# THE DEVELOPMENT AND TESTING OF A FIREPROOF BOOM

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## ABSTRACT

In situ burning of crude oil on water can be an extremely effective oil spill countermeasure, particularly in remote offshore areas and on cold water where conventional countermeasures are limited. In order for in situ burning to be an efficient mitigative technique, the oil must be contained and thickened. A novel fireproof boom has been researched, developed and tested that can:

a) survive, without damage, long-term exposure to the heat generated by burning crude oil in situ;

b) contain burning crude oil in at least Sea States of 2-3 and at current speeds up to 0.4 m/s without loss of combustion intensity;

c) survive, without damage, for periods of time at sea; and

d) withstand contact with small ice features.

This paper documents the results and conclusions of a 3-year, $500,000 fireproof boom study.

## INTRODUCTION

The Ixtoc I incident, the sinking of the ATLANTIC EMPRESS and the BURMAH AGATE spills provide evidence that it is possible to burn oil on open water with some success (Ross et al., 1979; Horn and Neal, 1981; Goodier and Siclari, 1981). Much work has been conducted on the fundamentals of in situ burning of oil both on ice and open water (e.g., Energetex, 1977, 1981; Arctic Canada, 1977; USDOE, 1979). One conclusion of this work has been that for oil to be efficiently burned in situ it must be contained and thickened. The use of in situ burning as an offshore oil spill cleanup technique offers a tremendous advantage over conventional containment, skimming, storage and disposal. The use of a fireproof boom would permit the containment and disposal of oil in one step using only one piece of equipment which, depending on the circumstances, could dispose of tens of thousands of barrels of oil per day (BOPD).

In the past, several studies in Canada (Purves and Daoust, 1978; Roberts and Chu, 1978; McAllister, 1979) have investigated the use of booms to contain and thicken oil so that it could be burned in situ on water. Each proposed design, however, failed to be an operationally feasible device for one reason or another.

As a result of work conducted on a fireproof boom constructed from empty drums, Dome Petroleum, through COOSRA, decided to undertake a project to research, develop, construct and field test a fireproof boom that had the following design criteria:

a) able to withstand flame temperatures of 980°C for extended periods of time in a saltwater environment and be reuseable;

b) able to contain burning oil in a "U" configuration in a Sea State 4 and survive Sea State 5;

c) be as compact as possible and remain flexible down to -20°C and storable to -50°C;

d) have good abrasion resistance so as to be able to withstand frequent handling and some contact with ice;

e) easily deployed using supply vessels and easily towed at 2 knots;

f) have a tensile strength of at least 110,000 Newtons (N).

Environment Canada. Arctic and Marine Oilspill Program (AMOP) Technical Seminar, 6th. Proceedings. June 14-16, 1983, Edmonton, Alberta, Canada, Environment Canada, Ottawa, Ontario, 70-84 pp, 1983.

This paper documents the 3-year program that was undertaken to develop the fireproof boom. Specifically, the initial design and subsequent towing, fire and test tank trials are discussed, followed by an analysis of the preliminary offshore trials. The paper concludes with a presentation of the final design of the boom and its potential for offshore oil spill cleanup.

## INITIAL BOOM DESIGN

In order to meet the design criteria, an extensive search for suitable materials of construction was instituted, using the paper by Roberts and Chu (1978) as a starting point. It became apparent that very few materials could meet the design requirements; only two were relatively inexpensive, these being high-chromium stainless steels, such as type 309 and 310 (Perry and Chilton, 1973), and a refractory blanket material manufactured by the Carborundum Company, "Fibrefrax L144", which is a cloth material woven with a Nichrome wire.

Using these materials, a 12 m section of prototype boom was constructed (Figure 1) which consisted of vented stainless steel flotation units with a pentagonal cross-section, a "sail" to provide freeboard, and a PVC-coated nylon skirt underwater to provide draft. The use of stainless steel at the waterline ensures high abrasion resistance. To provide wave conformation, each 1.5 m long flotation unit was joined to a 0.75 m long flexible panel constructed of stainless mesh-encased "Fibrefrax" blanket connected to a further section of PVC-coated nylon skirt.

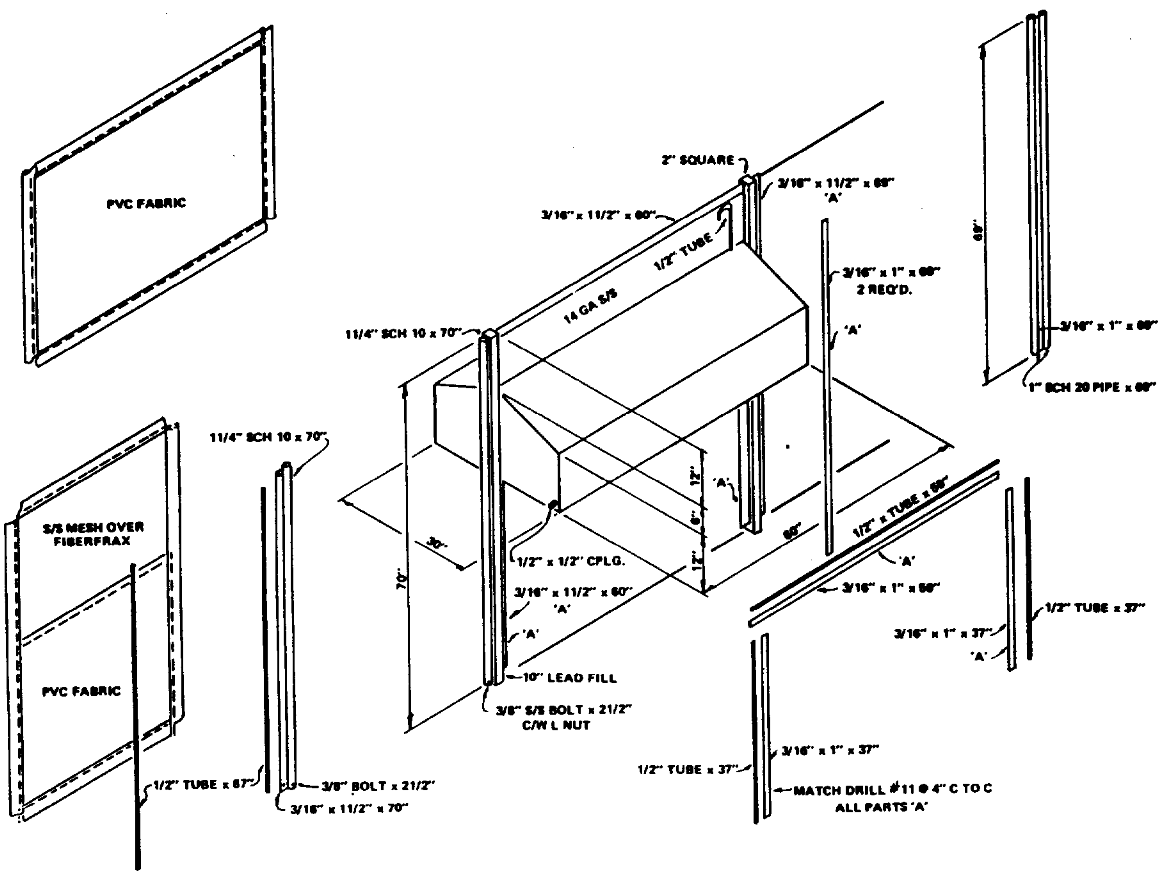


FIGURE 1 INITIAL FIREPROOF BOOM DESIGN

Tension members, consisting of 0.5 mm diameter stainless steel cables, were added to ensure no tension loads were placed on the flexible panels. The overall height of the boom was 1.77 m, with 0.66 m being the freeboard in calm water. Each section of the boom was connected by means of a sliding joiner. These joiners fit inside slotted pipes fastened to both the free end of a flexible panel and the end of the next flotation unit.

### Towing Trials

Following successful static flotation trials that confirmed the stability of the flotation units, the boom was tow-tested in both straight-line and catenary configurations. The straight line tests revealed that the boom could be successfully towed at speeds up to 5 knots; however, the prop wash tended to deflect the first section of the boom at this speed. Also, a significant bow wave was set up by the first section, resulting in a high drag force on the boom. It was concluded that a towing paravane should be included in an operational model.

The catenary towing trials were held in a short, choppy sea, with wave heights of approximately 1 m and a wind speed of 30 km/h. The boom conformed well to the waves, demonstrated excellent stability, and was only overtopped once by a small amount of spray from a breaking wave.

Following these trials, it was discovered that the "Fibrefrax" material had been seriously eroded by the action of the waves; it was concluded that the flexible panels, as originally designed, would not contain oil.

### Flexible Panel Redesign

Following a further investigation of suitable construction materials, it was decided that the flexible panels should be built from thin gauge (0.4 mm) type 321 stainless steel sheet that had been corrugated to provide the required flexibility (Figure 2). These panels were fitted to the boom and a second towing trial confirmed that they did have the required flexibility. As redesigned, each boom section now had a weight of approximately 125 kg, a gross buoyancy of approximately 440 kg, and a buoyancy-to-weight ratio of 3.5:1.

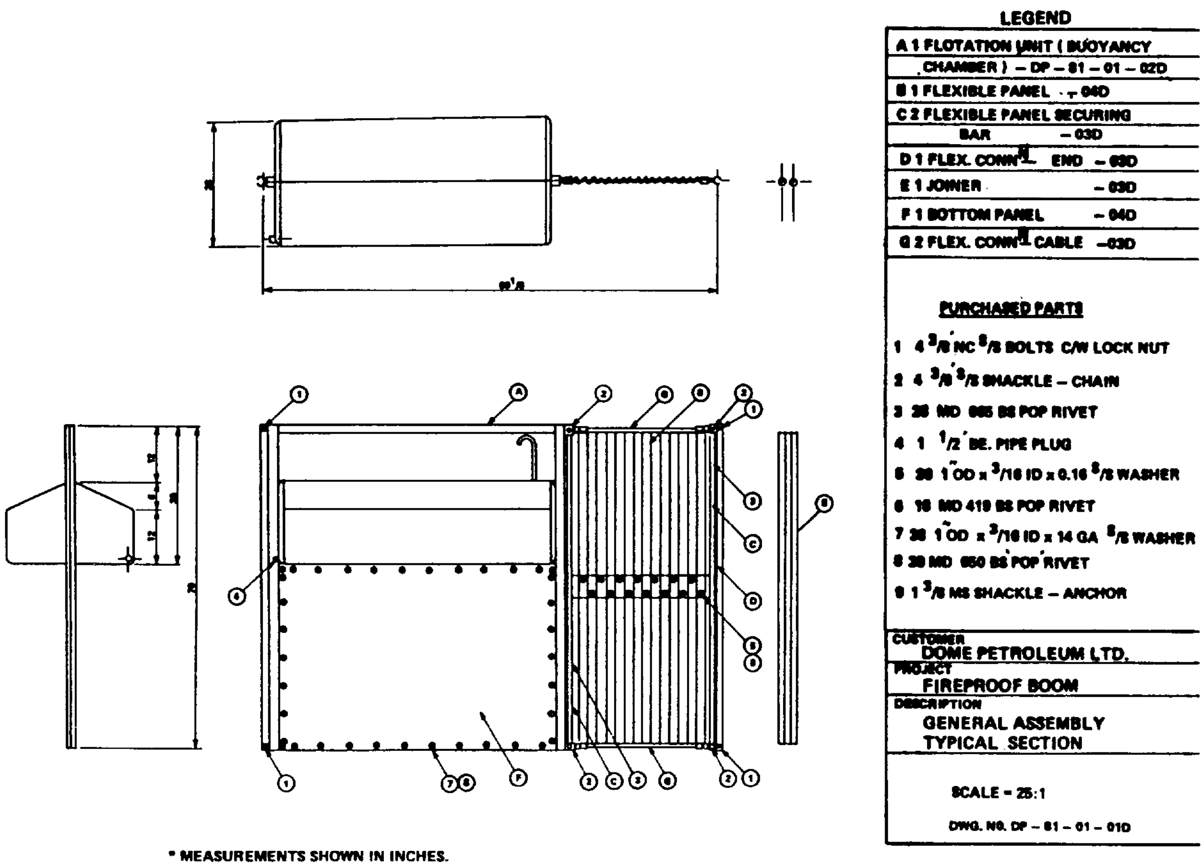


FIGURE 2 REVISED DESIGN WITH CORRUGATED STEEL CONNECTORS

## STATIC BURNING TRIALS

In order to confirm that the design of the boom and the materials selected would withstand the temperatures of a crude oil fire, that no corrosion problems would occur, and to investigate the continuous combustion of crude oil on water, a burning trial was held December 12, 1980, near Port Mellon, B.C. (McAllister and Buist, 1980).

The boom, with the redesigned flexible panels, was connected in a circle and secured inside an area encircled by 0.9 m inshore boom and fender logs, as shown in Figure 3. Thermocouples were mounted at various locations on one section of the boom and were monitored from a barge which was placed adjacent to the test site for use as a logistics and observation platform. Nine drums of Redwater crude oil (specific gravity = 0.839 @ 26°C, viscosity = 8 mPas @ 21°C) supplied by Imperial Oil were also placed on the barge, and a pump and hose were provided to pump the oil continuously under the skirt of the fireproof boom.

FIGURE 3 STATIC BURNING TRIALS

After a slick of 2-3 mm thickness had been pumped into the area enclosed by the fireproof boom, it was ignited by a burning sorbent pad soaked in oil. Over a 2-hour burning period, 1,545 L of crude were pumped into the boomed area. At the completion of the trial, only 2 L of oil residue remained within the boom, resulting in a burn efficiency of 99.87% and a slick regression rate of 2.3 mm/min. Analysis of the burn residue revealed that it had a specific gravity of 0.933; before and after analysis of the water column and sediments did not detect conclusive differences in hydrocarbon concentrations. Both these results led to the conclusion that no oil was lost to the water column during the burns.

The temperatures measured at various points on and around the boom are shown in Figure 4. The maximum temperature measured was 905°C, well within the design maximum exposure temperature of 980°C.

It is interesting to note that the inside boom skin temperature was consistently recorded as higher than the temperature just above the slick. This may either be a calibration error or a reflection of the fact that, due to oxygen starvation, the combustion process was taking place at the edges of the boom and in the air space above it rather than immediately above the slick.

The thermocouples located in the water below the fire (No.'s 1 and 2 on Figure 4) indicated that although some heat was being transferred to the water, it was not raising the water temperature appreciably, even 4 cm below the burning slick. Presumably, much of the heat transferred into the water column was being absorbed in boiling off a thin surface layer of water. This was evidenced by observations of some droplet carryover during the combustion, normally caused by boiling, and the fact that the surface water in close proximity to the flame could be observed to be boiling during gusts of wind that bent the flame over the side of the boom.

The smoke plume generated by the burn rose vertically to a height of approximately 300 m and then dispersed horizontally, with visible smoke disappearing within 2-3 km downwind.

When the fire had extinguished itself, the boom was examined and found to be in good structural condition. Some of the sheet metal was slightly warped, and the exposed surfaces were covered with droplets of a hard asphaltic residue caused by the aforementioned droplet carryover. On removal from the water, no further damage was observed and the boom was considered ready for immediate re-use.

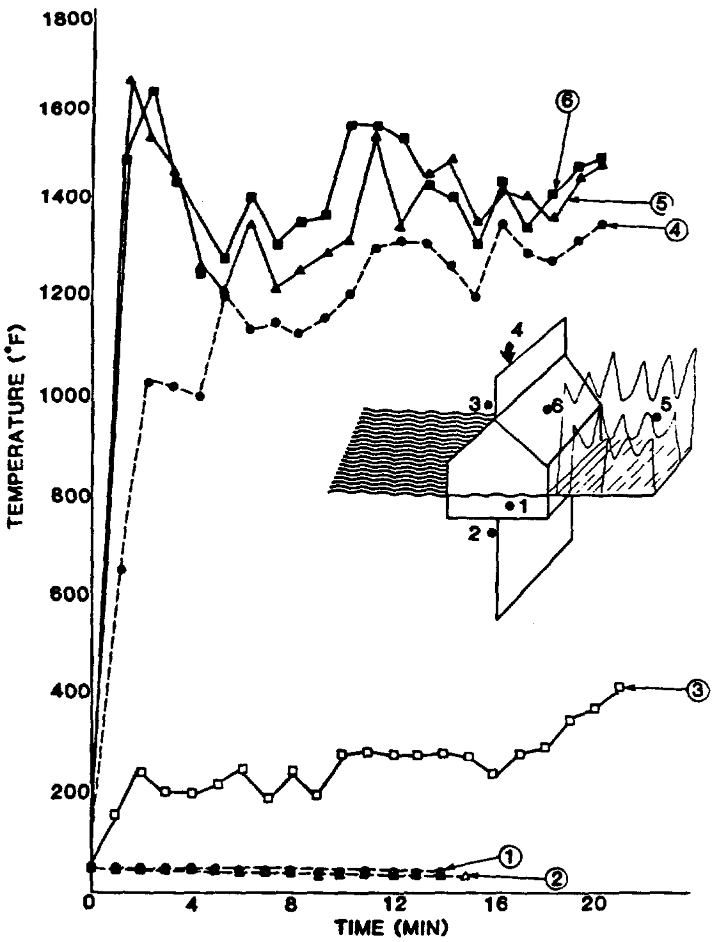


FIGURE 4 BURNING TRIAL TEMPERATURE PROFILES

**OHMSETT TRIALS**

Following the burn trials, the prototype boom was tested at the U.S. Environmental Protection Agency Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) facility to further confirm its towing and stability characteristics, define its oil containment characteristics in controlled wave and current conditions, and investigate the effects of waves and currents on in situ combustion (Dome, 1981).

Two oils were utilized for the testing, a Circo 4X light oil (specific gravity = 0.9, viscosity = 11 mPas @ 22°C) for the containment trials and Murban crude oil (specific gravity = 0.85, viscosity = 9 mPas @ 14°C) for the in situ combustion trials. Table 1 summarizes the test matrix and the results obtained from the program. As can be seen, the boom exhibited excellent stability in all the wave conditions tested and was found to contain oil at speeds up to 0.4 m/s (0.75 knots). As this speed, a vortex formed between adjacent flotation units drew small quantities of oil beneath the skirts. The anomalous containment of oil by the boom at up to 1.25 m/s tow speeds observed in Runs 3R, 4 and 19 was presumably due to the small volumes of oil used in these runs.

Runs 8, 9, 10 and 19 showed that in calm conditions, the combustion was not adversely affected by increased tow speed up to 1 m/s. However, it is probable that had larger volumes of oil been used, the combustion efficiency would be reduced due to entrainment of the oil beneath the boom at speeds exceeding 0.5 m/s. A comparison of runs 8, 18, 14 and 15 shows that increasing swell height did not affect the ability to ignite the slick or the intensity of the resulting in situ combustion (Figure 5). However, it was observed that the amount of residue left increased with increasing swell height. This was a function of the relatively small volumes of oil used in these trials and is not expected to seriously affect overall combustion efficiencies on a large scale.

The results of runs 15 and 16 illustrate that in the swell wave condition, the intensity of the burn was not affected until the tow speed reached 0.5 m/s (1 knot), at which point it was drastically reduced, presumably by the turbulence set up inside the catenary by the small waves reflected off the boom at this speed.

Of the three runs done in harbour chop (11, 11R and 11R'), ignition was only achieved once (11R') by increasing the oil volume and using two igniters. The flame spread was slow and the combustion poor. A breaking wave extinguished the flames before the entire surface area of the slick was ignited.

TABLE 1 TEST MATRIX AND RESULTS

| Test No.[a] | Tow Speed (m/s) | Wave Type | Wave Height x Length (m) | Wind Speed (m/s) | Wind Direction | Oil (L) | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | 0.25 - 1.0 | calm | - | - | - | - | stable in catenary; no rolling |
| 2 | 0.25 - 1 | swell | 0.4 x 19 | - | - | - | stable, good wave conformance; no rolling |
| 3 | 0.25 - 2.0 | calm | - | - | - | Circo (75) | first loss at 0.4 m/s at vortex between floats; oil kept from boom by reflected waves |
| 3R | 0.25 - 1.25 | calm | - | 5 | NE | Circo (38) | required 1.25 m/s to flush oil; at lower speeds, oil was not touching boom; first loss at 0.4 m/s, as in 3 |
| 4 | 0.25 - 1.0 | swell | 0.4 x 19 | 5 | NE | Circo (75) | first loss at 0.8 m/s; oil held out from boom by float backwash |
| 7 | 0.25 - 1.0 | harbour chop | 0.2 | 5 | NE | Circo (75) | first loss at 0.4 m/s; oil dispersed by turbulence in catenary |
| 8 | 0.25 | calm | - | 8 | NE | Murban (38) | intense burn for 5 min; estimated greater than 90% efficiency; probably only 10 L of Murban, not 38 |
| 9 | 0.15 | calm | - | 8 | NE | Murban (38) | intense burn for 5 min 51 s; estimated same efficiency as 8 |
| 10 | 0.35 | calm | - | 12 | WNW | Murban (38) | flames had some difficulty spreading upwind; intense burn after 4 min 43 s |
| 11 | 0.25 | harbour chop | 0.2 | 12 | WNW | Murban (38) | no ignition of oil, igniter pushing oil away by bobbing |
| 11R | 0.25 | harbour chop | 0.2 | 12 | WNW | Murban (38) | no ignition of oil using flare |
| 18 | 0.25 | swell | 0.2 x 19 | 12 | WNW | Murban (38) | ignited in calm condition; intense burn for 3 min 39 s, more residue than 7, 8 and 9 |
| 14 | 0.25 | swell | 0.4 x 19 | 12 | WNW | Murban (38) | ignited in calm condition; intense burn for 2 min 29 s, more residue than 18 |
| 15 | 0.25 | swell | 0.4 x 19 | 12 | WNW | Murban (57) | ignited in waves; intense burn for 2 min 54 s, approx. same residue as 14 |
| 16 | 0.35 - 0.5 | swell | 0.4 x 19 | 12 | WNW | Murban (57) | ignited in waves; intense burn for 2 min at 0.35 m/s, poor burn for 1 min 59 s @ 0.5 m/s |

TABLE 1 TEST MATRIX AND RESULTS (cont'd)

| Test No.[a] | Tow Speed (m/s) | Wave | | Wind | | Oil (L) | Remarks |
|---|---|---|---|---|---|---|---|
| | | Type | Height x Length (m) | Speed (m/s) | Direction | | |
| 19 | 0.35 - 1 | calm | - | 10 | W | Murban (57) | intense burn for 3 min 10 s; no difference in burning with increased speed |
| 11R' | 0.25 | harbour chop | 0.2 | 7 | S | Murban (57) | successful ignition; pool flame spread; poor combustion extinguished by breaking wave |
| 20 | 0.25 | calm | - | 7 | S | Murban (57) | emulsified oil from 11R' successfully burned for 7 min 10 s |
| 21 | 0.25 - 0.75 | calm | - | 7 | S | Circo (380) | first loss at 0.4 m/s through vortex; extensive loss by entrainment at 0.5 m/s |
| 22 | 0.25 - 1 | harbour chop | 0.6 m | 7 | S | | durability trial - survived well; excellent stability - minor damage to skirt observed on removal |

[a]For identification only, not necessarily consecutive order.

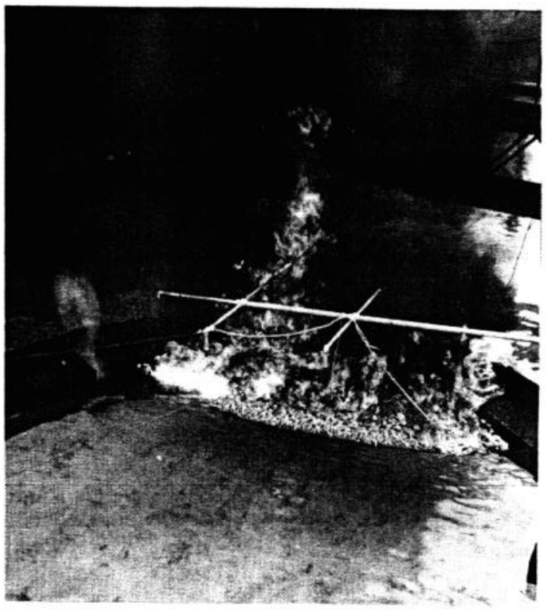

FIGURE 5 IN SITU BURNING IN WAVES AND CURRENT

Upon removal of the boom, the only damage observed to have occurred was the loss of six rivets, resulting in the slight bending of one of the skirt holding rods, and in some wear on the upper flexible panel tension cable securing points.

## PRELIMINARY OFFSHORE TRIALS

As a result of the successful test tank trials, 25 additional sections (60 m) of boom were constructed. This version of the boom incorporated several minor modifications, including rounded corners on the flotation sections, replacement of the PVC skirt beneath the flotation with stainless steel sheet, and reinforcement of the tension cable securing points. A towing paravane was also constructed.

In September, 1981, the boom was deployed near Mulgrave, Nova Scotia and towing trials were undertaken (Figure 6). The results, illustrated in Figure 7, indicated that the drag force on 55 m of boom was approximately 3,800 N at a speed of 2 knots. The boom followed the waves well and did not roll appreciably.

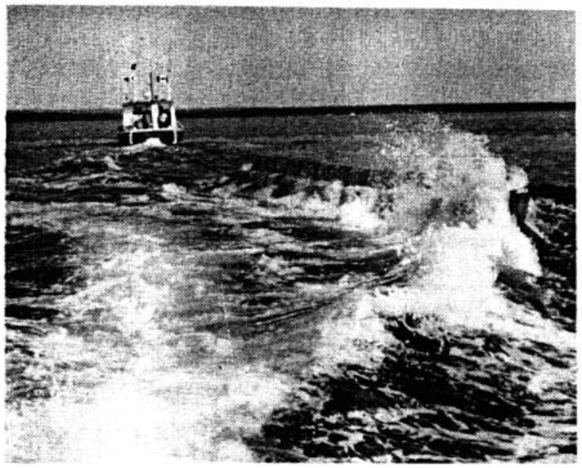

FIGURE 6 BOOM TOWING AND WAVE RESPONSE TRIALS

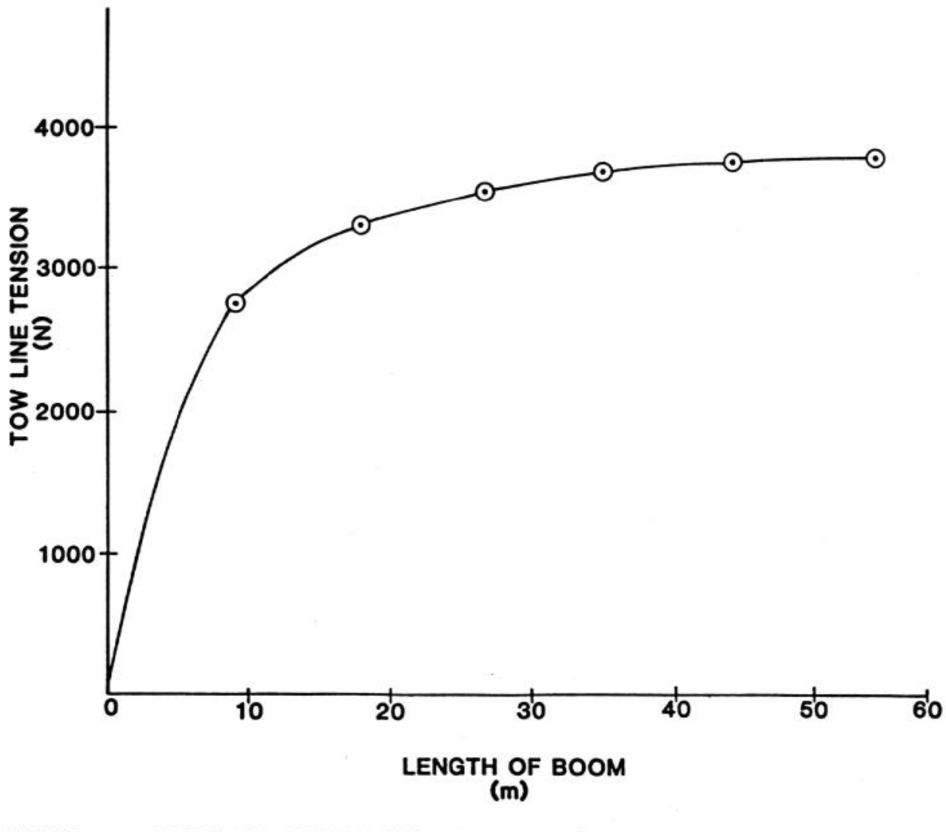


FIGURE 7 RESULTS OF 2 KNOT TOWING TEST (STRAIGHT-LINE TOW BEHIND WORKBOAT)

Following the tow tests, the boom was anchored in a catenary on Chedabucto Bay (Figure 8). After 24 hours exposure to Sea State 3-4 with a 4-s wave period, it was noted that several of the flexible panels had cracked vertically. It was initially thought that this was due to relative vertical motion of adjacent flotation units as waves passed beneath the boom. As such, the boom was recovered and a "cross-cable" arrangement installed to restrict this vertical motion (Figure 9) and the boom was redeployed. However, the cracks continued to appear. Metallurgical analysis revealed that the failure was due to stress cracking caused by the "flapping" motion of the flexible panel. In a 24-h exposure to a 4-s wave, the connector "flapped" some 22,000 times.

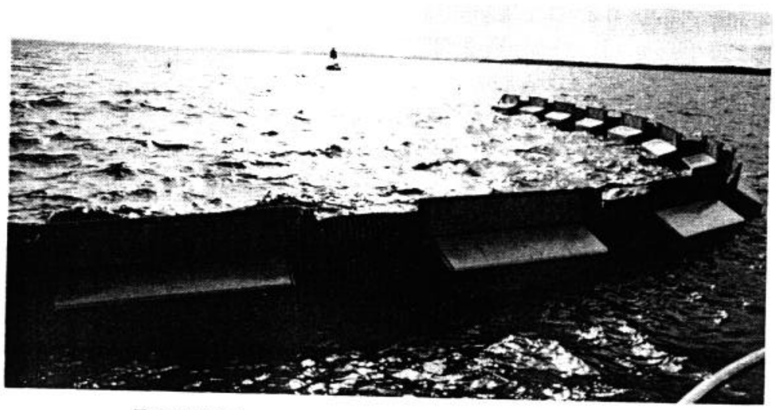

FIGURE 8 BOOM DEPLOYED OFFSHORE

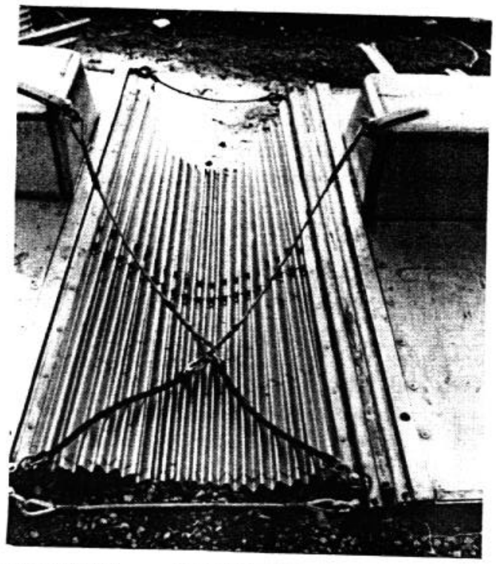

FIGURE 9 CROSS CABLES

In order to overcome this problem, a more robust flexible connector was designed. This connector consists of a sheet of pleated, light-gauge stainless steel through which is passed a universally jointed box beam to provide tensile strength to resist towing and ice loads (Figure 10). The pleat bends are reinforced by the addition of a tubular backing and are of a sufficient radius to reduce stress concentrations to well below the material's endurance limit. The relative vertical motion of two adjacent flotation sections is restricted by the use of a guide shoe mounted on the universally jointed tongue. Stainless steel hinges on either end of the connector permit the boom to form a curve to contain oil.

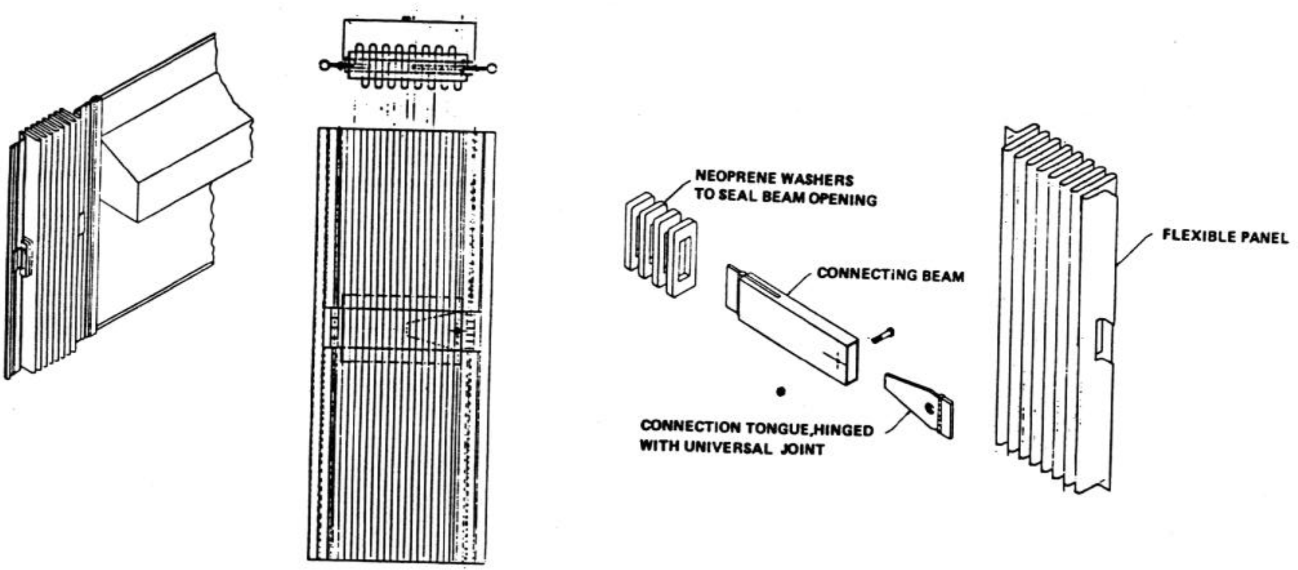


FIGURE 10 REVISED CONNECTOR DESIGN

Extensive bench testing of this connector was performed in a jig specially constructed to simulate the action of waves on the connector (Figure 11). The design finally selected was subjected to 502,232 cycles over a period of 10 days (equivalent to approximately 25 days in 4-s waves) without any sign of fatigue or damage.

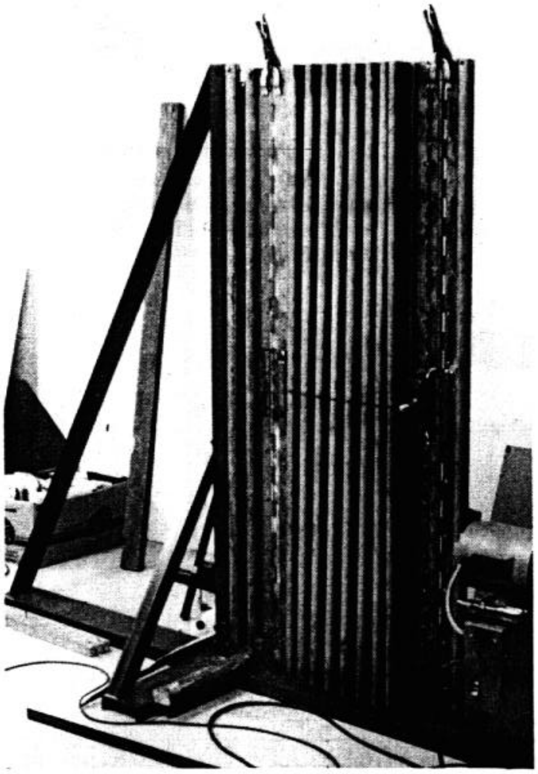

FIGURE 11 BENCH TESTING OF FINAL CONNECTOR DESIGN

**FINAL OFFSHORE TRIALS**

For a final durability test, 60 m of the redesigned boom were deployed off Roberts Bank Superport near Vancouver, B.C., and anchored at each end. This boom consisted of 19 connectors of the revised design and 20 flotation units modified to accept these connectors. After 3 days of moderate sea conditions, if was discovered that vandals had cut an anchor rope, causing one end of the boom to tie itself in a knot, submerging several sections in the process. The boom was towed back to shore for damage assessment. The damage included several bent joiners, damage to several pleated sections due to the boom overriding itself (Figure 12), numerous dents to the flotation sections, and the loss of several pleat backing tubes.

FIGURE 12 DAMAGE TO PLEATED SECTION DUE TO BOOM OVERRIDING ITSELF

Since the damage was not serious, it was decided to redeploy the boom without making repairs, but a series of storms prevented immediate redeployment. Upon receiving a favourable forecast, the boom was reassembled on the beach. However, the weather continued to be unfavourable and the boom was trapped in the surf zone of the pebble cobble beach where it was battered by a series of storms over the next several days (Figure 13). This resulted in considerable denting and bending of the flotation units and flexible connectors. In order to ensure a vigorous test of the boom's durability, it was redeployed "as is".

The boom was finally redeployed on November 2, again anchored at each end. Over the next 17 days, the waves ranged from 0.5 m with a 2-s period of 2 m with a 4-s period. The winds during this time were as high as 60 km/h. On November 7, it was noted that the wave action was more severe when the boom was not in tension; one end was therefore released and the boom allowed to weatherware. On November 19, the boom was subjected to a series of towing trials as a final test; it performed well (Figure 14).

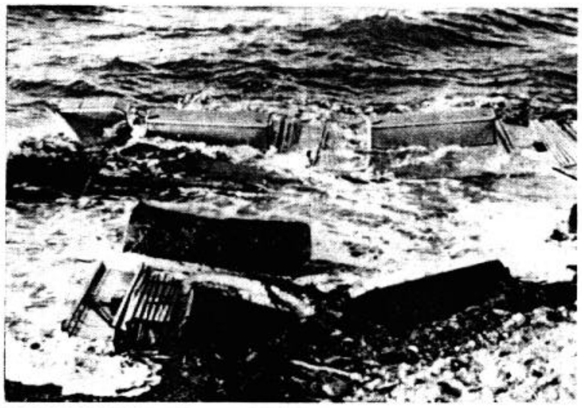

FIGURE 13 BOOM SECTIONS ON THE BEACH BEING BATTERED BY THE SURF

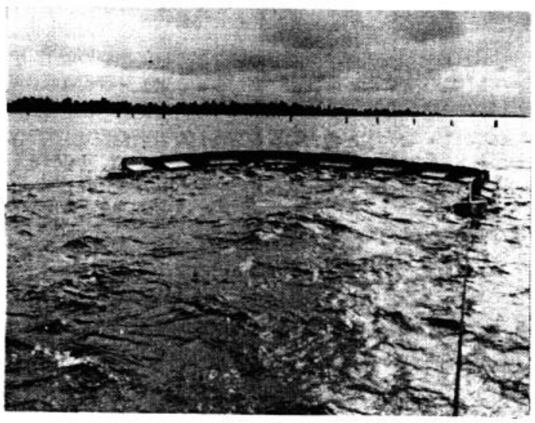

FIGURE 14 TOWING TRIALS CONDUCTED PRIOR TO RETRIEVAL

Upon removal from the water, each float and connector was thoroughly inspected; the following general observations were made:

a) despite the tremendous abuse that the boom had undergone, it was still operational upon retrieval;

b) while obviously damaged, particularly on the bottom and sides where backing tubes were missing, the connectors still permitted the boom to move freely and would have contained oil;

c) minor cracks were found in some pleats, but only in those missing backing tubes;

d) there was no appreciable damage to either the flotation units or the paravanes.

Based on the observations of the final durability trials, several modifications were recommended, including sealing the flotation vent tubes with wax to prevent possible flooding, attaching the pleat backing tubes more securely (with three or more rivets), and reducing the height of the pleated section to prevent damage to the bottom of the sheeting. The final design of the fireproof boom has the following major characteristics: section weight, 210 kg (boom and connector); section length, 2.58 m; linear weight, 81 kg/m; gross buoyancy, 440 kg; buoyancy/weight ratio, 2.1 to 1; draft, 1.2 m; freeboard, 0.57 m. It should be noted that this fireproof boom has been designed to operate and survive severe offshore conditions. Such booms for use in less severe conditions could be dramatically less massive.

## POTENTIAL FOR OFFSHORE IN SITU BURNING

The existence of an offshore boom capable of operating and surviving on the sea for extended time periods offers an efficient new technique for oil spill cleanup. In situ burning is a one-step removal process that can dispose of large volumes of oil on water. Based on the results of trials with the fireproof boom, Figure 15 illustrates the dependence of oil combustion rate on burning area. In an area of only some 2,000 $m^2$, 6,600 $m^3$ of oil could be burned daily.

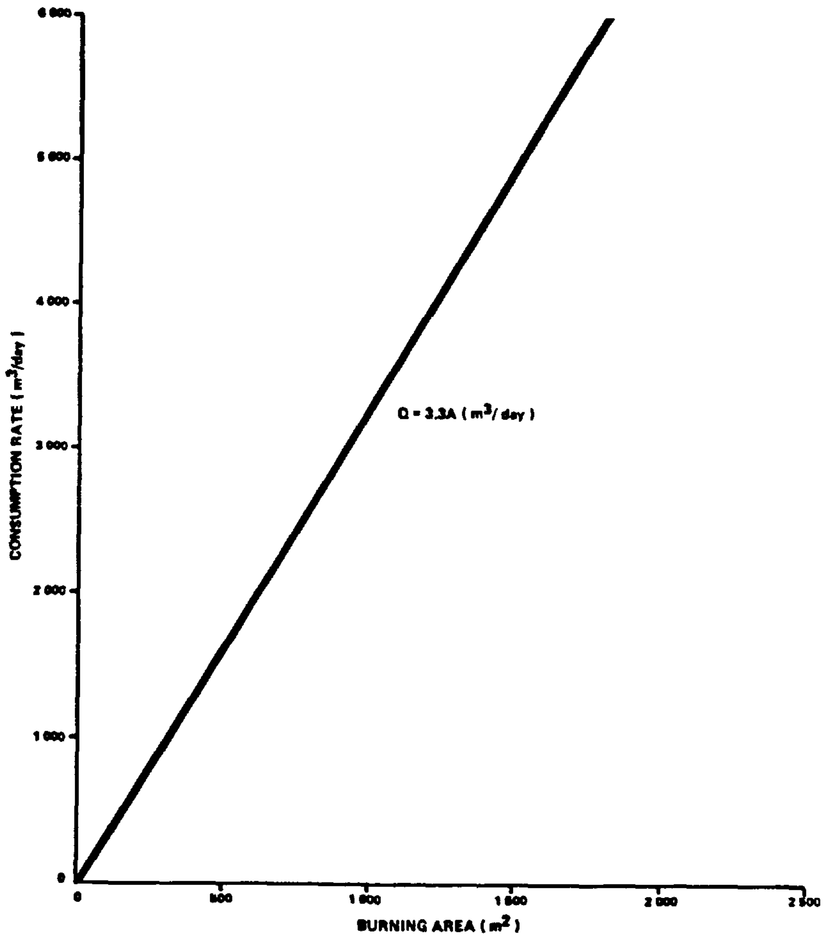


FIGURE 15 IN SITU BURNING OIL CONSUMPTION RATE

Assuming that the boom, when deployed in a current, takes the shape of a half ellipse, the length of boom required to contain a certain burning area can be calculated as follows:

a) Slick burning rate:

$$Q = rA' = 3.8 \times 10^{-5} A' \qquad (1)$$

Where

Q = oil burning rate ($m^3/s$)

A' = slick area on fire ($m^2$)

r = slick regression rate

= 2.3 mm/min or $3.8 \times 10^{-5}$ m/s

b) Area of half-ellipse:

$$A = \pi ab/2 \qquad (2)$$

Where

$A$ = Area of half-ellipse ($m^2$)

$a$ = length of semi-major axis of ellipse (m)

$b$ = length of semi-minor axis of ellipse (m)

c) Perimeter of half-ellipse:

$$X \simeq \pi \left(1/2(a^2 + b^2)\right)^{1/2} \qquad (3)$$

Where

$x$ = perimeter of half-ellipse or length of fireproof boom (m)

For oil leaking at a rate Q' ($m^3/s$) onto water moving at a velocity of U (m/s), the thickness t (m) at a width of 2b (m) is:

$$t = Q'/2Ub \qquad (4)$$

Since the minimum slick thickness to support in situ combustion of fresh oil on water is 1 mm, this thickness must not be exceeded before the oil enters the boomed area. Rearranging equation 4 with t = 0.001 yields:

$$b = 500\ Q'/U \qquad (5)$$

To optimize the length of boom required, the slick area on fire should be the same as the area contained by the fireproof boom (A = A'), and the oil burning rate should equal the oil leak rate (Q = Q'). Rearranging equation 2 yields:

$$a = 2A/\pi\ b \qquad (6)$$

Substituting equation 5 into equation 6 gives:

$$a = AU/250\ \pi\ Q \qquad (7)$$

Substituting equation 1 into equation 7 yields:

$$a = 33.5U \qquad (8)$$

Finally, substituting equations 5 and 8 into equation 3 gives:

$$X \simeq \pi\left(1/2\ (1100\ U^2 + \left(\frac{500\ Q}{U}^2\right)\right)^{1/2} \qquad (9)$$

Figure 16 illustrates the lengths of boom required for three burning rates as a function of current speed. As an example, surface statistics for the southern Beaufort Sea are superimposed on Figure 16. It can be seen that 250 m of fireproof boom would be sufficient to combust 5,000 BOPD in excess of 80%, 15,000 BOPD for 75%, and 30,000 BOPD for approximately 50% of the open-water period.

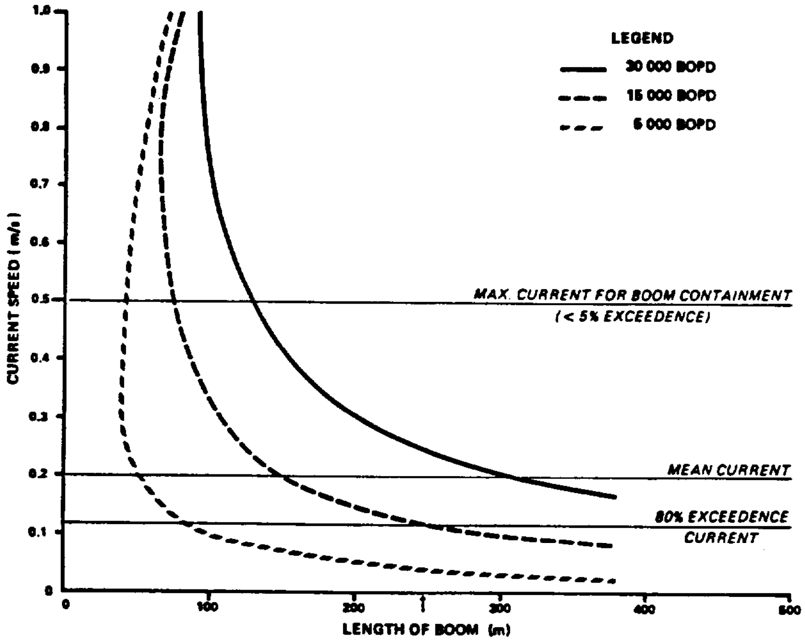


FIGURE 16 LENGTHS OF BOOM REQUIRED

Figure 17 illustrates one possible configuration for use of the boom in response to a blowout offshore. A conventional offshore boom is anchored or held by supply vessels to direct the oil toward a "pocket" of fireproof boom. As the oil moves toward this "pocket", it thickens; however, the overall slick thickness will not exceed 1 mm until the oil enters the "pocket". As the oil moves toward the back of the "pocket", it continues to thicken until it reaches the burning slick and ignites.

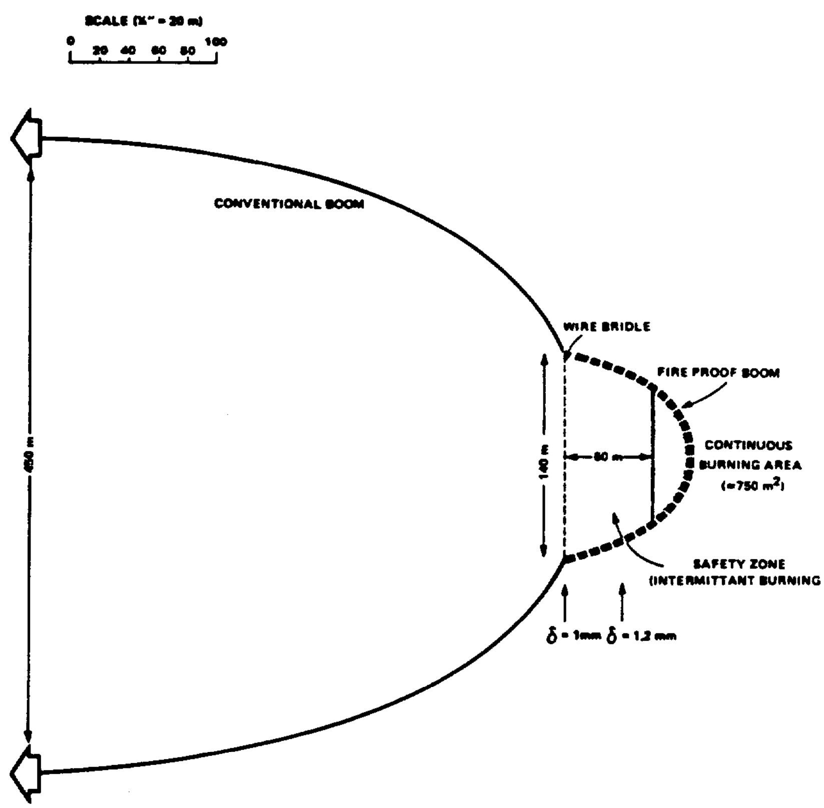


FIGURE 17 EXAMPLE OF BOOM CONFIGURATION (15,000 bbl oil/day)

## CONCLUSION

A durable offshore fireproof boom has been researched, developed and tested that can:

a) survive, without damage, long-term exposure to the heat generated by burning crude oil in situ;

b) contain burning crude oil in at least Sea States 2-3 and at current speeds up to 0.4 m/s without loss of combustion intensity;

c) survive, without damage, for long periods at sea; and

d) withstand contact with small ice features.

Although the boom is necessarily massive, it offers a significant advantage over conventional offshore spill cleanup systems in that it can collect and dispose of large flowrates of oil in one self-sustaining step with a minimum of logistics support. Once the final offshore trials are complete, the boom will be commercially available.

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