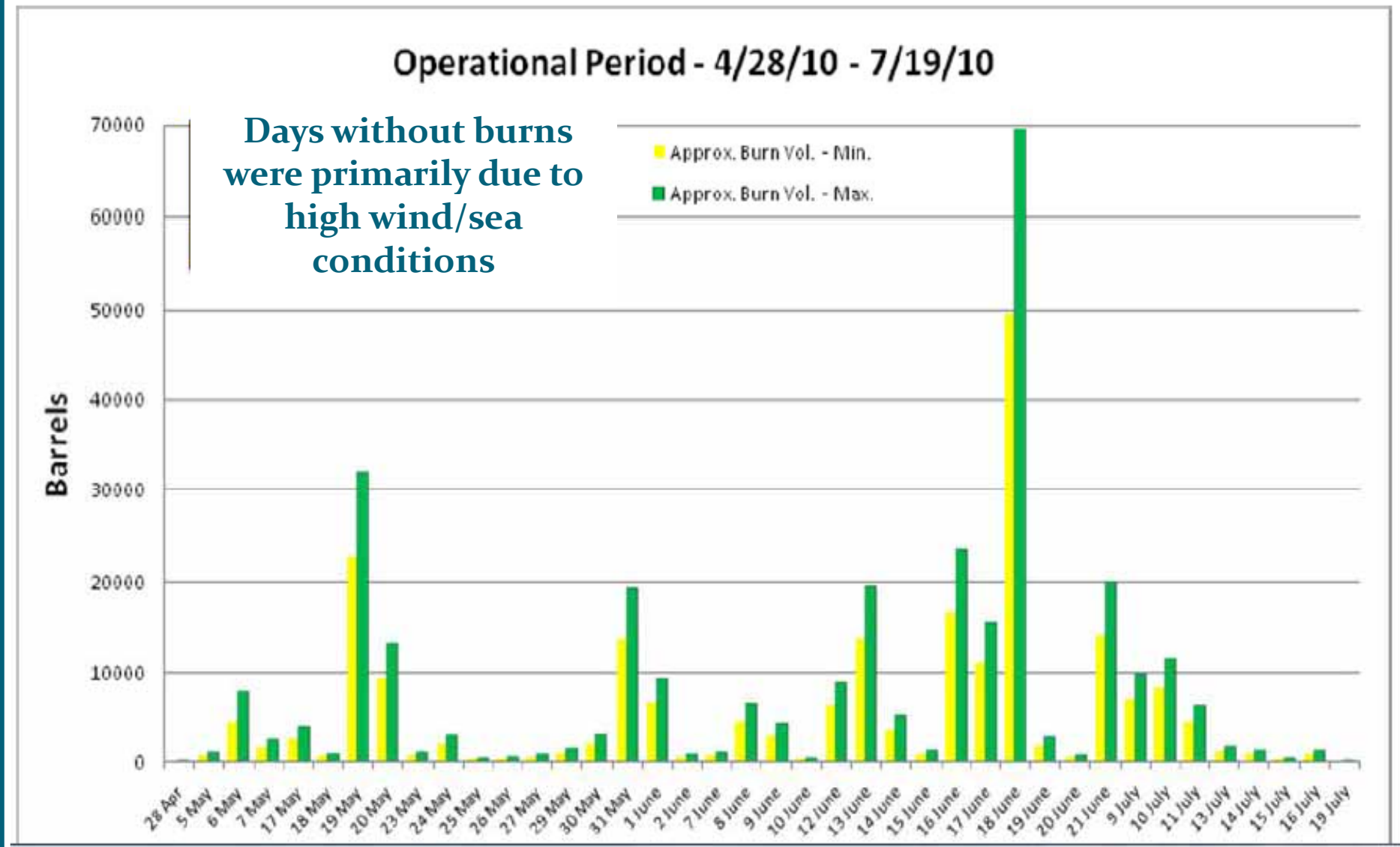


More than 400 burns conducted.  
376 burns of significant size eliminating  
between ~ 220,000 bbl and 310,000 bbl.





# Daily Burn Volumes



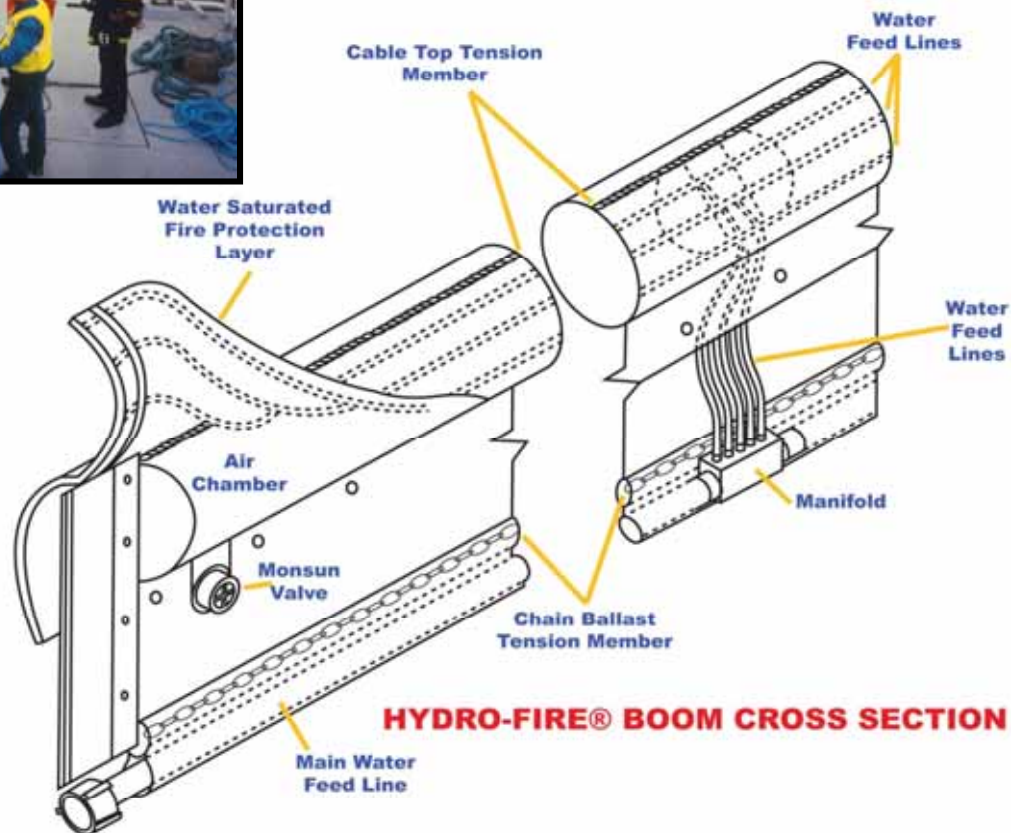
# Types of Fire Boom

- 23,000 feet of fire boom used:
  - Hydro-Fire Boom
  - Pyro Boom
  - 3M/AMI
  - Oil Stop
  - and Kepner



# Hydro-Fire Boom

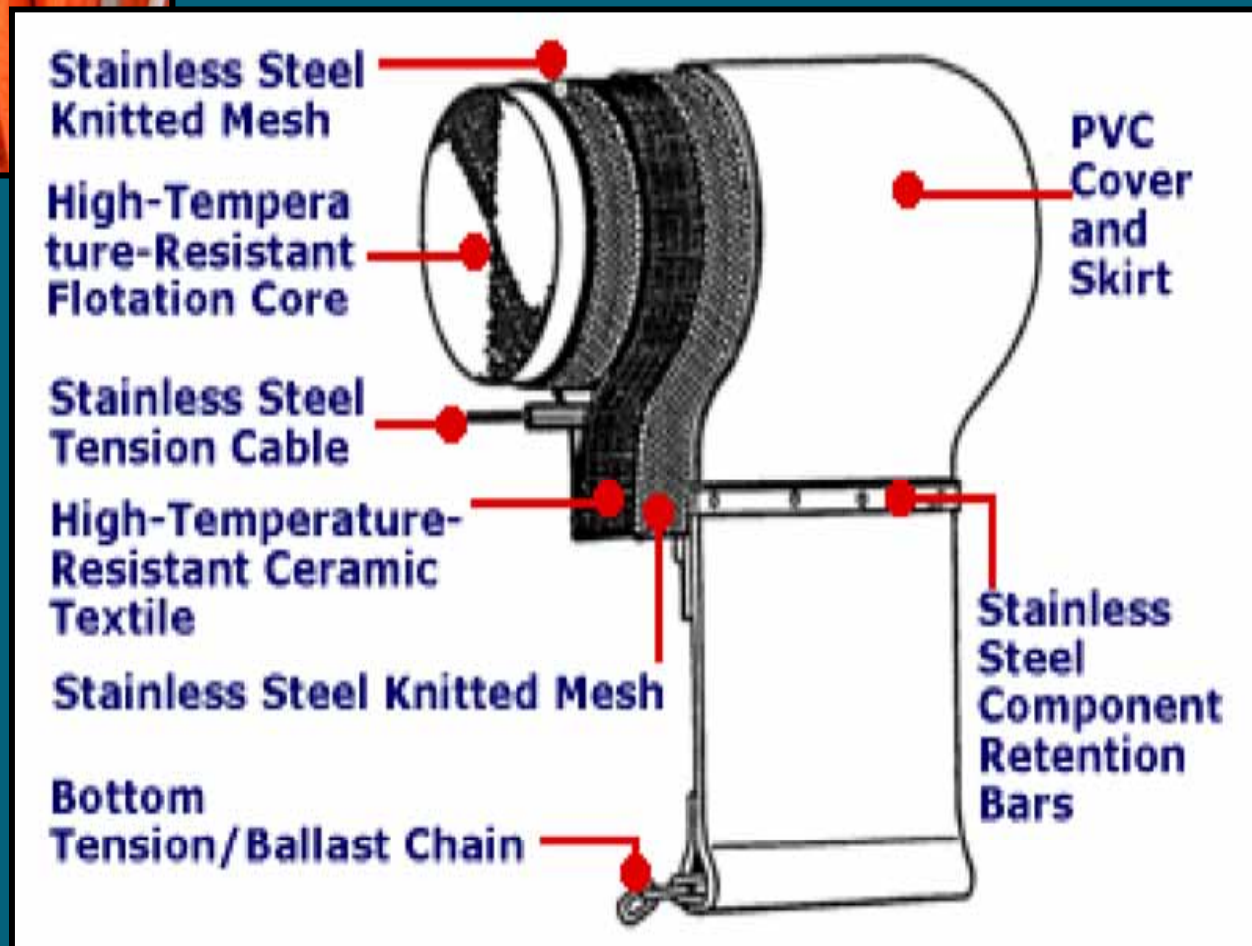
Water-Cooled    Reelable  
Individual Inflated Segments  
Redundant Water Cooling & Filtering Systems





# American Marine – 3M

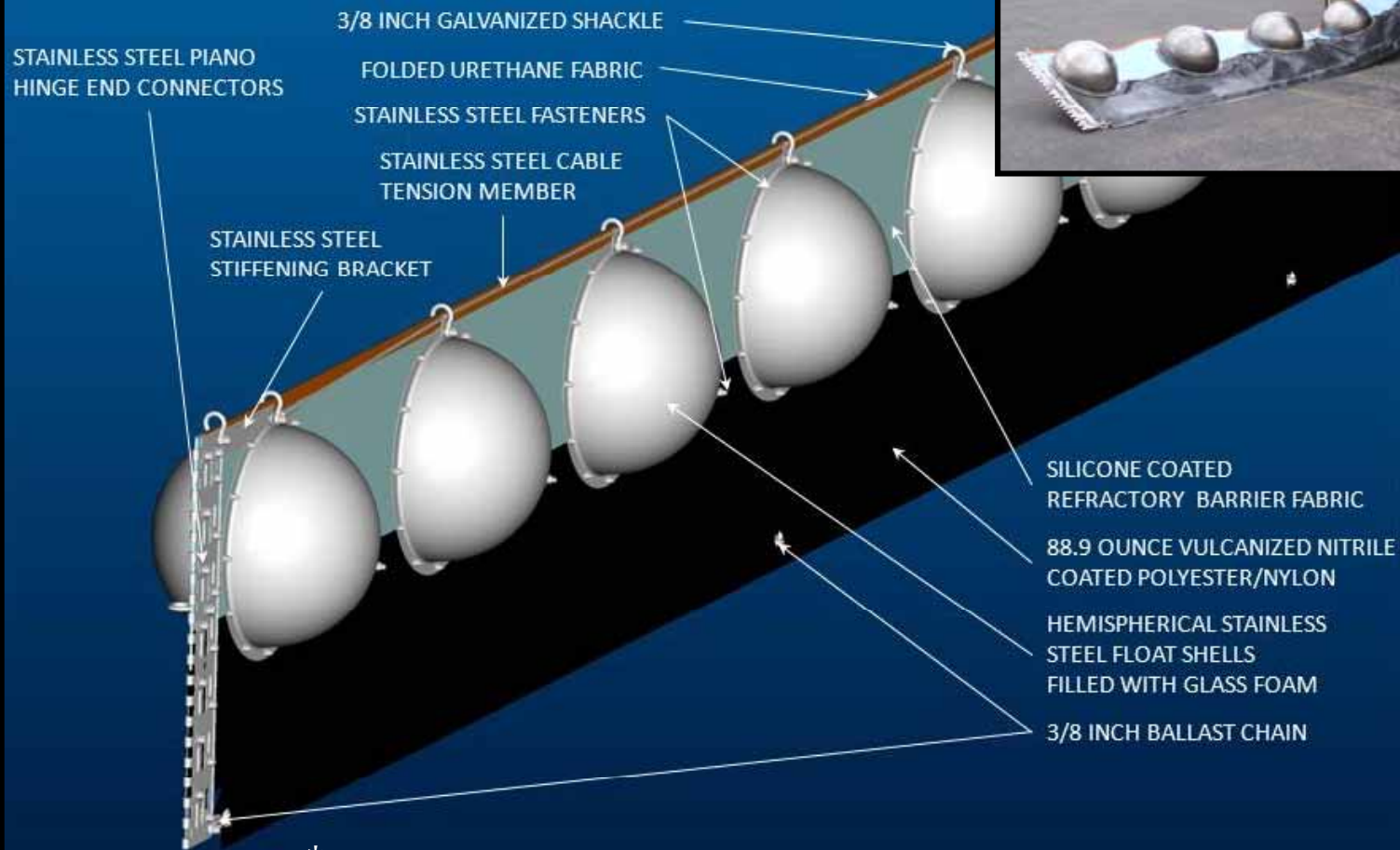
High-Temperature Ceramic and  
Stainless Steel Covers  
Solid Flotation Core





# PyroBoom

Fence-Type Boom with Silicone  
Coated Refractory Fabric  
Aluminum \*Connectors & Stainless  
Steel Floats with Glass Foam



\* Recent enhancements include SS Hinge Connectors & Top-Edge Reinforcement

# Fire Boom Summary

## (Used during Deepwater Horizon Spill – 2010)

Performance Factors	Elastec Hydro-Fire	Elastec American Marine-3M	AFT, Inc. Pyro	Oil Stop	Kepner
No. of Systems Used	27	37	13	3	2
Longest Continuous Burn	11 hours, 48 min.	11 hours, 21 min.	3 hours, 13 min.	27 min.	43 min.
Average No. of Barrels Burned per System	5,061	3,915	1,749	28	295

# Observations & Lessons Learned

- **Controlled Burning** – Shift from “Alternative” to “Primary” response option.
- **Fire Boom Technology** – Tools and Tactics now proven for the rapid and efficient elimination of large quantities of oil at sea.
- **System Performance** – Potential elimination of 300,000 bbl or more, representing approximately 17% of oil available at the sea surface.
- **Cost per Barrel Eliminated** – Typically US\$ 20 to 40 (a fraction of the cost for dispersant application and mechanical recovery/disposal).
- **Most Vital Ongoing Support** – Surveillance, Spotting & Communications.
- **Important Proactive Effort** – Coordination with regulators, public and media, and integration of all response options.