

OSPR/Chevron Oil Spill Response Technology Workshop

Chevron Park - San Ramon, California
February 15 -17, 2011

In-Situ Burn Operations During the Deepwater Horizon Oil Spill



Alan A. Allen
Spiltec



Topics

Brief History of Controlled Burning
Trade-offs and Constraints
Deepwater Horizon Experiences
Strategies & Tactics
Equipment & Personnel
Safety & Environment
Key Observations



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

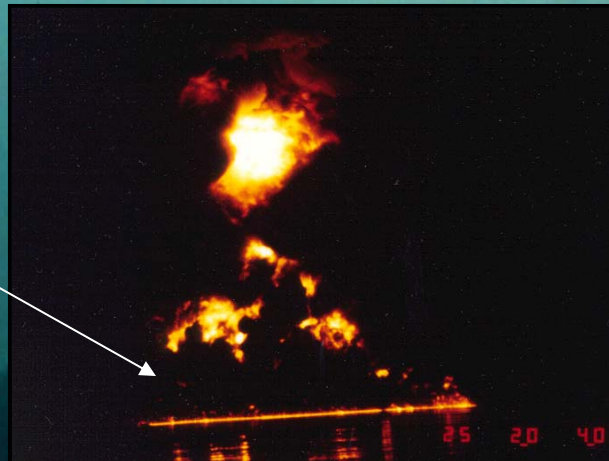
Prince William Sound, Alaska



Exxon Valdez

~ 17 km² (> 6 ½ miles²)
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)

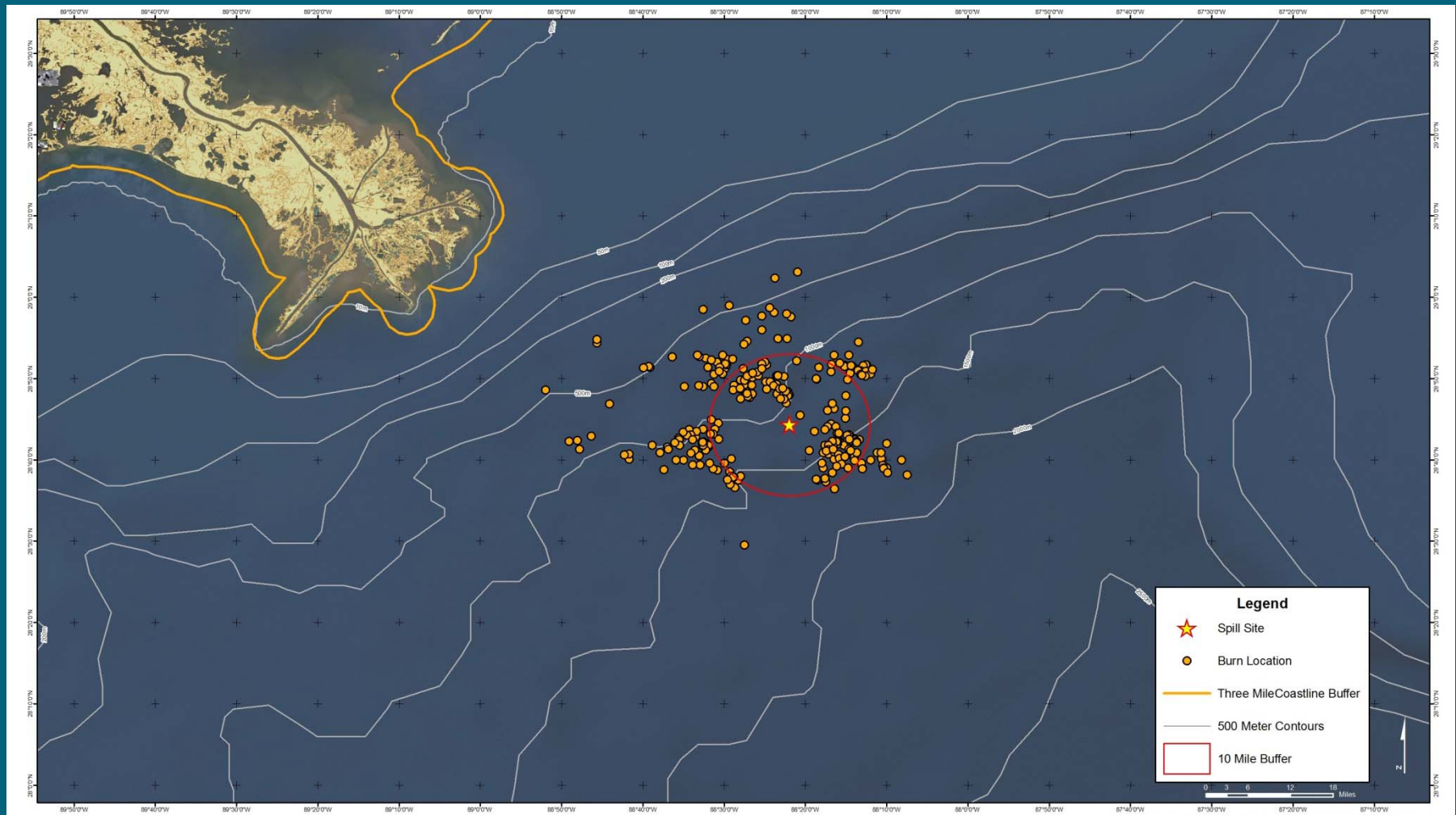
Deepwater Horizon Oil Spill

Burn Locations: ~ 25 to 55 miles off shore

Timing: April 28th - July 19th 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.)

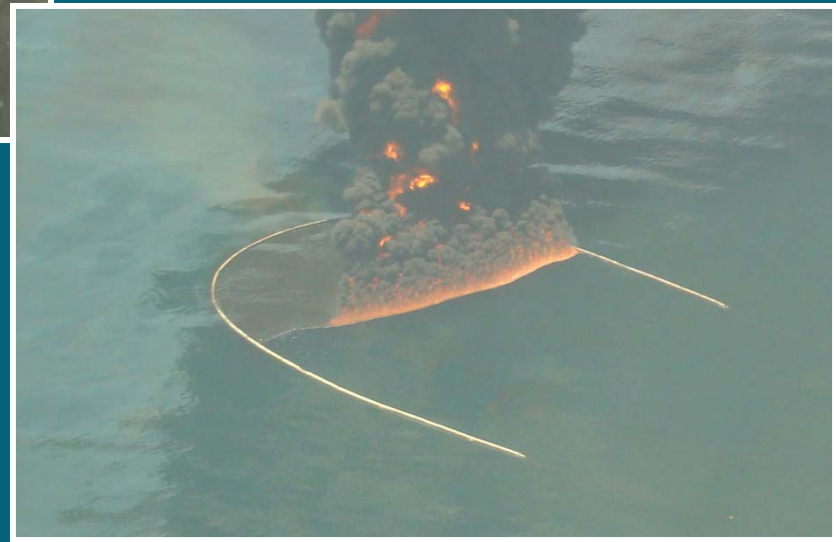
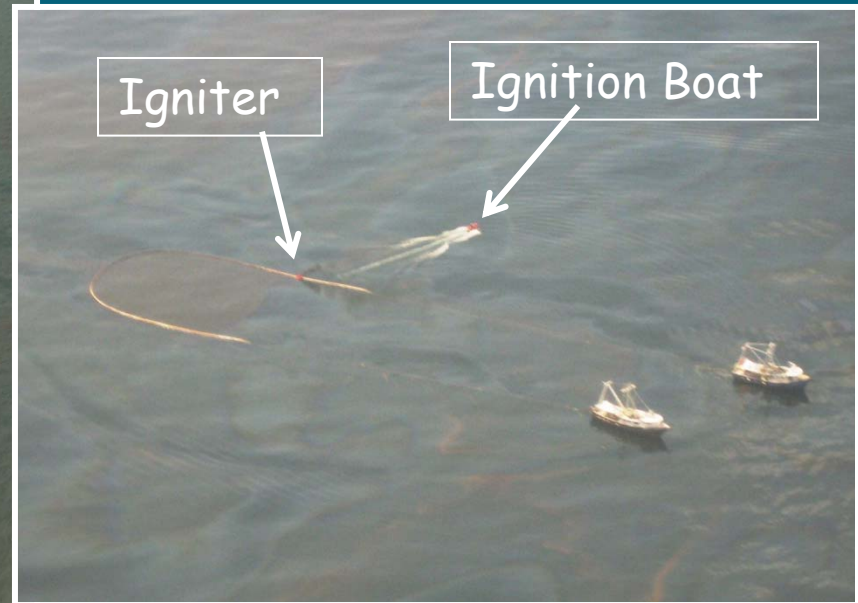
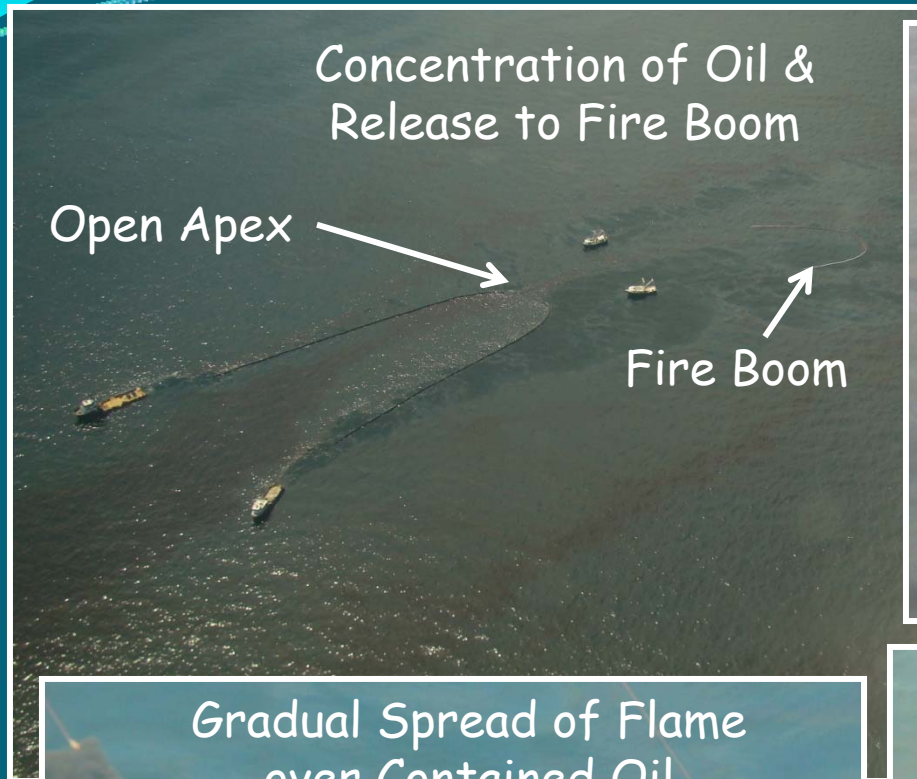
Integration of Response Options

(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



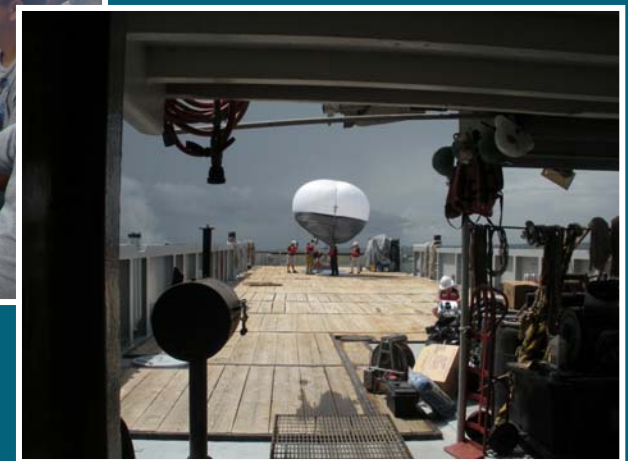
Wildlife & Responder Protection



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

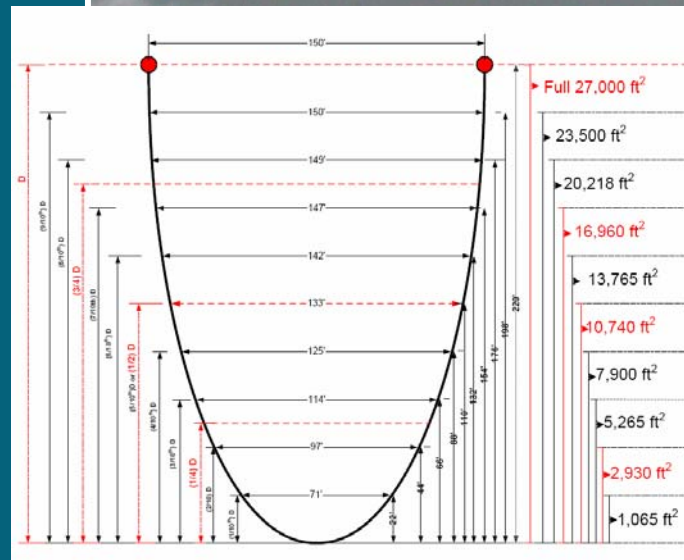
If sufficient volumes of oil collect directly downstream, burning may continue outside the boom. Such burning is normally small and can be controlled with boat wakes and fire monitors.

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

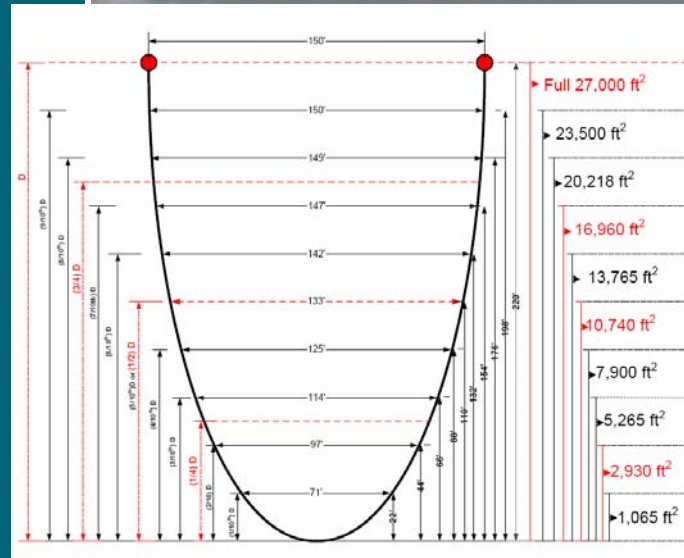
Many days involved multiple simultaneous burns

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



[illegible]

A man wearing a headset and glasses is shown in profile, holding a microphone to his mouth. He is wearing a blue and white striped shirt. The background features a large, circular window, likely from an aircraft or a train. There is some black scribbled text or markings over the top left portion of the image.

[illegible]

ation



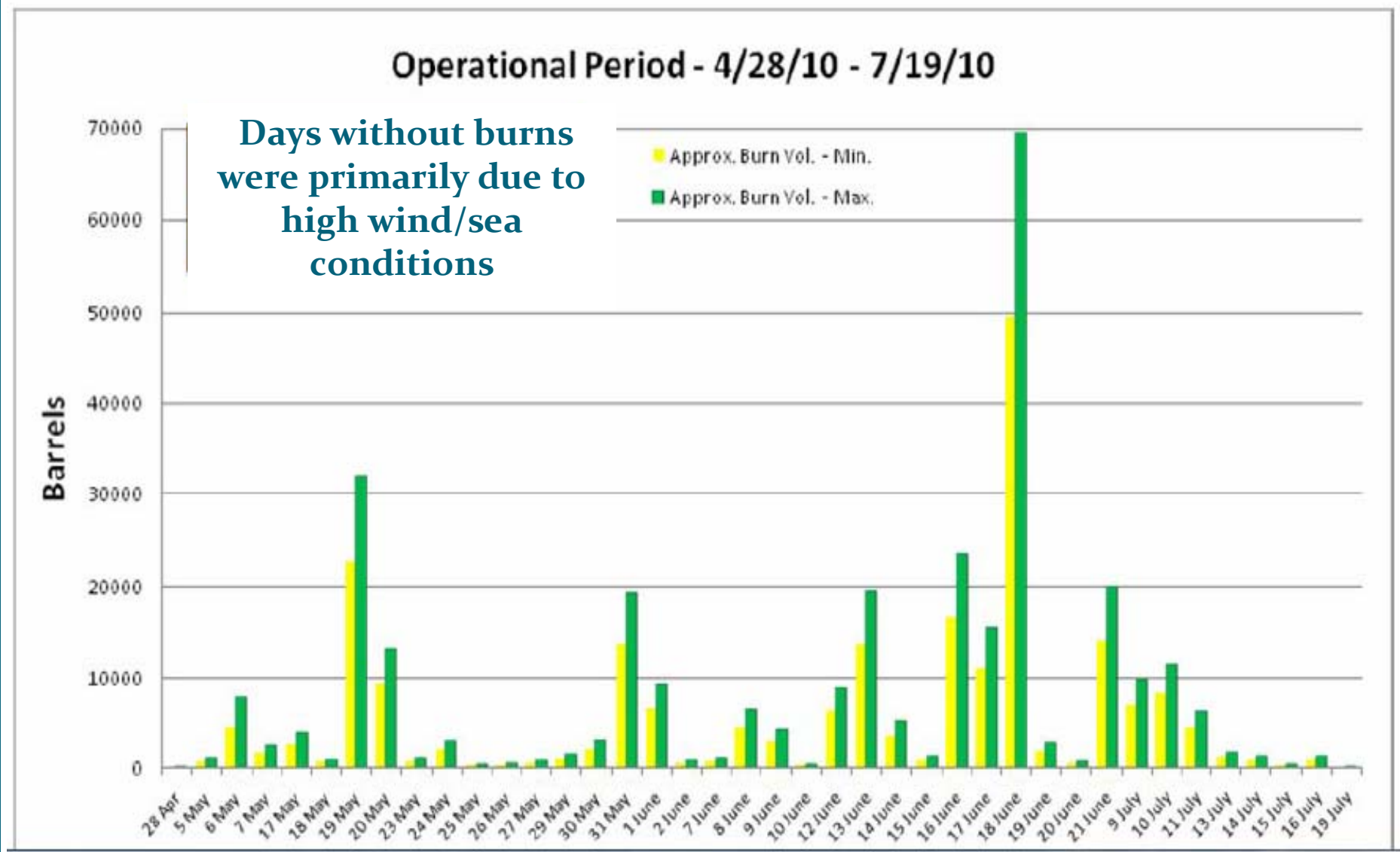
Documented by: _____ Signature: _____



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



Daily Burn Volumes



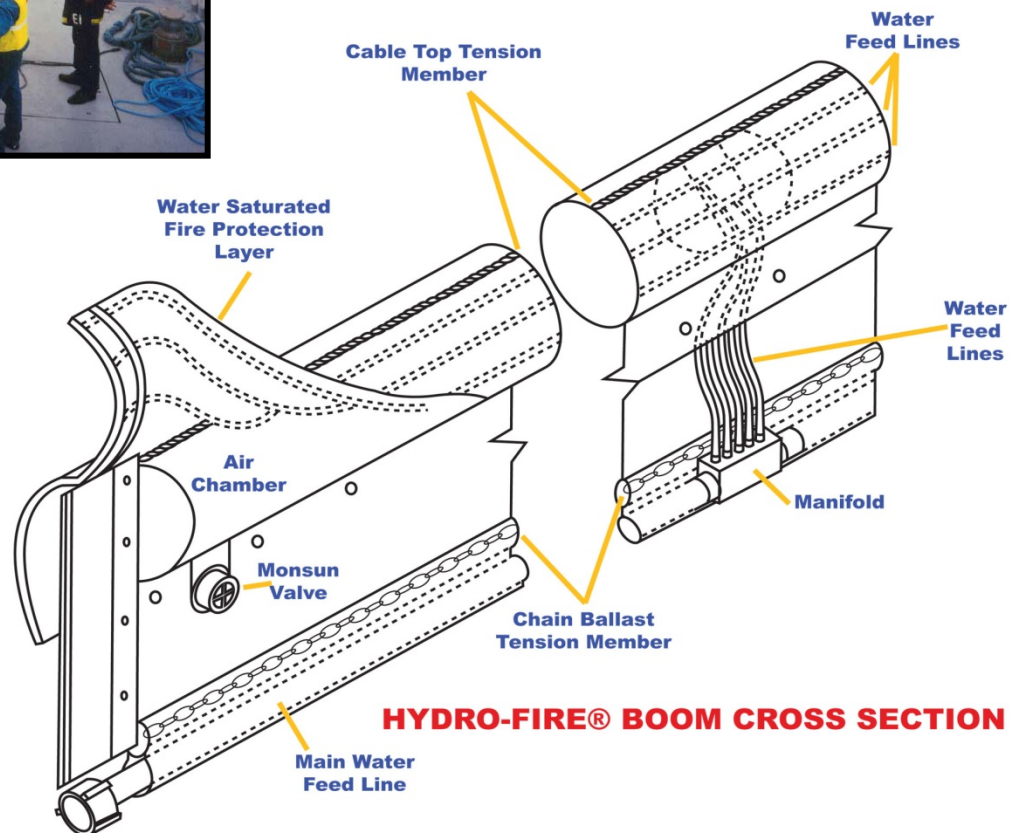
Types of Fire Boom

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



Hydro-Fire Boom

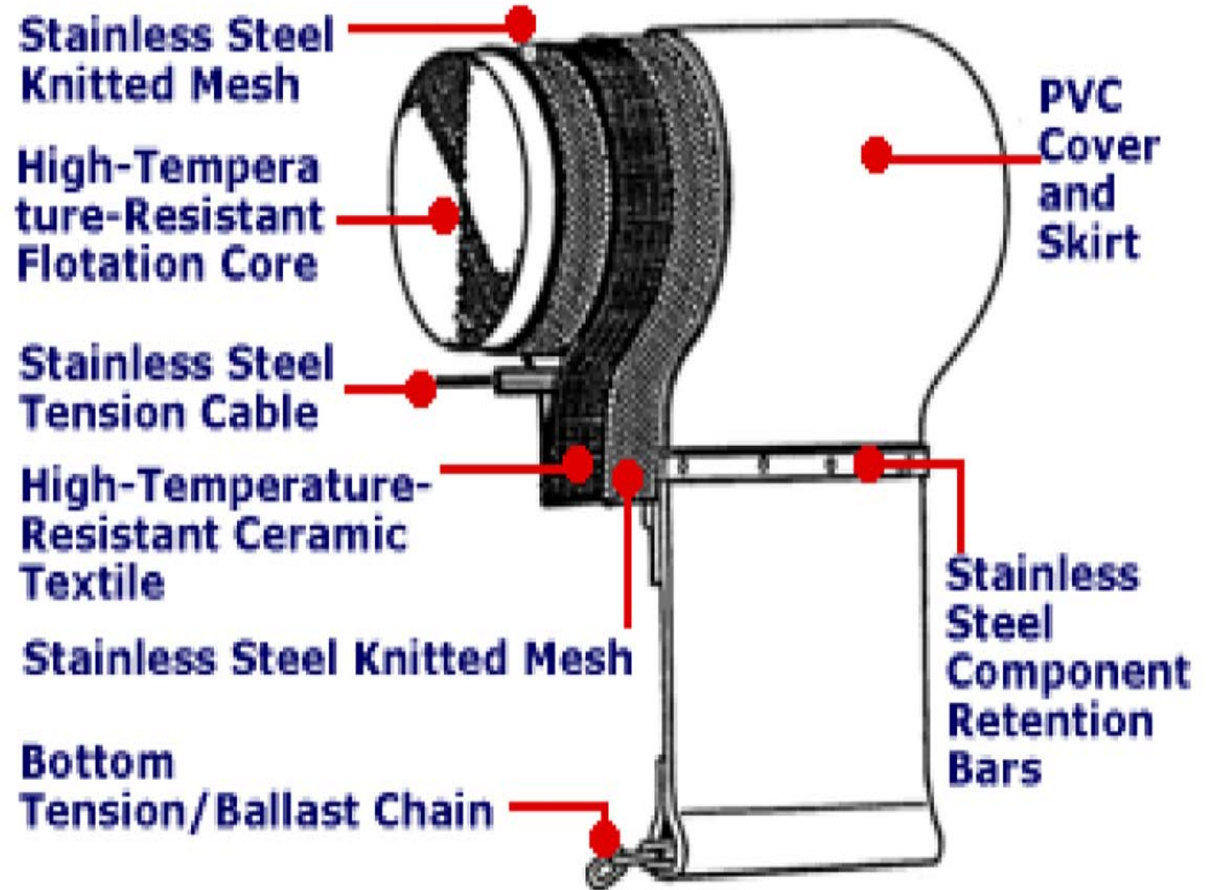
Water-Cooled Reelable
Individual Inflated Segments
Redundant Water Cooling & Filtering Systems



American Marine – 3M

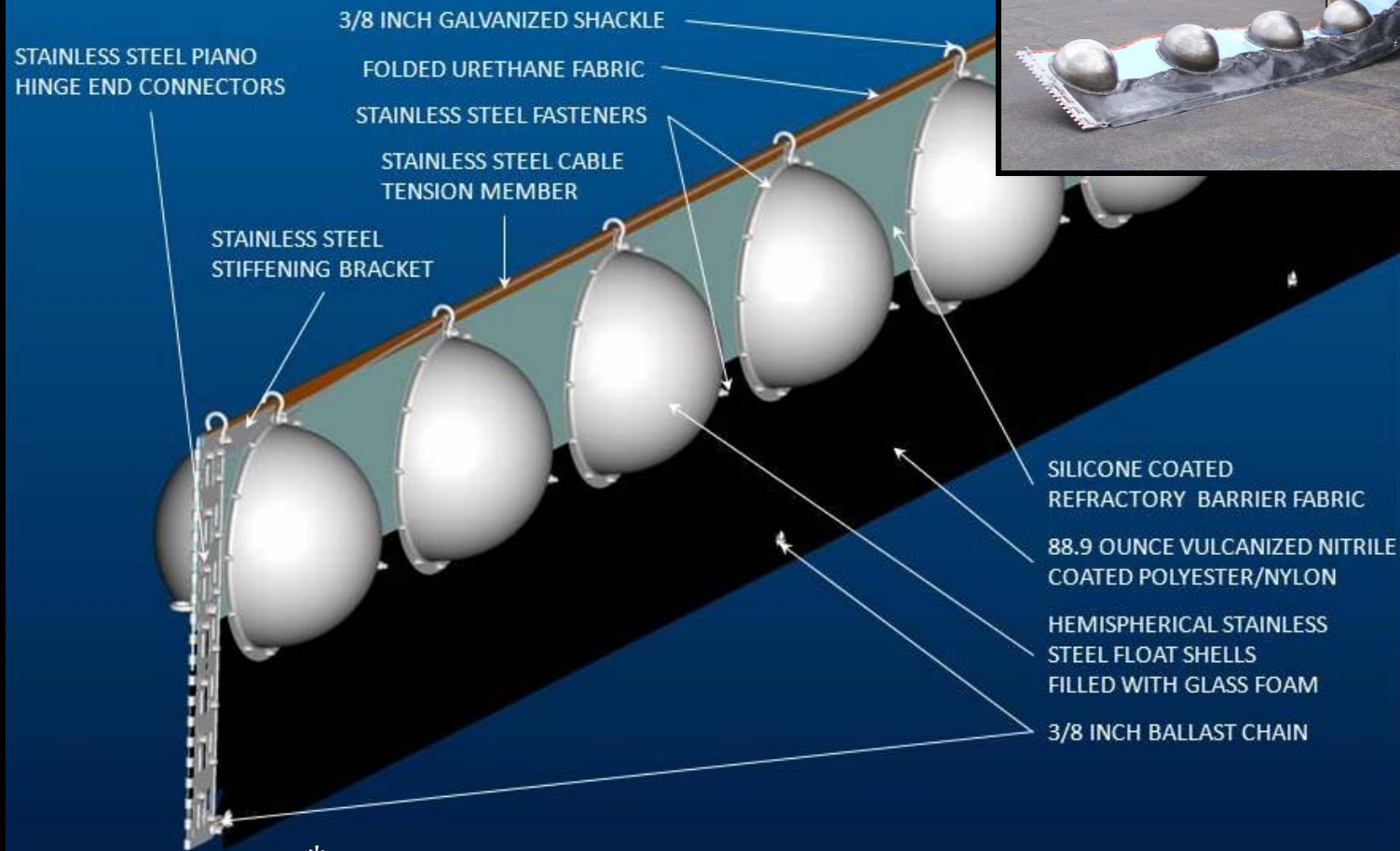


High-Temperature Ceramic and
Stainless Steel Covers
Solid Flotation Core



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.