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The MIT/Marine Industry Collegium

Opportunity Brief # 9

OIL SPILLS: PROBLEMS AND OPPORTUNITIES

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OIL SPILLS: PROBLEMS AND OPPORTUNITIES

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1.0 A BUSINESS PERSPECTIVE

The dependence of the United States on offshore and foreign sources of crude oil suggest that oil spills will be a continuing matter of concern for the foreseeable future. Grounded tankers, ruptured pipelines, and drilling platform accidents all produce oil spills. Primary prevention through better design, regulation, and enforcement will eventually lessen the hazards, but in the meantime most immediate relief must come from the development of new cleanup technology. In this Brief, the events occurring during the grounding and break up of the Liberian tanker, Argo Merchant, in December, 1976, are used to illustrate the types and magnitudes of problems involved in responding to accidental oil spills. The Argo Merchant incident provides a framework for understanding what is needed for dealing with such events in the future.

Section 2 presents a chronology of the important events between the grounding and the break up of the Argo Merchant. Those knowledgeable about tankers and accidents at sea may ignore this section without loss. However, for other readers the description should provide some insight into the special problems encountered.

In Section 3 we address the need for instrumentation and research to answer the questions, "How much oil has been spilled and where is it likely to go?" We then discuss equipment and vehicles needed for containment of a spill on the high seas. The logistical requirements of getting people and equipment to the spill, containing and collecting oil, and removing it are discussed in the final part of Section 3. General characteristics required for tow boats and barges are also summarized.

Effective clean-up, if possible at all will almost certainly require a national effort comprised of geographically distributed equipment and people operating under a single central control. Tanker operators or oil companies are unlikely to be the purchasers of equipment for clean-up on the high sea, because the task is too large and the industry is too fragmented. Most likely the U.S. Coast Guard will be the "market" for such equipment. A representative of the Coast Guard R & D Headquarters led part of a workshop on 17 May 1977 to provide Collegium members some insights into problems, opportunities, and equipment needs seen by the U.S. Coast Guard.

2.0 EVENTS OF THE ARGO MERCHANT INCIDENT RELATED TO POLLUTION OF THE SEAS

At approximately 6 a.m. on Wednesday, December 15, 1976, the Argo Merchant, carrying 7 million gallons of No. 6 crude oil, ran aground on Fishing Rip, a shoal located about twenty-seven miles southeast of Nantucket Island, Massachusetts. The engine room of the damaged vessel flooded, disabling the ship's power generators, and rendering the power-driven pumps inoperable. Steam could no longer be supplied to the heating coils in the ship's tanks. The No. 6 oil which is usually kept warm (32° to 50°C) so that it can be more easily pumped off, began to cool slowly to the temperature of the surrounding sea.

At 7 a.m. on Wednesday the U.S. Coast Guard station in Woods Hole, Massachusetts, received a Mayday message from the ship. Later that day, personnel of the Coast Guard Atlantic Oil Spill Strike Force boarded the vessel and delivered emergency water pumps.

When some of the sea-cooled No. 6 oil leaked into the engine room, it fouled the pumps. Cold No. 6 oil has a consistency like that of thin peanut butter. At 10°C, the estimated sea water temperature in the engine room, the viscosity of No. 6 oil is about 35,000 centipoise. By comparison the viscosity of water at room temperature is about 1 centipoise and that of a typical crude oil is about 100 centipoise.

By Wednesday evening, a Coast Guard helicopter had put aboard an

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*This section is an abridgement of a report by Professor Jerome Milgram entitled "Being Prepared for Future Argo Merchants" which will be printed as an MIT Sea Grant Report.[1]

ADAPTS pumping system designed for offloading oil from a stricken vessel. The system consists of a power source, an offloading pump, and hoses. In this case it was not used for offloading oil, but rather to pump the oil/water mixture out of the flooded engine room.

Because of high winds, rough seas, and nightfall, more ADAPTS systems were not brought aboard Wednesday. Even to get the one system aboard required first cutting all the antenna wires that ran between the midships and after houses so that the helicopter could safely lower the ADAPTS components by cable.

The Argo Merchant had a heel angle sufficient for the starboard side of the main deck to be nearly awash. The ship had taken on an abnormal trim with the stern lower than normal and the bow higher. With the equipment and facilities that were available, the precise nature of the damage could not be determined. Although the basic design parameters of the ship and even curves of ship stability were available on board, determination of the exact nature of the flooding in various parts of the ship was impossible, since the vessel was simultaneously grounded and flooded.

Measurements of the height of the liquid in a number of tanks were made as well as could be done under the circumstances. They were intended for comparison with later measurements to obtain information about the ratio of flooding and its distribution, which would determine the compartments to be pumped out.

During Wednesday, the Coast Guard had requested that the nearest available empty barge and tug come to the scene to assist in the offloading operations, but no barge could come near without large fenders. The Coast Guard had only two available and these were hundreds of miles away. Arrangements were therefore made to obtain the fenders and two more ADAPTS pumping systems.

By Thursday morning, the earlier fifteen knot winds and eight foot seas had diminished. The people aboard the vessel reported that the initial engine room flooding, which had reached a height of twenty-two feet, had been reduced to fifteen feet by the single ADAPTS pump. By 8 a.m. on Thursday morning, the two additional ADAPTS system were aboard the U.S. Coast Guard buoy tender, Bittersweet, in Woods Hole, Massachusetts, along with additional strike team members. Shortly thereafter, the Bittersweet left Woods Hole for the scene of the Argo Merchant.

During early Thursday afternoon, the personnel aboard the Argo Merchant reported that the water in the engine room was again rising. These people knew that additional ADAPTS systems would soon be aboard, and there was some question whether to use the additional pumps to lower the water level in the engine room or on some of the thirty tanks of the vessel, which were supposed to be empty but appeared to be flooding. Additional ADAPTS systems, if used to pump out some of the apparently flooding starboard tanks, might provide additional buoyancy and help to float her free of the shoal, assuming that the hole in the tank was not too large.

Had it been possible to ascertain that there were some undamaged cargo tanks, additional buoyancy could have been provided to the vessel by pumping oil from such tanks overboard. Although this may have been the most appropriate action if undamaged tanks could have been located, the responsibility for pumping oil overboard could not have been assumed by anybody involved. We will return to this point.

The Bittersweet arrived alongside the Argo Merchant at about 3 p.m. on Thursday and the two ADAPTS systems and additional strike force personnel were offloaded. At this time, the owners were responsible for the Argo Merchant and their responsibility was exercised by a representative of the Murphy Pacific Salvage Company who had earlier boarded the ship from a helicopter. He had decided to use one of the additional ADAPTS systems for pumping water out of one of the starboard cargo tanks, which was supposed to have been empty, but which appeared to be flooding. By this time, the heel of the vessel had increased, the sinkage towards the stern was larger, and the sea state was increasing. Waves were beginning to break onto the deck, hindering the set-up of the ADAPTS system and associated hoses.

The reader should try to appreciate the difficulty of handling heavy, six-inch diameter hoses covered with slippery oil in a tilted deck covered with slippery oil, waves, and spray. It was dark by the time the pumping system had been set-up on Thursday. When pumping began, oil, not water came out of the tank. This further increased the uncertainty of the situation and raised a number of questions./ Could the tank not have been empty when the ship began the voyage, even though the crew reported that it was empty? Could a bulkhead between that tank and another tank have been damaged in the grounding, resulting in a leak so that oil from an adjacent tank poured into a previously empty tank? Could The condition of the ship before the voyage have been so bad that there was leakage between one tank and another so that an initially empty tank slowly filled up? No answers were available.

During Thursday afternoon, the Coast Guard had assumed command of the salvage operation under authority of the 1974 Federal Intervention on the High Seas Act. All pumping until that time had been done by Coast Guard personnel with Coast Guard equipment. The owners had not made any plans for rapid delivery of barges, fenders, or pumps for offloading cargo, nor had they made any arrangements for cleaning up oil that had spilled or might spill later. The strike team aboard the vessel was informed of the Coast Guard intervention by radio.

During Thursday evening, the wind, which was now from the northwest, increased, as did the size of the waves breaking onto the main deck of the vessel. Some buckling of the main deck on the aft portion of the ship had been observed. Oil could be seen leaking from a cargo tank into the engine room around bolts or rivets in a bulkhead. In the region of this bulkhead, strange sounds were eminating from the ship structure as a result of the loads caused by the seas and the bottom against the grounded vessel. Only the one ADAPTS pump taking water out of the engine room was operating. No one aboard knew how long the ship would last.

Even though the Coast Guard had assumed command of the salvage operation, the Coast Guard personnel and the representative of Murphy Pacific worked together to arrive at some solution. Very little could be done immediately. The ship's tanks were not pumped because those thought to contain water were found to contain oil, and no special authority for deliberately pumping oil into the sea had been granted by anyone.

Strike force personnel inspected many of the ship tanks by opening cover plates. A number of the tanks exhibited agitation and sloshing of the surface of the oil, quite possibly indicating that the bottom of the ship was torn open. Water was now rising in the engine room so quickly that additional ADAPTS seemed unlikely to "stem the tide." Furthermore, work in the vicinity of the engine room was becoming increasing hazardous: the behavior of the deck and the bulkhead between the aftermost cargo tank and the engine room, together with the sounds the structure was making, indicated that the vessel might break at any time. Coast Guard helicopters began to take the people off the vessel. The effort was completed late Thursday evening. Lights from the helicopters showed a substantial rate of oil leakage into the sea. How much of this oil was coming out of the deck openings and how much was coming out of the damaged bottom was not clear.

At about 6 a.m. Friday, some 48 hours after the grounding, the 140,000-barrel barge, Nepco 140, towed by the tug, Marjorie D. McAllister, arrived. However, seas were four to six feet high and no fenders were yet available, so the barge could not be brought alongside the Argo Merchant. Substantial oil pollution was evident by now. One estimate put the pollution rate at approximately 40,000 gallons per hour.

The Coast Guard had now contracted the Murphy Pacific Company to supervise the salvage effort, and plans called for putting out two bow anchors to stop the heading changes of the ship. How much of this heading change was due to wave forces and how much due to forces of the currents was not known. Plans were to place around the ship a group of heavy moorings, each with a mooring buoy, to which barges could be tied. A work vessel was to be brought alongside the Argo Merchant with fendering to be provided by the two large Coast Guard fenders. This work vessel was to contain a steam heater that would pump steam through a portable coil placed in a tank so the oil could be heated until it was thin enough to be pumped.

On Friday, December 17th, conditions were somewhat rough. Work was limited to inspection of the ship, since all the salvage equipment was not yet available. Saturday, December 18th, was even rougher. Wind strength increased to over 40 knots and seas were nine to twelve feet high with almost every wave breaking on the shoals. The amount of heeling of the vessel seemed to change as the tide changed, and the stern of the vessel was definitely getting lower.

By Sunday morning, December 19th, the wind and seas had abated and conditions were nearly calm. Strike Force personnel and the crew of the tug, Sheila Moran, were able to put out one of the bow anchors on the Argo Merchant. In the calmer conditions, the oil leakage rate appeared to have abated. Wind and sea conditions were also moderate on Monday, December 20th. However, during the night, conditions worsened. By the morning of Tuesday, December 21st, strong northwest winds and large seas were again present. At 8:30 a.m. The Argo Merchant split in two and a great deal of oil escaped. By Wednesday morning, the wind strength had reached 45 knots and the seas were about twelve feet high. [illegible] section of the bow which had been afloat broke in two and most of the remaining oil escaped.

Fortunately, pollution damage in this case was small. During the time that oil escaped from the vessel, all strong winds were from the north or the southwest. The oil was driven away from the shore and south of George's

Bank. Only for one short period did the wind blow toward land. Some oil came within fifteen miles of Nantucket Island, but the wind direction again changed and the oil was again blown out to sea.

3.0 PROBLEMS AND OPPORTUNITIES IN OIL SPILL CONTROL

3.1 How Much Oil Has Been Spilled?

The Strike Force that boarded the Argo Merchant would clearly have benefitted from being able to determine quickly (a) how fast oil was being lost, and (b) from which tanks it was being lost. Such a determination would have provided essential information concerning how many pumps would be required, how best to deploy available pumps, and what parallel actions would need to be initiated to avert a disaster.

Because power is typically not available aboard a stricken ship, shipboard measurement equipment may not be functional. There is a need to develop additional instrumentation and portable measurement systems. Two approaches might be taken: first, instrumentation might be developed to measure how much oil is onboard at any time; second, techniques for measuring the volume of oil actually spilled might be feasible.

For the first type of system, knowledge of the initial load would be required. Any change in load onboard would be attributable to leaks or spills. The characteristics of such measurement equipment are difficult to specify. While it would be desirable to have an absolute measure of the total load of oil any time, measures of change in volume are also very useful, since they give a measure of rate of loss.

One method for making such measurements* might be to release quickly

*Suggested by Professor Jerome Milgram.

a known volume of a gas (from a high pressure air tank, for example) into a cargo tank. The time history of the resulting change in pressure could be used to compute the ullage (empty volume) and the rate of change in volume. Thus, the tanks from which oil is leaking could be identified, as well as the rate of leaking - provided of course the tops of the tanks are completely air tight or can be made so.

Capacitance or resistive probes (electronic dipsticks) might also be feasible, provided they were made to be rugged, portable, and accurate enough to detect small changes in volume.

The second approach to the problem would involve measurement of the volume of spilled oil on the surface by measuring both the area of the spill, through photographic means, and by measuring the thickness (at many points) simultaneously. Current advances in radar, infrared, and laser technology may make remote thickness measurements possible. However, if remote techniques are not feasible, boats on the scene might be used for sample measurements.

While such instrument systems would be valuable to salvage crews and Coast Guard Oil Strike Teams, the market for such devices would likely be measured in the tens, not hundreds.

3.2 Where Is the Oil Going?

Being able to predict where an oil spill will be six hours, or sixty hours, after it occurs, is important for planning clean-up logistics and assessing the magnitude of the problem.

Over the past fifteen years, a number of computer models designed to forecast the movement of oil spills have been built. However, proceedings of the recent conference on oil spills[2] and a review of the literature on movement of spilled oil at sea illustrate the limitations of the models developed to date.[3,4] The problems are many fold, but the most fundamental difficulty is that the basic physics of oil spills is not understood.

First, the spreading of oil on a calm, motionless water surface is in itself a complex problem. During the phase when gravitational forces and inertial forces predominate, the physics is reasonably understood. That is, theory and experiments are in reasonable agreement. But in the phase in which surface tension forces should predominate, much less is known, since oil contains some surfactants that may radically affect the surface tension forces. Additional research on oil spreading on calm seas is sorely needed.

Second, the oil spills rarely occur at times and places when there is a calm motionless surface. The ocean surface (and the oil on it) is moved by wind (stress), by waves, and by currents. Unfortunately, winds, waves, and currents are related variables. Any yachtsman who has traveled <u>with</u> a current against the wind will attest to the coupling effects of wind, waves, and currents. The problem simply cannot be solved by adding (vectorially) the separate effects that give rise to oil transport by wind, by waves, and by currents.

The foregoing is not meant to imply that forecasting of oil spill trajectories is hopeless. Rather it is to make clear that continued theoretical work and laboratory and field experiments must be carried out and the best current theories must be used in the design of the experiments.

For example, recent work by Professor J. Milgram[5] has shed some light on the importance of wave effects in understanding and forecasting oil transport at sea. His analysis deals with a thin layer of oil on an initially undisturbed body of water of infinite depth. A wave train impinges on the oil/water interface at $t = 0$. Professor Milgram calculates the mean velocity of the surface layer of oil/water as a function of time. Initially, the transport velocity of the oil at the surface is just "Stokes drift" velocity predicted for free waves with no oil. However, the velocity increases with a time constant that depends on thickness, viscosity, and other parameters.

It is important to note that the acceleration of the oil above the Stokes drift velocity takes place in the complete absence of wind. Milgram's analysis applies to the case, for example, of an oil slick on a windless day driven by waves from a previous day's storm. The oil would migrate owing to wave motion even in the absence of wind, its speed and direction being determined by wave height, wave length and period - not by wind.

The importance of Milgram's result is that rough calculations show that the wave-induced velocity of oil can under many circumstances be of the same order of magnitude or larger than the velocity traditionally ascribed to wind, i.e., $V_{oil} = .03\ V_{wind}$. Thus, it is clear that models built solely upon wind effects will be valid only when wind and wave effects happen to coincide in direction. Furthermore, the analyses of experimental or historical data and the design of experiments must remain inconclusive until wave effects are appreciated and incorporated. To assess wave effect more fully, more research is clearly implied and better at-sea experiments must be carried out.

3.3 How Can Oil on the Sea Be Contained?

The fact that no significant amounts of oil from the Argo Merchant reached land is attributable to favorable winds and currents - not to containment procedures. Opportunities abound for providing improved equipment for the Coast Guard to use in containing and cleaning up oil spills. Although each accident has a somewhat different time history and geometry for the spilling of oil, the example of the Argo Merchant demonstrates some important features of equipment needed to control oil slicks in typical environments.

For the Argo Merchant, the rate of leakage prior to breakup was estimated at about 40,000 gallons per hour. The width of the slick varied with the tidal currents, being about 600 to 1100 ft when the current was abeam and only 150 to 300 ft when the current was fore and aft.

The currents near the Argo Merchant were about 1.5 knots. Thus, the thickness of the slick was about 0.046 in. (1.18 mm) when the slick was 150 ft wide and only about 0.007 in. (.18 mm) when the slick was 1100 ft wide.

The thinness of the slicks severely aggravates the clean-up problem. The rate at which a device can clean up oil from water is fixed by the width of the device, the thickness of the oil, and the speed of the vehicle relative to the oil. For example, a skimming device moving at 1 knot relative to the 1100 ft wide slick (i.e., 0.007 inches thick) would <u>encounter</u> only about 4.5 gallons of oil per minute. (The <u>collection</u> rate would be somewhat less than the <u>encounter</u> rate.) Conceivably speed could be increased to 2 knots as some manufacturers' claim, but it's clear that meaningful containment and collection require devices two orders of magnitude wider than 10 ft, i.e., on the order of a thousand feet. Under the same condition, one could encounter and collect about 450 gallons per minute.

Many floating oil booms have been developed. Considerable research has taken place on the hydrodynamic effects that occur when oil is slowed down and collected in front of a barrier as shown in Figure 1.

For very low current speeds (less than 0.5 knot) and in the absence of ocean waves, the cross-sectional shape of the oil pool, as viewed from the side, is relatively smooth as sketched in the figure. At a higher speed of about 0.75 knot, the cross-sectional shape of the oil pool forms a lump near its leading edge, as shown in the figure. At a still higher speed of about 1 knot, the size of this leading edge lump, called a headwave, is increased. At an even higher speed (about 1.25 knots), oil droplets are torn off the headwave by the water stream and these droplets are carried below and past the boom or collection device. This particular effect has nothing to do with any details of any device except for the fact that some of the oil is slowed down. The effect results in a natural limitation in the relative speed of any containment or clean-up device of about 1 knot. Exceeding this limit will result in entrainment of oil in the water with this entrained oil moving under and past the device.

The figures are based on observations in the precision flume at MIT. Experience at sea substantiates these results. Although some calm water devices work at speeds as high as 2 knots, barriers and their 1 knot limitation appear to be a fundamental boundary condition for work offshore.

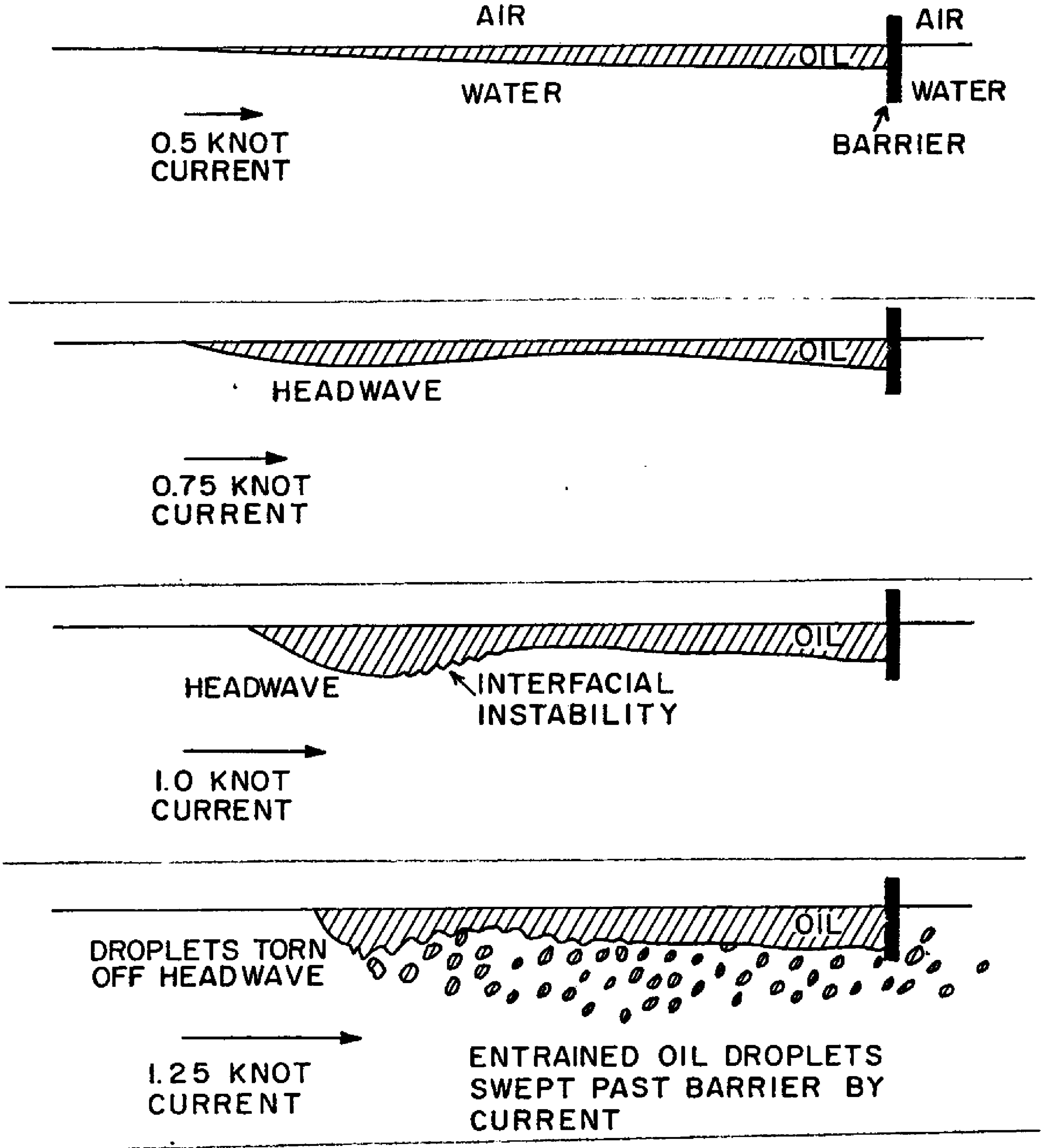

FIGURE 1. Sketches of Side Views of Oil Held by a Barrier Against a Current. As the current speed increases a headwave forms which becomes so unstable at speeds in excess of 1 knot, that oil droplets are torn off it and these droplets are entrained in the water and swept past the barrier.

3.4 Picking Up Oil

A barrier is needed to contain oil, but skimmers are necessary to pick it up. Both must closely follow the vertical motion of waves in order to skim the oil off the top without collecting a lot of water. The oil containment and clean-up devices with the best wave following ability can be divided into two categories: barriers with built-in skimmers, and barriers with multiple, free floating skimmers. High-seas barriers with built-in skimmers are designed to carry much of the seaload in lines external to the barrier sheets (fabric fences), thereby leaving the barrier sheet relatively free to respond to the motion of the water and oil. Free-floating skimming devices are relatively small and relatively light, with relatively large water plane areas that can follow the surface of the sea to much greater accuracy than large cumbersome devices. A multiplicity of small devices can do a much better job in this regard than a single large device. To provide high collection rates with floating skimmers, they must be used inside a barrier, where they can skim from the thick oil layer.

Even though barrier-based skimming systems appear to be the only feasible way to collect large quantities of oil from the open sea, their use is limited by the size of the waves. No barrier systems yet designed can work effectively in large breaking waves. Tests indicate that the maximum breaking wave height in which barriers now available can contain and collect oil, is about 8 ft. Much larger non-breaking waves (swell) can be accommodated. Larger barriers that could effectively work in larger seas could certainly be designed and constructed, but their size and weight would probably make them impractical for use.

3.5 Tow Boats and Barges

The vessels to tow the barriers can not be ordinary ships. They must be capable of maintaining accurate steering control while going at very low speeds. It is unlikely that new vessels will be designed and built exclusively to tow oil barriers, but it is quite within our capabilities to retrofit a large number of existing vessels to provide them with this added capability. To date, hardly any such retrofitting has been done.

The need to respond rapidly to a spill has led the Coast Guard to develop their Fast Surface Delivery System (FSD), a planing hull sled that can be towed at 15 to 16 knots by an 82-ft WPB (Coast Guard cutter) or by a large helicopter. This system can be used to tow a 20,000 lb load of barriers, ADAPTS, and/or skimmers. If low-speed towing capability were added to the 82-ft cutter, the WPB could both deliver and tow the barriers.

The formidable problem of what to do with the collected oil probably requires two kinds of barges. Smaller barges are needed for use with the barriers and skimmers, and larger barges are needed to store and remove the oil collected from the smaller barges and/or from a disabled ship - as in the case of the Argo Merchant. The larger barges could be commercial barges obtained under contract; however, the smaller barges must be specially designed for the task.

These barges would be stored near stockpiles of barriers and skimmers. The barges should be light so that they could be towed by the same type of vessels used to tow sleds containing barriers and skimmers. The capacity of these collection barges should be as large as possible, consistent with being towed by Coast Guard 82-ft cutters at speed of no less than 14 knots when empty. Preliminary calculations indicate that vessels of this type would be about 75 ft in length and could have a storage capacity of about 100,000 gallons of oil, which would represent about three hours of oil collection from a barrier/skimmer combination collecting oil at a rate of approximately 600 gallons per minute. The collection barges should also be designed to achieve gravity separation of oil and water, which would allow discharge of the water back into the sea so more oil could be collected. (Representative configurations of tows and barges are shown in Figures 2 and 3.)

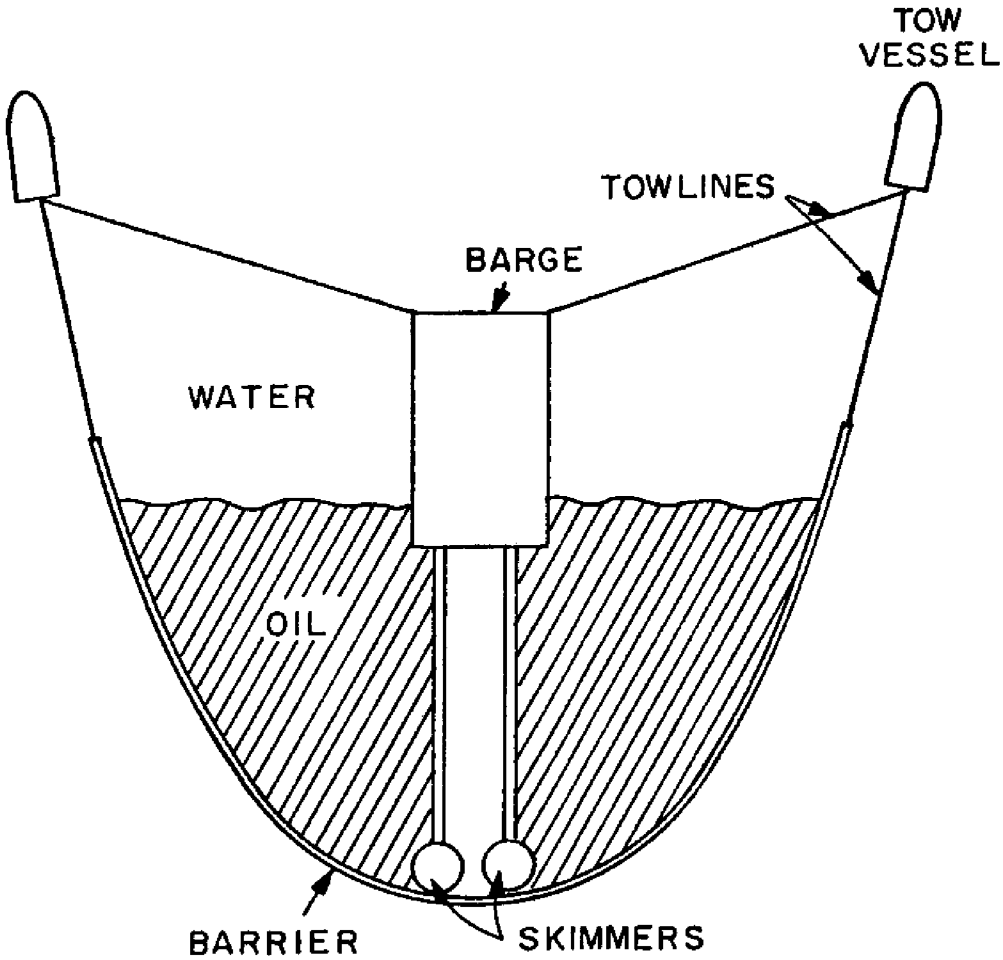

FIGURE 2. Top View Sketch of an Arrangement for High Volume Collection of Spilled Oil Offshore with Skimmers Inside U-Configuration of Towed Barrier. The barrier provides high oil encounter rate and a thick pool of oil in which the skimmers can operate efficiently. The tow vessels must not tow faster than 1 knot through the water. The oil shown in the sketch is the thick pool. Generally a thin pool is encountered ahead of the tow vessels.

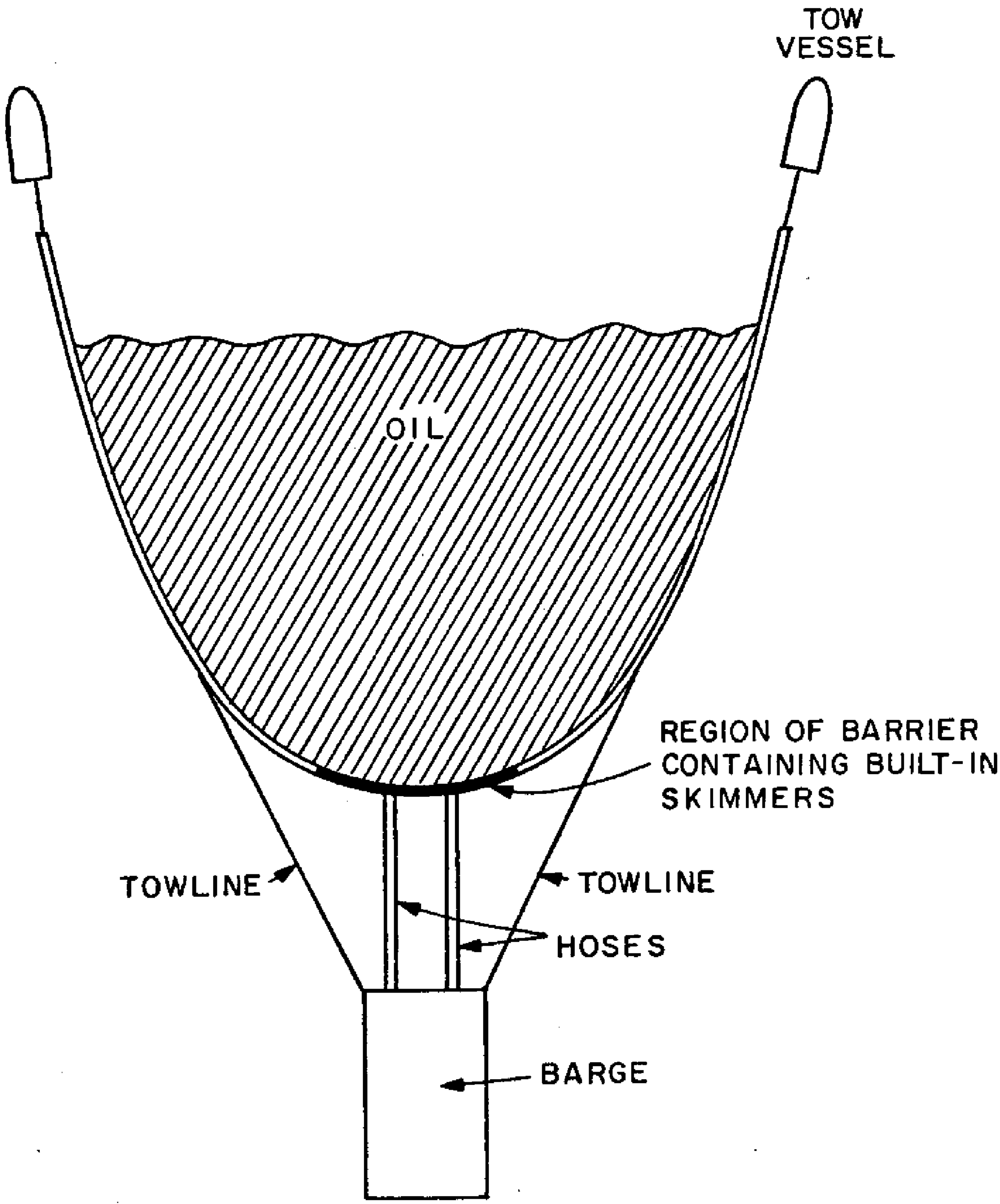

FIGURE 3. Top View Sketch of High Volume Collection of Spilled Oil Offshore Using a Barrier with Built-In Skimmers.

4.0 IT MIGHT HAVE BEEN...

As the Argo Merchant incident reveals, coping with a spill of major proportions requires new types of instruments, systems, equipment, and more timely information. Therein lie the opportunities for industry. Had more and better technology been available in the case of the Argo Merchant, the end result might still have been the same - but it would have occurred by design rather than good fortune. If the equipment and systems discussed in Section 3 had been available and if personnel were trained to use them, the following report on the fate of the Argo Merchant might have been possible...

At 7 a.m. on Wednesday, December 15, the U. S. Coast Guard Station at Woods Hole, Massachusetts, received a Mayday message from the grounded Argo Merchant. Both the Oil Spill Strike Force Team and the National Oil Spill Trajectory Center were promptly notified. By the time Strike Force members arrived on the Argo Merchant, the Trajectory Center had made preliminary computer predictions of the possible spill consequences and had recommended immediate dispatch of high-speed barges and ADAPTS pumps and later dispatch of barriers, as tow ships became available.

The first ADAPTS system, which arrived at 2 p.m., was immediately put to work pumping the flooded engine room. Using portable measurement equipment, the Strike Team determined that three cargo tanks were leaking oil below the water line. They devised an offloading program from the nonleaking tanks to minimize the strain on the hull while providing needed buoyancy.

Two high-speed towed barges arrived at 4 p.m. and offloading of 200,000 gallons of oil took place during the night. On Thursday, another

600,000 gallons were offloaded, with transfers to a larger barge taking place in the relatively calm waters in the lee of Nantucket. An additional 200,000 gallons were removed during the night of the 16th of December and the Argo Merchant was floated off the shoal on the high tide.

Offloading of the leaking tanks commenced as the Argo Merchant was towed seaward. At the same time barriers were deployed to clean up the oil nearest to Nantucket, as the Trajectory Center's computer models forecast that shifting winds would drive the spill toward land. Containment barriers were effective in the four foot seas on the 17th, but on the 18th the rough six to nine foot seas prevented further cleanup.

Since the Argo Merchant was in danger of sinking while still partially loaded, the Coast Guard decided to scuttle it during the night of the 18th. Computer predictions indicated that the oil would go further out to sea on the forecasted favorable winds and currents, so demolition teams opened all cargo tanks prior to sinking. During the calm weather of the 19th and 20th, the barriers and barges continued cleaup near shore until the Trajectory Center determined that further efforts were unnecessary, since an approaching storm would blow the remaining thin layer of oil out to sea.

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